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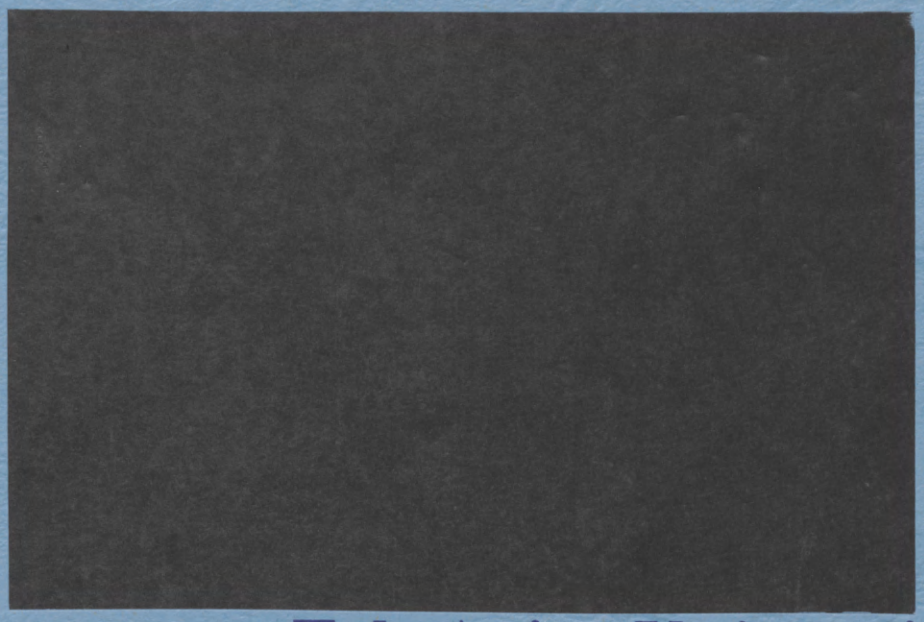

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IMMIGRATION, SEARCH AND LOSS OF SKILL

by

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1 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 which 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 three 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 USSR 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 452 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 jobs vary by skill requirements.

[1]For further details, see Flug and Kasir [1993]. Some downgrading of skills was also observed amongst immigrants who came from the USSR 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].)

To simplify, we consider a "job hierarchy"[2] where, in each occupation, 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 requirements which are the same or higher than his, or in a "low skill" occupation where most jobs have schooling requirements which are lower than his. If he searches in the "high skill" occupations then he may find a suitable job which fully exploits his skill, but he will need to wait a long time to find such a job, since most firms he meets will reject him as unqualified and because job offers may arrive at a slower rate. If he searches in the "low skill" occupation then he can 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, and the wages which they received on their first job, to estimate parameters of the job offers and of the arrival rates of job offers in different occupations, assuming that workers follow the search strategy outlined above. From these estimates we infer their expected loss of schooling. The estimated expected loss of years of schooling is 1.9 years, or 13 percent of the immigrants' average years of formal schooling (14.7). About 38 percent 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 also because firms relax their hiring standards.

this loss is due to the search for a first job. The remainder is due to the compromises that immigrants make in accepting job offers. The associated loss in wages is 9.5 percent per year.

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.[3] 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.[4] These losses occur because workers with a predetermined level of schooling find themselves with no jobs, and are willing to compromise and accept jobs with schooling requirements below their schooling endowment.

2 Labor Market Conditions

The loss of skill by recent immigrants is influenced by two interacting factors: the skills which they acquired abroad and local market conditions in Israel. Our main concern in

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

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

this paper is the first factor, specifically, the impact of schooling and former occupation on the labor market choices of the recent immigrants from the former Soviet Union. However, to put these choices in their proper context, we first describe the aggregate labor market conditions in Israel at the time of the immigration wave.

During the three-year period 1990-1992, a total of 205 thousand workers, of whom 75 percent were highly skilled, entered Israel. Because of its size and composition skill, the recent immigration from the former USSR created severe imbalances in the Israeli labor market. As can be seen by the figures in Table 1, absorption of all immigrants in the same type of occupation as their country of origin, requires that the stock of workers in the high skill occupations in categories 1 and 2 would increase by 41 and 28 percent, respectively, within 3 years. Clearly, such growth rates in employment cannot be accomplished without a substantial decline in wages. However, wages in Israel, especially in the public sector which employs many of the high skill workers, are not very flexible. Real wages in the public sector have increased slightly during the period 1990-1993, and in 1994 there was a marked increase of 10 percent. Over the period 1989-1994, wages in the public sector increased by 13 percent. In contrast, real wages in the private sector declined by 7 percent. It should also be noted that at the start of the immigration wave (late 1989), the unemployment rate in Israel was quite high, about 9 percent.

The initially high unemployment, combined with wage rigidities, caused substantial unemployment among immigrants. The average rates of unemployment among immigrants were 29.3 in 1990, 38.5 in 1991 and 28.4 in 1992. (During the same period, unemployment of veterans stayed at a stable level of 9 percent). However, unemployment among immigrants tends to decline quickly with their length of stay in Israel and after three years the unemployment rates dropped to 14 percent (see Panel B of Table 1).

Immigrants who found jobs were paid wages substantially below those of comparable

TABLE 1

Labor Market Characteristics of Israeli Workers and Employed Immigrants from the Former U.S.S.R.

Panel A: Occupational Distribution

Occupation	All Israeli Workers		Immigrants from the U.S.S.R.	
	Thousands	%	Thousands	%
1	204.7	13.7	84.2	41.1
2	244.2	16.4	69.3	33.8
3	1043.0	69.9	51.4	25.1
All	1491.9	100.00	204.9	100.00

Source: C.B.S. Labor Force Surveys and Appendix - Table 1.

Panel B: Unemployment by Schooling Level

(%)

Years of	All Israeli Workers	Immigrants from the U.S.S.R.	
		1990 cohort	1992 cohort
0-12	11.6	14.2	25.0
13-15	7.1	15.6	24.6
16+	3.8	13.8	32.9

Source: C.B.S. Labor Force Surveys and Immigration to Israel Surveys, 1990, 1992.

Panel C: Wages by Schooling Level

Years of	All Israeli Workers	Immigrants from the U.S.S.R.
0-12	2402	1588
13-15	2915	1770
16+	4252	2028
All	2872	1796

Source: C.B.S. Income Survey and Immigration Employment Surveys 1992, 1993.

Panel D: Wages by Occupation of Male Workers, Age 25+, 1993

Occupation	Israeli Workers	Recent Immigrants from the U.S.S.R. Year of Arrival > 1988
1	6467	3189
2	4573	2882
3	3284	2142
All	4275	2338

Source: C.B.S. Income Survey.

Israelis (see Panels C and D of Table 1). Among the highly educated, initial wages are less than half of the wages of comparable Israelis. This wage pattern is, in part, a reflection of occupational downgrading whereby immigrants accept work in jobs and occupations which require relatively less skill than the amount of skill which they possess.

The extent of the occupational downgrading can be seen in Table 2, which describes the occupational distribution for those immigrants who found employment in Israel within a period of 30 months, from a cohort of immigrants who arrived in 1990, by their occupation in the former Soviet Union. As seen, among the immigrants who were employed in high skill occupations in the former USSR, only 29.6 percent found jobs at the same occupational level with about 61 percent employed in low skill occupations. A similar pattern of downgrading is observed among those who worked in the former USSR in the second occupational category (i.e., technicians and professionals).

A major research question is whether, and to what extent, will these initial tendencies last. To address this question, one must distinguish between the process of the immigrant's absorption at given market conditions and changes over time in general market conditions.

Some indication of the individual absorption processes is provided by cross section data, where immigrants with different length of stay in Israel are observed. Figure 1 displays two simulated age-earning profiles, which summarize the absorption path implicit in a 1993 cross section.[5] The lower graph simulates the age-earnings profile of an immigrant who came to Israel at age 32 with 16.7 years of schooling (the average age and schooling of immigrants who work in occupation 1) and spent 5 years in occupation 3, switching later to occupation 1. The upper graph describes the age-earning profile of a (6 years younger) Israeli who has the same schooling and the same experience in Israel. As seen, the immigrant narrows the

[5]The data source is the 1993 Income Survey. The graphs are based on regressions 1 and 2 in Appendix Table 4.

TABLE 2

Occupational Distribution of Immigrants Employed in Israel in 1993, by Occupation in the Former U.S.S.R.

