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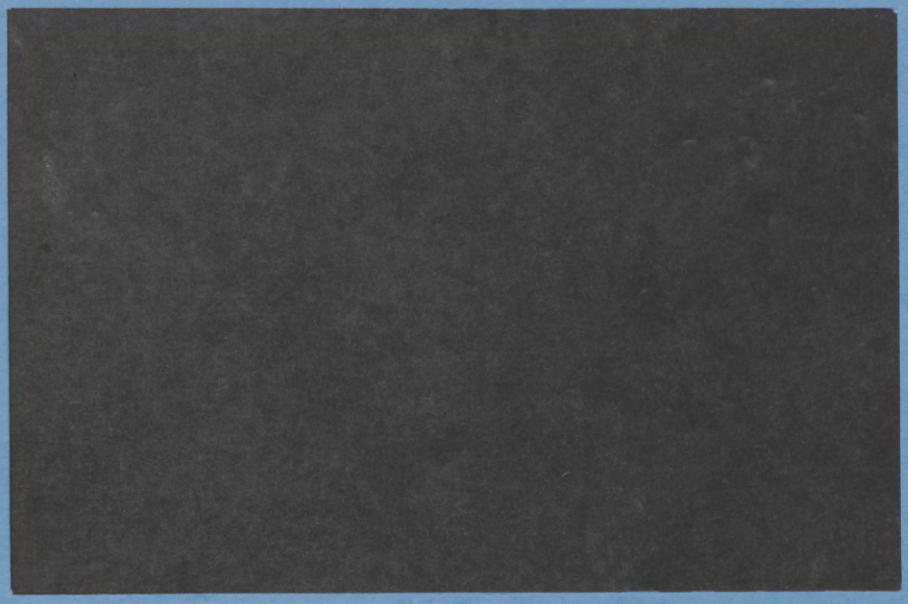

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IMMIGRATION, SEARCH AND LOSS OF SKILL*

by

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Working Paper No.18–94

August, 1994

* We wish to thank Z.Eckstein for many helpful comments. Tal Raviv provided assistance in programming. Financial support was provided by the Ministry of Science and Arts, Grant No.4801193.

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Introduction

Starting in 1990, Israel has experienced a major immigration wave of highly skilled workers from the former Soviet Union. About half a million immigrants entered Israel during the period 1990-1993, of those about 200,000 joined the labor market. The average level of schooling of these immigrants is high, 14.7 years of schooling for males and 14.3 for females. This wave is without precedent in terms of the imbalances it created in some high skill occupations. For instance, during the period 1990-1993, 12,000 physicians and 54,000 engineers immigrated to Israel. The number of workers employed as physicians and engineers in 1990 was 16,000 and 30,000, respectively. Thus, the supply in these two occupations has more than doubled within 3 years. Under these circumstances, it is not surprising that many highly skilled immigrants were forced into low skill occupations. Only 30 percent of the immigrants who worked in the former U.S.S.R. as scientists, engineers or managers found similar jobs within the first three years of their stay in Israel.[1]

The purpose of this paper is to investigate some aspects of the short run adjustment process and try to infer its long run implications. We are mainly interested in the loss of human capital suffered by the immigrants and the implications of this loss to the immigrants themselves and the Israeli economy. For this purpose we construct a model of job search and estimate its parameters, using a sample of 469 male immigrants who reported their labor market experience, during the period 1990-1992.

The model which we construct is designed to describe the process of matching immigrants with jobs in Israel where workers differ in skill and

[1] For further details, see Flug and Kasir [1993]. Some downgrading of skills was also observed amongst immigrants who came from the U.S.S.R. during the years 1970-1980. The skills and occupational compositions of these immigrants were similar to the current wave, but their number was smaller, about 150,000. (See Flug, Kasir and Ofer [1992].)

jobs vary by skill requirements. To simplify, we consider a "job hierarchy"[2] where jobs can be ranked according to the minimal level of schooling required to perform the job. Finding a suitable job, which maximizes the immigrant's output (and wages), given his schooling endowment, requires search. An immigrant who meets a particular job offer, will be qualified for the job only if his schooling exceeds the minimal requirement of the offered job. He will accept the job offer only if it is preferable to further search. An immigrant with a given level of schooling can choose whether to search for a job in a "high skill" occupation where most jobs have schooling requirement which are the same or higher than his, or in a "low skill" occupation where most jobs have schooling requirement which are lower than his. If he searches in the "high skill" occupations he may find a suitable job which fully exploits his skill but he will need to wait along time to find such a job, since most firms which he meets will reject him as unqualified and because job offers may arrive at a a slower rate. If he searches in the "low skill" occupation he will find a job quickly but the loss of skills may be larger. Generally, workers will select occupations and job acceptance rules which do not fully exploit their formal schooling.

In this paper we use data on the duration of waiting times of immigrants for their first full time job in different occupations to estimate parameters of the job offers and of the arrival rates of job offers, assuming that workers follow the search strategy outlined above.

Our main finding is that the estimated average loss of years of

[2] The approach was suggested by M. Reder [1957, pp. 291-295]. In his view, jobs are arranged in a "job hierarchy", workers search for the best jobs for which they are qualified but, failing to find them, may end up in a less preferred job. In favorable labor market (for workers), job seekers find it relatively easy to move up the job hierarchy towards better jobs and vice versa. This occurs because fewer workers compete for the good jobs and because firms relax their hiring standards.

schooling associated with the short run adjustment, which includes a substantial move down the occupational ladder, is 1.52 years, or 10 percent of their average years of formal schooling. The loss among the highly educated, with 16 years or more years of schooling, is 2.40 years or 14 percent of their average years of formal schooling. If one assumes that the short run adjustment is the same as the long run adjustment, that is, immigrants remain in their initial jobs, then, a rough estimate of the loss of human capital is about 13,000 dollars for an average immigrant and about 23,000 dollars to a highly educated immigrant. The corresponding aggregate losses are 1.8 and 2.6 billion dollars, respectively[3].

[3] Using a conservative estimate of .04 for the rate of return for schooling, the annual flow of earnings of each immigrant is reduced by .04*1.52 = .061 percent. Since the average age of the immigrants is about 40, a reduction in the annual flow by 1 dollars translates into 18 dollars of life time earnings, using an interest rate of .03. Thus each immigrants loses about .061*18 = 1.10 years of earnings. Using an estimated annual earnings of 12,000 dollars per year and aggregating over all working immigrants one gets an aggregate loss of 200,000* 12,000*1.10 = 2.6 billion dollars. Using a different perspective, the number of immigrants who arrived with a university degree, about 80,000, is roughly the same as the number of students currently trained in Israeli universities. The loss of the services of 2.4 years of schooling over a period 25 years is about .44 of the services obtained from the 3 years of university schooling that an Israeli college graduate provides over his working life of 45 years. The annual variable costs for training of an Israeli student are about 5000 dollars. Adding an estimated opportunity cost of 12,000 dollars per year we obtain a conservative estimate of 51,000 dollars for a college program of 3 years. Thus, the opportunity costs of the lost years of schooling by Russian immigrants with an academic degree is about .44*51,000 = 22,700 dollars in terms of the required costs of training an Israeli student. Aggregating the costs of lost training over all immigrants with an academic degree, one obtains a cost of 80,000* 22,700 = 1.8 billion dollars.

These calculations probably overstate the actual costs of lost skills, because, as time passes, immigrants gradually climb up the occupational ladder and because the quality of their schooling may be somewhat lower than that of Israelis. Cross section studies suggest that the wage effects of schooling and experience acquired abroad and in Israel are similar, suggesting convergence of the returns for skills of immigrants and natives.[4]

While the focus of this paper is on a particular episode, recent immigration to Israel, the methods which we develop can be applied to other situations in which a major occupational restructuring is required. The model which we develop is consistent with some "natural" loss of skills, akin to the natural rate of unemployment, which one would observe even in a smoothly operating economy, where individuals can select their schooling and firms can choose their job offers[5]. More substantial losses of human capital are expected as a consequence of aggregate labor market shocks such as technological innovation, changing trade patterns and immigration.[6] These losses occur because workers with a predetermined level of schooling find themselves with no jobs, and are willing to compromise and accept

[4] If one separates schooling and experience to the number of years accumulated in Israel and abroad, one gets similar coefficients in the wage function. (See Fishelson, Weiss and Mark [1980].) Studies from the U.S also show that the gap between immigrants and natives in wages and in occupation narrows quickly. (See LaLonde and Topel [1991] and Chiswick [1992]).

