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ABSTRACT

Immigration from the Eastern Block and the former Soviet Union to Israel: Who is coming when?*

Average education of new immigrants from the East European countries and the former Soviet Union (FSU) in Israel declined during the last ten years. I present a simple two-period model of migration with uncertainty about future conditions in both countries and estimate a reduced form, using data from the Israeli 1995 Census and several years of the Israeli Labor Force Survey. Wages in Israel in each period are the result of a human capital investment decision. In this framework, the return to migrating early is higher, the higher the education of a potential migrant, but education also increases the option value of staying. Estimation of a Cox proportionate hazard model and a discrete time hazard model suggest that human capital investment considerations indeed influence the timing of migration. Other variables that make people migrate earlier are being Jewish, being married, and having no children. Economic conditions in the source countries and in the destination country, which are also included in the regressions, do not seem to matter and cover mainly time effects.

JEL Classification: J24, J61

Keywords: Migration decision, human capital investment, migration as an option, duration model

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1. Introduction

In the ten years after the breakdown of the Communist Regimes in the Eastern European countries and the former Soviet Union (FSU) approximately 800,000 people from these countries immigrated to Israel. The main influx was in the years 1990 and 1991, with around 150,000 immigrants per year. From 1992 onwards, the yearly number of immigrants from these countries leveled off at around 60,000. Today, immigrants from these countries make up nearly 20% of the Israeli population.

In the course of these ten years, immigrants' characteristics upon arrival changed. More recent immigrants tend to be younger and less educated, and they are less likely to be married. In addition, the percentages of immigrants coming from the different countries of origin changed over time. For example, the share of Ukrainians rose from roughly 30% in the beginning of the 1990s to 40% in 1997 and 1998.

The aim of this paper is to explain these changes in immigrants' characteristics over time with a simple two-period model of human capital investment and to test its implications using data from the 1995 Israeli Census and different years of the Israeli Labor Force Survey. The main impact is on the decline of average education of new immigrants over time.

Throughout my analysis, I assume that the decision whether and when to migrate is altogether up to the potential migrants themselves. Hence, the observed differences in immigrants' characteristics are only due to different results for the individuals' maximization problems over time. In fact, the "Law of Return" gives every person of Jewish descent the right to immigrate to Israel at any time.[1] Emigration from the FSU and the East European countries, which previously was very difficult, has also been unrestricted since August 1989. Nevertheless, this assumption might be problematic. First, it was not obvious in 1989 that emigration would remain unrestricted. Some people left as early as possible, because they did not trust the promise that they would be allowed to leave in the future. Therefore, the number of immigrants peaked in the early 1990s. This peak due to panic migration was also boosted by the fact that migration to the other two main immigration countries for Jewish FSU

[1] Since 1970, the "Law of Return" grants automatic citizenship to all Jews, their children, grandchildren, spouses, and the spouses of their children and grandchildren. In addition to that, "aliya" (immigration) is promoted by organizations like the Jewish Agency for Israel, which inform Jewish people in the Diaspora about the possibility to make aliya. Furthermore, new immigrants get generous help; for example, free language classes (Ulpan) and generous rent subsidies during their first three years in Israel.

emigrants, the USA and Germany, was less easy. The application procedures for these countries are more complicated, and the legal basis for immigration is less clear. For the USA, there is a limitation of 50,000 immigrants from the FSU per year since 1990 (Gitelman, 1997), so that immigrants in the early 1990s had to queue for their visa. For Germany, regulations were a little bit vague (American Jewish Yearbook, 1990-1999). Therefore, panic migrants were not spread over the three countries, but almost exclusively came to Israel. This is reflected in the declining share of Jewish migrants to Israel over total Jewish migrants over time. In 1990 and 1991, 90% and 78% of all Jewish emigrants from the FSU went to Israel. In the following years, the share was around 55% (Tolts, 1999).[2] As a consequence of the panic migration, there are some immigrants in the data who did not choose their time of migration optimally.

In the model used in this paper, a potential migrant's decision whether to wait or to migrate in the current period is driven by two opposing forces. The first one is the option value of migration. Staying in the source country leaves open the possibility to migrate in the second period, whereas going to Israel includes paying a non-refundable migration cost. Return migration is excluded in my model, and future economic conditions are uncertain, so that migrating includes the risk of making a mistake that cannot be repaired.[3] This first force makes people more inclined to postpone migration to the second period when the realization of the second period shock is known. If wages increase with the amount of human capital a person has, the effect is stronger for the more educated. The second force is the development of immigrants' earnings in Israel. As immigrants' imported human capital has a very low value on the Israeli labor market, immigrants incur a substantial earnings loss upon arrival. However, they experience a big wage increase during the first years in the new country, as they acquire local skills. With per-period earnings in Israel increasing over time, average per-period earnings in Israel relative to the earnings of natives are increasing with total working time in Israel. This provides an incentive to migrate as early as possible. If there is some kind of complementarity between imported and newly acquired skills, this effect is stronger for more educated people. In the empirical part of the paper, the fact that the more educated come earlier is interpreted as evidence that the second force dominates the first. We also provide some evidence for the relevance

[2] Eventually, about 75% of the Jewish people leaving the FSU between 1989 and 1998 went to Israel.
[3] In reality, return migration is very low for this migration wave. One reason might be high migration costs that are not refundable because they consist of (illegal) transfers of assets to Israel.

of the reason given in the model for the decline in human capital as opposed to other possible reasons.

The rest of the paper is structured as follows: In section 2, I give a short overview of the related literature. Section 3 presents the model and discusses how it can be tested empirically. Section 4 describes the data and gives some summary statistics. Section 5 discusses the estimation methods used. Section 6 presents the estimation results. Finally, section 7 concludes.

2. Related Literature

This paper is related to two areas of research. First, it adds to the literature about the labor market assimilation of immigrants. This literature concentrates on the performance of immigrants after they arrived in the new country depending on the portability of imported human capital. The commonly observed assimilation pattern of earnings is explained with models of human capital investment. Second, this work is related to research regarding dynamic aspects of the migration decision.

2.1 Wage assimilation and human capital investment of immigrants

The literature on the influence of human capital on the migration decision concentrates on the classical immigration countries, i.e. the USA and Canada. Borjas (1985, 1995) adopts the Roy model of income distribution to the case of labor migration between two countries. He shows that, holding mean income constant, immigrants from countries with more inequality in their income distribution are expected to have a relatively low educational level, whereas immigrants from countries with a more equal income distribution have a relatively high level of education. The effect is stronger, the higher the transferability of skills among the source country and the host country. Although this model can explain the differences in immigrants' performance across different cohorts with changes in the composition of the country of origin mix for the USA, it cannot explain the changes in the level of education within one wave of immigrants coming from the same country of origin. This is the objective of this paper. In addition, Borjas' model assumes a fixed convertibility of source country to host country human capital, whereas in reality, the amount of human capital that will be converted seems to be an endogenous variable that changes over time. In particular, the return on imported knowledge seems to depend on the amount of newly acquired

human capital. For example, Friedberg (2000) estimates Mincer wage equations for immigrants to Israel in which she distinguishes between imported and newly acquired human capital and experience. She finds that the interaction term of domestic and imported human capital is positive and significant. The return on imported human capital is lower than the return on newly acquired human capital, and the return on imported experience is generally insignificant.

