Immigrant Children's Age at Arrival, Skill Formation, and Adult Socioeconomic Success

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Abstract

Immigrant children's age at arrival is assumed to be a key determinant of successful integration in adulthood, because young children tend to learn new languages with greater ease and success than adolescents and adults. Furthermore, age at arrival is likely to define life-cycle stages, such as school enrollment and labor market entry. Using Norwegian administrative data, I show negative age-at-arrival effects on immigrant children's educational attainment, labor market earnings, and social welfare dependency in adulthood. Results from family fixed-effect models in a sibling sample, controlling for all stable family background characteristics, and ordinary cross-sectional models yield similar estimates. Immigrant children's adult socioeconomic outcomes deteriorate progressively as their age at arrival increases. In summary, this indicates that cumulative skill formation disadvantage, possibly originating in language acquisition deficiencies and related learning problems in school, among later arriving immigrant children is a potent determinant of their long-term socioeconomic success in adulthood.

International migration has been a major force behind demographic change in affluent Western European and Northern American countries over the past decades. In recent years, a growing literature document patterns and determinants of socioeconomic integration among immigrant children and native-born children of immigrants in these countries (e.g., Heath, Rothon and Kilpi 2008).

Immigrant children's age at arrival is considered a key determinant of successful integration in adulthood, given that age is central in defining life-cycle stages, such as school enrollment, labor market entry and family formation (e.g., Oropesa and Landale 1997; Rumbaut 2004). This study examines whether immigrant children's arrival at sensitive ages throughout childhood has a long-term impact on three socioeconomic outcomes—educational attainment, labor market earnings, and social welfare dependency—in adulthood.

Age at Arrival, Child Development and Adult Socioeconomic Attainment

There is growing consensus on the long-lasting influence of early childhood experiences on individuals' later development and skill formation, particularly among children growing up in disadvantaged environments (Knudsen et al. 2006). Studies in neuroscience and developmental psychology indicate that the learning of new skills is easier during early childhood than later in life (Shonkoff and Phillips 2000). Early experiences shape social, emotional, and cognitive capabilities in a way that affects outcomes in adulthood because learning is hierarchical and because it progresses through a series of so-called sensitive periods over the life course ("skill begets skill").

Language proficiency is a basic compentency, central to later skill formation, where timing is crucial for successful acquisition. In developmental psychology, it is a stylized fact that younger children tend to learn new languages with greater ease and success than adolescents and adults. Both neuroscientific and behavioral research provide evidence on children's capability of learning new languages is senstitive to a 'critical period' for acquisition during childhood (e.g., Newport 2002; Birdsong 2006). Psychobiological processes in the brain in the period before the onset of puberty are steadily comprising an individual's capability of acquiring full proficiency in new languages (Penfield and Roberts 1959; Lenneberg 1967).

In this respect, later arriving immigrant children are likely to have passed their prime age for language learning. Furthermore, acquisition of subject skills in school is likely to be less efficient while these children are acquiring proficiency in the new second language. Previous research document effects upon immigrant children's educational outcomes during adolesence (e.g., Böhlmark 2008; Bratsberg, Raaum and Røed 2011; Heath and Kilpi-Jakonen 2012).

Immigration, language acquisition deficiency and learning disadvantage are events that are likely to cause stress and could lead to viscious developmental trajectories, cumulating disadvatage and adverse socioeconomic outcomes in adulthood. Recent studies do document long-term negative effects of age at arrival on adult socioeconomic attainment (e.g., Schaafsma and Sweetman 2001; Bleakley and Chin 2004; Böhlmark 2009; Myers, Gao and Emeka 2009; Lee and Edmonston 2011). However, few of these studies are able to establish causal links between immigrant children's age at arrival and their adult socioeconomic fortunes.

Materials and Methods

Norwegian population registries include information on all resident and alive individuals in any given year. A system of personal ID numbers identifies each individual, and enables linkage of information from different administrative registries. The system facilitates proper identification of siblings and their parents in the population registry. In this study, I consider all children with immigrant background (i.e., two foreign-born parents) in the birth cohorts 1965-1980 who were either born in Norway or arrived at age 18 or earlier. In 2010, these individuals were aged between 30 and 45 years. This sample restriction imply that included individuals are likely to merely have followed their parents when they immigrated and are less likely to have chosen the timing of their arrival themselves. Furthermore, I conduct analyses both on the total population sample of all immigrant children (22,465 children) and a sibling sample of all immigrant children in families with at least two siblings included by the initial sample restriction (13,144 children in 5,108 families).