[5] Sicherman [1990] noted the prevalence of over education in a sample American workers (the Panel Study of Income Dynamics). When asked "How much formal education is required to get a job like yours?" About 40% of the respondents report a number which is lower than their own schooling attainment (only 16% of the respondent report a higher number). The author ascribes this discrepancy to variety of reasons, including temporary mismatching and career mobility.

[6] Several recent studies analyze the unemployment spells and wage losses following papers have analyzed the impact of displacement due to plant closure. (See, for instance, Jacobson and al. [1993], Carrington and Zaman [1994] and Fallick [1993]). These studies find a substantial (about 13 percent) and long lasting loss of wages. The loss in wages tends to increase with age and tenure.

jobs with schooling requirements below their schooling endowment. The Israeli experience shows that the main problem is not the mere finding a job, i.e the problem of unemployment. Rather, the main short run impact of the adjustment is the downgrading of skills. One would expect that in the long run, the loss will be mitigated as new jobs are created and workers gradually sort themselves into more suitable jobs, but the cost of adjustment in terms of lost resources may be significant even in the long run[7].

[7] Some information about the adjustment process is included in a study by Amir [1993], who examined the employment patterns of early Russian immigrants at two points in time (1978 and 1984). He finds that, within 5 years, about 35 percent of young immigrants move up but almost none of the older ones. These findings suggest that the initial downgrading is sustained over a substantial period of time.

The Model

In this section we construct a simple search model which will serve for the estimation of skill loss by immigrants.[8]

Consider an economy where workers vary in their schooling endowments and jobs vary in their minimal schooling requirements. Each job can employ at most one worker. The output achieved by employing a particular worker on a particular job depends on the match between the worker and the job. Specifically,a worker with less schooling than the required minimum cannot perform the job. A worker with more than the required level of schooling produces the same amount as one who has just the minimal requirement for the job. Associated with each job is a unique wage that a qualified applicant will receive. Different jobs, with different schooling requirement pay different wages, but any qualified worker who is employed on a given job receives the same wage, irrespective of his actual level of schooling. (See figure 1.)

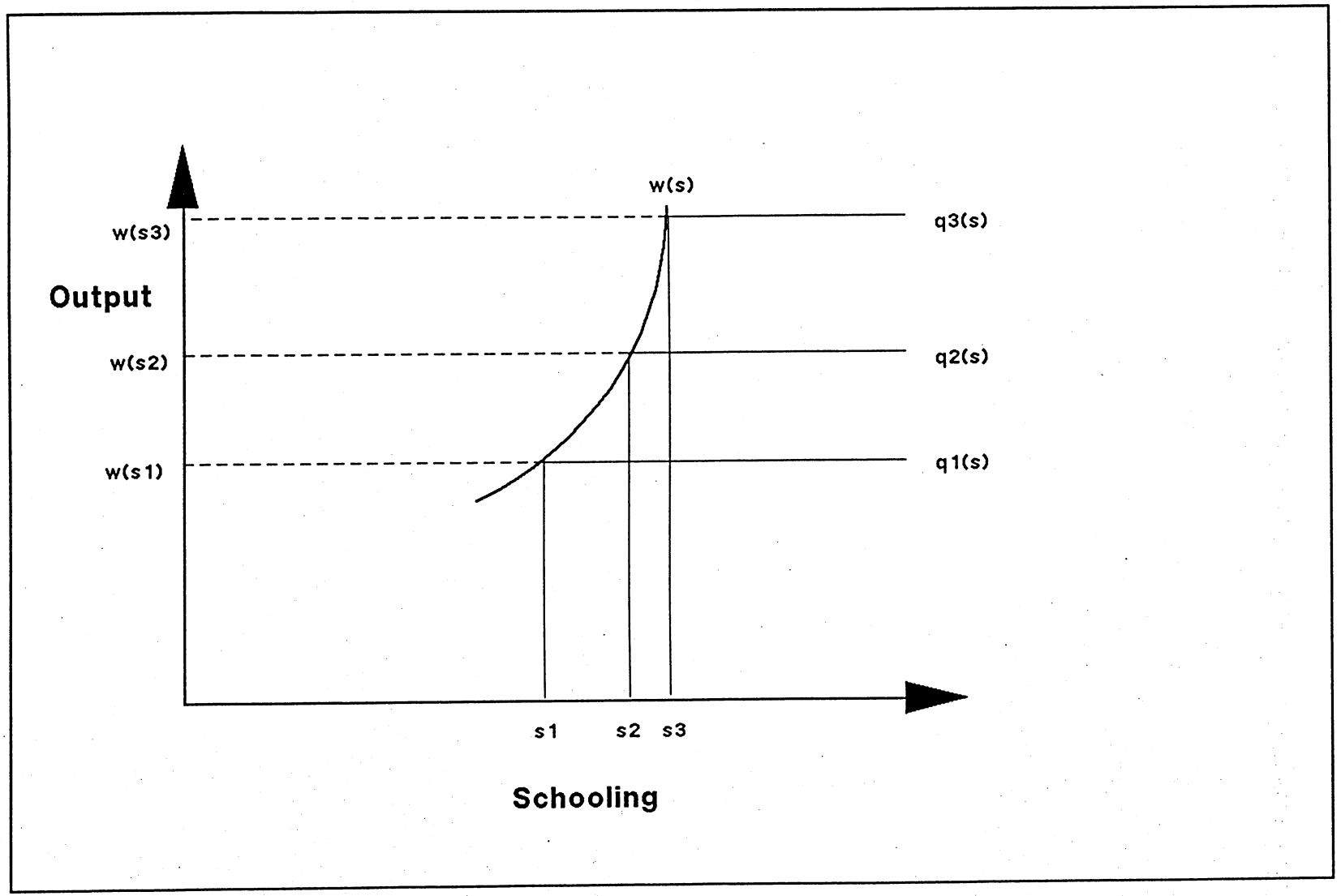
Given the assumption that firms pay in wages the whole product, there is no motivation for search by the firm. However workers seek a job in which their output (and wages) are maximized, given their skills. The main assumption is that finding the most suitable job is costly and requires search by the workers.

The search problem facing a worker with a specified level of

[8] The model combines features from several familiar search models. The first part, in which workers search from a given distribution, is similar to the standard model (see for instance, Heckman and Flinn [1982]). The only difference is that wage offers are truncated from above, in away which depends on the worker's characteristics. The extension to search from several distributions (occupations) is trivial, given that the distributions are known. A more complicated situation arises when workers experiment (see Miller [1984]). The model of search on the job is a direct application of Burdett [1978] and Mortensen [1986, section 3]. The only difference is that the reservation policy is in terms of schooling rather than wages. The main distinctive feature of our model is that workers of different skill can have the same productivity and wages on a given job, but different potential productivity and wages at other jobs, leading to a potential loss of skills.

figure 1

Output and Wages as Functions of Schooling in Different Jobs



schooling, s_i, is as follows. Workers receive job offers at a rate λ per period. Each offer is a random draw from a fixed distribution of job offers $F(s)$. A job offer consists of a minimal schooling requirement, s and an associated wage offer $w(s)$. If the drawn offer requires s which exceeds s_i, then the firm and the worker are mismatched, no deal will be struck and the worker will continue to search. If the offer requires s which is less than s_i, then the firm and the worker are well matched and it is up to the worker whether or not to accept the job. Such a search problem faces any worker who finishes school and enters the labor market. Search is particularly important for immigrants who arrive to Israel with a predetermined level of schooling.

