A Second Soul: Age at Immigration, Language, and Cultural Assimilation*

Jaime Arellano-Bover† Kobi Mizrahi‡ Shmuel San§

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Abstract

Using Israeli administrative records, we study age-at-arrival effects on the cultural assimilation of Former Soviet Union Jews who migrated to Israel as children. Focusing on the arrival waves who left the USSR immediately following the 1989 unexpected lifting of Soviet emigration restrictions lends a plausibly causal interpretation to age-at-arrival effects. We leverage a revealed-preference measure of language acquisition—the language in which a person chooses to take the university admissions standardized test—to study Hebrew knowledge in early adulthood as a function of age at immigration. Then, given the different fertility norms in the USSR and Israel, we consider intermarriage with natives, age at first child, and completed fertility as cultural assimilation outcomes. We additionally propose an intra-family research design based on comparing siblings who arrived in Israel at different ages. Lastly, we put forward a mediation framework that quantifies the links in the causal chain going from age-at-arrival, Hebrew knowledge, intermarriage, and fertility.

*Jaime Arellano-Bover gratefully acknowledges funding from a Modigliani Research Grant by the UniCredit Foundation.
†Yale University, IZA, CESifo. Email: **jaime.arellano-bover@yale.edu**
‡Princeton University. Email: **kmizrahi@princeton.edu**
§Hebrew University of Jerusalem. Email: **muly.san@mail.huji.ac.il**

1 Introduction

Recent trends in immigration and population aging across developed countries have brought immigration policy and immigrants' integration to the forefront of the policy and political debate. Immigration has the potential to increase aggregate productivity (Burchardi et al., 2020) and rejuvenate aging societies.[1] However, natives' anti-immigration sentiments are oftentimes mostly driven by cultural mismatch concerns (Tabellini, 2020; Alesina and Tabellini, 2024). In this context, it is important to improve our understanding on determinants of cultural integration and assimilation in large migration episodes.

In this paper, we analyze age-at-arrival effects on the long-term cultural assimilation of immigrants who arrive to their host country as children. As opposed to adults, immigrant children are in the midst of human capital development and identity formation. Age at migration might be a key determinant of cultural assimilation to the extent that children of different ages will arrive at different developmental, educational, and socialization milestones. However, identifying age-at-arrival effects is associated with a series of challenges which include the endogeneity of migration decisions, selection driven by out-migration, and data limitations in tracking long-term outcomes. Moreover, while language acquisition is a plausibly important driver of integration, it is typically not observed in longitudinal administrative datasets.

We overcome these empirical challenges studying Former Soviet Union (FSU) Jews who migrated to Israel shortly after the unexpected lifting of Soviet emigration restrictions in 1989. We argue for the exogeneity of the age at arrival of immigrant children given the pent-up demand to leave the FSU and desire to escape persecution (Abramitzky et al., 2022). We can track child immigrants in Israeli administrative data for up to 29 years after arrival, observing residential sorting, intermarriage, and fertility outcomes. FSU Jews were very different from Israeli natives and faced significant cultural barriers (Remennick, 2007), leaving ample scope for variation in long-term cultural assimilation. As FSU migrants generally did not speak Hebrew, language presented an important hurdle to integration. Our data include a unique revealed-preference measure of Hebrew knowledge at young adulthood—the language in which a person chooses to take the university admissions standardized test—allowing us to quantify the role of language acquisition in cultural assimilation.

Our empirical approach consists in comparing the long-term outcomes of FSU immigrant children who arrived in Israel at different ages between 1990–1991. Benchmarking age-at-arrival differences to natives of the same birth cohorts allow us to control for common time effects in the outcomes of interest. Based on the historical context and supporting balance tests, we argue for a causal interpretation of age-at-arrival differentials.[2] Outmigration among FSU Jews was rare and unlikely to lead to selection concerns when ex-

[1] See, for example, reports by Peri (2020) and Gokhale (2024).

[2] The bulk of the post-1989 FSU migration wave to Israel occurred between 1990–1999 (see Figure A1). The exogeneity of age at arrival is more plausible for the early arrivals we study, which can be thought of as refugees, while later waves can be thought of as economic migrants (Abramitzky et al., 2022) and for whom typical selection concerns regarding the timing of migration are more likely.

amining long-term outcomes (Arellano-Bover and San, 2024). Lastly, we put forward an alternative, intra-family research design based on comparing siblings who arrived in Israel at different ages.

An important advantage of our data and setting is the availability of a revealed-preference measure of child immigrants' Hebrew knowledge in young adulthood. Students applying for higher education programs in Israel take a standardized test called Psychometric Entrance Test (PET), typically between ages 18–25. Crucially, students can take the test in Hebrew or in Russian (as well as Arabic, English, and French) and this choice is reflected in our data. Given the high stakes and that students can freely choose, we interpret the choice to take the test in Hebrew as a revealed-preference measure of Hebrew knowledge. We can observe this measure for those who apply to higher education, which represent around 47% of our population of interest.

Our first set of empirical results quantify age-at-arrival effects on our measure of Hebrew language acquisition. We find a strong pattern of age-at-arrival effects on the probability of taking the PET test in Hebrew. FSU immigrants who arrived at age 7 are as likely as natives to take the test in Hebrew, whereas practically none of the ones who arrived at age 17 do so. The drop in the probability of Hebrew between ages 7–17 is strongly *non-linear*, with most of the drop occurring during a few critical years, between ages of arrival 10–14. Thus, our evidence suggests that small differences in the age at arrival between ages 10–14 can have meaningful, long-lasting consequences for language integration.

Next, we study residential sorting as a measure of integration, comparing the cities of residence at age 35 of FSU children who arrived at different ages. We characterize cities by the share of their population who are FSU immigrants, building on literature that studies residential segregation in immigrant enclaves (e.g., Eriksson and Ward, 2019). We find significant age-at-arrival gradients whereby those who arrived in Israel at ages 16–17 lived by age 35 in cities with FSU population shares that were on average 2 percentage points higher than those who arrived at age 7.

Matching with a native in the marriage (or partners) market is a meaningful dimension of integration which our data allow us to analyze. Regardless of whether we define partners by marriage or by having a child in common, we find a steep gradient between arrival age and the probability of matching with a native partner. For instance, the differential probability of having children with a native for FSU children who arrived at age 7 is -0.40, while the corresponding one for those arrived at age 17 is around -0.64.

Our last set of cultural assimilation outcomes relate to fertility behavior. The reasons are twofold. First, fertility has intrinsic interest in the context of the relationship between immigration and demographic decline. Second, the cultural norms between the FSU and Israel were very different—relative to the FSU, the Israeli norm is for women to have their first child at an older age, but have a greater number of children overall.[3] We find age-at-arrival effects that point towards assimilation in fertility norms in both of these dimensions. Relative to FSU immigrants who arrived age 17, those who arrived at younger ages had

[3]Among OECD countries, Israel has, by far, the highest total fertility rate (equal to 2.9 according to the UN).

their first child earlier and had a greater number of kids by age 35.

Presumably, Hebrew language acquisition could be a key mediator of age-at-arrival effects on the cultural assimilation outcomes we consider. Moving to a less segregated city and matching with a native-born partner could intuitively be easier for FSU immigrants who reached young adulthood with proficient Hebrew, relative to those who did not. While it's not clear that Hebrew knowledge could have direct effects on assimilation on fertility behavior once we condition on having a native partner, it could still have indirect effects through the effects on the probability of having such a partner to begin with.

Observing our revealed preference measure of Hebrew knowledge thus presents a valuable opportunity to rigorously explore such language mediating effects. We are currently working on a model that will allow us to quantify all direct and indirect mediating effects of Hebrew, while allowing for equilibrium effects in the partners market. Here, we present preliminary evidence of mediation effects by estimating age-at-arrival profiles in cultural assimilation that net out the choice to take the PET test in Hebrew. Results from this exercise suggest that accounting for Hebrew knowledge can indeed flatten age-at-arrival profiles, especially for the probability of having a native partner and for total number of children.

Contribution to the literature

This paper contributes to the literature on immigrants' cultural assimilation (Abramitzky et al., 2020) and papers that document age-at-arrival effects on the long-run integration of child immigrants. Many such works mainly (but not exclusively) focus on labor market outcomes (Friedberg, 1992; Bleakley and Chin, 2004; Alexander and Ward, 2018; Connolly et al., 2023; Åslund et al., 2023; Aloni and Avivi, 2024; Kerr et al., 2024). Instead, Bleakley and Chin (2010) is closest to this paper in that they use cross-sectional US 2000 Census data to relate age-at-arrival to English acquisition, intermarriage, fertility, and geographical sorting.