1990 Cohort

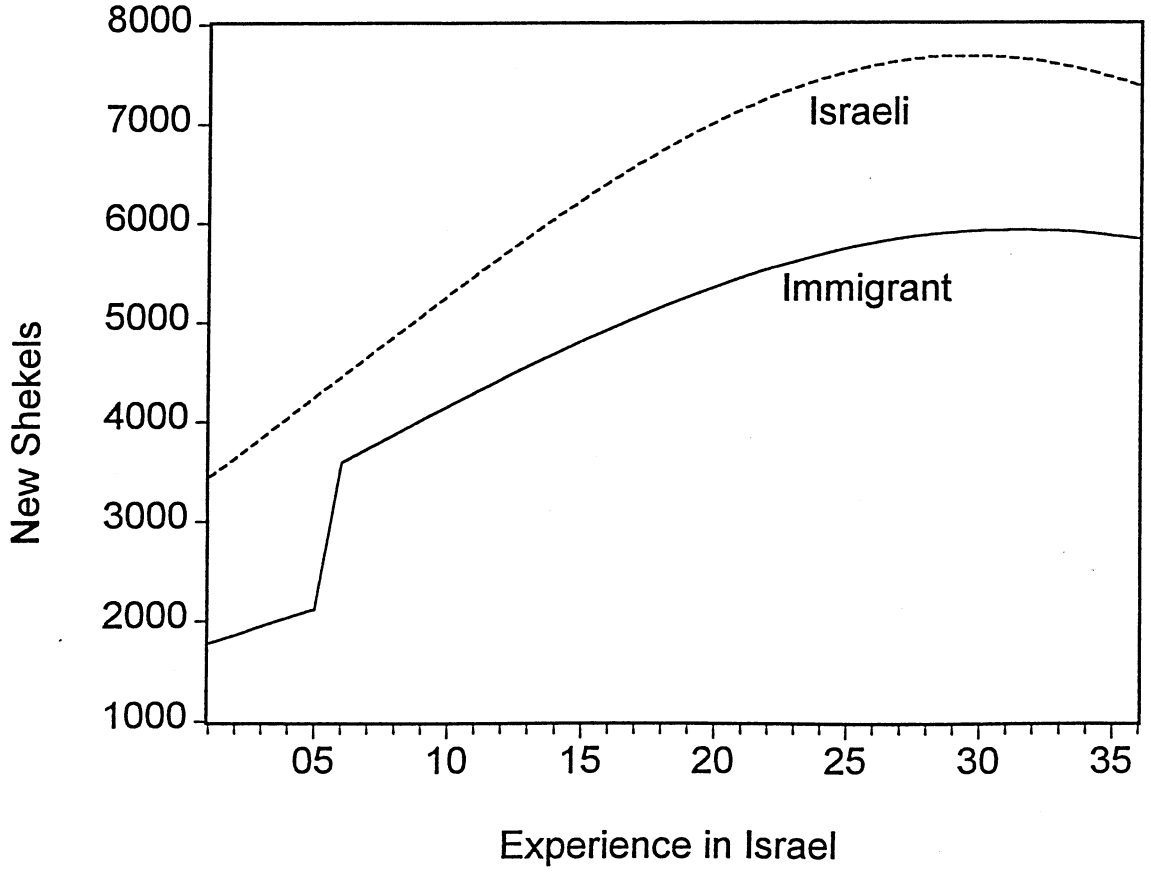
(%)

	Occupation in the Former U.S.S.R.		
Occupation in Israel	1	2	3
1	29.6	7.7	3.6
2	9.5	23.1	4.0
3	60.9	69.2	92.4
All	100.0	100.0	100.0

Source: C.B.S. Immigration Employment Survey 1993.

Figure 1:

Simulated Age-Earning Profiles of an Israeli Worker and an Immigrant from the U.S.S.R.



gap but does not catch up with the Israeli worker[6].

It is much more difficult to predict the market adjustment process that will follow the current immigration wave. Because of the exceptional size and composition of the current wave, it is unlikely that all immigrants will eventually find jobs in their original occupation. Therefore, compared with previous waves, one would expect to see a slower and only partial convergence towards the wages of Israeli workers.

3 The Model

In this section we construct a simple search model which will serve for the analysis of waiting times for the first full time job and for the estimation of the loss of skill by immigrants.[7]

Consider an economy in which workers vary in their schooling endowments and jobs vary in their **minimal** schooling requirements. Each job can employ at the 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 each qualified applicant will receive.

[6]Similar comparisons, for earlier cross sections are made by Friedberg [1995] and Flug et al. [1992]. In all cross sections, one finds a fairly strong effect for the early years since immigration. The extent of convergence is sensitive to functional specification.

[7]The model combines elements of search models with search on the job (Burdett [1978], Mortensen [1986, section 3], Heckman and Flinn [1982] and Miller [1984]). The main distinctive feature of our model is that workers of different skills 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 skill.

Different jobs, with different schooling requirements, pay different wages but any qualified worker who is employed on a given job receives a constant wage, irrespective of his actual level of schooling (see Figure 2).

Given the assumption that firms pay the whole product in wages, there is no motivation on the part of the firm for search. 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.

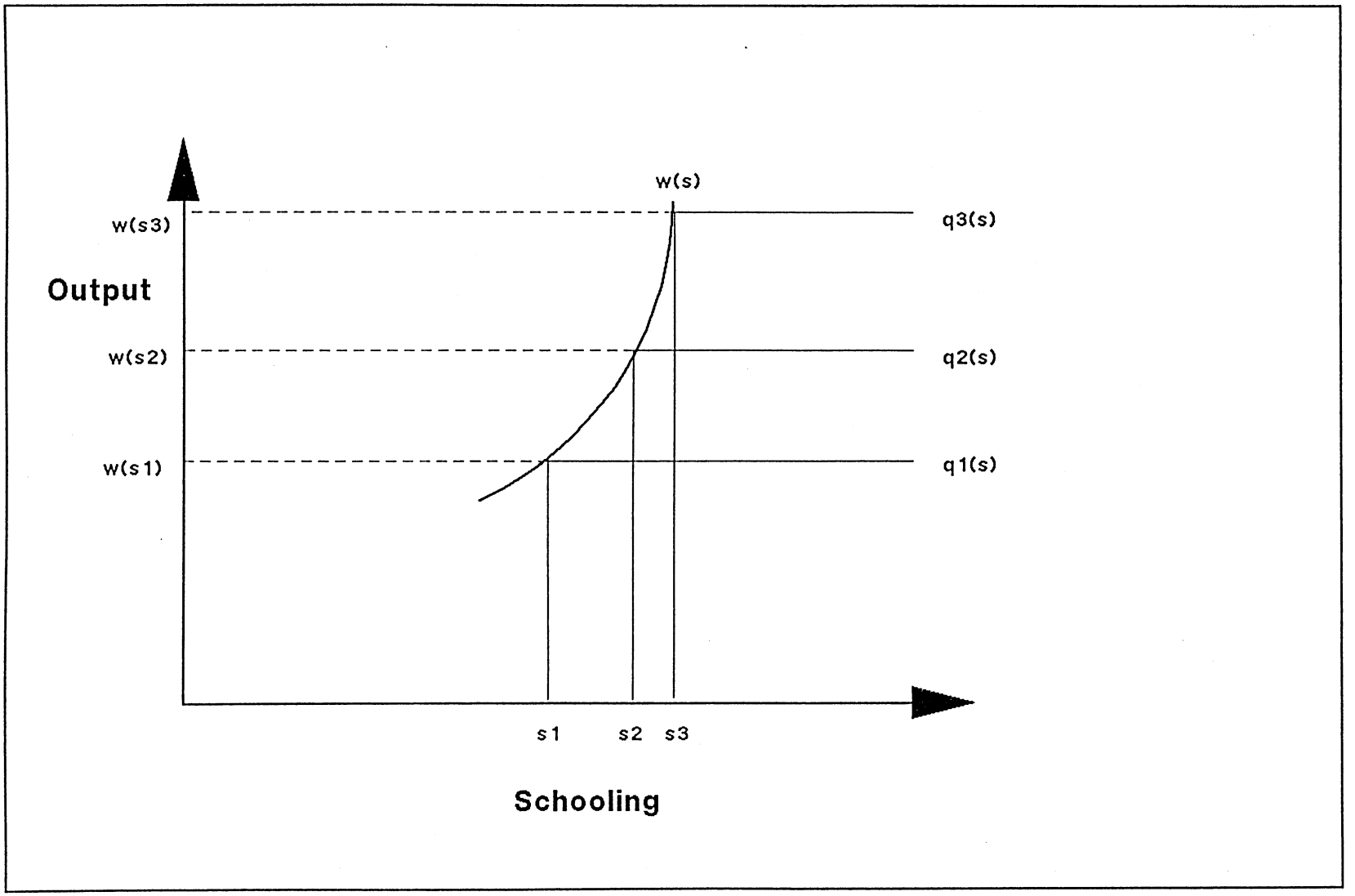
Workers meet employers randomly and receive job offers. A job offer consists of a schooling requirement, s, and an associated wage offer $w(s)$. To simplify notation, and in accordance with the empirical implementation, we take the set of job offers to be finite. That is, s ϵ {0,1,....S), where S is the maximal feasible level of schooling. If the drawn offer requires s which exceeds the worker's schooling endowment, 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 or equal to 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.