The acquisition of new human capital and its interactions with imported human capital have been studied in the context of immigrants' labor market assimilation. The respective literature does not look at the migration decision itself, but at the labor market decisions of people who already migrated. The main challenge is to explain why immigrants experience such a big increase in wages with years since migration, and to see if they eventually catch up or even overtake comparable natives. Duleep and Regets (1999) and Eckstein and Weiss (1998) have very similar models to explain that phenomenon.[4] The main point is that immigrants upon arrival invest more in human capital than comparable natives, because the cost of investment is lower and the return is higher than for natives. The fact that costs are lower is due to the big earnings loss immigrants experience upon arrival, which decreases the opportunity cost of using working time for schooling. The return on investment can be higher than the return for natives for two reasons: Either because imported human capital serves as an input in the production function of domestic human capital, or because the two kinds of human capital are complements on the labor market.

However, these models take the date of migration as given. But if the date of migration is not imposed on immigrants as a result of a country's migration policy, potential immigrants should choose it optimally according to the same objective function that determines their behavior after migration. This is why I use the models developed to explain post-migration behavior to explain the migration decision itself.

2.2 Dynamic aspects of the migration decision

More than half of the immigrants from the East European countries and the FSU to Israel in the 1990s came after 1991, which means that they did not come right after they got the option to do so, but more than two to three years later. Furthermore, the number of immigrants per year has remained roughly constant since 1993 until today.

[4] The model by Duleep and Regets is only a two-period-model, whereas Eckstein and Weiss solve a t-period dynamic programming problem.

Models trying to explain this sluggishness in the behavior of immigrants either stress the importance of future uncertainty or the role of changes in the variables determining the migration decision.

In models that explicitly take uncertainty about the future realizations of state variables into consideration, migration is interpreted as an investment. Like an investment, migration is characterized by a high fixed cost in the beginning and a distant future return, which, as is characteristic for future values, is uncertain. It has been shown by Pindyck (1991), among others, that a simple net present value calculation overpredicts the amount of investment to a large scale. Taking into account both this high initial cost and the fact that an investment can be delayed leads to much lower predictions for the amount of investment. In these models, the possibility to investment is considered as an option, and models are solved using option pricing methods. The same has been done for immigration. The trade-off in the individual's migration decision is not whether to "migrate" or "not migrate", but whether to "migrate" or to "stay now and perhaps migrate in the future". If there is uncertainty about future gains of migration, the value of waiting is positive. Burda (1995) develops a model in which future wage gaps between the source country and the destination country are uncertain, but diminish over time. O'Connell (1997) presents a similar model with a constant wage differential and uncertainty both about future wage differentials and current economic conditions in the destination country. Both models are continuous in time, and the wage gap follows a Brownian motion.

These models could explain why not all potential immigrants in the FSU came at once. But the only explanation for the fact that annual migration was roughly constant for the last eight years would appear to be regular and constant shocks that enlarge the wage gap over the whole range of time. However, this was not the case. Another problem for the empirical application of this model is the infinite horizon aspect. This implies that the value function is stationary, i.e. it does not allow for the migration decision to change as people get older.

The other explanation for inertia in migration is that the determinants of migration change over time. These determinants can be the economic conditions in the source country and in the destination country, or they can be variables that change because the number of migrants is changing. Hatton (1995) tries to explain the time series of the emigration rate for the U.K. to the New World in the turn of the last

century (1870-1913). He develops a model where the migration rate in each period is a function of current economic conditions and the number of immigrants already living in the new countries. In his estimations, fluctuations in the business cycle both in the source and in the destination countries explain a considerable amount of variation in the migration rate. As new immigrants are very severely affected by a high unemployment rate (Chiswick et al., 1997), it might pay not to leave in a recession, but to wait for a period of economic expansion.

The dependency of the migration rate on the number of previous migrants can be explained with network effects. The more people of the same origin already live in a new country, the less foreign it is, which makes migration easier. Immigrant networks lower the risk and the cost of migration, because they help newcomers to find their way in the new country (Bauer and Zimmermann, 1998).[5]

The model in this paper concentrates on the human capital investment effects and the option value of migration. Macroeconomic time series variables are also included in the estimations to cover the effect of changes in economic conditions over time, but the interdependency of migration decisions, e.g. through network effects, is not analyzed.

3. The Model

In this section, we present a simple two-period model explaining how immigrants decide when to migrate. Utility in each period t = 1,2 and in each country i = S,I is given by the sum of earnings w, non-monetary utility b, and a random shock ε. Furthermore, if migration takes place, utility is reduced by a migration cost c that has to be paid once in the migration period.

(1) $U_t^i = w_t^i + b_t^i - I \cdot c + \varepsilon_t^i$, i = S (source country), I (Israel), t = 1,2.

I is an indicator function, i.e. I = 1 if migration takes place in t, and I = 0 otherwise. The random shock ε is assumed to have zero mean. The difference between the shocks in the two countries in a period t is $\Delta\varepsilon = \varepsilon^I - \varepsilon^S$. $\Delta\varepsilon$ is normally distributed with $N\sim(0, \sigma^2)$. Earnings, non-monetary utility and the random shock may differ in the two periods and in the two countries in which the potential migrant can stay.

[5] In the case of the Russian immigration, the network effect might also work as a push factor. The more Jewish people leave the Russian Jewish Community, the more difficult it becomes to stay there, because the remnants become a real minority. This might be an explanation why the emigration rate tends to be lower for those FSU countries that have a bigger Jewish community.

In the beginning, all potential migrants are staying in the source country. Before period 1, the period 1 shocks are realized. In period 1, the potential migrants decide whether to stay or whether to go to Israel. Between the first and the second period, the period 2 shocks are realized. Finally, in the second period, those who have migrated in period 1 stay in Israel, whereas those who have remained in the source country again decide whether to stay or to migrate.

For two reasons, the migration decision in period 2 will be different from the migration decision in period 1. First, in period 2 there is no uncertainty, whereas in period 1 the migrant does not know yet the realization of the shock ε in the second period. Second, the immigrant's wage in Israel in period 2 will be higher if he migrates in the first period than if he migrates in the second period. If he comes in period 1, he will have invested in Israeli human capital in the first period, which will increase his earnings in the second period.

3.1 The determination of earnings in Israel and in the source country

Earnings in period t in Israel are given by the product of the hourly wage, $k(\cdot)$, and time spent working, h_t^w. Hourly wages depend on the stock of Israeli human capital the person possesses in the beginning of the period, s_{t-1}^I. Notice that imported human capital does not enter the Israeli wage equation.