Relative to this existing literature, this study is unique in that we can leverage policy-induced exogenous age at arrival for a wide support of arrival ages, track a variety of cultural assimilation outcomes in long-term administrative data, and crucially, observe a high-stakes, revealed-preference measure of language acquisition in administrative data. This last point is relevant as language is typically either observed only in cross-sectional survey/census data, in a self-reported way (e.g., Bleakley and Chin, 2004, 2010; Kerr et al., 2024), or altogether unobserved in most administrative datasets (e.g. Åslund et al., 2023; Connolly et al., 2023). While language as a mediator has been proposed before in an instrumental variables context (Bleakley and Chin, 2004, 2010), we will be able to carry out a detailed mediation analysis that teases out direct and indirect effects in the causal chain going from age at arrival, language, the partner market, and fertility.

Additionally, this paper contributes to a body of work studying the relationship between immigration and fertility (Adserà et al., 2012; Adserà and Ferrer, 2015). An unusual feature of our setting is the fact that migrants' origin country (FSU) had lower fertility than the destination country (Israel), implying that assimilation points in the direction of greater number of children. Similarly, Mussino et al. (2021) study age-at-arrival effects on fertility assimilation of immigrants in Sweden from low-fertility countries. However, this and related studies could face endogenous selection into age at arrival in a way that we circumvent. Other papers have studied immigrants' fertility in Israel, using birth records, survey, and census data, without focusing on age-at-arrival effects of child immigrants (Nahmias, 2004; Okun and Kagya, 2012).

The remainder of this paper is structured as follows. Section 2 provides an overview of the relevant historical and institutional context. Section 3 describes the data. Section 4 lays out our empirical model and identification assumptions. Section 5 presents the baseline results on age-at-arrival effects, while Section 6 provides preliminary evidence on the mediating role of Hebrew knowledge. Section 7 concludes.

2 Historical and Institutional Context

2.1 FSU migration to Israel

Beginning in 1989 and following the unexpected lifting of Soviet emigration restrictions, there was a mass exodus of FSU Jews. Most of them migrated to Israel—which encouraged FSU Jews to do so and granted them citizenship on arrival—while others went to Germany and the US. Between 1989–1999, around 840,000 FSU Jews migrated to Israel. While more educated than native Israelis, these immigrants faced large native-migrant earnings gaps upon arrival on Israel, which eventually closed after three decades (Arellano-Bover and San, 2024).

Abramitzky et al. (2022) argue that FSU migrants who arrived in Israel between 1989–1992 can be described as refugees, in contrast to those who arrived from 1993 onward which they describe as economic migrants. Following this interpretation, our empirical analyses focus on the early 1990–1991 arrivals. These arrivals were more likely to migrate driven by persecution, and the spike in arrivals during those early years (Figure A1) is suggestive of a pent-up desire to leave the FSU. We later argue that these features are useful to identify year-of-arrival effects for those who arrived as children. The intuition behind this is that 1990–1991 families left whenever they got the chance, rather than at a carefully chosen time that potentially took into consideration what was the best age of migration for their children.

2.2 Cultural differences between FSU immigrants and Israeli natives

FSU immigrants arriving in Israel faced significant cultural differences with respect to existing residents. Language presented a large barrier as the vast majority of FSU immigrants did not speak Hebrew. Moreover, Soviet policies had for decades suppressed Jewish cultural and religious life which resulted in FSU Jews not following many Judaism practices that are commonplace in Israel. Remennick (2007) provides a detailed description of resulting cultural clashes between FSU and Israeli incumbents.

2.3 Fertility norms

Israeli norms favor large families, to a degree that is unparalleled among rich countries. It has, by far, the highest total fertility rate (TFR) among OECD countries, equal to 2.9 in 2024 according to the UN. Comparing Israel to the FSU yields striking results. Also according to the UN, from 1985–1990, the TFR in Israel was 3.07 while TFRs for what is now Russia and Ukraine were 2.12 and 1.95, respectively. As such, when thinking about fertility and number of children, we expect FSU migrants' cultural assimilation to work in the direction of having more children. This makes the FSU migration to Israel a nice setting to study assimilation in fertility patterns as in most context the opposite is true, with immigrants' origin countries featuring greater fertility than their destination countries (Tønnessen and Mussino, 2020; Mussino et al., 2021).

While Israeli women had significantly more children than FSU women, the average age at first birth is and was *higher* in Israel than in the FSU. According to UN statistics, in 2008/2009, the mean age at first birth was 27 in Israel compared to 24.6 and 25.8 for Russia and Ukraine, respectively. As such, we expect cultural assimilation in this direction to push FSU immigrants women to have their first child at later ages.

Overall, prevailing fertility norms in Israel and the FSU suggest a two-dimensional assimilation pattern. For FSU immigrants, assimilating into Israeli culture would on the one hand imply postponing parenthood, but eventually building larger families on the other hand.

2.4 The Psychometric Entrance Test and Revealed Hebrew Knowledge

The Psychometric Entrance Test (PET) is a standardized test that is used for Israeli higher education admissions, typically taken between ages 18–25. Crucially, PET test-takers can choose whether to take it in Hebrew or Russian (as well as Arabic, French, and English). In our empirical analysis, we interpret the decision to take the test in Hebrew as a revealed preference measure of Hebrew knowledge. This measure has two main advantages. The first is that, as opposed to self-reported measures of language knowledge typically available in survey and census data, this is a high-stakes decision with real-life consequences. Although binary, we expect it to carry high information content. Second, while immigrants' language proficiency is rarely observed in large-scale administrative datasets, the Israeli institutional and data context allow us to precisely observe this measure for the entire population of FSU immigrants (and natives) who take the PET (in our setting, close to 50% of the entire sample take the PET).

3 Data

We use population-level administrative data from the Israeli Population Registry between the years 1989–2019. The data allows us to observe place of birth, date of migration to Israel for those born abroad, marriage links, parent-child links, and location of residence (starting in 2000). Crucially, we can link these data to PET test-taking records, including the language in which the test was taken. Moreover, the population registry is linked to tax records, which allows us to study earnings. Lastly, we have access to data on the self-reported level of education and occupation that FSU immigrants declared upon arrival in Israel.

Our main population of interest are Jewish persons who were born in the FSU and arrived in Israel in 1990 or 1991, between 7 and 17 years of age. We focus on FSU children arrived in 1990 or 1991 because for these early arrival waves, age-at-arrival is plausibly exogenous for the reasons mentioned in Sections 2 and 4. We use age 17 as the maximum age cutoff to focus on those who arrived as minors. We use the age 7 as the minimum age cutoff because this allows us to study outcomes at age 35 for all children in our data.

Throughout the analysis, we compare the outcomes of these FSU child immigrants with natives of the same birth cohorts (i.e., birth years 1973–1984). Including natives has a dual purpose: comparing age-at-arrival effects to the natives' benchmark and accounting for secular time effects in the outcomes of interest separately from age-at-arrival effects. As a native comparison group, we focus on people who satisfy the following conditions: being born in Israel between 1973–1984, being non-Ultra Orthodox Jewish, and having parents who were not born in the FSU. Overall, our sample is composed of around 627,000 individuals, out of which approximately 296,000 are PET test-takers.

4 Framework: Age-at-Arrival Effects

We capture age-at-arrival effects by estimating versions of the the following linear regression model among the sample of FSU child-arrivals and comparison natives of the same birth cohorts:

$$y_i = \sum_{k=7}^{17} \gamma_k \cdot \mathbb{1}\{A_i = k\} \cdot M_i + X_i'\beta + \varepsilon_i, \tag{1}$$

where M_i is a dummy variable equal to one for FSU immigrants, $\mathbb{1}\{A_i = k\}$ is a dummy variable equal to one if person i arrived in Israel at age k. The vector X_i includes birth year fixed effects that are common for immigrants and natives and account for time trends in y_i.

We estimate (1) for a variety of outcome variables y_i which fall into two broad groups. First, a dummy variable equal to one if person i chose to take the PET in Hebrew. This variable is defined for the subsample of PET test-takers (roughly half of the overall sample) and is typically measured between ages 18–25. Second, outcomes measured when person i is age 35 including immigrant share in the city of residence, partner characteristics, age at first child, number of children, and earnings.