Age at Arrival and Adult Socioeconomic Outcomes. Age at arrival, the key explanatory variable, is measured as the difference between year of immigration and year of birth. I focus on three adult socioeconomic outcomes: (i) Completed years of schooling is calculated from information on the child's highest level of educational qualification at age 28 using the International Standard Classification of Education, ISCED-97. (ii) Data on the child's adult earnings are gleaned from all available registry reports on annual earned income, starting when the immigrant child is 28 years old and onwards to the maximum age of 45 for the oldest birth cohorts. This annual earnings measure includes wages and income from self employment. Annual earnings are CPI adjusted to Norwegian Kroner (NOK) in 2010. Annual earnings are calculated by taking the mean of all valid CPI adjusted annual earnings in the years relevant for each individual. Finally, I take the natural logarithm. (iii) To measure welfare dependency, I rely on the basic amount threshold of the Norwegian Social Insurance Scheme (used to define labor market status, determining eligibility for unemployment benefits as well as disability and old age pensions). In 2010, one basic amount was about 12,520 USD. For each single year, a person is defined as being on welfare if he or she receives more than one basic amount of public cash transfers. The percentage of years spent on social welfare is then calculated for all relevant years starting with the year the individual turned 28.

Demographic Characteristics. Information on the child's birth cohort, child sex, whether the child was the first born of his or her mother, parents' country of birth (or the mother's country of birth if these differ between the parents) and the parents' highest registered educational qualifcations was merged.

Analytic Approach. In order to identify the effect of immigrant children's age at arrival on their socioeconomic outcomes I use two different strategies. First, I fit cross-sectional OLS models controlling for all exogenous demographic characteristics listed above. Next, I estimate of family fixed-effects models in order to handle endogenous timing of family migration and endogenous return migration. Comparison of siblings who were at different ages at family migration exploit plausibly exogenous within-family variation in age at arrival (cf. Böhlmark 2008). Comparisons of siblings holds equal characteristics such as growing up in the same family (e.g., skill levels and ethno-cultural aspirations/traits) and parental genotype, as well as similar neighborhood contexts and schools attended during childhood. The family fixed-effects equation can formally be expressed as:

$$\mathbf{Y}_{ij} = \alpha + \gamma \mathbf{AaA}_{ij} + \beta \mathbf{X}_{ij} + \delta_j + \varepsilon_{ij}, \qquad (1)$$

where $\mathbf{Y}_{ij}$ is the relevant socioeconomic outcome, α is the intercept, $\mathbf{AaA}_{ij}$ is a (semi-parametrically specified) set of dummy variables indicating the immigrant child's age at arrival, $\mathbf{X}_{ij}$ is a vector of sibling-specific family and demographic characteristics (i.e., child sex dummy, first born dummy, and birth cohort dummies), δ_j represents family-specific fixed-effects capturing time-invariant family characteristics common to all siblings within the same family and ε_{ij} is a sibling-specific error term. The dummies in $\mathbf{AaA}_{ij}$ range from 0 to 18, while Norwegian-born

children of immigrants constitute the reference alternative. Identification of the age-at-arrival estimates (γ) relies solely upon within-family variation between siblings in age at arrival, and should thus not be subject to any bias due to the influence from stable observable and unobservable family background characteristics captured by the family-specific fixed effects (δ_j)that are also associated with the outcome.

Preliminary Results and Discussion

Table 1 presents the main results from the cross-sectional and within-family regression analyses. Results show declining educational attainment and labor market earnings, as well as heightened social welfare dependency, in adulthood at higher ages at arrival. Cross-sectional models include controls for all demographic characteristics listed above, in particular birth cohort (dummy fixed-effects) and country of origin (dummy fixed-effects). Family fixed-effects models include control for all stable family background characteristics, in addition to birth cohort (dummy fixed-effects), child sex, and birth order. (See notes in Table 1 for detailed description of controls in cross-sectional and family fixed-effect models.)

Using the sibling sample estimates, Figure 1 shows the patterns of age-at-arrival effects on completed years of schooling, annual earnings, and welfare dependency from the cross-sectional and family fixed-effects models. The results are strikingly similar, although the confidence intervals of the within-family estimates are wider. The age-at-arrival effects on completed years of schooling are most consistent in both model specification, but the patterns are also clear for annual earnings and social welfare dependency. In the case of social welfare dependency, within-family estimates have particularly wide confidence intervals but the point estimates are relatively robust.

In summary, these results indicate that immigrant children's age at arrival, through a process of cumulative skill formation disadvantage, is a potent determinant of their life chances and socioeconomic success in adulthood. Furthermore, the within-family identification of age-at-arrival effects strengthens the interpretation that these patterns of estimated effects are unbiased.