The arrival rate of job offers and the offered wage at a given level of schooling generally depend on the immigrant's background and the occupation at which he searches. We use an index i, to indicate each individual and an index j to indicate the occupation. Thus, $w_{ij}(s)$ indicates the wages that immigrant i can obtain in occupation j at a job which requires s years of schooling. Similarly, λ_{ij} indicates the arrival rate of offers for person i when he searches in occupation j. Finally, $F_j(s)$ indicates the distribution of jobs, by their schooling requirements, in occupation j.

We assume that, at any given period, one can search in only one occupation and distinguish two possible cases, depending upon whether search on the job is feasible. If it is impossible (or too expensive) to search on the job, there will be no voluntary quits, following the acceptance of the first job. In this case, the search problem facing the immigrant reduces to two questions: At which sector (occupation) should I concentrate my search effort? If a job offer arrives, should I accept it? If, on the other hand, a worker can search on the job, then one must also

answer the question: Having accepted a job, where should I search and under what circumstances should I quit?

To simplify our analysis we assume stationary conditions and let the decision horizon be infinitely long. Under these assumptions, one can associate a value to each state in which the individual finds himself which is independent of time.

Consider, first, the case in which it is impossible (or too expensive) to search on the job. Suppose that an immigrant i searches in occupation j. If a job offer arrives, requiring s years of schooling, where $s \leq s_i$, and if the worker will choose to accept the offer then his expected life time earnings are given by

$$(1) \qquad W_{ij}(s) = w_{ij}(s)(1+\rho)/\rho.$$

The value of searching in occupation j is given by

$$(2) \qquad V_{ij}(s_i) = \underset{r}{\text{Max}} \frac{b(1+\rho) + \lambda_{ij}\int_r^{s_i} W_{ij}(x)\, dF_j(x)}{\rho + \lambda_{ij}\int_r^{s_i} dF_j(x)}$$

subject to $r \leq s_i$, where, ρ is the monthly interest rate and b is the monthly unemployment benefit. Condition (1) states that, since the worker expects to maintain his job forever, the value of a job is the discounted present value of wages in this job. It is seen that a job with a higher schooling requirement, and thus a higher wage, is more valuable to the worker, provided that s does not exceeds s_i. Because of this monotonicity, the decision whether or not to accept a job offer in occupation j, when it arrives, is characterized by reservation rule r,

such that the worker rejects all jobs offers with $s < r$ and accepts all other job offers. This pattern of decision is reflected in the calculation of the expected value of search. Condition (2) states that the immigrant will choose a reservation value, r_{ij}, which maximizes the value of search.

The first order condition induced by the maximization with respect to r implies that an interior solution, where $r_{ij} < s$, satisfies

$$(3) \quad W_{ij}(r_{ij}) = V_{ij}(s_i).$$

That is, the reservation level of schooling is set to equate the value of accepted job to the value of continued search. The value of being unemployed is, then, the expected present value of the unemployment benefits during the random search period, added to the value of the option of accepting job offers in the range between r_{ij} and s_i, when they arrive. A necessary and sufficient condition for the existence of an interior solution to (3), which satisfies $r_{ij} < s_i$, is that the individual can find a job which pays more then the available unemployment benefits. That is,

$$(4) \quad w_{ij}(s_i) > b.$$

Otherwise, the individual would prefer not to work.

Differentiating both sides of (2) with respect to s_i, using the envelope theorem, we obtain

$$(5) \quad V'_{ij}(s_i) = \frac{\lambda_{ij} f_j(s_i)}{\rho + \lambda_{ij}\int_{r_{ij}}^{s_i} dF_j(x)} (W_{ij}(s_i) - V_{ij}(s_i)),$$

where, $f_j(s_i)$ is the density of job offers in occupation j which require s_i years of schooling. It is seen that, as long as (4) is satisfied, $V'_{ij}(s_i) > 0$. Therefore, by (3) and (1), a higher value of s_i implies a higher value of r_{ij}. That is, a more educated immigrant will choose a higher reservation value and reject more job offers than a less educated one, in any occupation in which he chooses to search.

Dividing the two sides of (5) by $V_{ij}(s_i)$, one obtains an expression for the rate of return from schooling in occupation j, defined as $V'_i(s_i)/V_{ij}(s_i)$. In this model, an individual who raises his schooling level from s_i to $s_i + \varepsilon$, gains from the additional investment only if he actually finds a job requiring more than s_i and less than $s_i + \varepsilon$ years of schooling. Thus, as seen in (5), the value of increased schooling depends on the probability of getting such a job and on the value added, relative to continued search, which can be attained if the job is found.

Having determined the value of search in any given occupation, the individual will choose to concentrate his search effort in the occupation which yields him the highest value. Because of the assumed stationarity of the problem, he will continue to search in his chosen occupation until he receives an offer with schooling requirement which exceeds the reservation value, and will not search elsewhere.

The exit rate from the unemployment state for a person who chose to search in occupation j is given by

$$(6) \quad \gamma_{ij} = \lambda_{ij} \int_{r_{ij}}^{s_i} dF_j(x).$$

A highly educated immigrant, with high s_i, will not necessarily search in occupations with high proportion of high skill jobs. He may

maximize the value of his search job by settling on an occupation with many jobs offers requiring less than s_i. Despite the fact that this policy gives on the average lower wages, it has the advantage of a higher probability of finding a job. The standard result from search theory, that a person always prefers to search from a distribution with higher probability for attaining high values (first degree stochastic dominance) does not hold here, because of the upper truncation on the distribution of wage offers. Thus, the model can easily capture the phenomenon of compromise indicated in the introduction. Immigrants may search in the non academic sector simply to increase their chances of finding a job.

Consider, next, the case where a person can search on the job. Search on the job is similar to search while unemployed, except that the person does not give up all his earning capacity while searching and the arrival rate of offers is correspondingly lower. If an immigrant i who works in j chooses to search in occupation k, then his wage in j, for any given s, will be $(1-\tau)w_{ij}(s)$ and the arrival rate of job offers from k will be $\tau\lambda_{ik}$, where, τ is the amount of time that one spends on the job searching for other jobs. We assume that there is an exogenously determined maximal value of τ, denoted by $\bar{\tau}$, and set $\bar{\tau} < 1$. (If a person spend more than $\bar{\tau}$ of his time searching on the job, he would be fired.) Since both the benefits and the costs from search are linear in τ, each immigrant will choose either $\tau = 0$ or $\tau = \bar{\tau}$. We continue to assume that, in any period t, one can search in only one occupation.

The option of search on the job can be incorporated in the value of work. Let $W^k_{ij}(s)$ denote the value of working in j while searching in k at the optimal intensity and using the optimal reservation rule. Then the value of work in j when one chooses the best avenue for search is

$$(7) \quad W_{ij}(s) = \max_{k} W^{k}_{ij}(s), \quad j,k \in \{1,\ldots N\},$$

and

$$(8) \quad W^{k}_{ij}(s) = \max_{r,\tau} \frac{w_{ij}(s)(1-\tau)(1+\rho) + \tau \lambda_{ik} \int_{r}^{s_i} W_{ik}(x)\, dF_k(x)}{\rho + \tau \lambda_{ik} \int_{r}^{s_i} dF_k(x)}$$

subject to

$$0 \leq \tau \leq \bar{\tau} \quad \text{and} \quad r \leq s_i.$$

Note that if an employed worker chooses not to search, i.e to set $\tau = 0$, the value defined by (8) reduces to $w_{ij}(s)(1+\rho)/\rho$, as in (1) above. With the value of work at hand, we can substitute it into equation (2) to obtain the value of searching for the first job, $V_{ij}(s_i)$.

The system (7) and (8) above determines a process of transitions from any given first job that the immigrant selects to the next one. This process has some general features which are very intuitive. First, the direction of transitions always involves and improvement in wages. This is a direct outcome of the assumption that the arrival rate of offers depend only on the person characteristics and the occupation targeted for search, but not on the job at hand. By accepting an offer with a lower wage, a person does not improve his search opportunities and yet he reduces his income for the period of random duration in which he waits for acceptable job offers to arrive. This cannot be optimal. The second general feature is that at some point, a worker does not find it profitable to search

anymore.