The parameters $\mathbf{\Gamma} \equiv \{\gamma_k\}_{k=7}^{17}$ represent the non-parametric conditional expectation function of outcome y_i, relative to natives, as a function of age at arrival in Israel A_i, adjusting for time trends β. The age-at-arrival profile $\mathbf{\Gamma}$ has a causal interpretation under an assumption of no systematic differences in unobservable characteristics by age at arrival A_i:

$$\mathbb{E}\left[\varepsilon_i | A_i = k, X_i\right] = \mathbb{E}\left[\varepsilon_i | A_i \in [7, 17], X_i\right] = 0 \quad \forall \quad k = 7 \ldots 17. \tag{2}$$

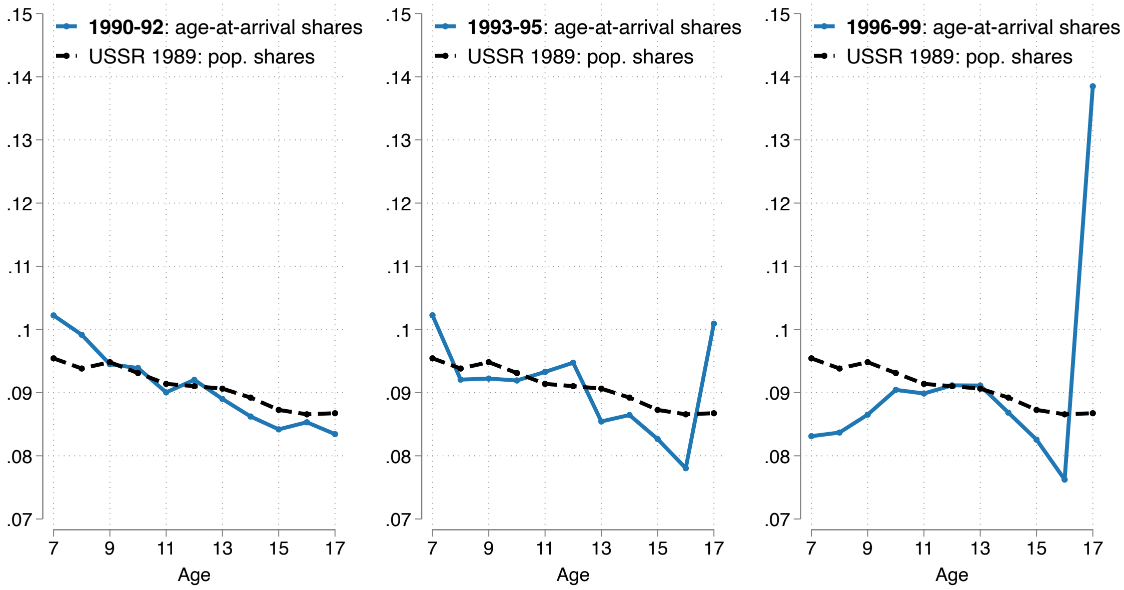
In many contexts this assumption is unlikely to hold as migrant households likely internalize that the shock of international migration will affect children of different ages differently, and that the long-term prospects of children are also affected by age at immigration (Aloni and Avivi, 2024). As a result, children whose families decided to migrate at different ages will likely have different unobserved characteristics that potentially impact language learning and age-35 outcomes.

However, our context is one of immigrants who can best be thought of as refugees fleeing persecution in the USSR, leaving the country whenever a window of opportunity arose (Abramitzky et al., 2022). The large spike in 1990–1991 arrival numbers that followed the lifting of Soviet emigration restrictions in 1989 and preceded more stable arrival numbers throughout the 1990s (Figure A1), suggests pent-up demand to leave the USSR. It thus seems a plausible assumption that most of the immigrants in our sample left as soon as they could, with little considerations of age-at-arrival effects for their children. In this context, assumption (2) is more likely to hold. Sections 4.1 and 4.2 provide two pieces of evidence that further suggest this is a reasonable assumption.

4.1 Child age distribution comparison

Figure 1 compares the age distribution of children in 1989 USSR to the age distribution of FSU child immigrants arriving in Israel in 1990–92, 1993–95, and 1996–99. The goal of this comparison is to illustrate the selective migration is likely less of a concern for the early arrival waves compared to the later ones.

Figure 1: Age-at-arrival distribution by arrival cohort



Notes: Each panel represents a different arrival cohort: 1990–1992, 1993–1995, and 1996–1999. The solid line in each panel represents the age-at-arrival distribution of FSU immigrants who arrived between ages 7–17 (as share of total 7–17 year-old arrivals). The dashed line, equal across panels, represents the USSR age distribution of 7–17 year-olds in 1989 (as share of total 7–17 year-olds). Source for the USSR population is UN Population Division (2024)

The age distribution of 1990–92 child arrivals (the arrival cohorts Abramitzky et al. (2022) classify as immigrants) is very similar to the overall Soviet age distribution. However, for the subsequent arrival cohorts, these distributions start to look quite distinct. Assuming that USSR distribution represents the distribution of "potential migrants," these results would suggest that FSU immigrants in the initial period were representative of the overall pool of potential migrants, lessening worries of selective migration and differences in unobserved characteristics of children arrived at different ages.

4.2 Balance: Parents' characteristics upon arrival in Israel

While assumption (2) is inherently untestable, we provide evidence in its favor by showing balance in observable, predetermined characteristics. To do that, we leverage that FSU immigrants, upon arrival to Israel, reported their level of education and occupation in the Soviet Union. Using these data, we show that

$$\mathbb{E}\left[Z_i | A_i = k, M_i = 1\right] = \mathbb{E}\left[Z_i | A_i \in [7, 17], M_i = 1\right] \quad \forall \quad k = 7 \ldots 17 \tag{3}$$

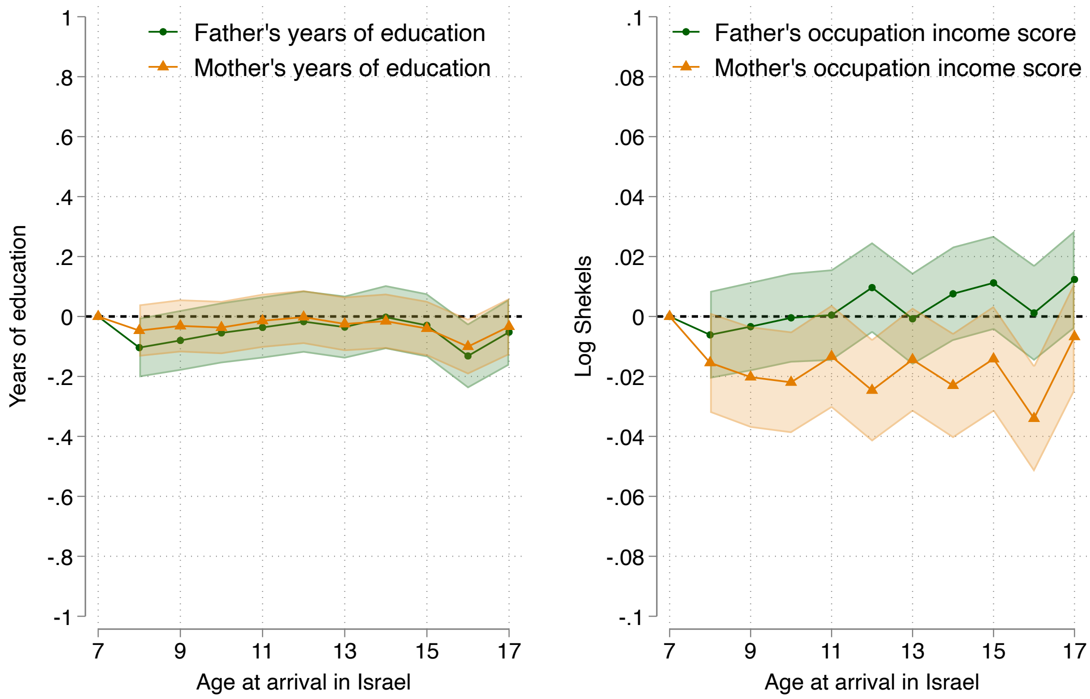
holds for four predetermined variables Z_i measured upon arrival in Israel: father's occupation and education and mother's occupation and education.