The arrival rate of job offers and the offered wage at a given level of schooling generally depend on the worker's characteristics and the occupation at which he searches. We use an index $i, i = 1, 2, ..., I$, to indicate each individual and an index j, $j = 1, 2, ..., J$, 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, at the maximal intensity. Finally, $p_j(s)$ indicates the probability of obtaining a job offer, requiring s years of schooling in occupation j.

We assume that, at any given period, one can search in only one occupation. We allow workers to search on the job as well as when unemployed. A worker who selects a

figure 2

Output and Wages as Functions of Schooling in Different Jobs



search intensity, τ, $0 \leq \tau \leq 1$, obtains offers in occupation j at the rate $\tau\lambda_{ij}$. The costs of search depend on whether or not the worker is employed. A worker who is employed in job s in occupation j and who searches at a rate τ forgoes a part of his wage given by $\kappa_j \tau w_{ij}(s)$, where, κ_j, $0 \leq \kappa_j < 1$ is a parameter which may depend on the occupation in which the immigrant works. An unemployed worker has no costs of search. The linear search technology implies that a worker will either search at the maximal rate, $\tau = 1$, or not at all, $\tau = 0$. Thus, we can omit the search intensity variable, τ, and simply ask whether or not the worker searches.

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, that is independent of time. We denote by $W_{ij}(s)$ the value of having a job s in occupation j and by V_i the value of being unemployed. We can also define conditional value functions which describe the value of being in a particular state and pursuing a particular policy. Specifically, let $W_{ij}^k(s)$ denote the value of being employed in job s in occupation j, while searching for job offers in occupation k. Let $W_{ij}^0(s)$ be the value of being employed in job s in occupation j and not searching. Similarly, let V_i^j denote the value for a person i, of being unemployed and searching for job in occupation j, and let V_i^0 be the value of being unemployed and not searching. These values can be calculated recursively. One first finds the values of being employed and then derives the value of searching for a job.

The values of being employed conditioned on not searching, is simply the discounted present value of the infinite wage stream. Thus,

$$W_{ij}^0(s) = w_{ij}(s)(1+\rho)/\rho, \tag{1}$$

where ρ is the monthly interest rate.

The value of having a job s in occupation j, while searching in occupation k, is given by

$$W_{ij}^{k}(s) = \underset{r \leq s_i}{Max} \frac{w_{ij}(s)(1-\kappa_j)(1+\rho) + \lambda_{ik} \sum_{r}^{s_i} p_k(x) W_{ik}(x)}{\rho + \lambda_{ik} \sum_{r}^{s_i} p_k(x)}, \tag{2}$$

where

$$W_{ij}(s) = \underset{k}{Max}\, W_{ij}^{k}(s),\ k \in \{0, 1, ..., J\}. \tag{3}$$

Equations (1), (2) and (3) form a system of simultaneous equations, which can be solved for the unknown value of each job. Associated with this solution is a set of reservation values and implied transition probabilities across states. Equation (2) presupposes that the search policy is characterized by a reservation rule, $r_{ij}^{k}(s)$, such that the worker accepts all offers in which the job requirement exceeds $r_{ij}^{k}(s)$, and rejects all offers with $s < r_{ij}^{k}(s)$. This characterization is justified because the value of being employed in a particular job increases monotonically with the job requirement. (Recall that, in each occupation, a higher wage is associated with a higher job requirement). The value of the optimal search policy is found by selecting the best reservation value.

A worker who works in job s in occuaption j will search on the job only if $W_{ij}^{k}(s) \geq W_{ij}^{0}(s)$ for some k, k>0. This requirement is equivalent to the requirement that

$$\lambda_{ik} \sum_{r}^{s_i} p_k(x)(W_{ik}(x) - (1+\rho)w_{ij}(s)/\rho)) \geq \kappa_j(1+\rho)w_{ij}(s). \tag{4}$$

The left-hand-side of (4) is the expected marginal benefit from increased search intensity, and is evaluated at the optimal reservation value for r. The right-hand-side of (4) is the marginal cost in terms of forgone earnings. From this comparison it is seen that the possible reasons for **not** searching in k are: a slow arrival rate of job offers, i.e., a low λ_{ik}, a low probability of a match indicated by an offer distribution which has most of its weight

above s_i, a low potential gain indicated by a small difference in wages between the current job and potential jobs and high opportunity costs of search, indicated by a high value for κ_j.

The process of transitions from any given first job that the immigrant selects to the next one has two general features which are very appealing. The first feature is that the direction of transitions always involves an improvement in wages. This is a direct outcome of the assumption that the arrival rate of offers depend only on the person's 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 feature is that at some point a worker does not find it profitable to search any more. As can be seen in condition (4), if the costs of search are positive, $\kappa_j > 0$, then a worker who is employed at an s close to s_i, and at an occupation where his wage, given s_i, is maximized, has no incentive to move.

An unemployed immigrant who searches for his first job in occupation j expects to obtain

$$V_i^j = \underset{r \leq s_i}{Max} \frac{b(1+\rho) + \lambda_{ij} \sum_r^{s_i} p_j(x) W_{ij}(x)}{\rho + \lambda_{ij} \sum_r^{s_i} p_j(x)}, \tag{5}$$

where b is the monthly unemployment benefit. Again, because of the monotonicity of $W_{ij}(x)$, the search policy consists of a reservation rule, such that the worker rejects all job offers with $s < r_{ij}$, and accepts all other job offers. The immigrant will choose a reservation value r_{ij}, which maximizes the value of search.

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

$$\gamma_{ij} = \lambda_{ij} \sum_r^{s_i} p_j(x). \tag{6}$$

Assuming that $w_{ij}(s_i) > b$, it is easy to show that $V_i^j > V_i^0 = b(1+\rho)/\rho$ and,

therefore, it is always optimal to search in the unemployed state. Moreover, V_i^j is increasing in s_i. With the option of search on the job, $W_{ij}(s)$ also increases with s_i, for any given s. Therefore, the effect of s_i on the reservation rule is, in general, ambiguous. However, if the worker does not search on the job, then he will choose a higher reservation value and reject more job offers, the higher is his schooling endowment.

A highly educated immigrant, with high s_i, will not necessarily search in occupations with a high proportion of high skill jobs. He may maximize the value of his search by selecting an occupation with many job 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 feasibility of search on the job provides the immigrant with the option to first work in a low skill occupation and then switch to a high skilled occupation when the opportunity arises. 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.

The process of absorption into the Israeli labor market is not only a matter of search but also a process of learning whereby new immigrants acquire local skills such as language and familiarity with local institutions. The process of acquisition of local human capital can be added into the stationary framework of the model in the following way. At each point of time after he started on his first job in Israel, the immigrant can experience an increase in his wage according to Poisson process with a fixed arrival rate. This process is independent of the occupation or type of job and represents a pure "experience in Israel" effect. In addition, acquisition of local capital is likely to increase with the number of jobs that the immigrant has experienced in Israel. We assume, therefore, that an immigrant worker who already had a job, can get some premium if he switches to a new job. The consequences of these two modifications are that the immigrant has an added incentive to exit from unemployment and

to enter the job ladder at a relatively low rung, where the chances of finding a job are high.[8]

4 Data and Empirical Implementation

The focus of this study is on the early decisions taken by immigrants under the adverse labor market conditions described in Section 2. In particular, we analyze the duration up to the first full-time job acquired in Israel and the occupation in which this job was obtained. We assume that immigrants follow the search policy described in Section 1 and estimate the parameters of the model. This section describes the data and statistical methods used to estimate the model.

4.1 The Data

The main data source for this study is a survey conducted by the Brookdale Institute in April-August 1992, which interviewed 1203 immigrants who had recently arrived from the former Soviet Union. The current analysis is restricted to a sub-sample of 452 males whose age falls in the range of 25-55. The respondents' length of stay in Israel ranged from 8 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.

The possible educational levels are represented by years of schooling ranging from

[8]The incorporation of the added Poisson process is described in the Appendix. The potential wage raises associated with work experience in Israel, increases the number of possible states and affects the calculations of values for each state. However, because of the assumed neutrality and stationarity, the only effect on the search strategy is to speed up the transition into work. The incorporation of wage premia associated with the number of jobs held in Israel is described in the empirical implementation. This effect is not neutral and provides an incentive to start in occupation 3, switching later to occupation 1 or 2.