To characterize the process of transitions more sharply, let us assume that

$$(9) \quad w_{ij}(s) = e^{\alpha s} w_{ij},$$

where, w_{ij} is wage that person i can get in occupation j for the most "basic" job which requires no schooling. The parameter α may be interpreted as the rate of return in production from for an additional year schooling[9]. We assume that this rate of return is the same in all occupations. That is, depending upon the background characteristics of the immigrant, there is a unique ranking of the occupations that he may obtain in Israel, in terms of the wages offered at a given level of schooling. This ranking can be represented by the "base" wage w_{ij}. The independence assumption implies that the same ranking of occupations is maintained for all levels of schooling.

Without loss of generality, let occupation 1 be the occupation with the highest base wage for immigrant i, occupation 2 the second in the ranking and so on. Assume, first, that i is employed at job s_i in occupation 1. (Strictly speaking, this is a zero probability event, but we may imagine that job requirements, s, are set in discrete form, i.e $s \in \{0,1,....S\}$, or, instead, assume that i has a job close to s_i.) It is clear that i cannot expect a better offer than the one he already has and he has thus no incentive to search. Now assume that i is employed at a job s_i, in occupation 2. This person has no incentive to search in occupation 2 or in any job with lower wages, but may search in occupation

[9] Observe that, because of search, the rate of return from schooling in occupation j, defined as $V'_{ij}(s_i)/V_{ij}(s_i)$, is generally <u>not</u> equal to the rate of return in production, α.

1. Whether or not he searches in occupation 1 depends on the comparison of the marginal benefits and costs associated with increased search intensity. Differentiating the right and of (8) with respect to τ, it is seen that the derivative is positive iff

$$(10) \qquad \lambda_{i1}\int_r^{s_i}(W_{i1}(x) - (1+\rho)w_{i2}(s_i)/\rho\ )dF_1(x)\ > (1+\rho)w_{i2}(s_i).$$

The left hand side of (10) is the expected marginal benefit from an increase in search intensity, and is evaluated at the optimal reservation value for r. The left hand side of (10) is the marginal costs, in terms of forgone earnings. From this comparison it is seen that possible reasons for not searching are: a slow arrival rate of jobs in 1 indicated by a low λ_{i1}, a low probability of a match indicated by an offer distribution in 1 which has most of its weight above s_i, a low potential gain indicated by a small difference in wages between the two sectors, and high opportunity costs of search indicated by a high wage in occupation 2. By a similar kind of arguments, a worker in 2 may not search even if his current position requires an s below his credentials, s_i.

The potential of search on the job and the gradual filtering towards high wage-high schooling positions imply that the long run loss in schooling will be smaller than the one observed in the short run. However, since the finding the most suitable job is a costly process, some degree of compromise will be sustained in the long run.

The process of absorption into the Israeli labor market is not only a matter of search, but, to some degree, a process of learning whereby new immigrants acquire local skills such as language and familiarity with local institutions. An important consideration influencing the transition from

unemployment to work is that work, at any job, provides an opportunity to acquire "local" human capital. A simple way to capture this effect in our model is to allow w_{ij} in equation (9) to depend on the number of jobs that the immigrant held in Israel. In particular, we may assume a uniform improvement of wage opportunities following the acquisition of a first job in Israel. The calculations of the value of search remain the same accept that one need to keep track of the number of past jobs. The consequence of this modification is that the immigrant has an added incentive to enter the job ladder at a relatively low rung, where the chances of finding a job are high, acquire local human capital, and then search for a better job. This strategy may be superior to a lengthy wait for a high quality first job.[10]

Data and Empirical Implementation.

The data used for this study is a survey conducted by the Brookdale Institute in April-August 1992, which interviewed 1203 immigrants who have recently arrived from the former Soviet Union. The respondents' length of stay in Israel ranged from 8 months up to 30 months. Each immigrant supplied information on his occupational and educational background in the former soviet union and a detailed job history on his experience in Israel. Wages on the most recent job in Israel were also reported.

Data on labor market conditions in Israel, which includes the distribution of workers by their schooling in different occupations and the wages of the basic job (i.e the job requiring minimal schooling) where obtained from 1992 survey of incomes. This survey covers the whole population of wage earners in Israel.

[10] Another, short run, consideration in preferring speedy employment in low skill occupations, is investment in eligibility to higher unemployment benefits. In Israel, all immigrants obtain some unemployment benefits, even if they have no prior work experience. However, work experience may increase the level of the benefits.

The possible educational levels are represented by years of schooling ranging from 0 to 20. The possible occupations in Israel and the U.S.S.R. are: 1) Scientific and academic occupations, combined with management. 2) Other professional occupations, including technical workers, teachers, nurses and artists. 3) All others.

At this stage of our analysis, we only analyze the durations up to the first full job acquired in Israel and the occupation in which this job was obtained. We do not use data on the wage obtained by immigrants in Israel nor the transitions from one occupation to another. This analysis will be performed later based on a planned reinter view of the same sample. The current analysis is restricted to a sub sample of 469 males whose age falls in the range 25 to 55.

Table 1 describes our sample of male immigrants, who are 25 to 55 in age, sub classified by occupation and work status in the U.S.S.R. and in Israel. The basic pattern in this table is a transition by many immigrants down the occupational ladder from occupations 1 and 2 in the former Soviet Union to occupation 3 in Israel are 53 percent and 70 percent, respectively. This phenomenon can be easily explained if one considers the size of the immigration wave and the occupational composition of the immigrants. (See Table 2.) During the three years 1990-1992, a total of about 205 thousands workers, of whom 70 percent where highly skilled, entered Israel. Would all these workers be absorbed in the same type of work as in their country of origin, the stock of workers in the high skill occupations 1 and 2 would increase by 48 and 33 percent, receptively, within 3 years. Such high growth rates in employment cannot be accomplished without a substantial wage reductions. Wages in Israel, especially in the public sector which employs many of the high skilled workers, are not very flexible.

Table 1

Sample Distribution of Immigrants by Occupation and Work Status in Israel and The Former U.S.S.R.

U.S.S.R.	Occupation					
Israel	1	2	3	Working	not working	Total
1	38	4	0	42	1	43
2	24	17	3	44	2	46
3	112	85	113	310	5	315
working	174	106	116	396	8	404
Not Working	36	17	11	64	1	65
Total	210	123	127	460	9	469

1) Academic and Scientific + Managers
2) Technical workers, Teachers, Nurses and Artists
3) Others

Table 2

Occupational Distribution of Israeli Workers and of Immigrants from the Former U.S.S.R.

	Israel (1992)				Immigrants From The U.S.S.R. (1990 – 1992)			
	Male		Total		Male		Total	
occupation	Thousands	%	Thousands	%	Thousands	%	Thousands	%
1	116.8	17.6	175.8	14.5	39.8	39.7	84.2	41.1
2	75.0	11.3	208.7	17.2	26.6	26.6	69.3	33.8
3	473.0	71.1	829.4	68.3	33.7	33.7	51.4	25.1
All	664.8	100	1213.9	100	100.1	100	204.9	100

Source: Appendix A.

In addition to the downgrading of skills, there is a substantial non-employment amongst the immigrants. As seen in Table 1, about 14 percent of the immigrants did not work in a full time job since arriving to israel. The rate of non employment among immigrants who worked in the high skill occupations in the former U.S.S.R. is 21 percent.

The focus of this study is on the decisions taken by immigrants under these adverse labor market conditions. We assume that immigrants follow the search policy described in section 1 and estimate the parameters of the model.

The basic ingredients of the model are specified as follows. The wage that an immigrant can expect on a basic job in occupation j in Israel is given by

$$(11) \quad w_{ij} = w_j + \beta e_i - \gamma e_i^2 + \sum_{k \neq j} o_{ik}\delta_{kj}(w_j - w_k) + \sigma_j.$$

The variables in (11) have the following interpretations:

w_j is the wage rate that an average Israeli with no schooling and no experience obtains in job j.

e_i is the work experience which the immigrant acquired in U.S.S.R..

o_{ik} is a dummy variable which assumes the value 1 if the immigrant worked in U.S.S.R. in occupation k and assumes the value 0 otherwise.