In particular, Figure 2 provides estimates of δ_k in the following linear regression, estimated among our sample of FSU child immigrants:

$$Z_i = \delta_0 + \sum_{k=8}^{17} \delta_k \cdot \mathbb{1}\{A_i = k\} + \eta_i, \tag{4}$$

where 7 is the omitted age-at-arrival category and Z_i represents i's parents' occupation and years of education upon arrival in Israel. We summarize the information contained by occupation using an income score (average income of a given occupation in Israel).

Figure 2: Balance: Parental education and occupation, by age at arrival



Notes: Point estimates and 95% confidence intervals of parameters δ_k in equation (4). Left subfigure: outcome variables Z_i are father's and mother's years on education. Average years of education for $A_i = 7$ are 13.5 and 13.6 for fathers and mothers, respectively. Right subfigure: outcome variables Z_i are father's and mother's occupational income score, in logs. Parental education and occupation measured at the time of arrival in Israel.

Figure 2 shows that the education levels of the parents of children arriving in Israel at different ages were extremely similar to each other, both for fathers and mothers. Relative to the age-7 arrivals benchmark, we can rule out differences in years of education larger than 0.2 in absolute value. The results for occupational income score are similarly reassuring. Fathers' differentials are not statistically different from each other. While some of the mothers' age-specific estimates are statistically different from the age=7 benchmark, they are small in magnitude and do not follow any clear pattern as a function of age at arrival.

Overall, together with Figure 1, we interpret the evidence in Figure 2 as being consistent with assumption (2).

4.3 Sibling comparisons

We will estimate versions of equation (1) in which X_i features mother fixed effects. As such, this approach identifies age-at-arrival profiles through intra-family comparisons—i.e., comparing siblings who arrived in Israel as kids but did so at different ages. The identification assumptions in this case are less strict as assumption (2) would only need to hold within families.

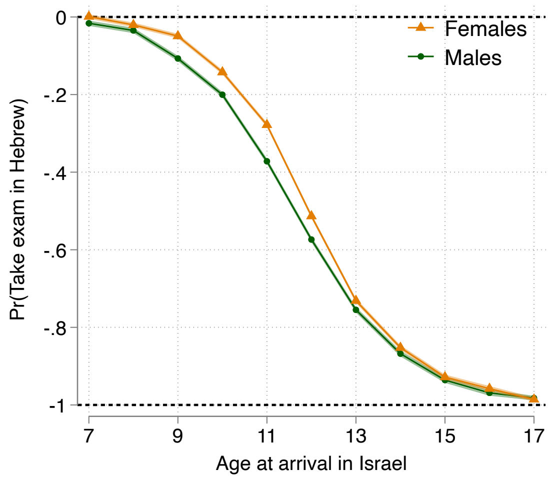
5 Baseline Results

This section presents baseline results from estimating equation (1) when the outcome variable is (1) revealed-preference Hebrew knowledge at young adulthood, and (2) cultural assimilation outcomes at age 35. Age-at-arrival effects on Hebrew knowledge are estimated within the sample of PET test-takers, whereas results for cultural assimilation outcomes are estimated for the full sample. The latter results for the subsample of PET test-takers are quite similar and presented in Appendix A.

5.1 Language acquisition by young adulthood

Figure 3 shows estimates of γ_k parameters in equation (1) when y_i is equal to a dummy variable equal to one if person i took the PET standardized test in Hebrew (instead of Russian or other available languages).

Figure 3: Hebrew test-taking: Immigrant-native gap by age at arrival



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is a dummy equal to one if person i chose to take the PET university entrance standardized test in Hebrew. Estimated among the subsample of PET test-takers.

There are three main takeaways. First, there is a strong assimilation pattern as immigrants who arrived in Israel at age 7 are as likely as natives to take the test in Hebrew, while those who arrived at age 17 have practically zero probability of doing so.

Second, the age-at-arrival profile is non-linear, with most of the drop in probability of Hebrew test-taking occurring between arrival ages 10–14. It would thus seem that there are a few critical ages around early adolescence for which language acquisition is highly sensitive to age at arrival, whereas the specific age at arrival is not so meaningful conditional on arriving before age 8 or after age 15. This is consistent with patterns documented by Bleakley and Chin (2004, 2010) in US census data showing a flat language profile from age-at-arrival 0–7 and a decline thereafter.

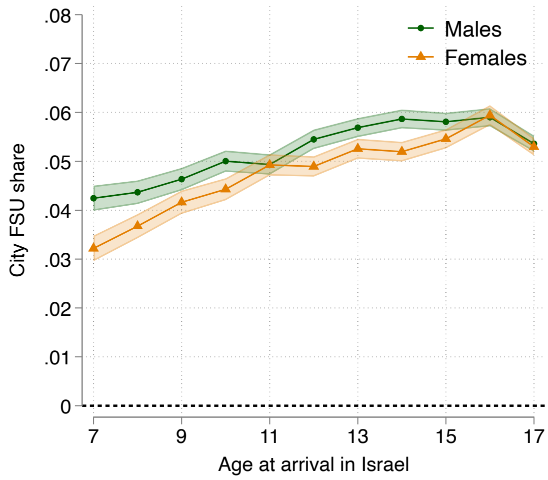
Third, a clear gender gap arises by which girls are significantly more likely than boys to take the PET test in Hebrew, for all arrival ages. The gap is particularly salient for those arriving at the critical ages of 9–12. For instance, among those who arrived at age 11, boys were 37 percentage points less likely than natives to take the exam in Hebrew while girls were 28 percentage points less likely—a 24% differential. This is strong evidence for immigrant girls learning the second language faster than immigrant boys. While this aligns with conventional wisdom, systematic empirical evidence such as this one is sparse (see van der Slik et al., 2015).

5.2 Geographical Sorting

Figure 4 shows age-at-arrival effects on geographical sorting and segregation. The outcome variable is the FSU-immigrants population share of the city where person i resides at age 35.[4] The positive estimates throughout show that FSU child arrivals, compared to natives and regardless of age at arrival, reside by age 35 in Israeli cities with higher shares of FSU immigrants. However, the slope in Figure 4 illustrates statistically significant age-at-arrival effects. Those who arrived in Israel at ages 16–17 lived by age 35 in cities that had FSU share differentials of 5 to 6 percentage points. Instead, those who arrived in Israel at age 7 were residing by age 35 in cities with differentials of 3 to 4 percentage points. For reference, the average FSU city share for natives is equal to 0.08. The age-at-arrival profiles are positively sloped for both genders, but steeper for women relative to men.

[4]Note that since we observe place of residence starting in 2000, we cannot study the initial geographical sorting upon arrival in Israel in 1990–1991.

Figure 4: FSU city share: Immigrant-native gap by age at arrival



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is the FSU immigrants' population share in the city of residence of person i by age 35. Average FSU city share among natives is 0.083 for men and 0.080 for women.

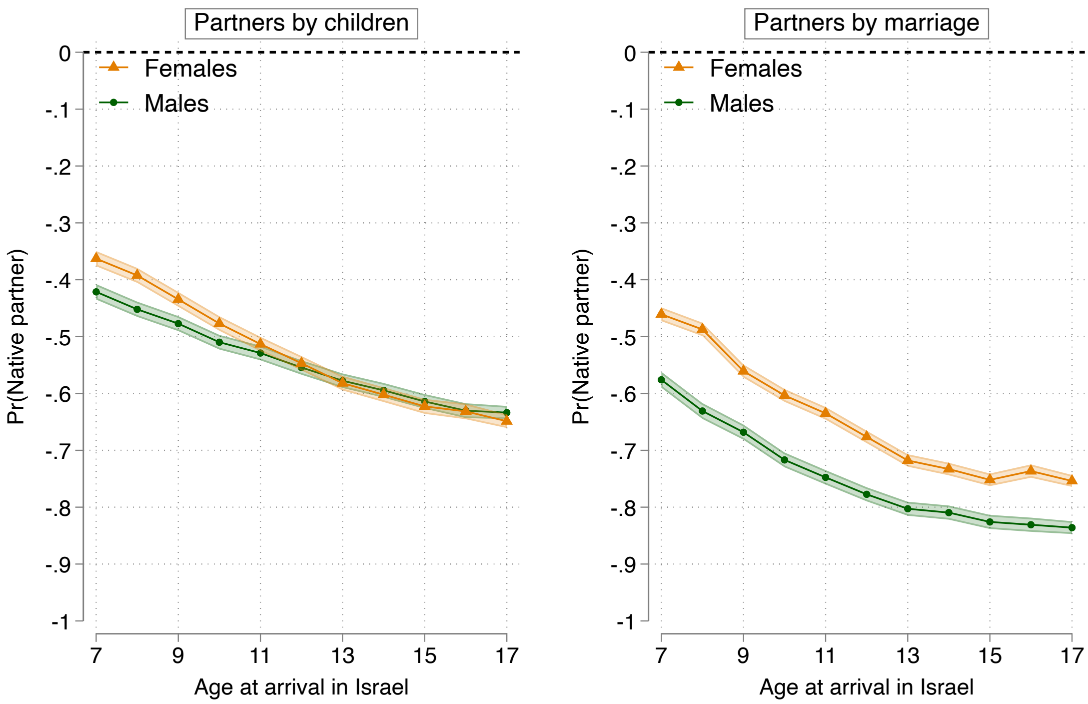
5.3 Partners

Figure 5 shows age-at-arrival profiles on the probability of matching with natives in the mating/marriage market. In particular, the left panel shows estimates of γ_k in equation (1) when y_i is a dummy equal to one if person i has, by age 35, had children with a native partner. The right panel has a similar interpretation but defines partners by marriage, instead of by the existence of children in common.