(2) $w_t^I = k(s_{t-1}^I) \cdot h_t^w$ $\qquad k' > 0,\ k'' < 0,\ k(0) > 0,\ k'(0) \to \infty$

In each period, individuals have one unit of time, which they allocate between working (h_t^w) and schooling (h_t^s).

(3) $1 = h_t^w + h_t^s$

The two inputs for the production of Israeli skills are imported source country skills and schooling time.

(4) $s_t^I = h_t^S \cdot g(s^S)$ $\qquad g' > 0,\ g'' < 0,\ g(0) \geq 0$

The idea behind this production function is that there is some kind of complementarity between imported skills and newly acquired skills. An engineer's engineering skills are worthless if he does not have a basic knowledge of Hebrew. Hence, upon arrival, he is not better off than any unskilled worker. However, if he studies Hebrew, the amount of human capital that he can use on the labor market increases not only to the extent that he learns to speak Hebrew, but also to the extent that his Hebrew makes his

engineering knowledge usable. An unskilled worker, on the other hand, gains nothing but improved language skills if he goes to Hebrew classes.

As it is only human capital of the previous period that influences the wage, the return on investment in human capital in the last period is zero. Therefore, all time in period 2 will be used for working, i.e.

(5) $h_2^{w*} = 1.$

This is independent of whether migration takes place in period 1 or 2.

In the first period, the immigrant chooses h_1^{w*} so as to maximize discounted lifetime earnings over the two periods:

(6) $h_1^{w*} = \arg\max [w_1^I + \beta w_{2,1}^I]$

The optimum is characterized by

(7) $k(0) = \beta g(s^S) \cdot k'[(1 - h_1^{w*}) \cdot g(s^S)]$.[6]

Equation (7) says that the opportunity cost of investment, the wage in period 1, equals the marginal return to investment, the discounted marginal increase in the second period hourly wage. It is now clear why the earnings of a person who is in Israel in period 2 depends on whether migration took place in period 1 or 2. We have $w_{2,1}^I > w_{2,2}^I$, where the second subscript indicates the period of migration. The amount of schooling, h_1^s, may increase or decrease with the amount of imported human capital, s^S. Yet, in any case $w_{2,1}^I$ increases in s^S, i.e., in the second period in Israel, earnings are higher for more educated immigrants.

In the source country, earnings are a constant function of source country human capital, s^S, in both periods. The process of human capital accumulation is assumed to be complete, so that all the time is spent working and there is no need for a time subscript for s^S.

(8) $w_t^S = l(s^S). \quad l' > 0, l'' < 0$

3.2 The migration decision

Migration in period 2 takes place iff $U_2^I > U_2^S$, i.e. iff

(9) $\varepsilon_2^I - \varepsilon_2^S > w_2^S - w_{2,2}^I + b_2^S - b_2^I + c$

As we are not interested in absolute utility levels, but only in the difference in utility between the two countries, we write this as

(9') $\Delta\varepsilon_2 > c - \Delta w_{2,2} - \Delta b_2 = \Delta\varepsilon_2^*$

[6] The assumptions about g(0) and k'(0) guarantee an interior solution.

where $\Delta w_{2,2} = w_{2,2}^I - w_2^S$, and $\Delta b_2 = b_2^I - b_2^S$, and $\Delta\varepsilon_2^*$ is the value of the difference in shocks between the two countries that triggers migration. Other differences will be defined accordingly. The probability of staying in period 2 is given as $\Phi(z)$, where $z = (c - \Delta w_{2,2} - \Delta b_2)/\sigma$.

Migration in period 1 takes place if the net present value of the utility of staying in Israel in periods 1 and 2 is higher than the utility of remaining in the source country in period 1 and making the optimal decision (stay or leave) in period 2.

(10) $\Delta w_1 + \Delta b_1 + \Delta\varepsilon_1 + \beta[\Delta w_{2,1} + \Delta b_2] - c >$

$$\beta[1 - \Phi(z)]E[\Delta w_{2,2} + \Delta b_2 + \Delta\varepsilon_2 - c \mid \Delta\varepsilon_2 > \Delta\varepsilon_2^*]$$

The left hand side of (10) describes the utility gain of migrating now versus staying in both periods. The right hand side corrects for the fact that there may also be migration in period 2, in case the utility difference turns out to be positive. Calculating the conditional expectation and arranging terms as in (9'), we get to

(10') $\Delta\varepsilon_1 > c - \Delta w_1 - \Delta b_1 - \beta[\Delta w_{2,1} - \Delta b_2]$

$$+ \beta[1 - \Phi(z)][\Delta w_{2,2} + \Delta b_2 - c] + \beta\sigma\phi(z) = \Delta\varepsilon_1^*$$

with $\Delta\varepsilon_1^*$ being the value for the difference in shocks between the two countries that triggers migration in the first period.

To focus these ideas, let us assume now that $w_2^S = w_1^S$, and $\Delta b_1 = \Delta b_2$. Individuals are expected to migrate in the first period rather than in the second if $\Delta\varepsilon_2^* > \Delta\varepsilon_1^*$. This is the case iff

(11) $[\Delta w_1 - \Delta w_{2,2}] + \beta[\Delta w_{2,1} - \Delta w_{2,2}]$

$$> \beta\Phi(z)[\Delta w_{2,2} + \Delta b_2] + \beta\sigma\phi(z) - \beta[1-\Phi(z)]c$$

The left-hand side of this inequality reflects the **wage effect** due to the investment in human capital. The first term in brackets is the difference in earnings an immigrant experiences in the first period in which he is staying in Israel. This term is negative, as $h_1^s{}^* > 0$. The second term on the left hand side of (11) is the difference in wages in period 2 in Israel, depending on whether migration took place in the first period or in the second. The second difference in wages, discounted by β, is at least as big in absolute value as the first one. Otherwise, there would be less investment in human capital in the first period. So the left-hand side of (11) will always be positive. The right-hand side of the inequality describes the **option value effect** of waiting. The first term measures the expected regret if migration takes place in period 1. Personal characteristics that increase wages or non-monetary utility of living in the source

country (in Israel) increase (decrease) the amount of loss in case the decision to migrate in the first period turns out to be wrong ex-post. The amount of the loss in that case is weighted by the probability that this loss occurs. The second term reflects the fact that, in case the decision is procrastinated to the second period, knowledge of the realization of the period 2 shocks can be taken into account for the decision. The last term discounts migration costs.

The higher the wage effect compared to the option value effect, the more likely it is that migration will take place in the first period.

3.3 The influence of human capital on the timing of migration

To investigate the influence of source country human capital on the timing of the migration decision, we define $D(s^S)$ as the difference between the right-hand side and the left-hand side of (11). The bigger $D(s^S)$, the more people are expected to come in the first period.

(11') $D(s^S) = [\Delta w_1 - \Delta w_{2,2}] + \beta[\Delta w_{2,1} - \Delta w_{2,2}]$

$- \beta\Phi(z)[\Delta w_{2,2} + \Delta b_2] + \beta\sigma\phi(z) - \beta[1-\Phi(z)]c$

We are interested in how this function depends on s^S. If the first derivative with respect to s^S is positive, this means that people coming in the first period have more schooling than people coming in the second period. However, the sign of the derivative turns out to be ambiguous.