The coefficients β γ and δ_{kj} σ_j are parameters to be estimated.

The probability that immigrant i will receive a job offer in occupation j within a month is assumed to depend on his age and the occupation in which he searches. Specifically,

$$(12) \quad \lambda_{ij} = L(\lambda_j + \sum_t \lambda_t a_{it}),$$

where, $L(x)$ is the logistic function given by

(13) $L(x) = e^x/(1+e^x)$,

and a_{it} is a dummy variable indicating the age group to which i belongs. We use three age groups: 25 to 35, 36 to 45 and 46 to 55. The coefficients λ_j and λ_t are parameters to be estimated.

Job offers are be characterized by two parameters: a minimal schooling requirement, s, and an associated wage. The particular value of s is a random variable whose distribution is the same as the empirical distribution of workers by level of schooling in each occupation (see figures 2a to 2c). The wage associated with a particular s is determined by (9), where w_{ij} is given by (11) and α is a parameter to be estimated.

Given the assumed parameters and the information on the distribution of jobs by level of schooling, we use a discretised version of equation (2) to calculate for each person the reservation level of schooling that he will select if he searches in occupation j, r_{ij}, and the associated value V_{ij}. This is done, for each occupation separately, by going over all possible reservation values from 0 to s_i and selecting the one which gives the highest value of search for the individual.

We assume that the immigrant's true evaluation of each option is given by $V_{ij} + \varepsilon_{ij}$ where the ε are independently and identically distributed according to the extreme value distribution, $G(\varepsilon) = 1-\exp(e^{-\varepsilon})$. Thus, the probability that a person will choose to search in occupation j is

(14) $g_{ij} = \exp(V_{ij}) \; / \; \sum_j \exp(V_{ij})$.

figure 2a

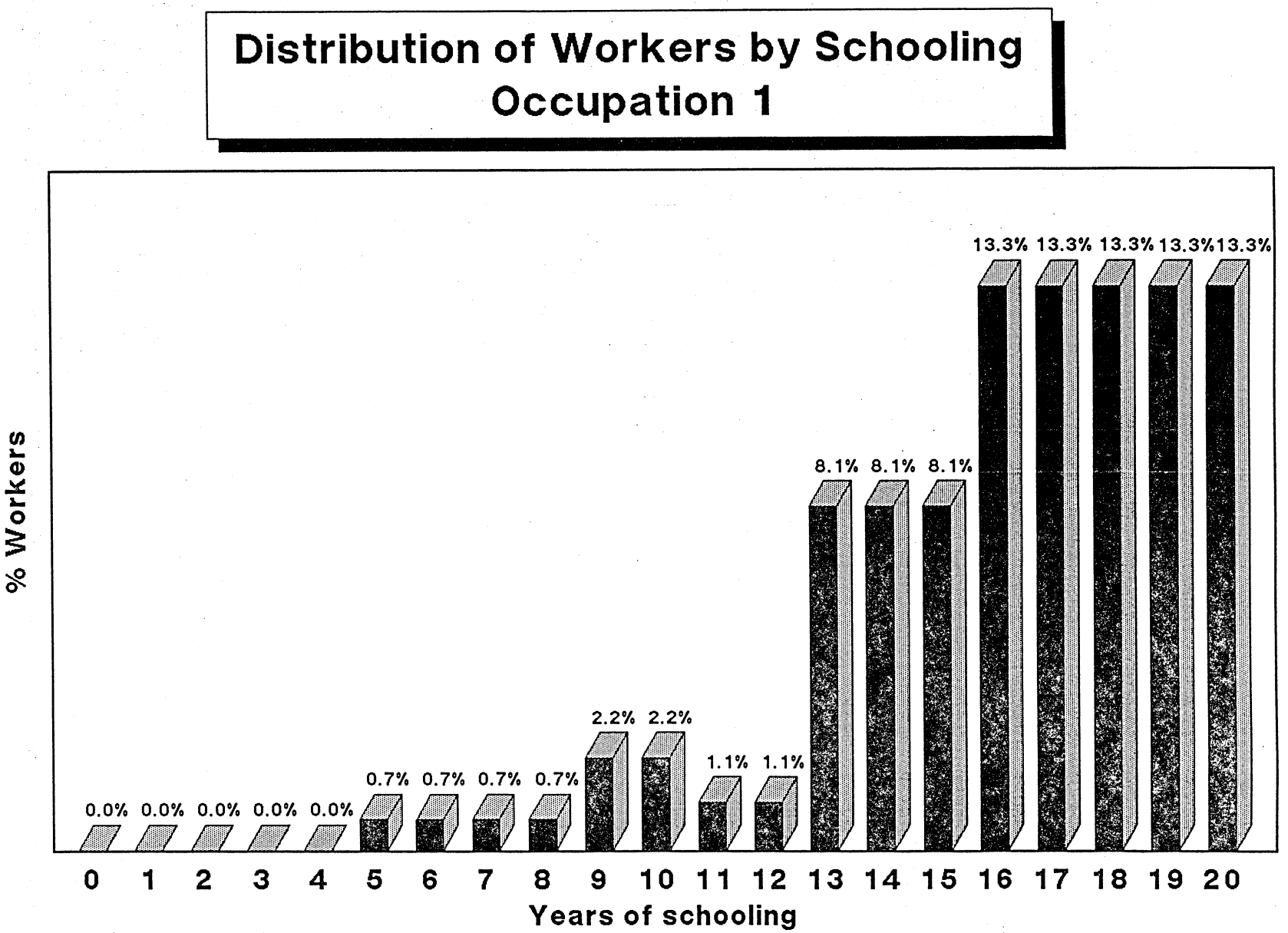

Distribution of Workers by Schooling
Occupation 1
% Workers
0.0% 0.0% 0.0% 0.0% 0.0% 0.7% 0.7% 0.7% 0.7% 2.2% 2.2% 1.1% 1.1% 8.1% 8.1% 8.1% 13.3% 13.3% 13.3% 13.3% 13.3%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years of schooling