0-20. The possible occupations in Israel and the USSR are: 1) scientific and academic occupations, combined with management; 2) other professional occupations, including technical workers, teachers, nurses and artists; 3) all other. This classification is based mainly on the schooling requirements levels. In our sample, the first group mainly includes engineers and physicians. For a more detailed information on the composition of these occupational groupings see Appendix Table 1.

Table 3 describes our sample of male immigrants who are in the 25-55 age group, sub-classified by occupation and work status in the former USSR 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 - 56 and 68 percent, respectively. Note that, despite differences in sample composition, the distribution of employed workers in Table 3 is similar to that of Table 2. For instance, the proportions employed in occupation 3, from all employed immigrants who worked in occupation 1 in the former USSR are 63.8 and 60.9 in the two samples, respectively. In addition to the downgrading of skills, there is a substantial non-employment amongst the immigrants. As seen in Table 3, 11.5 percent of the immigrants did not work in a full-time job since their arrival to Israel (the average length of stay in Israel being 22 months in our sample). The rate of non-employment among immigrants who worked in the high skill occupations in the former USSR is 12.8 percent

Wage information is available only at one point in time, the sample date. These wage data are used only if the job at sample date is the same as the first full-time job. Although we have no direct information on future wages, we make some predictions based on a cross section of 501 immigrants from the former Soviet Union who were employed in Israel in 1993. Since respondents in this sample vary in the length of their stay in Israel, we can estimate the effect of time in Israel. Some descriptive regressions from these sample are provided in

TABLE 3

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

	Occupation in the Former U.S.S.R.		
Occupation in Israel	1	2	3
1	40	5	0
2	24	18	2
3	113	84	114
Employed	177	107	116
Unemployed	26	16	10
Total	203	123	126

Appendix Table 4. These regressions indicate quite strong effects for the time spent in the Israeli labor market. For instance, an increase in experience in Israel by one year, holding total experience constant, raises wages by about 3 percent.

4.2 Implementation of the Model

Job offers are characterized by two parameters: a minimal schooling requirement, s, and an associated wage. The actual job offer that the worker receives is unobserved, but we assume a known distribution which generates these offers. Specifically, random values of s are drawn from a probability distribution which is the same as the empirical distribution of employed workers by level of schooling in each occupation (see Appendix Table 2). The initial wage associated with any particular s is given by

$$w_{ij}(s) = w_{ij}e^{\alpha_j s}, \tag{7}$$

where w_{ij} is the initial wage that an immigrant can obtain in occupation j, for a job which requires no schooling. The parameter α_j may be interpreted as the rate-of-return in production for an additional year of schooling for a worker in occupation j.[9]

The initial wage that an immigrant i obtains in occupation j in Israel is determined by the relationship

$$\ln(w_{ij}) = a_0 + a_1 immage_i - a_2 immage_i^2 + a_{3j} english_i, \tag{8}$$

[9]The value of an additional year of schooling to the individual may differ from α_j. In this model, an individual who raises his schooling level from s_i to $s_i + 1$ gains only in the event that he gets an offer requiring $s_i + 1$ years of schooling. Thus, the value of increased schooling depends on the probability of getting such a job offer in each occupation and on the value added, relative to continued search, which can be attained if the job is accepted.

where $immage_i$ is the immigrant's age at survey time and $english_i$ measures the immigrant's knowledge of English.[10] Knowledge of Hebrew is not introduced into the wage equation since all immigrants have access to free Hebrew schools upon entry into the country.

We assume that observed initial wages are noisy measures of the wages that immigrants actually receive, where the error of measurements are normally distributed with zero mean and a variance to be estimated.

Our model uses not only the wages in the immigrant's first job, but also the wage that he expects to get in the future. There are two different processes which govern the development of wages. First, wages change as a result of endogenous transitions across jobs. Although we do not observe these transitions, the model infers the probabilities of such transitions, based on the selection of the first job. We allow the transitions to influence the earning capacity of the individual, reflecting the experience gained from sampling several jobs. Specifically, for immigrants who worked in occupations 1 and 2 in the USSR and who selected to work in Israel in occupation 3, we set their prospective wage in the second job in occupation k, $k = 1, 2$, at a level which is ξ_{3k} higher than the (unobserved) wage that they would get at a first job in these occupations. A second process which is assumed to take place is the acquisition of general local capital which is useful in all jobs, reflecting the increased familiarity of the immigrants with the Israeli job market. This process is captured by a Poisson process whereby the immigrant's future wage is assumed to equal his initial wage for some period of random duration ζ and then to jump by a fixed proportion Δ, where ζ is distributed exponentially with a known parameter δ.

The probability that immigrant i will receive a job offer in occupation j within a

[10]This variable is based on four questions relating to understanding, speaking, reading and writing ability. On each measure there is a score ranging from 1-4, where 1 indicates fluency and 4 indicates no knowledge at all. The variable $english_i$ is the sum of the four scores minus four, ranging from 0-12.

month is assumed to depend on his age, on his occupation in the former USSR and on the knowledge of Hebrew that he possessed upon entry into the country. Specifically,

$$\lambda_{ij} = L(b_j old_i + c_j hebrew_i + \sum_k d_{jk} occ^R_{ik}), \tag{9}$$

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

$$L(x) = e^x/(1+e^x), \tag{10}$$

and

old_i = 1 if the immigrant is over 40, and zero otherwise,

$hebrew_i$ = 1 if the immigrant knew Hebrew at entry, and zero otherwise,

occ^R_{ik} = 1 if the immigrant worked in occupation k in the USSR and *zero* otherwise.

Given the assumed parameters and the information on the job distribution by level of schooling, presented in Appendix Table 2, we use equation (5) 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^j_i. 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.

The calculations of V^j_i requires prior calculation of W^k_{ij}. These calculations are simplified considerably by making prior assumptions on the optimal search pattern. Specifically, we **assume** that an immigrant searches on the job only if his first choice involved a downward move in the occupational scale, and he accepted a job in occupation 3. In addition,

while employed, immigrants only search for a job in the same occupation in which they were employed in the former Soviet Union. Thus, an immigrant who worked in occupation 1 in the USSR and found a first job in Israel in occupation 3 may continue to search in occupation 1. Similarly, an immigrant who worked in occupation 2 in the USSR and found a first job in Israel in occupation 3 may continue to search in occupation 2. All other workers do **not** search on the job. In particular, since by assumption workers with a second job do not search, we apply equation (1) in these "final" nodes and then calculate W_{ij}^k, recursively, going over all possible reservation values and choosing the one which maximizes the value of search on the job. The optimal search policy is calculated under the assumption that $\kappa_3 = 0$, that is, an immigrant employed in occupation 3 can search on the job without sacrificing current wages.

We assume that the immigrant's true evaluation of each search option is given by

$$U_i^j = V_i^j \exp(\theta_j \epsilon_{ij}), \tag{11}$$

where θ_j is a parameter and ϵ_{ij} are independently and identically distributed according to the standard extreme value distribution, $G(\epsilon) = 1 - \exp(e^{-\epsilon})$. Thus, the probability that a person will choose to search in occupation j is

$$g_{ij} = \frac{(V_i^j)^{1/\theta_j}}{\sum_j (V_i^j)^{1/\theta_j}}. \tag{12}$$

This formulation allows the immigrants to randomly depart from a strict maximization of monetary values in choosing a search strategy. These departures may reflect, for instance, non-monetary preferences for academic work. It also allows for possible errors in maximization. The parameter θ_j may be interpreted as the weight given to monetary considerations, or as a measure of the variance in maximization errors. The probability that the option with the highest monetary value is selected decreases with θ_j and approaches 1 as θ_j

approaches zero. As θ_j approaches infinity, the three alternatives become indistinguishable and each will be selected with the same probability, 1/3. Observe that $1/\theta_j$ is the elasticity of the selection probability with respect to a change in V_j, holding other values constant and starting from full equality. Finally, note that the selection probabilities are independent of a proportional change in all V_{ij} and are, therefore, independent of the monetary unit which is used to measure wages and unemployment benefits.

The exit rate from the unemployment state for a person i who chooses to search in occupation j is

$$\gamma_{ij} = \lambda_{ij} \sum_{r_{ij}}^{s_i} p_j(s), \tag{13}$$

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

$$1_{ij} = g_{ij}\gamma_{ij}(1-\gamma_{ij})^{\tau_i}. \tag{14}$$

When wage information is also available, the likelihood of observing a particular wage, $\hat{w}_{ij}$, is

$$1_{ij} = g_{ij}\gamma_{ij}(1-\gamma_{ij})^{\tau_i} \frac{\sum_{r_{ij}}^{s_i} p_j(s)\phi\{[\ln(\hat{w}_{ij}) - \ln(w_{ij}(s))]/\sigma\}}{\sigma \sum_{r_{ij}}^{s_i} p_j(s)}, \tag{15}$$

where $\phi(.)$ denotes the standard normal density, σ is the variance of the measurement error and $w_{ij}(s)$ is the predicted wage, given by (7) and (8) as a function of the parameters. Recall that we do not observe the actual job, s, at which the worker is employed and therefore must sum over all possible jobs that are implied by his search policy.