(12) $\partial D/\partial s^S = \beta(1 - h_1{}^{w*})\cdot k'(\cdot)\cdot g'(s^S)$

$- [1 - \beta\Phi(z)]\partial w^S/\partial s^S + \beta\phi(z)[\Delta w_{2,2} + \Delta b_2 - c]/\sigma - \beta\phi'(z)$

There are four terms influencing the likelihood to migrate earlier. The first one comes from the wage effect; it is positive. The impact of the wage effect increases with the amount of source country human capital a person has, because the marginal return on the investment of new human capital per unit of time increases with the amount of source country human capital that is used in the production process. The three terms in the second line of (12) describe the impact through the option value effect. The second term is negative, the third and the fourth term can be positive or negative, depending on the sign of z. Notice the separability of the two kinds of effects: The first effect is only due to the dependency of Israeli wages on skills, whereas the effects in the second line are only due to the dependency of source country wages on skills.

As the overall effect of human capital on the timing decision is ambiguous, it remains an empirical issue to show which effect dominates.

3.4 Empirical Implementation

In the last two paragraphs, I presented a hypothesis of how potential migrants decide when to come. One prediction of the model is that, because of the option value effect, people who, ceteris paribus, have a higher utility of staying in Israel or a lower utility of staying in the source country should come earlier.

Concerning the effect of education, however, the prediction of the model is ambiguous. If the model describes the timing of the migration decision accurately, the sign of the education coefficient shows which effect dominates. But we would also like to test whether the story the model tells makes sense. The fact that we observe that the more educated immigrants came earlier might be due to other reasons. For example, the more educated might have different information about the possibilities of migration. They might rely relatively more on written information than on reports of other people who migrated earlier. Moreover, they might live in bigger towns, where it is easier to gather information and to apply for a visa. In both cases, they may get quicker access to information about immigration than less educated potential migrants, which makes them come earlier.

Therefore, I will present three tests that support the explanation of the model as opposed to the explanations just given. The common idea of all three is, that if it is wage growth in Israel, and not inherent characteristics of more educated people that makes them come earlier, the effect should only hold among the working force of the immigrants. In addition, notice that among the working force itself, the impact of education should be stronger for younger persons. The younger someone is, the longer he profits from the returns to investments in education. Hence, if we have a positive coefficient for education, which means that the wage effect dominates the option value effect, we also expect an interaction term of age and education in the estimation to be negative, because human capital investment loses importance the older an individual is.[7] Thus, the sign of the coefficient for the age-education interaction term is the first test. The second test will be to investigate the coefficient for education in a regression including only retired people. The inherent characteristics of a person who

[7] A similar idea has been used by Schwarz (1976). He uses the interaction between age and education in the likelihood to migrate to test an application of human capital theory.

is more educated do not change with retirement, so if the education coefficient is insignificant for this sample, this is a hint that it is not living in a city or differences in the access to information that makes the more educated come earlier, but the effect on wage growth. A third test will be to compare the education coefficients for women with and without children. Having children decreases the probability of participation in the labor market, so the wage effect should be less important for mothers than for non-mothers.

In the model, shifts in the difference in utility in the two countries are covered by changes in $\Delta\varepsilon$. We would like to incorporate this in the estimation with variables describing changes in the individuals' life during the time spent in the country of origin, e.g. whether relatives already migrated, wages, or employment status. However, this information is not available. Therefore, changes in economic conditions are proxied by macroeconomic time series variables of Israel, the countries of origin, and the USA. Information on the USA is included to reflect the fact that the outside option for many immigrants is not only to stay in their country of origin, but also to go to the USA instead of Israel. Changes for the better in the source country and in the USA are expected to mitigate the likelihood of migration, whereas improvements of economic conditions in Israel are expected to increase the likelihood of immigration.

4. Data

The individual data I use in this paper are from the 1995 demographic Census of Israel and from the 1995-1998 samples of the demographic Labor Force Survey (LFS) of Israel. From these two data sets I selected all individuals who immigrated to Israel from countries of the FSU and six other Eastern European countries[8] since 1989.[9] The Census includes detailed information about 20% of the Israeli population in 1995. Therefore, I have data on 20% of all immigrants from the FSU and the Eastern European countries. Excluding children that were under 15 in 1995, I end up with around 90,000 observations.

The Labor Force Survey (LFS) is a yearly data set containing information for approximately 12,000 Israeli households. As it is on the characteristics of the Israeli Labor Force, there is no information about persons under the age of 15, and persons

[8] These countries are Romania, Bulgaria, Poland, Slovakia, the Czech Republic and Hungary.
[9] I also include Israeli-born offspring.

aged more than 75 (in the 1995 sample) or more than 85 (in the succeeding years) are reported as being 75 or 85, respectively. Combining the LFS data sets for the years 1995 to 1998, I end up with around 20,000 observations. The main advantage, compared to the Census, is that it includes some observations of immigrants who came during the years 1996-1998, which extends the range of my dependent variable. However, immigrants arriving after 1995 are underrepresented in this data, and more so the later they came, because in every year, the LFS has only observations of immigrants up to that year. Therefore, observations for 1996 immigrants enter with double weight in the estimations, observations for 1997 enter with triple weight, and observations for 1998 with quadruple weight. Table 1 presents the number of observations for every year and the total number of immigrants from the FSU. After the weighting, the distribution of immigrants over the years reflects the population distribution fairly well.

Table 2 presents some summary statistics for the two data sets. Note that with more than 13 years of schooling on average, the immigrants have slightly more schooling than native Israelis. About 85% of all immigrants come from only five different source countries out of twenty.

The focus of this paper is on the changes in the observable characteristics of newly arriving immigrants over time. Figure 1 shows the development of the average age of immigrants who were between 25 and 60 years old in 1989, separate for all immigrants, for immigrants from the Ukraine, and for immigrants from Russia. There is no clear pattern, and differences between the graph for the Ukraine and for Russia are large. Figure 2 shows the development of average years of schooling for the same three groups. Immigrants from the Ukraine, and even more so those from Russia, generally have a higher level of education than the other immigrants. However, the downward trend is the same for all groups depicted. Hence, the decline in education seems not to be due to a change in the composition of the countries of origin.

The data on GDP growth and unemployment in Israel is calculated using official data from the Israeli Central Bureau of Statistics. GDP growth rates in the source countries and the data on the USA are from the EIU (Economics Intelligence Union), the research department of the Economist.

5. Estimation Methods and Econometric Issues

The data introduced in the last section are used to see in which way observable characteristics influence the timing of migration. In particular, we want to see if more educated people migrate earlier. We use duration in the country of origin as the dependent variable and estimate both a continuous and a discrete failure time model.