figure 2b

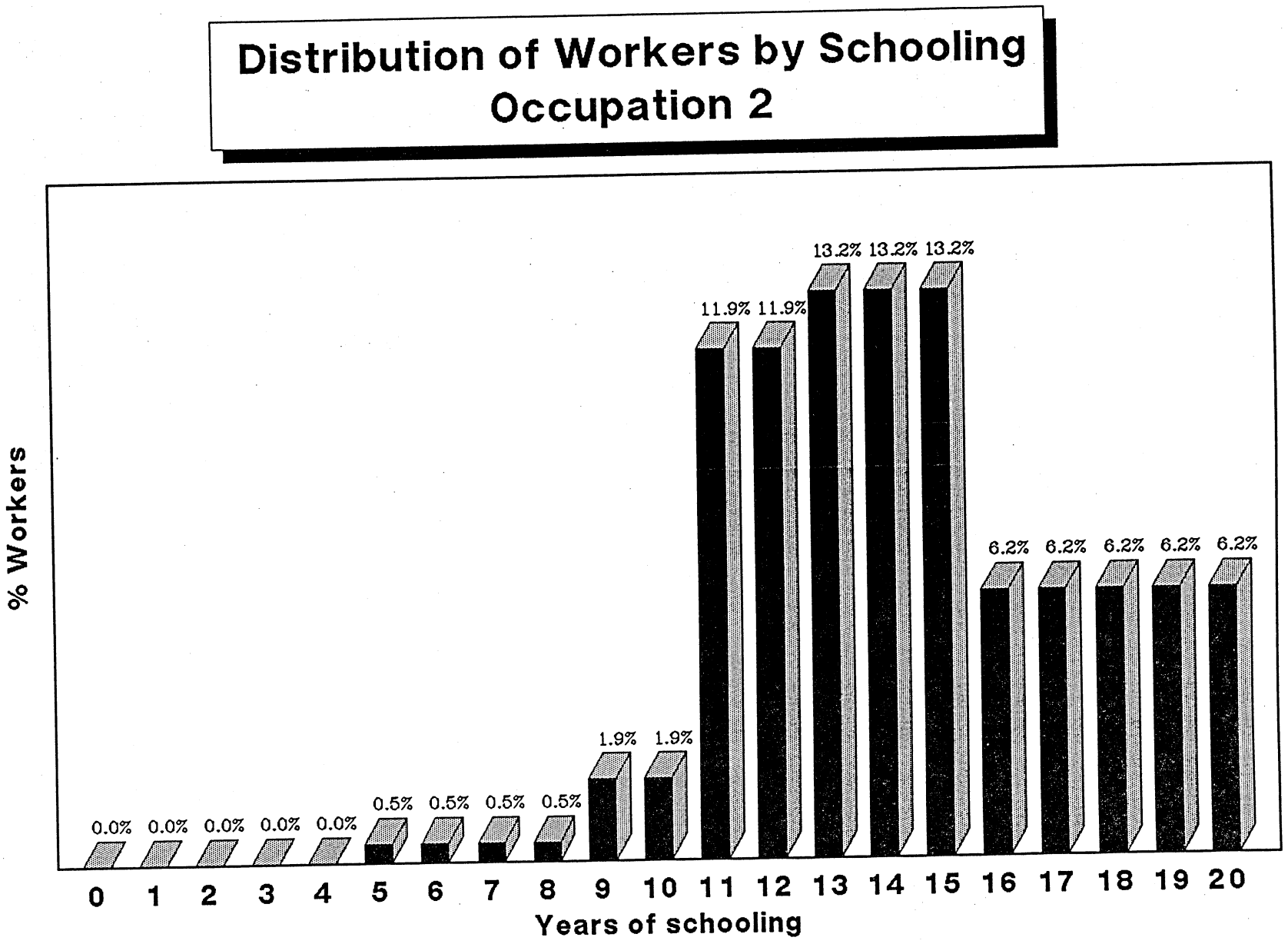
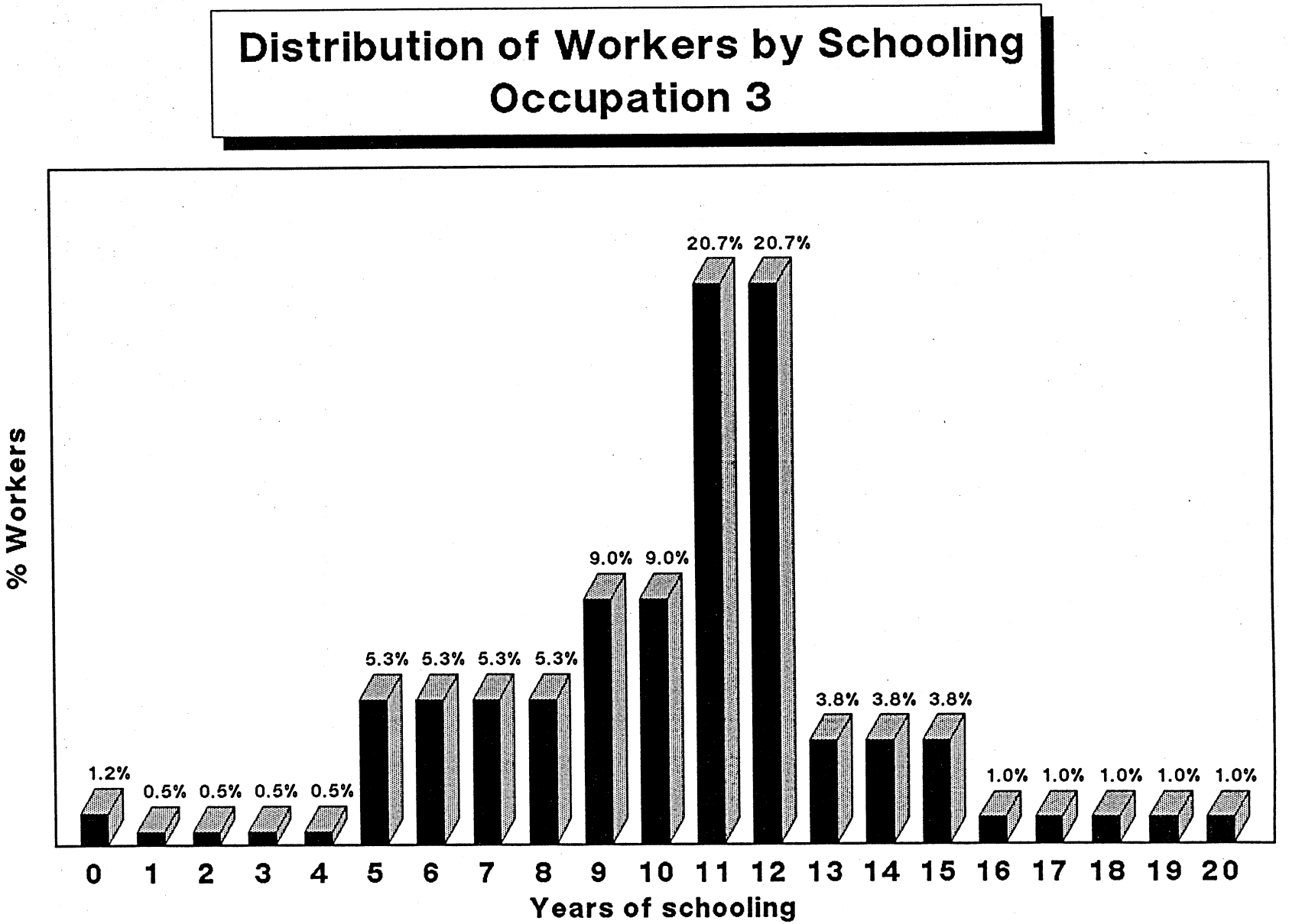

Distribution of Workers by Schooling
Occupation 2
% Workers
0.0% 0.0% 0.0% 0.0% 0.0% 0.5% 0.5% 0.5% 0.5% 1.9% 1.9% 11.9% 11.9% 13.2% 13.2% 13.2% 6.2% 6.2% 6.2% 6.2% 6.2%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years of schooling

figure 2c


Distribution of Workers by Schooling
Occupation 3
% Workers
1.2%
0.5%
0.5%
0.5%
0.5%
5.3%
5.3%
5.3%
5.3%
9.0%
9.0%
20.7%
20.7%
3.8%
3.8%
3.8%
1.0%
1.0%
1.0%
1.0%
1.0%
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Years of schooling

The exit rate of person i who chose to search in occupation j from the unemployment state is

$$(15) \quad \gamma_{ij} = \lambda_{ij} \sum_{r_{ij}}^{i} p_j(s),$$

where, $p_j(s)$ is the discrete frequency of jobs requiring s years of schooling in occupation j.

The likelihood of observing that i found a first job in occupation j after τ_i months of search (unemployment) is

$$(16) \quad l_{ij} = \gamma_{ij}(1-\gamma_{ij})^{\tau_i}.$$

The likelihood that a person searched throughout his period of stay in Israel, T_i without finding a job is

$$(17) \quad l_i = \sum_j g_{ij}(1-\gamma_{ij})^{T_i}.$$

We then form the log likelihood of the whole sample and search numerically for the parameters which maximize it.

Having estimated the model parameters, we can calculate for each immigrant in the sample the arrival rate of job offers, λ_{ij}, the reservation level of schooling, r_{ij}, the value of search V_{ij}, the value of work W_{ij} and the selection probability g_{ij} for each of the potential occupations in Israel.