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

$$\ell_i = \sum_j g_{ij}(1-\gamma_{ij})^{T_i}. \tag{16}$$

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

Some of the parameters are estimated separately and taken as given in the maximization of the likelihood. These include the interest rate r, the unemployment benefit b, the parameters of the wage growth process $\Delta, \delta, \xi_{31}, \xi_{32}$, and the age concavity parameter a_2.

Having estimated the model's parameters, we can calculate the arrival rate of job offers for each immigrant in the sample, λ_{ij}, the reservation level of schooling, r_{ij}, the value of search, V_i^j, the value of work W_{ij} and the selection probability, g_{ij}, for each of the potential occupations in Israel. We can further calculate the exit rates from unemployment and the quit rates for those workers whom we allow to search on the job and the expected loss of skill.

5 Estimated Parameters of the Model

The estimated parameters of the model describe the labor market conditions as perceived by the immigrants themselves and to some extent, their preferences. Given the non-linear structure of the model, the estimated coefficients do not have an immediate economic interpretation. We therefore report the parameter estimates in Appendix Table 3, and consider only the economic implications of these estimates in the text. We discuss the results on each component of the model separately.

5.1 Wages

Immigrants obtain in Israel only a moderate return for the labor market skills which they acquired in the USSR. The initial effect of age (experience) on wages is approximately 3 percent. It then declines as the immigrant gets older,[11] implying a maximal wage at age 37.6 (the average age in our sample is 39). The returns for schooling, as indicated by the estimated α_j are 4.8, 3.7 and .7 percent if the immigrant finds a job in occupations 1, 2 and 3 respectively. As one would expect, schooling has a stronger effect on wages in the high skill occupations and almost no effect if he works in a low skill occupations (the estimated coefficient α_3 is not significantly different from zero). Somewhat surprisingly, knowledge of English has a substantial effect on the wage that an immigrant earns in Israel if he finds a job in occupations 1 or 2. The difference in wages of an immigrant with a good command of English and one who possesses no knowledge at all are 36, 33 and -11 percent in occupations 1, 2 and 3, respectively. (The negative impact of English in occupation 3 is not significantly different from zero.) The strong effect of this measure is probably because knowledge of English is correlated with other unmeasured attributes such as the quality of schooling.

Table 4 compares the actual and predicted initial wages for immigrants in Israel, classified by occupation in Israel and in the former Soviet Union. Given the occupation in the former USSR, we present the mean predictions for (i) all immigrants; (ii) those who actually found employment and (iii) the mean sample wages for each of the three occupations in Israel. Actual wages in occupation 1 are about 40 higher than wages in occupation 2 and about 60 percent higher than wages in occupation 3, reflecting the higher frequency of jobs with high schooling requirements and the higher return for schooling in the high skill occupations. The predicted wages display a similar pattern. However, our model underpredicts wages in

[11]The coefficient of age squared was not estimated within the maximum likelihood procedure, but set at -0.0003922, based on a preliminary wage regression.

TABLE 4

Expected and Actual Wages of Immigrants, by Occupation

	Occupation in the former U.S.S.R.		
Occupation in Israel	1	2	3
1	1,953* 2,129** (2,356)	1,678* 1,930** (2,117)	1,395* - -
2	1,686* 1,688** (1,637)	1,549* 1,616** (1,577)	1,306* 1,433** (1,600)
3	1,335* 1,345** (1,380)	1,358* 1,364** (1,556)	1,372* 1,373** (1,403)
Expected wages	1,571	1,460	1,380
Sample wages	1,708	1,603	1,406

*Expected wages in occupation *j* in Israel for all immigrants who worked in occupation k in the former USSR.

**Expected wages of immigrants who work in occupation j in Israel and worked in occupation k in the former USSR.

( ) Average sample wages of immigrants who work in occupation *j* in Israel and worked in occupation k in the former USSR.

occupation 1 by about 10 percent (in occupation 3 there is a slight underprediction and in occupation 2 a slight overprediction). Those who choose to search in occupation 1 and find employment there, may have higher than average wages. To some extent, this selection is captured by our model, as indicated by the higher predicted wages for those who actually found employment in occupation 1.

The parameters Δ and δ,which govern the Poisson process representing the impact of time spent in Israel, were estimated from a cross section of 501 immigrants who reported their wage in 1993.[12] The estimate for the exit rate from the initial wage δ is 20 percent per year and the estimate of the wage jump Δ is 67 percent. After some experimentation, we found that wage premiums of 5 and 10 percent for a second job in occupations 1 and 2 respectively can rationalize the data in Table 3. Table 5 presents the actual and predicted choices, based on these values of ξ_{31} and ξ_{32}. The correspondence between actual and predicted values is quite good in all three occupations, as indicated by the χ^2 tests for goodness of fit. (In each column, the model should be rejected if and only if $Q > \chi^2_{.95}(3) = 7.81$.)

5.2 Job Offers

The mean predicted arrival rate of job offers for immigrants from a given occupational category in the USSR, in each category in Israel, are presented in Table 6. An immigrant who worked in occupation 1 in the USSR obtains a wage offer within a month with probabilities of .20, .43 and .16 in occupations 1, 2 and 3 respectively. It seems surprising that offers

[12] Given the assumed process for wages, the expected wage at time from arrival, t, is $w_0 e^{-\delta t} + w_1(1-e^{-\delta t}) = w_1 - \Delta e^{-\delta t}$, where, w_0 is the initial wage, w_1 is the new wage and $\Delta = w_1 - w_0$ is the size of the jump. We let w_1 depend on age at immigration and on its square, as well as on schooling interacted with occupation, and ran a non linear regression to estimate Δ and δ. The explanatory power of this regression, adjusted R^2=.3314, is similar to that of the descriptive regressions in Appendix Table 4.

TABLE 5

Expected and Actual Distribution of Immigrants and Israeli Workers, by Occupation

	Occupation in the Former U.S.S.R.					
Occupation in Israel	1		2		3	
	Actual	Predicted	Actual	Predicted	Actual	Predicted
1	40	41	5	7	0	0
2	24	22	18	20	2	1
3	113	111	84	79	114	109
Employed	177	174	107	106	116	110
Unemployed	26	29	16	17	10	16
Total	203	203	123	123	126	126
Q-statistic for $\chi 2$ test		0.55		1.15		3.48

TABLE 6

Estimated Monthly Probability of a Job Offer, by Occupation in the Former U.S.S.R. and by Occupation in Israel

	Occupation in the Former U.S.S.R.		
Occupation in Israel	1	2	3
1	0.204	0.081	0.003
2	0.438	0.827	0.010
3	0.158	0.193	0.260

in occupation 3 arrive at a slower rate. Recall, however, that, on the average, offers in occupation 3 require less schooling than offers in occupation 1. An immigrant with 16 years of schooling (the average among those who worked in occupation 1 in the USSR) has a probability of 50 percent to obtain an acceptable offer in occupation 1, while in occupation 3 the comparable probability is 95 percent (see Appendix Table 2). Therefore, the arrival rate of "effective" offers is higher in occupation 3. The high estimated arrival rate of job offers in occupation 2, reflects the relatively short unemployment for these workers in our sample.

As one would expect, immigrants who worked in low skill occupations in the USSR have a small chance of obtaining offers in Israel in a high skill occupation.

Older immigrants have a lower (higher) probability to obtain wage offers in occupations 1 and 2, respectively. In occupation 3 the effect of age on the arrival of job offers is not significant.

Surprisingly, knowledge of Hebrew upon arrival to Israel has no significant effect on the chances of obtaining job offers in any of the three occupations.

5.3 Variance Components

The estimated value of σ is .296, indicating a substantial measurement errors in the log of wages. For instance, the probability that the proportional error will exceed 30 percent (in absolute value) is about 32 percent. The estimate values of θ_j are .08 in occupation 2 and about .125 in occupations 1 and 3, indicating a small variance in the maximization error. For instance, if $\theta = .1$ (roughly the mean of these estimates) then the probability that the error will exceed 10 percent (in absolute value) is about 12 percent. Put differently, the elasticity of the selection probability with respect to a change in V_i^j, holding other values constant and starting at full equality, is about 10, suggesting considerable sensitivity to monetary rewards.