Table 1 shows that the number of immigrants peaked in 1990 and 1991 and subsequently levels off at a roughly constant number of immigrants per year. This pattern is not reflected in the time series behavior of education over time, where, except for 1989, a continuous decline is observed (cf. figure 2). The same holds true for other explanatory variables like being Jewish, being married, or the number of children (not reported in the paper). It seems that the baseline hazard of migration varies strongly over time, whereas the coefficients for the explanatory variables are time-invariant. This suggests a Cox proportional hazards model (Cox, 1972). The hazard is assumed to be

(13) $\lambda(t;x(t)) = \cdot\exp(x(t)\beta)\lambda_0(t)$,

where β is the vector of unknown parameters and $\lambda_0(t)$ is the baseline hazard. The baseline hazard is an unknown function giving the hazard for x = 0, which is allowed to vary arbitrarily over time. Covariates also may vary over time. If there are no ties in the data, the partial likelihood function is given by

(14) $$L(\beta) = \prod_{j=1}^{k}\left[\frac{\exp\left[x_{(j)}(t_{(j)})\beta\right]}{\sum_{l\in R(t_{(j)})}\exp\left[x_l(t_{(j)})\beta\right]}\right]$$

where k is the number of failure times with $t_{(1)} < t_{(2)} < \ldots < t_{(k)}$, $x_{(j)}(t_{(j)})$ is the value of x(t) for the item failing at t(j), $x_l(t_{(j)})$ is the value for the *l*th item at the sample elapsed time t, and $R(t_{(j)})$ is the set of individuals at risk at time $t_{(j)}$. The fact that the explanatory variable is on a yearly basis, however, leads to a large number of ties, i.e. many "failures" happen at the same time. Assuming that every failure in a given year is the first to fail (Breslow approximation) gives a crude approximation, which can seriously distort results if the number of ties is large.

Therefore, we also estimate a discrete time hazard model. The data is arranged in person-year form. Every person in every year up to the year in which migration takes place is considered one observation, which results in an artificial, unbalanced panel. The dependent variable, whether migration takes place for a certain observa-

tion, is binary, which suggests estimation of a logit model.[10] Time dummies fulfill the task of the baseline hazard in the continuous model. However, my data set has a serious drawback for this kind of estimation. Namely, as the data is Israeli data, it includes only persons that actually migrated until 1995 or 1998, respectively, so that the data is choice-based. There are no observations for people who migrated to another country or who have been remaining in the FSU so far. The estimated coefficients can only be interpreted as conditional on the fact that somebody left for Israel up to a certain time. In addition to that, the data is not censored as usually the case with duration data. In my sample, everybody who enters the last period is sure to fail, so that inclusion of yearly time dummies leads to collinearity. In addition to the reference year, the time dummy for the last year also has to be omitted. Another possibility to cover time effects is to include a polynomial of time in the regression.

Two problems are associated with the coefficients of the macroeconomic variables. These variables turn out to be highly significant in many cases, especially if there are no time effects included. However, first, macroeconomic variables for Israel and the USA, which are the same for all individuals, are likely to absorb some of the time effects. Analogously, the coefficient for GDP growth in the source countries may also include common unobservable characteristics of individuals from the respective source countries (Moulton, 1990). Second, the number of degrees of freedom used for the calculation of the standard errors is the number of individuals in the sample, whereas the number of different observations is restricted to the number of countries times the number of years (Card, 1995). A regression of the probability to migrate on the cell means of the individual characteristics and the macroeconomic variables delivers more realistic values for the standard errors. In this case, the coefficients are not significant.

[10] The model I estimate is very similar to a random effects probit with an unbalanced panel. Apart from the different assumption about the distribution of the dependent variable, the random effects probit allows for individual heterogeneity. In this case, however, individual heterogeneity does not seem to be important. I estimated the model as a random effects probit, and the estimated within-group correlation is rather low and the coefficients hardly change compared to a probit estimation that does not allow for individual heterogeneity.

6. Estimation results

6.1 General results

Estimations are made using the Census and the Labor Force Survey, including immigrants who were between 25 and 60 in 1989 and did not study at survey time.[11]

The results of the Cox proportionate hazard model are reported in table 4. The first column reports results of an estimation with the Census, including dummies for Europe or a south-eastern country of the FSU as country of origin[12]. The second column replaces the two region dummies by dummies for every country of origin. Columns 3 and 4 repeat the estimations with the Labor Force Survey.

The dummy that is equal to one if the immigrant is not from the FSU, but from one of the six East European countries is expected to have a positive coefficient, because the possibility to emigrate arouse slightly earlier in these countries. In contrast to that, the dummy for the south-eastern countries of the FSU is expected to have a negative coefficient. The south-eastern countries of the FSU are relatively less developed than the other areas of the FSU, therefore migration is likely to be more complicated to organize. In addition to that, only in recent years, when the flow of FSU immigrants started to decrease, did the Jewish Agency for Israel (JAFI) place big immigration campaigns in these countries. Using dummies for every country of origin instead of these two regions only does not change the results. Therefore, in the discrete case only estimations with the two region dummies are reported. The logit estimations are presented in table 5. For both the Census and the Labor Force Survey, there are three different specifications to cover the time effect. The specification in the first and the fourth column is closest to the continuous case. The baseline hazard is replaced by yearly time dummy variables, with the last year omitted and the last but one year as the dummy reference group. The second and fifth column presents a specification with a third order polynomial of time and two macroeconomic variables. Results hardly differ. Finally, the estimation in the third and sixth column records a specification with two more macroeconomic variables, but without any time effect. Time effects are hidden in the macroeconomic variables. Although the macroeconomic variables in

[11] The data sets contain only information about the immigrants' characteristics at the date of the survey, whereas the model is about the immigrants' characteristics at the date of migration. If characteristics change in Israel because of being in Israel for a certain amount of time, there is an endogeneity problem. Therefore, people that are still studying in Israel are excluded, because the decision about the duration of education might be different in Israel than in the source country.

[12] The countries are Armenia, Azerbaijan, Georgia, Kazakhstan, Kurdistan, Tajikistan, Turkmenistan, and Uzbekistan.

this specification all have the right sign and are highly significant, the size of the parameters is quite implausible. Problems concerning the reported standard errors of these variables were discussed in the previous section.

The coefficient for education, measured as years of schooling, is positive. More educated people migrate earlier. In terms of the model, the wage effect clearly dominates the option value effect. In the Census, older people come earlier, but this effect diminishes with age. The interaction variable of age with education is negative. This is the first of the three tests mentioned in section 3.4 to see if it is really due to human capital investment considerations and not for other reasons that the more educated are migrating earlier. Human capital considerations lose importance for older people, so, according to the theory, the interaction term is expected to be negative. The second and third test will be reported in section 6.2.