An immigrant with schooling endowment s_i will accept job offers in

occupation j which fall in the range between r_{ij} and s_i. Consequently, he will generally work at jobs which require less schooling than he possesses. His expected loss, given that he found a job in occupation j, is

$$(18) \quad LS_j(s_i) = \sum_{r}^{s_i} p_j(s)(s_i - s) \; / \; \sum_{r}^{s_i} p_j(s).$$

The expected loss of schooling, conditioned an finding a job, of an immigrant who comes to Israel is

$$(19) \quad LS(s_i) = \sum_j g_{ij} LS_j(s_i).$$

The expected loss of earnings to the immigrant, implied by the necessity to search and the willingness to compromise for lower quality jobs and occupations is

$$(20) \quad LW_i(s_i) = \sum_j g_{ij}(W_i(s_i) - V_{ij}(s_i))/W_i(s_i).$$

where,

$$(21) \quad W_i(s_i) = \operatorname{Max}_j \; W_{ij}(s_i).$$

If the immigrant can search on the job, then the loss of schooling defined in (19) reflects the initial compromise that he makes on his first job and provides an upper bound on the long run loss. If information on

job transitions is available, one nay incorporate this information in the likelihood to obtain tighter estimates of the parameters.

Results.

Table 3 presents the estimated coefficients of the model. Let us consider first the coefficients of the wage function.

We calibrate the model by selecting as constants the base wages that Israeli workers obtain in each occupation (the base wage is the wage of a worker with no schooling or experience). Compared with this standard, we allow the model to select the wages of immigrants with different observable characteristics. It is important to note that wage data of immigrants is not used in these estimates. The wages are inferred from the selection of occupation in which each immigrant prefers to search, and the waiting times in the unemployment state. To reduce the number of estimated parameters, we restrict the effects of occupational transitions to be the same for all immigrants who stayed in the same occupation, $\sigma_1 = \sigma_2 = \sigma_3$, all immigrants who moved up the occupational scale $\delta_{21} = \delta_{31} = \delta_{32}$, and for all immigrants who moved down, $\delta_{12} = \delta_{13} = \delta_{23}$, irrespective of their occupation in Israel.

An immigrant who finds a job in the same occupation as in the former Soviet Union expect to receive about the same base wage as an Israeli (σ = .017 and is insignificant). An immigrant who worked in occupation k in the Soviet Union and moved up the occupational scale upon moving to Israel (i.e from 2 to 1, 3 to 1 or 3 to 2) receives in occupation j $-1.894*(w_j-w_k)$ less than the base wage of Israeli workers in the same occupation. An immigrant who moved down the occupational scale (i.e from 1 to 2, 1 to 3 or 2 to 3) receives in occupation j $1.107*(w_j-w_k)$ more than the Israeli workers in the same occupation. The base wages implied

Table 3

Parameter Estimates for the Search Model

Parametrs of the wage Function		Estimate	t - Value
w1		7.6290	----
w2		7.3130	----
w3		6.9080	----
sigma1=sigma2=sigama3		.0168	0.79
delta21=delta31=delta32		-1.8938	-8.05
delta12=delta13=delta23		1.1070	33.15
alfa		.0088	6.10
beta		.0299	7.14
gamma		-.0008	----
Parametrs of Arrival Rates			
Occupation:	1	-2.2178	-18.47
	2	-3.2461	-28.27
	3	4.9311	33.77
Age	<= 35	1.6483	13.30
	45 - 36	.6128	5.20
	55 - 46	0	----
Interest rate		.025	----
Unemployment benefit		500	
Log Likelihood		-3.27682	----
N		469	----

by the estimated coefficients $\delta_{kj}(w_k - w_k)$ are represented in Table 4. As seen, all immigrants expect to receive in Israel a higher base wage if they move to the low skill sector rather than stay in their original occupation, or move up in the occupational scale. However, given the occupation in Israel, immigrants who worked in high skill occupations in the former U.S.S.R. receive a wage premium.

The Israeli market pay immigrants a very low premium for their schooling and only a moderate return for their experience in the U.S.S.R. (α = 0.0088 and β = 0.03). Consequently, when one compares the predicted wages of immigrants and Israelis, taking into account their education and experience, the wages of immigrants in occupation 1 and 2 are substantially lower (see Table 5). The expected wages of immigrants, inferred from their search policy, fit reasonably well the observed wages of stayers who worked in the same type of occupation in Israel as in the U.S.S.R.. However, for movers we see noticeable differences, in particular immigrants who worked in academia in Russia and move to the low skill sector, expect a wage which twice as high as the wage they receive at the time of the survey, and also exceeds the wages of Israeli workers. Most likely, these immigrants expect to move upwards in the occupational ladder later on.

The estimated arrival rate of job offers differ substantially by age and by occupation. As seen in Table 6, the monthly probability of receiving a job offer is close to 1 in the low skill occupation for all age groups. In the two high skill occupations the monthly probabilities of a job offers are .23 for scientists and academicians and only .10 for technical workers, teachers and artists. In the high skill occupations the probabilities decline sharply with age.

The interest rate and the unemployment benefits were estimated by a grid method, varying each parameter over a relevant range and picking the

Table 4

Estimated Base Wages of Immigrants and Israeli Workers * (Shekels)

Immigrents

Occupation in Israel	Israeli Workers	Occupation in the Former U.S.S.R 1	2	3
1	2,057	2,092	1,131	525
2	1,500	2,128	1,525	696
3	1,000	2,222	1,566	1,017

* base wages are the wages for a worker with no schooling and no experience

Table 6

Estimated Monthly Probability of Job Offers by Age of Immigration and Occupation in Israel

Occupation in Israel

Age group	1	2	3
<= 35	.36	.17	.999
36 - 45	.17	.07	.996
46 - 55	.10	.04	.993
All	.23	.10	.996

value which maximizes the likelihood. Both estimates seem plausible.[11]

Having summarized the market conditions faced by the immigrants, we now turn to their choices. In Table 7 we present the reservation levels of schooling chosen by subgroups of the immigrants classified by schooling, age and occupation in the former Soviet Union. We also present the implied probabilities that an immigrant will match a job in each of the three possible occupations in which he searches and the probability that a particular occupation will be selected. Generally, the reservation level of schooling is increasing with the level of schooling, declines with age and is higher for immigrants who worked in occupations 1 and 2 in the former Soviet Union. In each subgroup, the immigrants select a higher reservation value for occupation 3. Since jobs requiring high levels of schooling are relatively rare in occupation 3 (see Figures 1a to 1c) such a policy implies relatively low match probability in this sector. Immigrants can afford to be more choosy with respect to jobs in the low skill occupations because of the higher arrival rate of job offers (see Table 6). The combined effects of high arrival rate and high expected wages (see Table 4) make occupation 3 the most attractive option for most immigrants. For the wholes sample, the probability that an immigrant will select to search in occupation 3 is .69 while it is only .11 and .20 for occupations 1 and 2, respectively. Immigrants with low level of schooling, who are old and who worked in occupation 3 in the former Soviet Union have a higher propensity to search in occupation 3.

In Table 8 we present the consequences of these individual choices to

[11] During the sample period the unemployment benefit for an immigrant with no prior work experience in Israel was 578, 868 and 1012 Shekels for single, married and married with one child, respectively. Only 35 immigrants in our sample reported an unemployment benefit, ranging from 90 to 1,500 Shekels per month, with an average of 903 Shekels.