For both native partner definitions, we see sharp age-at-arrival profiles that narrow gaps with natives for FSU children who arrived at younger ages. For instance, the differential probability of having children with a native for FSU children who arrived at age 7 is -0.40 while the corresponding one for those arrived at age 17 is around -0.64.

In contrast to the profile for Hebrew knowledge, these age-at-arrival profiles on the probability of a native partner are quite linear throughout the age-at-arrival distribution. Thus, small age-at-arrival differences seem to matter, even at relatively young and old ages, in terms of long-term partner market outcomes.

Figure 5: Native partner probability: Immigrant-native gap by age at arrival



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is a dummy equal to one if having a child with a native partner (left panel), and a dummy equal to one if being married to a native person (right panel).

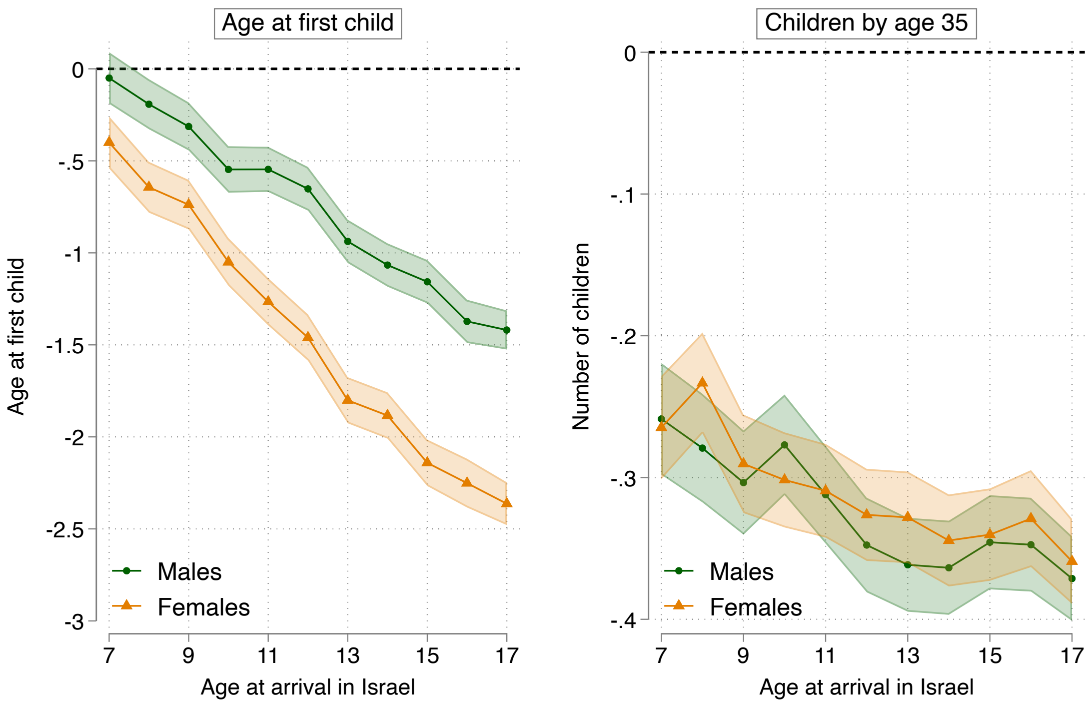
5.4 Fertility

As outlined in Section 2.3, the Soviet norm compared to the Israeli one was to start having children at a younger age, but having a smaller number of children in total. As such, assimilation would predict that FSU immigrants, as a function of time living in Israel, have their first child at older ages but have more children over their lifetimes.

Figure 6 shows age-at-arrival effects that broadly align with the predictions above. The left panel shows a strong age-at-arrival gradient when estimating equation (1) using age at first child as outcome variable. This gradient is particularly steep for women. FSU women who arrived in Israel at age 7 had their first child, on average, half a year before native Israelis of their same birth cohort. Instead, FSU women who arrived at age 17 had their first child almost two and a half years before natives.

The right panel shows that the negative immigrant-native gap in number of children narrows for younger arrival ages, with point estimates ranging from -0.26 for age 7 arrivals to -0.36–0.37 for age 17 arrivals. This implies that these ten years of difference between younger and older arrivals narrow the gap in total number of children with natives from slightly above one-third of a child to around one-fourth of a child.

Figure 6: Fertility outcomes: Immigrant-native gap by age at arrival

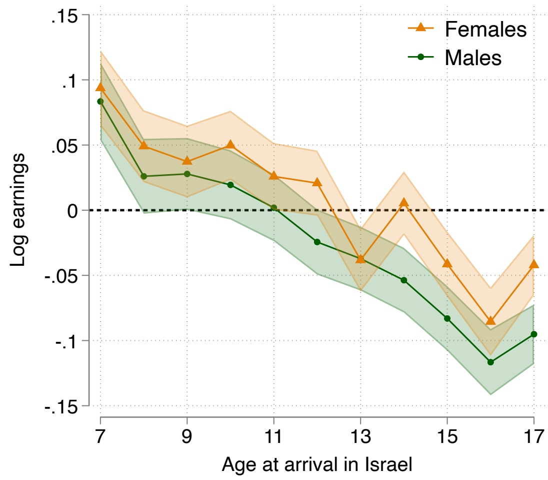


Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is the age at first child (left panel) and total number of children by age 35 (right panel). Results on age at first child condition on having at least one child. Results on number of children by age 35 condition on having at least one child.

5.5 Earnings

Lastly, we examine age-at-arrival effects on earnings at age 35. Figure 7 shows there are meaningful age-at-arrival earnings effects. FSU children who arrived at age 7 outperform comparable natives by about 10%, while those who arrived at age 16–17 underperform natives by about 5–11%. These findings are consistent with Arellano-Bover and San (2024) who document heterogeneous wage assimilation profiles by age at arrival (within the broader population of FSU immigrants). Alexander and Ward (2018) and Bleakley and Chin (2004) show comparable age-at-arrival earnings profiles for the 1940 and 1990 US Censuses, respectively.

Figure 7: Log earnings at age 35: Immigrant-native gap by age at arrival



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is log monthly earnings at age 35.

6 Mediation Role of Hebrew Knowledge

As preliminary evidence for the mediating role of Hebrew knowledge in cultural assimilation estimates, we estimate different versions of the following linear regression model:

$$y_i = \sum_{k=7}^{17} \gamma_k^{(H)} \cdot \mathbb{1}\{A_i = k\} \cdot M_i + X_i'\beta^{(H)} + \delta_0 H_i + \delta_1 H_i \cdot M_i + \nu_i, \tag{5}$$

where M_i and X_i are defined as in equation (1), we consider the same cultural assimilation and earnings outcomes y_i, and H_i is a dummy variable equal to one if person i took the PET test in Hebrew. Given that we only observe H_i among PET test-takers, in this section we focus on that subsample.

Figures 8–12 below compare estimates of γ_k from equation (1) to estimates of $\gamma_k^{(H)}$ in equation (5). To keep sample composition comparable, γ_k estimates in Figures 8–12 are estimated using only the subsample of PET test-takers.