Being Jewish has a strong positive impact on the time of immigration.[13] Assuming that the non-monetary utility b of living in Israel is higher for Jewish than for Non-Jewish persons, this reflects the option value effect. The higher the utility of living in Israel, the earlier migration is expected to take place. However, there might also be some other reasons that play a role here. First, Jewish people might come earlier because they have better information about the options of migration to Israel, or because they are more inclined to migrate to Israel than to any other country. So they do not wait to see how the options of going somewhere else turn out to be. Second, applicants who are themselves Jewish probably get their permission to make aliya (i.e. to migrate to Israel) quicker than people who are not Jewish and have to prove that they are of Jewish origin. And finally, if some Non-Jewish immigrants decide to convert to Judaism after having spent some time in Israel, the percentage of Jewish people in the data set is higher among immigrants who came earlier.

Being married increases the probability of migrating early. Eckstein and Weiss (1999) found a strong positive wage effect of being married for FSU immigrants in Israel. Without having an explanation for this effect, my result nevertheless is consistent with their finding. If the return to being married in Israel is higher than in the FSU, the wage gap is bigger for couples so that they are more likely to come than singles. Concerning children, results are mixed: In general, children delay migration.

[13] Jewish people in the data set are Jewish themselves. The Non-Jewish are those that immigrate as spouses or descendants of Jews.

However, in the Labor Force Survey the hazard of migration increases in the number of children.

The results for the estimations with the Census and the Labor Force Survey differ only slightly. The main differences are in the coefficients for age, for the number of children, and for the region dummies. Concerning age, results are not very robust to different specifications anyway. The distribution for the "number of children" variable is extremely skewed in both samples. In addition to that, the variable is not measured correctly in the Labor Force Survey. The Survey has only information about the number of kids of age less than 15 in the year of the survey. I merge four different survey years without correcting for that. Concerning the region dummies, the number of observations is very low for some years in the Labor Force Survey. Census results are therefore likely to be more reliable in that respect.

6.2 The role of education for people out of the labor force

In section 3.4, we discussed three informal tests to find evidence for the relevance of the human capital investment model to explain the decline in immigrants' education over time. The first test was presented in the last section: With increasing age, the impact of education on the timing of migration decreases. In this section, we check if the education coefficient for people out of the labor force differs from the coefficient for the working population. First, we look at a sample of retired people and compare the education coefficient in this sample with the coefficient for the working population. Second, we look at a sample of couples and compare the education coefficient of wives with and without children. In both cases, only Census estimations are reported. In the Labor Force Survey, the age variable is right-censored, and there is only poor information about family status. Therefore it is not suitable for this kind of analysis.

Table 6 repeats the estimation reported in the second column of table 5, but using the sample of immigrants who were at least 60 years old in 1989. To make comparison easier, the respective estimation from table 5 is repeated in the second column. The third column reports the estimation with a Census sample of couples, married at least since 1989, who migrated together.

If educated people have a different migration behavior because of different underlying characteristics or because their access to information is different, this should hold for all age groups. However, human capital investment considerations are

no more relevant after retirement.[14] In fact, the estimated coefficients for being Jewish, being married and for region of origin are roughly the same for the group aged 60+ and the group aged between 25 and 60. However, the education coefficient is not significant for the group aged 60+, and the hypothesis that the coefficient for education is equal to the coefficient in the 25-60 group can be rejected at any common significance level.[15] This is the second of the three tests discussed in section 3.4 to see whether the human capital investment story is reasonable.

The third test compares the impact of education for married women with and without children. In the estimation for couples in the last column in table 6, the education coefficient for wives is interacted with a dummy for the couple having children aged between 0 and 12 in 1995. The coefficient for wives without children is positive and significant. The hypothesis that it is equal to the coefficient of the husband cannot be rejected. In contrast to that, the coefficient of the wives with children is not significant, and the hypothesis that it is equal to the coefficient for wives without children has to be rejected.

The other results are similar to the results in the estimations with individuals. Not surprisingly, both spouses being Jewish has a big positive impact; and the effect of only one partner being Jewish is still positive and significant, but smaller.[16]

6.3 Migration and wage assimilation of couples

The fact that the estimated impact of education on the migration decision is the same for men and women if the couple has no children is an interesting feature of this immigration wave. It suggests that the family investment hypothesis does not apply in this case. In a nutshell, the family investment hypothesis states that upon arrival in the new country, it is the husband who invests in human capital, whereas the wife starts to work right from the beginning to earn a living for the family.[17]

It seems, however, that the labor market assimilation for FSU immigrant couples is much more symmetric than the family investment hypothesis suggests, and if there are any gender differences in labor market characteristics, they are rather in the

[14] Immigrants who immigrate to Israel after retirement get a pension (Bituach Leumi), which is independent of their educational level and of their former earnings in the source country.
[15] The insignificance of the education coefficient of the old age sample is not due to less variation in the dependent variable.
[16] In the sample, in 73% of the couples both spouses are Jewish, 23% of the couples are mixed, and 4% are both Non-Jewish.
[17] For Canada, see Baker and Benjamin (1997), for the USA, see Duleep and Sanders (1993).

opposite direction. This is in line with the literature. Cohen (2000), using a data set with detailed information about the labor market history of FSU immigrants, finds that the unemployment rate for women in this sample is about 50% higher than the respective rate for men, and participation in training programs is slightly higher. However, the family investment hypothesis predicts that this is the other way round. One reason for the more symmetric behavior of couples might be that in this immigration wave, usually both spouses have the same amount of schooling, and the differences in schooling between the spouses are symmetrically distributed. The main argument against a family investment hypothesis in Israel, however, is that living expenses during participation in the training program are part of the absorption basket every new immigrant in Israel is entitled to get, so that the household budget constraint does not exclude the possibility that both partners participate in training.

7. Conclusions

This paper presents a simple model to explain the influence of the educational level on the timing of migration. Immigrants with a higher level of education have an incentive to come earlier, because they need time in the new country to make their imported human capital usable on the new labor market. On the other hand, their initial wage decrease is higher than the decrease for unskilled immigrants. Although the theoretical effect is ambiguous, the estimations clearly suggest that the investment effect for human capital dominates the initial earnings loss. Other empirical findings are that being Jewish, being married, and having no children encourage early migration. Changes in macroeconomic conditions are not able to explain changes in the number of immigrants over time.

8. Literature

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Tables and Figures

Table 1: Number of immigrants per year (in thousands)

Year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Census	2.3	27.7	21.5	9.8	9.5	9.7	7.3			
LFS	0.5	5.1	4.3	1.8	1.9	2.0	1.8	2.5	2.1	0.7
Total	12.9	176.5	140.2	61.2	64.2	64.5	61.2	59.2	55.6	47.0

Note: Total is total number of immigrants from the FSU, data from the Israeli Central Bureau of Statistics

Table 2: Summary statistics

	Census	Labor Force Survey 1995-1998
Total number of observations	87,931	19,536
Avg. education (years of schooling) for people between 25 and 60 in 1989	13.39	13.76
Percentage married*	57.03	59.78
Percentage Jewish	89.75	93.76
Percentages coming from the five countries with the most immigrants**[18]	Ukraine 34.77 Russia 33.48 Belarus 7.49 Uzbekistan 6.12 Moldova 5.12	Ukraine 33.29 Russia 29.91 Belarus 8.01 Uzbekistan 7.84 Moldova 5.34

Note: *for the Census married since 1989 at least, ** percentages are given excluding "Soviet Union" as an answer

[18] The information in the data set is not "country of origin", but "country of birth", and I take them as being the same. I do not consider that as a problem because a dummy for persons with younger family members that were born in a different country than they themselves proved to be insignificant.