5.4 Interest Rate and Unemployment Benefits

Two important parameters of the model, the interest rate and the size of the unemployment benefit have been imposed, based on outside information. The interest rate was set at 6 percent. This is roughly the real borrowing rate[13] which we assume to be applicable because most immigrants came without assets and are therefore borrowers at the margin. It can be argued that higher interest rates should be applied because immigrants have only limited access to the capital market. We also experimented with higher interest rates but these led to inferior likelihood.

Unemployment benefits were set at 580 shekels per month, the official unemployment benefit for a single immigrant during the sample period. We experimented with some higher benefit levels which led to inferior likelihood.[14]

6 Behavioral Consequences of the Estimated Parameters

The estimated parameters of the model reflect the market conditions that immigrants perceive. We now turn to the choices which are implied by the estimated parameters. The endogenous decision variables are the reservation values and the selection probabilities which, in turn, determine the exit rate from unemployment, the quit rate from different jobs and the expected loss of skill.

[13]The real interest rate on mortgage loans for 15 years was 5.11 and 5.33 in 1991 and 1992 respectively.

[14]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.

6.1 Reservation values and selection probabilities

In Table 7 we present the reservation levels of schooling chosen by immigrants and the probabilities that they will select to search in different occupations in Israel, classified by schooling level and occupation in the former Soviet Union.

Generally, the chosen reservation values increase with the level of schooling. The only exception is among immigrants who worked in occupations 1 and 2 in the former USSR and have the option to search on the job. There, the highly educated are less selective in accepting jobs in occupation 3. This occurs because they wish to take advantage of the opportunity to move later on to their preferred occupation. For the same reason, immigrants who worked in occupations 1 and 2 in the former Soviet Union generally choose lower reservation values for offers from occupation 3 in Israel than for offers from occupations 1 and 2.

The option to climb up the occupational ladder makes occupation 3 the most attractive option for most immigrants. For instance, among immigrants with 16+ years of schooling who worked in occupation 1 in the former USSR, the probabilities that occupations 1,2 and 3 will be selected are .321, .103 and .576. Immigrants with a low level of schooling, who are old and who worked in occupation 3 in the former Soviet Union have an even higher propensity to search in occupation 3.

6.2 Exit and Quit Rates

In Table 8 we present the consequences of these individual choices to the exit rates from unemployment, quit rates, and the probability of being unemployed.

The mean exit rates from unemployment for the immigrants who worked in occupation 1 in the former USSR would be .053, .098 and .150 if they would search for a job in Israel in occupations 1, 2 and 3, respectively. Thus, an average person in this group should expect 20

TABLE 7

Components of Search Policy for Alternative Occupations in Israel, by Schooling and by Occupation in the Former U.S.S.R.

0 - 12 Years of Schooling

Reservation Schooling

	Former U.S.S.R.		
Israel	1	2	3
1	5.80	2.04	0.00
2	9.80	9.09	0.03
3	0.60	0.00	5.02

Selection Probability

	Former U.S.S.R.		
Israel	1	2	3
1	0.093	0.005	0.000
2	0.254	0.160	0.002
3	0.654	0.834	0.998

13 - 15 Years of Schooling

Reservation Schooling

	Former U.S.S.R.		
Israel	1	2	3
1	12.61	10.23	0.00
2	13.74	14.38	2.06
3	0.00	0.00	8.64

Selection Probability

	Former U.S.S.R.		
Israel	1	2	3
1	0.268	0.107	0.001
2	0.160	0.205	0.064
3	0.571	0.689	0.936

16+ Years of Schooling

Reservation Schooling

	Former U.S.S.R.		
Israel	1	2	3
1	15.66	13.75	0.25
2	15.59	16.02	6.83
3	0.00	0.00	9.42

Selection Probability

	Former U.S.S.R.		
Israel	1	2	3
1	0.321	0.244	0.008
2	0.103	0.162	0.180
3	0.576	0.595	0.812

TABLE 8

Exit Rates from Unemployment, Quit Rates, Probability and Duration of Unemployment

	Exit From Unemployment			Quits		Unemployment Probability		Unemployment Duration***	
	1	2	3	3→1	3→2	Predicted*	C.B.S. Sample**	Predicted	Actual
Years of schooling									
0-12	.003	.026	.121	.006	.051	.096	.096	7.95	4.64
13-15	.026	.086	.165	.030	.108	.092	.057	7.39	6.61
16+	.047	.093	.164	.045	.057	.116	.192	8.29	8.51
Age groups									
All immigrants									
25-40	.030	.067	.156	.044	.078	.090	.110	7.74	6.97
41-55	.029	.090	.156	.032	.077	.119	.121	8.01	6.95
Occupation 1 in the U.S.S.R.									
25-40	.059	.084	.150	--	--	.108	.143	8.64	9.10
41-55	.046	.112	.151	--	--	.117	.160	8.40	7.61
Occupation in the U.S.S.R.									
1	.053	.098	.150	.038	--	.113	.151	8.52	8.37
2	.022	.116	.170	--	.079	.106	.059	7.71	6.35
3	.001	.004	.152	--	--	.082	.080	6.92	5.30
All immigrants	.030	.077	.156	--	--	.102	.115	7.85	6.96

* Probability of being unemployed after two years.

** C.B.S Immigration Employment Survey 1993.

*** Duration of unemployment if observed, search period otherwise.

months of unemployment in occupation 1 and only 6 months of unemployment in occupation 3. A similar pattern applies for immigrants who worked in occupations 2 and 3 in the former USSR, except that, if they would search in occupation 1 in Israel their rate of exit from unemployment would be very low.

The effect of age on the exit rate from unemployment is generally ambiguous. Among immigrants who worked in occupation 1 in the former USSR and search in the same occupation in Israel, the age effect is negative. Among immigrants who search in occupation 2 in Israel, the age effect is positive. For those who search in occupation 3, there is no age effect on the exit rate from unemployment.

Immigrants with more schooling generally have a higher exit rate from unemployment in any occupation in which they search. However, because they are more inclined to concentrate their search effort in occupation 1, where the exit rate is low, the expected duration of unemployment increases with schooling.[15] This pattern contrasts with the usual pattern of lower unemployment rates for higher levels of schooling among Israeli workers, reflecting the special circumstances faced by immigrants who must start afresh in a new labor market.

The estimated exit rates from unemployment that the model can be used to generate predictions for other variables of interest. We consider two such variables: the probability of still being unemployed after two years in Israel and the duration of unemployed conditioned on the length of stay in Israel. The observed sample statistic for duration is obtained from our sample, [16] but the observed sample statistic for the probability of being unemployed

[15]The patterns described above are similar to those obtained by Eckstein and Shachar [1995] who use the same sample and estimate Weibull regressions for the determinants of exit to full time job.

[16]The actual duration is the time until the first full-time job was acquired or the time in Israel, depending upon whether or not a first job was found. The expected value of duration for immigrant i who searches in occupation j is (1- $\exp(-\gamma_{ij}t_i)$)/γ_{ij}, where γ_{ij} denotes the exit rate from unemployment in occupation j for immigrant i and t_i is the length of time that he is observed. We can then weigh each of these predictions by

is obtained from the CBS sample of the 1990 cohort.[17] As seen from the comparison of column 6 to column 7 and column 8 to column 9, the model is quite successful in predicting unemployment rates and durations. The predicted probability of being unemployed after two years in our sample is about 10 percent, compared with the observed 11.5 percent in the CBS sample. The mean duration of unemployment within our sample, which includes immigrants with different lengths of stay in Israel ranging from 6-30 months, is 7 months. The model overpredicts this figure by one month. The predicted patterns of duration and unemployment by schooling, age and occupation are similar to the actual patterns. The predicted and actual duration of unemployment tend to rise with schooling and be higher among immigrants who worked in occupation 1 in the former Soviet Union. The predicted and actual probability of unemployment tend to rise with schooling and age and to be higher among immigrants who worked in occupation 1 in the former Soviet Union. The success in out of sample predictions (compare columns 6 and 8) deserves particular attention.

The quit rate that the model predicts is quite high. Immigrants who worked in occupation 1 in the former USSR and found jobs in Israel in occupation 3 flow back to their original occupation at a rate of 3.8 percent per month, implying an expected stay in occupation 3 of only 26 months. For immigrants from occupation 2, the expected stay in occupation 3 is surprisingly short, roughly one year. Some indication for the actual speed of transition from occupation 3 to occupation 1 is provided by data from the 1990 cohort. These data show that, among those who worked in occupation 1 in the former USSR and were employed in Israel in 1992 in occupation 3, 12 percent moved up to occupation 1 in 1993. Thus the model's predicted speed of transition far exceeds the observed rates. It

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the selection probability, g_{ij}, to obtain the predicted value conditioned on personal attributes.