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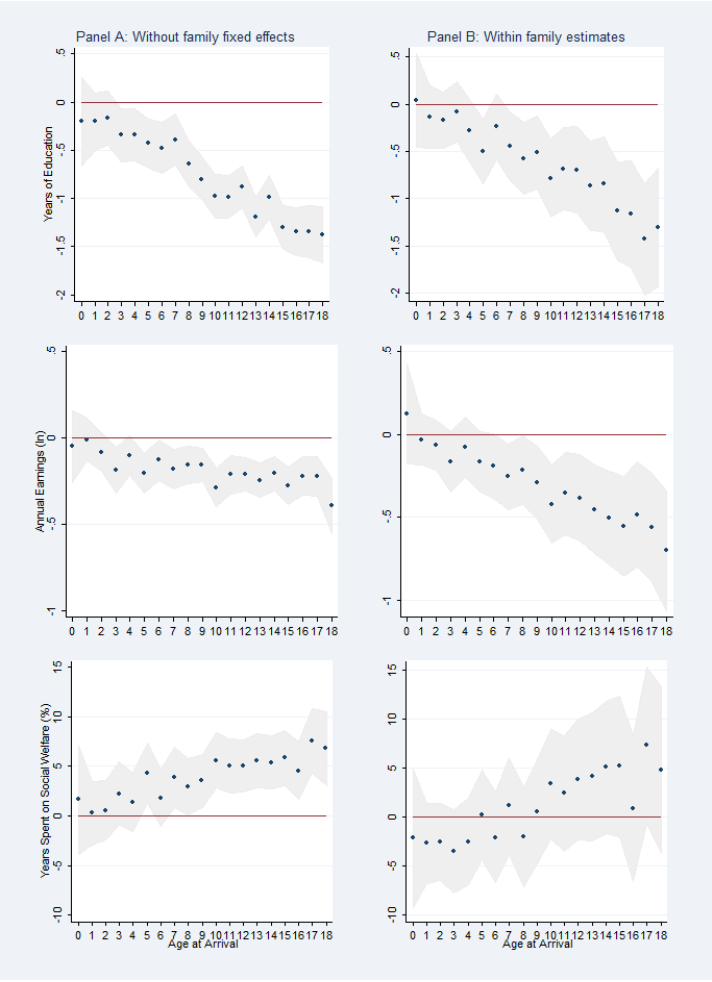
Fig. 1. Estimated Adult Socioeconomic Outcomes and Age at Arrival Among Immigrant Children.



Note: Scatter point shows the estimated difference in (i) completed years of schooling, (ii) annual earnings (ln), and (iii) percentage of years spent on social welfare in adulthood among immigrant children arriving at different ages throughout childhood. The red bar refers to the estimated reference outcomes for immigrant children born in Norway. Using the sibling sample, Panel A shows estimates from cross-sectional models and Panel B shows estimates from family fixed-effects models in Table 1. Shaded areas indicate 95% confidence intervals around point estimates.

Table 1. Estimated Models of Age at Arrival Effects on Adult Socioeconomic Outcomes. Cross-Sectional and Within-Family Estimates.