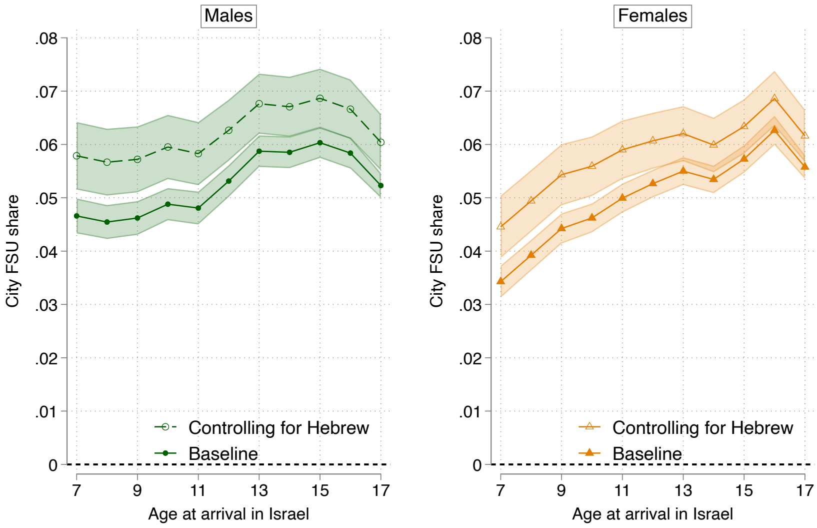
While γ_k represent the unconditional age-at-arrival profile, the parameters $\gamma_k^{(H)}$ instead adjust for the fact that FSU immigrants who arrived younger are much more likely to learn Hebrew than those who arrived older. To the extent that the age-at-arrival profile $\gamma_k^{(H)}$ is flatter than the profile γ_k, this would be consistent with Hebrew knowledge being a mediator of age-at-arrival cultural assimilation effects.[5]

Evidence of such a mediating pattern—i.e., a steeper γ_k relative to $\gamma_k^{(H)}$—is particularly evident for the probability of being married with a native (Figure 9) and, although imprecisely estimated, for total number of children (Figure 11). Instead, age-at-arrival slopes are

[5]Note that while the difference in slopes in γ_k and $\gamma_k^{(H)}$ speaks to the mediating role of Hebrew in age-at-arrival effects, the difference in levels is more nuanced as it also incorporates the fact that $\gamma_k^{(H)}$ represents the age-at-arrival-specific immigrant-native gap *conditional on* $H_i = 0$.

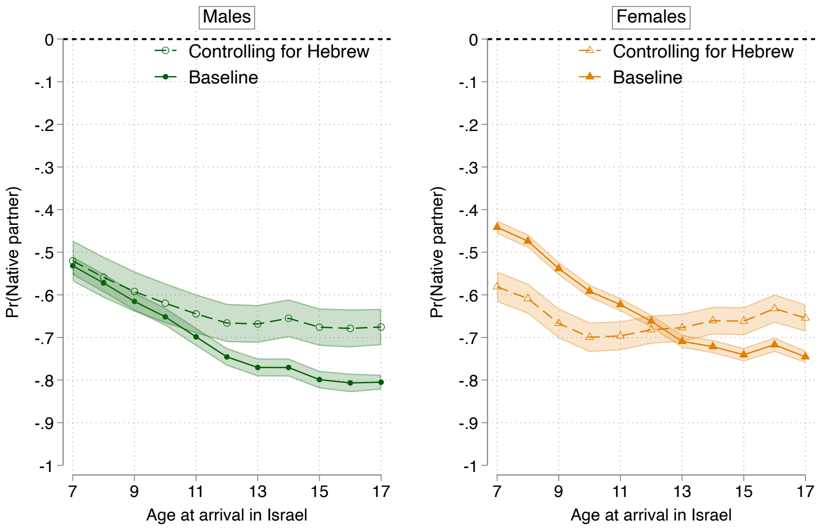
quite comparable in both cases for FSU city share (Figure 8), age at first child (Figure 10), and age-35 earnings (Figure 12).

Figure 8: FSU city share: Immigrant-native gap by age at arrival, with and without controlling for Hebrew knowledge



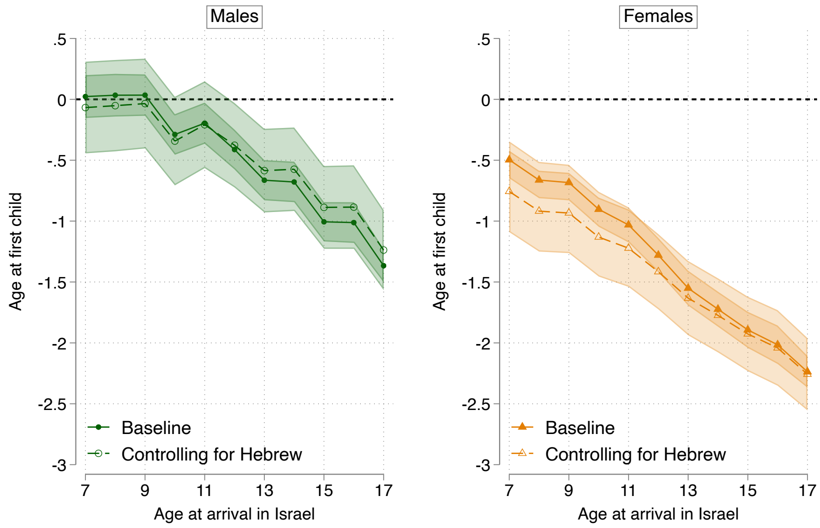
Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) (solid line) and parameters $\gamma_k^{(H)}$ in equation (5) (dashed line) when outcome variable is the FSU immigrants' population share in the city of residence of person i by age 35. Both sets of estimates are estimated among the subsample of PET test-takers.

Figure 9: Native partner probability: Immigrant-native gap by age at arrival, with and without controlling for Hebrew knowledge



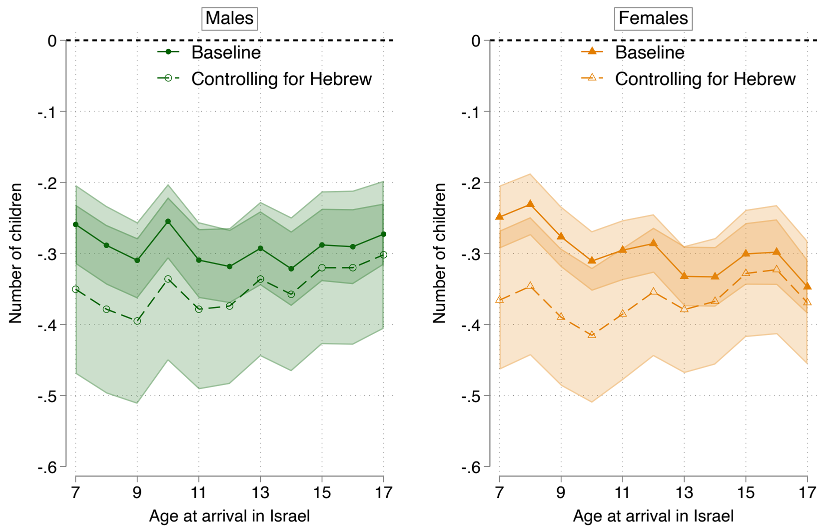
Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) (solid line) and parameters $\gamma_k^{(H)}$ in equation (5) (dashed line) when outcome variable is a dummy equal to one if being married to a native person. Both sets of estimates are estimated among the subsample of PET test-takers.

Figure 10: Age at first child: Immigrant-native gap by age at arrival, with and without controlling for Hebrew knowledge



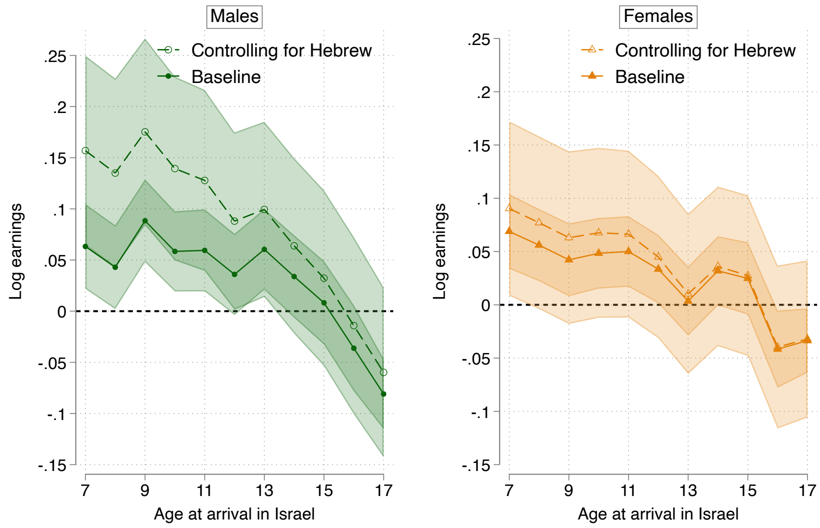
Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) (solid line) and parameters $\gamma_k^{(H)}$ in equation (5) (dashed line) when outcome variable is age at first child. Both sets of estimates are estimated among the subsample of PET test-takers who have at least one child by age 35.