[17] Because of the variability in the time spent in Israel, it is not possible to provide a sample statistic for the probability of being unemployed after two years. However, this measure is directly available from the sample of the 1990 cohort. The predicted value of this statistic for person i is $\sum_j g_{ij} \exp(-\gamma_{ij} 24)$.

should be noted that the estimates of the **expected** transitions are based only on observed initial choices. [18]

6.3 Loss of Schooling and Wages

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 and a corresponding loss in wages. One may distinguish several types of losses associated with the transition of immigrants into the Israeli market. The first type of loss is associated with the time spent until the immigrant finds a first job. During this period, the immigrant does not use his human capital at all. The second loss is the loss associated with the transition period, where the immigrant works temporarily in jobs and occupations in which his skill is not fully utilized, while continuing to search for a better job. The third loss is the permanent loss where an immigrant which schooling endowment s_i accepts an offer in occupation j which falls in the range between r_{ij} and s_i, and then does not continue to search. Using a continuous time approximation, the duration of time spent in each such interval is a random variable which is distributed exponentially with a parameter which equals the estimated exit or quit rate. One can exploit the properties of the exponential distribution to derive explicit formulas for the loss of schooling and wages.

To illustrate these calculations, consider the expected loss in years of schooling for an immigrant who in the former USSR worked in occupation 1, and is searching for a job in Israel in occupation 3. His expected discounted loss during the period of unemployment while waiting for a job in occupation 3 is

$$\frac{1}{\rho + \gamma_{i3}} s_i,$$

[18] Our data provides no information on actual transitions. A second wave of the sample, soon to be available, will provide such information.

where γ_{i3} is the quit rate from unemployment in occupation 3. His expected discounted loss while working in occupation 3 and searching for a job in occupation 1 is

$$\frac{\gamma_{i3}}{\rho+\gamma_{i3}}\frac{\sum_{r_{i3}}^{s_i} p_3(s)\frac{s_i - s}{\rho+\gamma_{i,31}(s)}}{\sum_{r_{i3}}^{s_i} p_3(s)},$$

where r_{i3} is the reservation rule for accepting jobs in occupation 3 and $\gamma_{i,31}(s)$ is the quit from occupation 3 to 1 for a worker who has job s in occupation 3. His expected loss from accepting a "final" job in occupation 1 is

$$\frac{1}{\rho}\frac{\gamma_{i3}}{\rho+\gamma_{i3}}\frac{\sum_{r_{ie}}^{s_i} p_3\frac{\gamma_{i,31}(s)}{\rho+\gamma_{i,31}(s)}\frac{\sum_{r_{i,31}(s)}^{s_i} p_1(e)(s_1-e)}{\sum_{r_{i,31}(s)}^{s_i} p_1(e)}}{\sum_{r_{i,3}}^{s_i} p_3(s)},$$

where $r_{i,31}(s)$ is the reservation rule for accepting offers from occupation 1 when employed at job s in occupation 3. For workers who do not search on the job, $\gamma_{i,31}(s) = 0$ and only the first two terms apply.

Similar calculations can be made for the loss of wages where we replace the schooling endowment, s_i, by the immigrant's potential wage, w_i^*, and the schooling requirement, s, by the offered wage, $w_{ij}(s)$, where, w_i^* is the wage that the immigrant obtains if he exploits all his schooling and works in the same occupation as he did in the USSR. Having defined the loss of wages and schooling conditioned on searching in occupation j, we can calculate the unconditional means by using the selection probabilities, g_{ij} as weights.

In Table 9 we present the expected loss of schooling and wages during the period of unemployment, in the first job, in the second (and last) job and the total expected loss, for immigrants with different attributes. The expected loss of schooling in our sample is 1.9 years. That is, on the average, an immigrant with 14.1 years of schooling works in jobs requiring only 12.2 years of schooling. About 38 percent of this discrepancy is a result of the search for the first job, the remainder being due to the compromises made by immigrants

TABLE 9

Expected Loss of Schooling and Wages

	Unemployment Period		First job		Last Job		Expected total loss	
	schooling (years)	wages (%)	schooling (years)	wages (%)	schooling (years)	wages (%)	schooling (years)	wages (%)
Years of schooling								
0-12	.48	.048	.21	.000	1.19	.015	1.90	.063
13-15	.71	.049	.20	.012	.95	.034	1.87	.095
16+	.88	.052	.36	.018	.73	.042	1.96	.112
Age groups								
All immigrants								
25-40	.67	.047	.22	.010	.91	.030	1.80	.087
41-55	.78	.054	.34	.014	.92	.038	2.07	.106
Occupation 1 in the U.S.S.R.								
25-40	.78	.049	.36	.021	.44	.051	1.58	.121
41-55	.82	.051	.47	.025	.52	.059	1.81	.135
Occupation in the U.S.S.R.								
1	.80	.050	.41	.023	.48	.055	1.69	.128
2	.73	.050	.31	.006	.21	.018	1.25	.074
3	.63	.050	---	---	2.29	.012	2.92	.062
All immigrants	.73	.050	.27	.012	.91	.033	1.91	.095

on accepting job offers. The loss of schooling tends to increase with schooling and age. Somewhat surprisingly, the model predicts high loss of schooling for immigrants who worked in occupation 3 in the former Soviet Union. These immigrants are less selective in their choice of the last job because the returns to schooling in this occupation, as captured by α_3, are small.

The average proportionate loss of wages is 9.50 percent.[19] About half of this loss reflects the costs during the unemployment period (converted to a loss in a permanent wage flow), the other half reflects the accepting of job offers below requiring less than s_i years of schooling. In contrast to the loss in schooling, the loss in wages takes into account the different value of schooling in different occupations, represented by different α_j, and the impact of all the factors correlated with knowledge of English. These factors may have conflicting effects on the loss of schooling and wages. For a given loss of schooling, the finding $\alpha_1 > \alpha_3$ implies that an immigrant who worked in occupation 1 in the USSR will have a relatively large wage loss during the period which he spends in occupation 3. However, to the extent that he has no knowledge of English, this loss will be relatively small, because knowledge of English is important in occupation 1 but not in occupation 3. This explains why Table 9 displays diverging patterns of lost schooling and wages across occupations in the USSR and across schooling levels. As seen, the highest loss of wages is for immigrants who worked in occupation 1 in the USSR and who had more than 16 years of schooling, while the highest loss of schooling is for immigrants who worked in occupation 3 in the USSR.

Another aspect of wage loss is the loss associated with the gradual acquisition of local labor market skills. If one compares the predicted wage paths under two alternative

[19]The earning capacity of each immigrant, w_i^*, includes the wage premiums for a second job, ξ_{31} and ξ_{32}. The jump in wages, Δ, is included in both the actual and potential wage after it occurs. By definition, the proportional loss is independent of the Poisson process for the wage growth. However, the absolute loss will depend on whether or not a jump has occurred.

assumptions: gradual adjustment (i.e., the jump in wages by $\Delta = .67$ occurs at a random time which is distributed exponentially with $\delta = .20$) versus an immediate adjustment where the immigrant gets his final wage upon arrival to Israel (i.e., the jump $\Delta = .67$ occurs at time 0) then the loss in present value of wages is equivalent to a permanent reduction in wages by 18 percent.

7 Conclusions

The analysis in this paper focused on the career choices of immigrants in the early phase of their adjustment to the Israeli labor market. We have seen that the initial adjustment is characterized by unemployment and occupational downgrading. Our presumption was that initial decisions undertaken by immigrants reflect not only the severe constraints which the immigrants face upon entry, but also consideration of the future. Specifically, the large flow into the low skill occupations is assumed to involve anticipation of a later switch to more preferred occupations. Based on this forward looking approach, we were able to estimate, not only the immediate costs of adjustment associated with unemployment, but also the long run costs, reflecting the anticipation of future moves. We have estimated the loss of skill to be 1.9 years of schooling and 9.5 percent of wages. The tentative nature of these estimates should be emphasized. In particular, we did not use any data on actual job or wage changes.

In interpreting our results it is important to distinguish private and social costs. Our measure of loss is derived from the actual behavior of immigrants, based on the market conditions which they perceive. The private loss associated with the adjustment process reflects the high interest rate that immigrants face and the low return that the Israeli labor market pays for the skills which they acquired in the former Soviet Union. Under these conditions, we estimated that the **private** loss in wages, associated with the loss of 1.9

years of schooling, is 9.5 percent of what the immigrants would expect to obtain in Israel under **current** market conditions, if they could be immediately employed in their original occupation.

In calculating the social costs of the adjustment process, the policy maker may consider the alternative uses of the immigrants' skills, disregarding market imperfections such as borrowing constraints and employer's uncertainty about the immigrant's skills. That is, he may assume that society faces a "normal" rate of interest and that, with proper allocation, it is possible to obtain a "normal" rate of return on the human capital embodied in immigrants. Following this approach, let us perform some back-of-the-envelope calculations in order to obtain a rough estimate for the social costs of adjustment.