	Years of Education			Annual Earnings (ln)			Percentage of Years Spent On Social Welfare		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age at arrival									
Born in Norway	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
0	-0.334	-0.204	0.040	-0.065	-0.050	0.124	3.501	1.669	-2.155
	(0.202)	(0.233)	(0.253)	(0.089)	(0.106)	(0.153)	(2.369)	(2.821)	(3.601)
1	-0.283*	-0.204	-0.135	-0.129*	-0.010	-0.032	1.244	0.288	-2.692
	(0.130)	(0.153)	(0.168)	(0.060)	(0.062)	(0.079)	(1.433)	(1.636)	(2.086)
2	-0.131	-0.169	-0.171	-0.070	-0.082	-0.063	0.941	0.552	-2.544
	(0.125)	(0.143)	(0.151)	(0.049)	(0.058)	(0.076)	(1.310)	(1.519)	(1.987)
3	-0.295*	-0.343*	-0.076	-0.207***	-0.188**	-0.165	2.631	2.245	-3.499
	(0.122)	(0.139)	(0.164)	(0.059)	(0.068)	(0.092)	(1.415)	(1.648)	(2.162)
4	-0.364**	-0.342*	-0.276	-0.105*	-0.102	-0.077	1.878	1.350	-2.518
	(0.116)	(0.137)	(0.168)	(0.050)	(0.059)	(0.094)	(1.265)	(1.492)	(2.244)
5	-0.440***	-0.430***	-0.502**	-0.175***	-0.206***	-0.165	3.974**	4.301**	0.191
	(0.110)	(0.128)	(0.174)	(0.049)	(0.059)	(0.093)	(1.308)	(1.544)	(2.323)
6	-0.449***	-0.475***	-0.239	-0.130**	-0.128*	-0.189	2.255	1.821	-2.076
	(0.111)	(0.135)	(0.178)	(0.051)	(0.061)	(0.100)	(1.245)	(1.471)	(2.350)
7	-0.460***	-0.389**	-0.446*	-0.143**	-0.180**	-0.254*	3.998**	3.887*	1.140
	(0.109)	(0.135)	(0.187)	(0.047)	(0.059)	(0.102)	(1.273)	(1.558)	(2.514)
8	-0.731***	-0.641***	-0.572**	-0.121**	-0.156**	-0.214*	2.892*	2.987*	-2.053
	(0.100)	(0.122)	(0.192)	(0.043)	(0.056)	(0.107)	(1.171)	(1.452)	(2.568)
9	-0.664***	-0.799***	-0.509*	-0.170***	-0.158**	-0.291**	3.337**	3.541**	0.505
	(0.093)	(0.114)	(0.197)	(0.043)	(0.050)	(0.112)	(1.100)	(1.351)	(2.707)
10	-0.937***	-0.975***	-0.785***	-0.245***	-0.288***	-0.419***	4.411***	5.594***	3.357
	(0.093)	(0.115)	(0.212)	(0.045)	(0.057)	(0.119)	(1.135)	(1.429)	(2.871)
11	-0.934***	-0.987***	-0.683**	-0.219***	-0.214***	-0.353**	5.456***	5.039***	2.409
	(0.091)	(0.113)	(0.224)	(0.045)	(0.057)	(0.127)	(1.126)	(1.385)	(3.018)
12	-0.936***	-0.878***	-0.693**	-0.180***	-0.213***	-0.382**	5.045***	5.054***	3.850
	(0.089)	(0.112)	(0.232)	(0.040)	(0.049)	(0.133)	(1.086)	(1.341)	(3.140)
13	-1.004***	-1.192***	-0.867***	-0.191***	-0.246***	-0.450**	3.823***	5.585***	4.136
	(0.086)	(0.107)	(0.244)	(0.038)	(0.051)	(0.137)	(1.063)	(1.390)	(3.340)
14	-0.999***	-0.987***	-0.846***	-0.184***	-0.206***	-0.503***	5.083***	5.406***	5.060
	(0.088)	(0.118)	(0.255)	(0.038)	(0.050)	(0.143)	(1.044)	(1.389)	(3.433)
15	-1.222***	-1.300***	-1.133***	-0.288***	-0.276***	-0.556***	6.638***	5.842***	5.179
	(0.086)	(0.115)	(0.268)	(0.041)	(0.055)	(0.153)	(1.070)	(1.416)	(3.652)
16	-1.177***	-1.344***	-1.161***	-0.234***	-0.221***	-0.484**	4.782***	4.564**	0.902
	(0.091)	(0.126)	(0.285)	(0.041)	(0.057)	(0.162)	(1.060)	(1.482)	(3.796)
17	-1.146***	-1.343***	-1.431***	-0.226***	-0.224***	-0.560***	5.194***	7.598***	7.306
	(0.090)	(0.136)	(0.301)	(0.040)	(0.058)	(0.167)	(1.088)	(1.664)	(4.065)
18	-1.230***	-1.373***	-1.308***	-0.295***	-0.394***	-0.700***	4.515***	6.785***	4.792
	(0.088)	(0.148)	(0.320)	(0.041)	(0.082)	(0.184)	(1.047)	(1.921)	(4.322)
Family of origin dummies	No	No	Yes	No	No	Yes	No	No	Yes
Sample	Population	Sibling	Sibling	Population	Sibling	Sibling	Population	Sibling	Sibling
N individuals	22,465	13,144	13,144	20,913	11,900	11,900	22,465	13,144	13,144
N families		5,108	5,108		4,696	4,696		5,108	5,108

Notes: Regressions in Model 1 (i.e., columns 1, 4, and 7) and Model 2 (i.e., columns 2, 5, and 8) include controls for year of birth fixed effects, country of origin fixed effects, child sex (female=1), whether the child was the first born to his/her mother, and parents' educational qualifications. Regressions in Model 3 (i.e., columns 3, 6, and 9) include controls for family specific fixed effects on family ID, year of birth fixed effects, child sex, and whether the child was the first born to his/her mother. Huber-White standard errors in parentheses are robust to within-family clustering and heteroskedasticity.

* $p<0.05$; ** $p<0.01$; *** $p<0.001$ (two-tailed tests)