Table 3: Maximum and minimum GDP growth rates of the countries of origin (EIU data)

Year	Minimum	Country	Maximum	Country
1989	-7	Turkmenistan	8.8	Moldova
1990	-12	Poland	11.3	Uzbekistan
1991	-20.6	Georgia	-.5	Uzbekistan
1992	-52.4	Armenia	2.6	Poland
1993	-29.3	Georgia	3.8	Poland
1994	-30.9	Moldova	5.4	Armenia
1995	-12.4	Tajikistan	7.2	Romania
1996	-10.1	Bulgaria	11.4	Georgia
1997	-25.9	Turkmenistan	11.4	Estonia
1998	-7	Moldova	7	Belarus

Table 4: Cox proportionate hazard model

	Census (25-59)		Labor Force Survey (25-59)	
Education	0.053*** (.005)	0.054*** (.005)	0.090*** (.016)	0.088*** (.016)
Age in 1989	0.041*** (.004)	0.040*** (.004)	0.013 (.013)	0.012 (.013)
Age in 1989 squared	-0.0005*** (.00004)	-0.0005*** (.00004)	0.00002 (.00013)	0.00014 (.00019)
Education * Age 1989	-0.0007*** (.0001)	-0.0007*** (.0001)	-0.0014*** (.0004)	-0.0013*** (.0004)
Jewish	0.508*** (.011)	0.500*** (.011)	0.515*** (.034)	0.512*** (.036)
Married	0.174*** (.009)	0.170*** (.009)	0.148*** (.028)	0.147*** (.028)
Child (<15[1])	-0.041*** (.015)	-0.043*** (.015)	-0.132*** (.045)	-0.112** (.045)
Number of Children (<15[1])	-0.015* (.008)	-0.015* (.008)	0.093*** (.025)	0.075*** (.026)
South-East	-0.178*** (0.011)		-0.004 (0.032)	
Europe	0.108*** (0.031)		-0.100 (0.086)	
GDP growth rate source country	0.003*** (0.0007)	-0.002** (0.0009)	0.005** (0.002)	-0.004* (0.002)
Country dummies	no	yes	No	yes
Observations	40,843	40,843	10,036	10,036
Wald chi2	3738.39	3738.39	361.13	440.41
Log likelihood	-403085.59	-403085.59	-99182.18	-99111.01

Note: robust standard errors in parentheses, *** sign. 1%, ** sign. 5%, *sign. 10%, [1)] 1995 is reference year, for Labor Force Survey children younger than 15 in the survey year

Table 5: Discrete time hazard model (logit)

	Census (25-59)			Labor Force Survey (25-59)		
Education	0.095*** (.008)	0.096*** (.008)	0.092*** (.008)	0.135*** (.023)	0.134*** (.023)	0.095*** (.014)
Age in 1989	0.070*** (.007)	0.071*** (.007)	0.068*** (.007)	0.021 (.019)	0.020 (.019)	0.021* (.011)
Age in 1989 sq	0.0008*** (.00007)	0.0008*** (.00007)	0.0008*** (.00007)	-0.00003 (.0002)	-0.00003 (.0002)	-0.00001 (.0001)
Education * Age 1989	-0.001*** (.0001)	-0.001*** (.0001)	-0.001*** (.0002)	-0.002*** (.0005)	-0.002*** (.0005)	-0.001*** (.0003)
Jewish	0.833*** (.017)	0.890*** (.020)	0.854*** (.020)	0.762*** (.056)	0.762*** (.058)	0.565*** (.028)
Married	0.292*** (.015)	0.304*** (.015)	0.294*** (.015)	0.222*** (.021)	0.224*** (.042)	0.168*** (.024)
Child (<15[1])	-0.071*** (.024)	-0.076*** (.026)	-0.073*** (.024)	-0.192** (.066)	-0.190** (.066)	-0.153** (.040)
# Children (<15[1])	-0.025* (.014)	-0.027* (.015)	-0.025* (.014)	0.132*** (.036)	0.131*** (.037)	0.099*** (.023)
South-East	-0.308*** (0.017)	-0.313*** (0.018)	-0.292*** (0.018)	0.006 (0.046)	0.001 (0.047)	0.024 (0.028)
Europe	0.145*** (0.055)	0.189*** (0.055)	0.190*** (0.052)	-0.148 (0.133)	-0.171 (0.137)	-0.039 (0.075)
GDP growth rate origin	0.018*** (0.001)	0.012*** (0.001)	0.010*** (0.001)	0.006*** (0.002)	0.010*** (0.002)	-0.008*** (0.002)
GDP growth rate Israel		0.013*** (0.004)	0.479*** (0.005)		0.008 (0.008)	0.042*** (0.009)
Unemployment Israel		-0.204*** (0.021)	-1.049*** (0.009)		-0.745*** (0.027)	-0.395*** (0.017)
GDP growth rate USA			-0.728*** (0.007)			-0.204*** (0.013
Unemployment USA			1.491*** (0.016)			0.201*** (0.038)
Time dummies 89-93	yes	no	no	yes	no	no
Time polynomial (t, t^2, t^3)	no	yes	no	no	yes	no
Macroeconomic variables		for Israel	for Israel and USA		for Israel	for Israel and USA
Observations	40,843	40,843	40,843	10,036	10,036	10,036
Wald chi2	20969.56	26599.08	29078.60	3056.80	2971.42	1452.35
Deviance	140584	137858	140713	48158	48134	55150

Note: robust standard errors in parentheses, *** sign. 1%, ** sign. 5%, *sign. 10%, standard errors corrected for clustering on id, [1)] 1995 is reference year, for Labor Force Survey children younger than 15 in the survey year

Table 6: Discrete time hazard model for immigrants 60+ and couples

	Individuals		Couples	
Age group	60+	25-59	25-59	
Education	0.002 (.012)	0.096*** (.008)	0.105*** (.023) 0.059** (.024) -0.004 (.004)	Educ. husband Educ. wife no kid Educ. wife kid
Age in 1989	0.001 (.003)	0.071*** (.007)	0.059*** (.023) -0.016 (.023)	Age 1989 husband Age 1989 wife
Age in 1989 sq	0.0000(.00000)	0.0008*** (.0001)	-0.0005** (.0003) 0.00004 (.0003)	Age 1989 sq husb. Age 1989 sq wife
Education * Age 1989	0.001 (.0002)	-0.001*** (.0001)	-0.002*** (.0005) -0.0003 (.0006)	Educ. * Age husb. Educ. * Age wife
Jewish	0.658*** (.052)	0.890*** (.020)	1.390*** (.080) 0.389*** (.081)	Both Jewish One spouse Jewish
Married	0.122*** (.023)	0.304*** (.015)		
Child (<15[1])	-0.115* (.064)	-0.076*** (.026)	-0.190*** (.037) -0.173*** (.037)	Child (0-6[1]) Child (7-15[1])
# Children (<15[1])	-0.017 (.042)	-0.027* (.015)	0.120*** (.023)	# Children (<15[1])
South-East	-0.295*** (.040)	-0.313*** (.018)	-0.331*** (.040)	South-East
Europe	0.109* (.059)	0.189*** (.055)	0.815*** (.193)	Europe
GDP growth rate origin	0.004* (.002)	0.012*** (.001)	0.010*** (.002)	GDP growth rate origin
GDP growth rate Israel	0.002 (.007)	0.013*** (.004)	0.017*** (.044)	GDP growth rate Israel
Unemployment Israel	-0.162*** (.035)	-0.204*** (.021)	-0.252*** (.044)	Unemployment Israel
Observations	14,234	40,843	10,741	Observations
Wald chi2	9343.22	26599.08	6420.79	Wald chi2
Deviance	49629	137858	34072	Deviance