Figure 11: Children by age 35: Immigrant-native gap by age at arrival, with and without controlling for Hebrew knowledge



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) (solid line) and parameters $\gamma_k^{(H)}$ in equation (5) (dashed line) when outcome variable is number of children by age 35. Both sets of estimates are estimated among the subsample of PET test-takers with at least one child by age 35.

Figure 12: Log earnings at age 35: Immigrant-native gap by age at arrival, with and without controlling for Hebrew knowledge



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) (solid line) and parameters $\gamma_k^{(H)}$ in equation (5) (dashed line) when outcome variable is log monthly earnings at age 35. Both sets of estimates are estimated among the subsample of PET test-takers.

7 Conclusion

This paper estimates age-at-arrival effects on the long-term cultural assimilation of child immigrants, leveraging a unique historical context providing arguably exogenous variation in age at immigration, together with rich population-level administrative data that allows us to track immigrants from the moment of arrival for up to 29 years afterwards. Moreover, we can use a novel, high-stakes, revealed-preference measure of language acquisition in administrative data—the language chosen to take the university entrance standardized test.

Our granular estimates indicate that, indeed, small differences in the age at arrival of immigrant children can have long-lasting integration effects. This is the case for language acquisition, residential segregation, intermarriage, fertility, and earnings. We are currently working on a model that will quantify the mediating role of language in terms of direct and indirect effects on other assimilation outcomes.

In the FSU-Israel context, immigrants moved from a low- to high-fertility country. Our findings on fertility effects are relevant. While the general consensus is that economic incentives to enhance fertility have been unsuccessful,[6] this paper can be interpreted as evidence of how exposure a cultural norm of having many children *can* increase fertility.

From an immigration perspective, we present strong causal evidence that children who arrive at younger ages exhibit greater levels of cultural integration in the long run. To the extent that different immigration systems reward different traits when admitting foreign

[6] See https://www.wsj.com/world/birthrate-children-fertility-europe-perks-family-04aa13a0?st=tCep3y&reflink=article_copyURL_share.

migrants, governments who are concerned about cultural mismatch and aging populations could consider policies rewarding the arrival of immigrant families with young children.

References

Abramitzky, R., T. Baseler, and I. Sin (2022). Persecution and migrant self-selection: Evidence from the collapse of the Communist Bloc. Working paper, National Bureau of Economic Research.

Abramitzky, R., L. Boustan, and K. Eriksson (2020). Do immigrants assimilate more slowly today than in the past? *American Economic Review: Insights 2*(1), 125–141.

Adserà, A. and A. Ferrer (2015). Immigrants and demography: Marriage, divorce, and fertility. In *Handbook of the Economics of International Migration*, Volume 1, pp. 315–374. Elsevier.

Adserà, A., A. M. Ferrer, W. Sigle-Rushton, and B. Wilson (2012). Fertility patterns of child migrants: Age at migration and ancestry in comparative perspective. *The Annals of the American Academy of Political and Social Science 643*(1), 160–189.

Alesina, A. and M. Tabellini (2024). The political effects of immigration: Culture or Economics? *Journal of Economic Literature 62*(1), 5–46.

Alexander, R. and Z. Ward (2018). Age at arrival and assimilation during the age of mass migration. *The Journal of Economic History 78*(3), 904–937.

Aloni, T. and H. Avivi (2024). One land, many promises: Assessing the consequences of unequal childhood location effects. Mimeo, New York University and Princeton University.

Arellano-Bover, J. and S. San (2024). The role of firms and job mobility in the assimilation of immigrants: Former Soviet Union Jews in Israel 1990–2019. Mimeo, Yale University and The Hebrew University of Jerusalem.

Åslund, O., L. Liljeberg, and S. Roman (2023). The long-term integration of refugee children: Swedish experiences after the Yugoslav Wars. Working paper, IFAU.

Bleakley, H. and A. Chin (2004). Language skills and earnings: Evidence from childhood immigrants. *Review of Economics and statistics 86*(2), 481–496.

Bleakley, H. and A. Chin (2010). Age at arrival, English proficiency, and social assimilation among US immigrants. *American Economic Journal: Applied Economics 2*(1), 165–192.

Burchardi, K. B., T. Chaney, T. A. Hassan, L. Tarquinio, and S. J. Terry (2020). Immigration, innovation, and growth. Working paper, National Bureau of Economic Research.

Connolly, M., C. Haeck, and A. M. L. Bourdais-Coffey (2023). Age at immigration and the intergenerational income mobility of the 1.5 generation. Working Paper 23-03, Research Group on Human Capital, ESG UQAM.

Eriksson, K. and Z. Ward (2019). The residential segregation of immigrants in the United States from 1850 to 1940. *The Journal of Economic History 79*(4), 989–1026.

Friedberg, R. M. (1992). The labor market assimilation of immigrants in the United States: The role of age at arrival. Mimeo, Brown University.

Gokhale, J. (2024, March). U.S. demographic projections: With and without immigration. Wharton Budget Model, University of Pennsylvania.

Kerr, S. P., W. R. Kerr, and K. E. Smith (2024). Age at immigrant arrival and career mobility: Evidence from Vietnamese refugee migration and the Amerasian Homecoming Act. Technical report, National Bureau of Economic Research.

Mussino, E., B. Wilson, and G. Andersson (2021). The fertility of immigrants from low-fertility settings: Adaptation in the quantum and tempo of childbearing? *Demography 58*(6), 2169–2191.

Nahmias, P. (2004). Fertility behaviour of recent immigrants to Israel: A comparative analysis of immigrants from Ethiopia and the former Soviet Union. *Demographic Research 10*, 83–120.

Okun, B. S. and S. Kagya (2012). Fertility change among post-1989 immigrants to Israel from the former Soviet Union. *International Migration Review 46*(4), 792–827.

Peri, G. (2020). Can immigration solve the demographic dilemma? Finance & Development, International Monetary Fund, March 2020, pp. 26-29.

Remennick, L. (2007). *Russian Jews on Three Continents. Identity, Integration, and Conflict*. Transaction Publishers.

Tabellini, M. (2020). Gifts of the immigrants, woes of the natives: Lessons from the age of mass migration. *The Review of Economic Studies 87*(1), 454–486.

Tønnessen, M. and E. Mussino (2020). Fertility patterns of migrants from low-fertility countries in Norway. *Demographic Research 42*, 859–874.

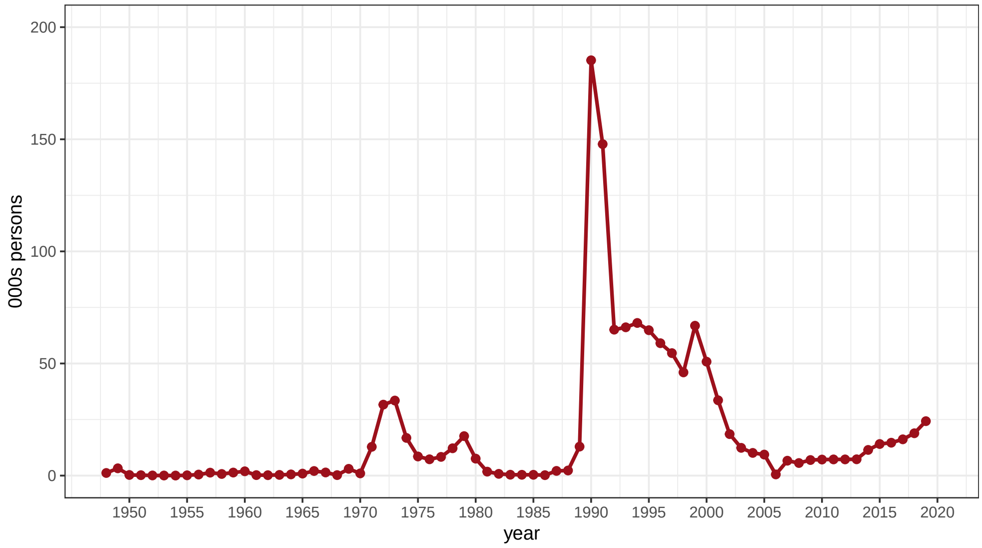
UN Population Division (2024). 2024 Revision of World Population Prospects.

van der Slik, F. W., R. W. van Hout, and J. J. Schepens (2015). The gender gap in second language acquisition: Gender differences in the acquisition of Dutch among immigrants from 88 countries with 49 mother tongues. *PLOS One 10*(11).