Using a conservative estimate of .04 for the "normal" rate-of-return for schooling, the annual flow of earnings of each immigrant is reduced by .04*1.91 = .076 percent. Since the average age of the immigrants is about 40, a reduction in the annual flow by 1 dollar for 25 years translates, using an interest rate of .03., into 18 dollars of life-time earnings. Thus, each immigrant loses about .076*18 = 1.37 years of earnings. Using an estimated annual earning of 12,000 dollars per annum, one gets an estimated cost of 16,440 dollars per immigrant in present value. Aggregating over all working immigrants, one obtains an aggregate loss of 200,000*16440=3.29 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 discounted loss of the services of 1.96 years of schooling over a working period of 25 years is about .49 of the services obtained from the three years of university schooling that an Israeli college graduate provides over his working life of 40 years. The annual variable costs for training of an Israeli student are about 5,000 dollars. Adding an estimated opportunity cost of 12,000 dollars per annum 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 .49*51,000 = 24,990 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* 24,990 = 2 billion dollars.

The above calculations are intended only for illustrative purposes. The actual social cost associated with the loss of schooling by immigrants requires information which is not available to us. One issue is the quality of schooling which the immigrants acquired in the former Soviet Union. Another issue is the capacity of the Israeli market to absorb a large number of high skill workers without a marked reduction in the return for schooling. It is possible to argue that the loss that we have estimated is consistent with no social costs because the schooling of immigrants from the USSR is of low quality[20] and because the demand for skilled labor is highly inelastic. We do not subscribe to this view but cannot refute it. These important issues are subject for future research.

[20]Some indication of the difference in the quality of schooling can be obtained by comparing the return for schooling that immigrants receive in Israel for the education which they acquired in Israel and in the USSR. Friedberg [1995] estimates of these rates of return for 1983 are 7.7 and 6.3 percent, respectively. The corresponding estimates for the 1993 cross section are 2.8 and 1.8 percent (see regression 3 in Appendix Table 4). A similar difference in the rates of return is reported by Fishelson, Weiss and Mark [1980] for a 1976 cross section of immigrants from Europe and America (5.0 and 4.0 percent, respectively).

APPENDIX

The purpose of this appendix is to outline the modifications implied by the introduction of wage growth. Recall that wage growth is modeled as a single step Poisson process. After the exogenous jump in wages occurred, no further jump is expected and all the formulae in the text apply. In particular, $W^k_{ij}(s)$ indicates the value of a job s in occupation j, conditioned on search in occupation k, and $W^0_{ij}(s)$ indicates the corresponding value, conditioned on no search.

The value of having a job s in occupation j, conditioned on no search and expecting wage growth is

$$N^0_{ij}(s) = w_{ij}(s) + \frac{1}{1+\rho}[\delta \Delta W^0_{ij}(s) + (1-\delta)N^0_{ij}(s)]. \tag{A1}$$

Let $r^k_{ij}(s)$ denote the optimal reservation rule which person i who has job s in occupation j selects for accepting offers from occupation k. This reservation rule is implicitly defined by the maximization on the RHS of equation (2) in the text and is not affected by the introduction of growth which, by assumption, changes wages in all occupations by the same proportion. The value of having a job s in occupation j, conditioned on search and expecting growth is

$$\begin{aligned} N^k_{ij}(s) \;=\; & w_{ij}(s) + \frac{1}{1+\rho}\{\delta\Delta\lambda_{ik}[\sum_{r^k_{ij}(s)}^{s_i} p_k(x)W^0_{ij}(x) + W^k_{ij}(s)(1 - \sum_{r^k_{ij}(s)}^{s_i} p_k(x))] + \\ & +(1-\delta)\lambda_{ik}[\sum_{r^k_{ij}(s)}^{s_i} p_k(x)N^0_{ij}(x) + N^k_{ij}(s)(1 - \sum_{r^k_{ij}(s)}^{s_i} p_k(x))] \\ & +(1-\lambda_{ik})\delta\Delta W^k_{ij}(s) + (1-\lambda_{ik})(1-\delta)N^k_{ij}(s)\}. \end{aligned} \tag{A2}$$

One can solve equations (A1) and (A2) for the values of having a job which incorporate wage growth, $N_{ij}^{k}(s)$ and $N_{ij}^{0}(s)$. Defining $N_{ij}(s)$ to be the maximum over all possible options, one can replace $W_{ij}(s)$ in equation (5) by $N_{ij}(s)$ to obtain a modified value for search. Note that the value of search for the first job increases as a consequence of adding growth. Because the unemployment benefit, b, remains the same, immigrants will be more inclined to accept the first job.

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APPENDIX TABLE 1

Occupational Distribution Of All and Male Immigrants From the Former U.S.S.R. (Years of immigration 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 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 institutions, 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 analysts and computer programmers	11.5%	13.5%
Other professinal and technical workers	3.2%	3.8%
Occupation 3:		
Other:	25.1%	33.7%
Sale 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: C.B.S. Labor Force Surveys.

* 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.

APPENDIX TABLE 2

Distribution of Male Israeli Workers, by Occupation and Level of Schooling

1991

Schooling	Occupation		
	1	2	3
0	0.000	0.000	0.012
1 - 4	0.000	0.000	0.019
5 - 8	0.029	0.018	0.213
9 - 10	0.044	0.038	0.181
11 - 12	0.022	0.237	0.413
13 - 15	0.242	0.397	0.114
16+	0.663	0.310	0.048

Source: C.B.S. Labor Force Surveys.

APPENDIX TABLE 3

Parameter Estimates of the Search Model

Parameter	Estimate	t-value
Wage function parameters		
Constant	6.5310	37.83
Immage	0.0295	12.87
Immage squared	0.0003922	---
English * occ1	-0.0303	-3.73
English * occ2	-0.0276	-3.38
English * occ3	0.0090	1.24
Schooling * occ1	0.0480	4.64
Schooling * occ2	0.0372	3.71
Schooling * occ3	0.0069	0.50
Arrival rates parameters		
Occupation in U.S.S.R. and in Israel		
1→1	-1.0999	-3.32
1→2	-0.7018	-1.71
1→3	-1.7314	-12.06
2→1	-2.2316	-5.39
2→2	1.3160	1.36
2→3	-1.4712	-9.37
3→1	-5.7920	-4.92
3→2	-5.0167	-8.39
3→3	-1.0753	-8.06
Immage > 40		
occupation 1	-0.5680	-1.87
occupation 2	1.0711	2.02
occupation 3	0.0405	0.26
Hebrew * occ1	-0.0513	-0.11
Hebrew * occ2	-0.4772	-0.71
Hebrew * occ3	0.1775	0.79
Variance components		
σ	0.2958	22.61
θ_1	0.1256	4.66
θ_2	0.0834	5.11
θ_3	0.1239	1.91
Log Likelihood	-3.39158	
N	452	

APPENDIX TABLE 4

Descriptive Wage Regressions From the 1993 Income Survey, Males, Age 25+

(Dependent Variable is Log of Annual Earnings)

Explanatory Variable	1	2	3	4
Schooling abroad			0.018	
			(2.71)	
Schooling in Israel			0.028	
			(2.53)	
Schooling * Occ 1	0.072	0.019		0.027
	(16.51)	(3.10)		(4.53)
Schooling * Occ 2	0.055	0.010		0.020
	(11.09)	(1.29)		(2.66)
Schooling * Occ 3	0.046	-0.010		0.0004
	(8.33)	(-1.49)		(0.06)
Experience abroad		0.025	0.021	
		(3.98)	(3.06)	
Experience in Israel	0.056	0.057	0.057	
	(13.05)	(8.14)	(7.63)	
Experience Sq.	-0.001	-0.0008	-0.0007	
	(-10.36)	(-6.29)	(-5.30)	
Age at Arrival				0.075
				(4.94)
Age at Arrival Sq.				-0.001
				(-5.73)
Time in Israel				0.073
				(5.23)
Time in Israel Sq.				-0.0006
				(-4.01)
Time in Israel * Age at Arrival				-0.001
				(-3.40)
Constant	6.939	7.526		6.220
	(83.94)	(64.91)		(19.78)
No. of Observations	1735	501	501	501
R^2	.233	.365	.291	.351

Notes:

Experience abroad = Max[Age at Arrival - Schooling - 8, 0].

Experience in Israel = Time in Israel, if Experience abroad > 0,
= Time in Israel - Schooling in Israel, Otherwise.

Schooling abroad = Min[Age at Arrival - 8, Schooling].

Schooling in Israel = Schooling - Schooling abroad.

For Israeli Workers: Experience = Age - Schooling - 9.

The definitions above include 3 and 2 years of military service for Israeli natives and immigrants, respectively.

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