Note: estimations include a time polynomial of order 3, robust standard errors in parentheses, *** sign. 1%, ** sign. 5%, *sign. 10%, standard errors corrected for clustering on id, [1)] 1995 is reference year

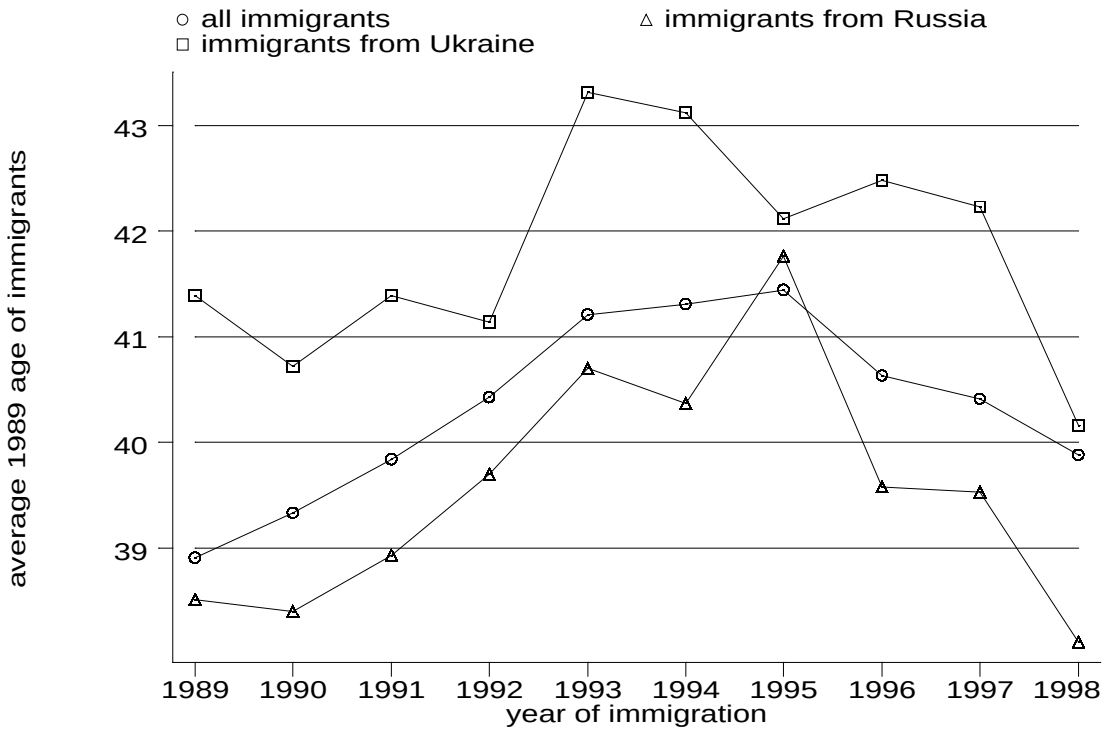

Figure 1: average age in 1989 for all immigrants, for immigrants from Russia, and for immigrants from the Ukraine (between 25 and 60 in 1989, data from the LFS 1995-1998)

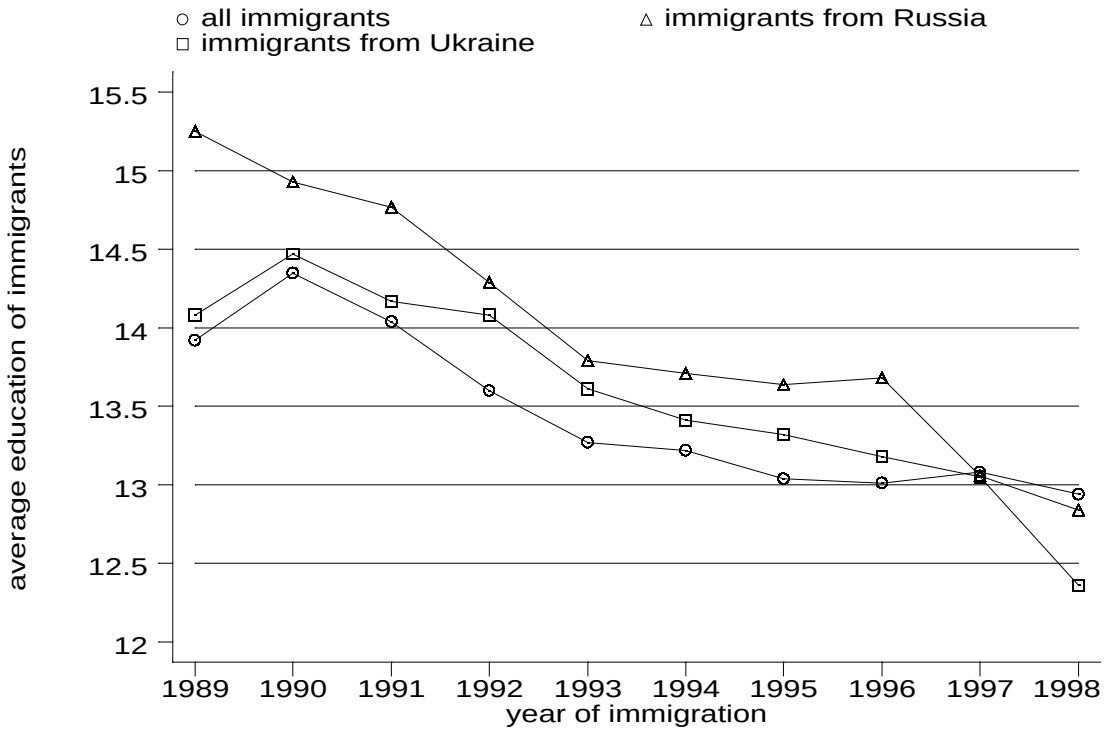

Figure 2: average education (years of schooling) for all immigrants, for immigrants from Russia, and for immigrants from the Ukraine (between 25 and 60 in 1989, data from the LFS 1995-1998)

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