- SUPPLEMENTARY APPENDICES -
For Online Publication Only

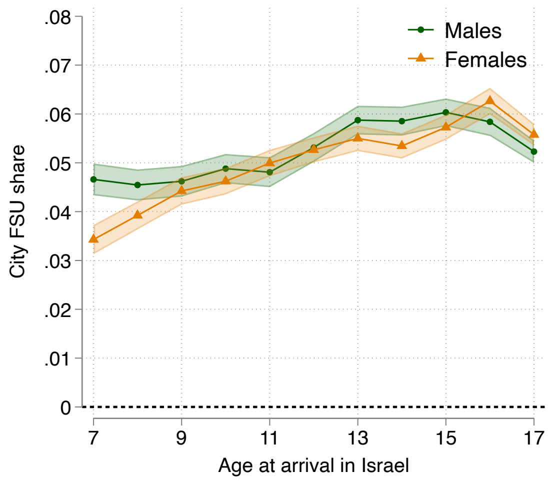
A Additional Tables and Figures

Figure A1: FSU Immigration to Israel



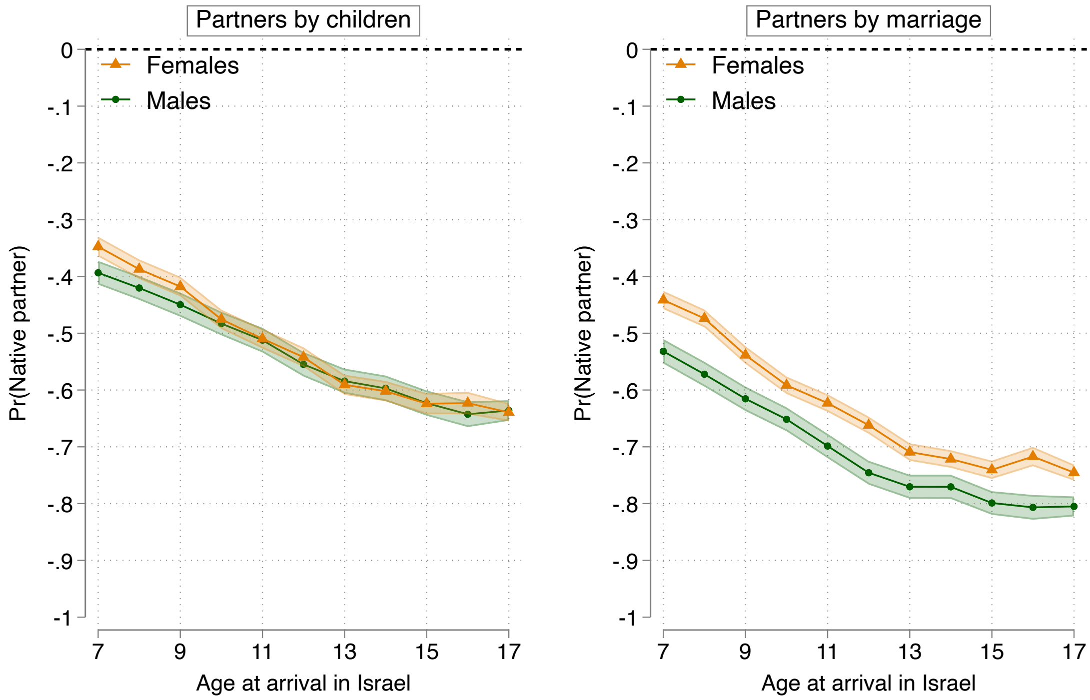
Notes: Number of immigrants arriving in Israel from the former Soviet Union, by year. Source is the Israel Central Bureau of Statistics.

Figure A2: FSU city share: Immigrant-native gap by age at arrival. Test-takers only



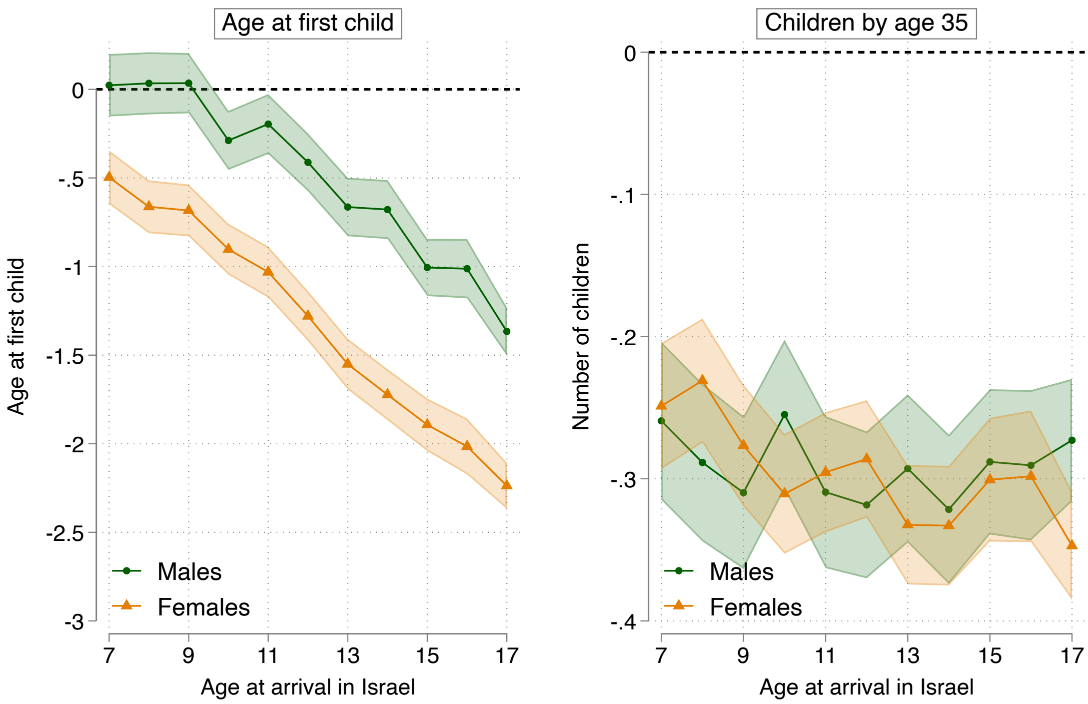
Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is the FSU immigrants' population share in the city of residence of person i by age 35. Estimated among the subsample of PET test-takers.

Figure A3: Native partner probability: Immigrant-native gap by age at arrival. Test-takers only



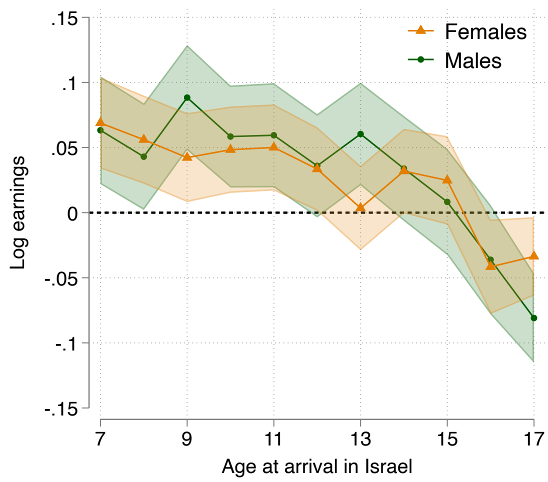
Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is a dummy equal to one if having a child with a native partner (left panel), and a dummy equal to one if being married to a native person (right panel). Estimated among the subsample of PET test-takers.

Figure A4: Fertility outcomes: Immigrant-native gap by age at arrival. Test-takers only



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is the age at first child (left panel) and total number of children by age 35 (right panel). Results on age at first child condition on having at least one child. Results on number of children by age 35 condition on having at least one child. Estimated among the subsample of PET test-takers.

Figure A5: Log earnings at age 35: Immigrant-native gap by age at arrival. Test-takers only



Notes: Point estimates and 95% confidence intervals of parameters γ_k in equation (1) when outcome variable is log monthly earnings at age 35. Estimated among the subsample of PET test-takers.