Table 7

Components of Search Policy of Immigrants by Schooling, Age and Occupation in Former U.S.S.R

Years of schooling	Number of Observation	Years of schooling *	Reservation schooling *			Match probability *			Selection probability *		
			1	2	3	1	2	3	1	2	3
0 - 7	5	6.6	4.0	0	5.4	.09	.01	.10	.07	.08	.85
8 - 11	56	10.2	4.3	2.2	9.6	.07	.10	.19	.03	.08	.89
12 - 15	224	14.0	9.8	9.2	12.5	.21	.50	.18	.08	.21	.71
16+	184	17.1	13.8	10.5	13.4	.43	.72	.12	.17	.23	.60
Age groups:											
<=35	180	14.2	11.3	10.4	12.3	.20	.40	.17	0.10	0.23	0.67
36 - 45	184	14.9	10.4	8.4	12.5	.29	.59	.15	0.11	0.19	0.70
46 - 55	105	15.4	10.0	6.6	12.6	.38	.65	.14	0.12	0.17	0.71
Occupation in U.S.S.R:											
1	210	16.1	11.9	9.7	13.1	.37	.66	.13	0.21	0.20	0.59
2	123	14.7	10.2	8.8	12.5	.27	.53	.16	0.03	0.32	0.65
3	127	12.5	8.8	7.0	11.3	.14	.33	.20	0.03	0.08	0.89
whole sample	469	14.7	10.6	8.8	12.4	.28	.53	.16	0.11	0.20	0.69

* In each cell we present the average quantity for immigrants in the cell.

the expected duration of unemployment, the expected loss of years of schooling and the expected loss of earning power. The expected durations of unemployment are quite long, 24 months in occupation 1, 26 months in occupation 2 and 7 months in occupation 3, for the whole sample. Because of the presence of incomplete spells in the data, these expectations exceed the average completed unemployment spells in the sample which are 9.3, 6.3 and 4.9 months in occupations 1, 2 and 3, respectively. As one would expect, the duration of unemployment is substantially longer if one searches in the high skill occupations. Averaging over the three search option, using the selection probabilities in Table 7, we see that the expected duration of unemployment rises with age and, except for the workers with little schooling, tend to increase with schooling. This contrasts with the usual pattern of lower unemployment rate for higher levels of schooling among all Israeli workers. This discrepancy reflects the special circumstances faced by immigrants who must start afresh in a new labor market.

The immigrant's optimal search policy is to accept, within some reasonable range, jobs which require less skill than he actually possesses. This policy implies a loss of years of schooling. The loss of schooling depends on the distribution of job offers and the expected gains from continued search. Consider, for example, the highly educated immigrants in the group 16+. One can see that, on the average, they select similar reservation levels for schooling, if they search in occupation 1 or in occupation 3 (13.8 and 13.4 years, respectively). Since in occupation 3 "good jobs" are relatively scarce, the probability of finding a match is much smaller than in occupation 1 (.12 and .43, respectively). However, conditioned on finding a job, the expected loss in years of schooling is noticeably higher, 2.42 years in occupation 3 vs 1.33 in occupation 1.

Table 8

Expected Loss of Schooling, Expected Duration of Unemployment and Expected Loss of Wages

Years of schooling	Number of Observation	Years of schooling (1)	Expected loss of Years of Schooling (1) 1	2	3	Average expected loss (2)	Duration of Unemployment (1) (Months) 1	2	3	Average Duration (2)	Average loss of wages (%) (2)	Average Return to Schooling (2)
0 - 7	5	6.6	0.86	0.97	0.45	0.53	50.00	50.00	10.75	16.79	9.37	0.010
8 - 11	56	10.2	1.66	1.17	0.32	0.42	45.03	45.63	5.47	9.72	4.98	0.009
12 - 15	224	14.0	1.40	1.51	0.94	1.10	26.05	24.69	6.50	10.77	5.37	0.007
16+	184	17.1	1.33	3.25	2.42	2.40	14.78	21.67	8.64	12.21	6.55	0.005
Age groups:												
<=35	180	14.2	1.15	1.45	1.15	1.15	19.55	18.18	6.76	9.03	5.43	0.007
36 - 45	184	14.9	1.45	2.39	1.51	1.62	25.09	27.17	7.38	11.50	5.67	0.007
46 - 55	105	15.4	1.74	2.92	1.82	1.98	30.40	38.59	7.91	14.72	6.78	0.007
Occupation in U.S.S.R:												
1	210	16.1	1.45	2.70	1.88	1.90	17.28	22.16	8.25	12.24	5.99	0.007
2	123	14.7	1.46	2.11	1.41	1.61	22.29	24.58	7.25	12.14	5.10	0.007
3	127	12.5	1.30	1.35	0.79	0.84	37.25	35.32	5.75	9.09	6.17	0.006
whole sample	469	14.7	1.40	2.15	1.44	1.52	24.15	26.28	7.26	11.28	5.83	0.007

1) In each cell we present the average quantity of immigrants in the cell.

2) For each immigrant we first average over all occupations, using the selection probabilities in table 7, we then average over all immigrants in the cell.

Averaging over the three search options, using the selection probabilities in Table 7, we see that the expected loss of years of schooling tend to increase with schooling and age and is higher for immigrants who worked in occupation 1 in the former Soviet Union.

The over all impact of the immigrant's search policy is summarized in the value of his search policy. This value reflects not only the expected duration of unemployment and the loss of years of schooling but also the cost of these losses in terms of lost wages. We have calculated these values as part of our estimation procedure and can compare them to the wages that the immigrant would have received, would he find a job immediately at the occupation of his choice, using his educational endowment, s_i, to its full extent. The relative difference between the value of search and the maximal value of work is presented in the last column of Table 8. For the whole sample, immigrants lose about 6 percent of their earning capacity as a consequence of not finding a job immediately and of compromising by accepting jobs with low schooling requirements. The relative wage loss tends to increase with age and schooling, except at the lower levels.

The average return from schooling, defined as the relative impact of an additional year of schooling on the expected value of search in the Israeli job market, is extremely low, less than one percent (see the last column of Table 8). This result is influenced by the previously mentioned low returns for schooling in production, i.e. a low α, but it is conceptually separate, incorporating search parameters as well. Taken together, the two findings indicate that in the short run, additional education is of little use to the immigrants in the Israeli labor market.[12]

[12] It may be noted that if, instead of inferring the rate of return from the search policy, one uses the wage information in the data, the estimated rate of return for schooling which immigrants obtain in Israel is practically zero.

It is not clear whether this low rate of return indicates that immigrants have skills which are of little value for the Israeli labor market, or is a reflection of the adjustment process. We hope to address this issue in future research.

We have also examined the role of knowledge of Hebrew in determining labor market outcomes of immigrants, a question which received some attention in the literature (see Chiswick [1992]). Reestimating the full model, we found that knowledge of Hebrew has a positive impact on the rate of arrival of jobs offers. However, the coefficients are not statistically significant. We therefore do not maintain these variables in the estimated model. Knowledge of Hebrew is generally positively correlated with variables included in the model. Using simple linear regressions, we find that the estimated arrival rate of job offers, λ_{ij}, is positively and significantly affected by knowledge of Hebrew, especially in the high skill occupation, occupation 1. Similar results hold for the expected wage in each occupation. Consequently, the probability of selecting the high skill occupation, g_{i1}, is increasing with knowledge of Hebrew.

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Appendix A

Occupational Distribution Of All Immigrants and of Males From the Former U.S.S.R. (1990 - 1992)

(% of Total Workers abroad)

Ocuppations: Occupation 1:	Precent of All Workers	Precent of Male Workers
Scientific and academic workers, Managers:	41.1%	39.7%
Academic workers in life sciences and natural sciences	1.6%	1.5%
Engineers and architects	24.0%	29.8%
Medical doctors, dentists and dental therapists	5.2%	4.2%
Pharmacists and veterinarians	0.6%	0.2%
Jurists, academic social sciences and humanities workers	5.0%	3.1%
Teachers in higher education institution, in secondary and post secondery institutions	0.4%	0.2%
Managers and clerical workes	4.3%	0.7%

Occupation 2:	Precent of All Workers	Precent of Male workers *
Other professional, technical and related workers:	33.8%	26.6%
Teachers and principals in kindergartens, primary and intermediate schools	9.8%	3.2%
Authors, artists, composers and journalists	4.8%	4.9%
Nurses and para-medical workers	4.5%	1.2%
Physical sciences technicians, engineering technicians and practical engineers, systems analysys and computer programmers	11.5%	13.5%
Other professinal and technical workers	3.2%	3.8%
Occupation 3:		
Other:	25.1%	33.7%
Sales workers	2.5%	1.3%
Service workers	3.9%	2.4%
Agricultural workers	0.01%	0.1%
Skilled workers in industry, mining, transport and building	14.5%	24.1%
Unskilled workers	4.2%	5.8%

Source: Central Bureau of Statistics.

* Classification by occupation is avaliable for all years. However, the classification by sex and occupation is available only for 1992. To construct estimate for 1990 and 1991, we assume that the proportion of males in each occupation was the same as in 1992.

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