Young immigrants: age at migration and performance in education

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April 15, 2013

Preliminary Draft, Do Not Cite

1 Introduction

A growing proportion of schoolchildren in Norway have migrant background and a performance gap between children born in Norway and immigrant children exists both in Norway (Bratsberg, Raaum & Røed 2012) and in other OECD countries [Schnepf, 2007a]. Educational performance is not only important for successful assimilation in the labour market, but also for a range of other outcomes, so better understanding of the factors that influence human capital development among childhood immigrants would allow society to respond better to the challenges of increased international migration. Furthermore, studying and understanding the unique experience of immigrants can shed light on the more general issue of the relevance of different types of human capital (such as language skills) in labor markets Bleakley and Chin [2004].

Immigrants arriving in Norway as children face the challenge of mastering a new language at the same time as learning the regular curriculum taught in school. They also do this while adjusting to a different cultural and social setting. Several studies suggest that language learning is more difficult after early childhood (Lenneberg, 1967, Newport, 1990). A large and growing body of literature also more generally points to the existence of critical or sensitive periods of development relevant for both economic and social outcomes (Knudsen et al., 2006, Cunha and Heckman, 2008). The quality, content and accessibility of (pre-migration) schooling from the home country can also have an impact on adjustment to the Norwegian educational system and subsequent educational

performance. Some of the skills learned at school will also be country-specific. We would therefore expect to find a negative relationship between educational attainment and age at migration.

However, there are a number of different reasons why we might suspect that timing of migration (relative to a child's age) might not be entirely random. Refugees and persons seeking political aslylum and protection have less opportunity to choose if and when to migrate, but other types of families might choose to migrate before they start a family or when the children are young, precisely because they wish to ensure better educational opportunities for their children. Some labor migrants might have very high levels of human capital and move to Norway because of high-level positions in international firms, even when their children are older. Finally, due to similarities in language and culture as well as immigration laws, Scandinavian citizens are able to move easily and freely between the Scandinavian countries. Comparing immigrant children from such diverse backgrounds and subject to such different circumstances could lead to incorrect inferences about the effect of age at migration. Indeed, the previous literature in this area exhibits somewhat differing results, and this might be partly due to selection differences in age at migration for different types of immigrants by reason for migration and/or country of origin.

We overcome such selection issues by exploiting sibling fixed effects in the analysis. Siblings are exposed to the same family when growing up and they thus share the (fixed) family characteristics and circumstances, but their migration age differs. The timing of migration in childhood will affect not only language learning but also the general extent of their exposure to Norwegian culture and institutions. Timing of the initial integration process, as well as the initial stress (or even trauma) of migration, is also related to age at migration such that the timing of migration in relationship to a child's social and intellectual development can also have an effect beyond the direct effect from ease of language acquisition.

The main purpose of this paper is to uncover the effect of age at migration on a series of educational outcomes from middle school and upper secondary education with a family fixed effect approach to limit the contamination of selection factors in age at migration potentially due to family background or country of origin. We are able to study both average middle school grades as well as grades in individual school subjects, where there are important differences in results. Furthermore, we will discuss why it is important to extend our analysis beyond school grades to include the analysis of choices and progression in upper

secondary education and we show that important differences in the relevance of age at migration exists for grades on the one hand and completion of upper secondary education on the other.

2 Background

2.1 Previous thought and research

Following the seminal work on the earnings assimilation of immigrants by Chiswick [1978] and Borjas [1985], interest in the unique aspects of human capital accumulation among immigrants has grown and since evolved into a substantial sub-field of labor economics. Early works naturally discussed the relevance of language skills in explaining the wage assimilation of adult immigrants (McManus et al. [1983],Kossoudji [1988],Tainer [1988]Chiswick, 1991), although such topics as cultural assimilation and the complementarity of skills between the home and host (receiving) country were also considered, see Borjas [1994] for an early review. The relevance of language skills in the labor market remains a topic of great interest, with more recent articles employing more sophisticated strategies to address issues of endogeneity in earnings, educational attainment and language skills among adult immigrants (Chiswick and Miller, 1995, Dustmann and Van Soest, 2002, Bleakley and Chin, 2004).

The increasing number of children with immigrant background in a large number of Western countries has also spurned interest in issues pertaining to the educational attainment, human capital development and labor market outcomes of childhood immigrants and children of immigrants (Gang and Zimmermann, 2000, Schaafsma and Sweetman, 2001, van Ours and Veenman, 2003, Chiswick and DebBurman, 2004, Schnepf, 2007b). More recently, studies have begun to focus more closely on the relevance of age at migration for educational and labor market outcomes (Cahan et al., 2001, Schaafsma and Sweetman, 2001, Gonzalez, 2003, Bleakley and Chin, 2004, van Ours and Veenman, 2006, Böhlmark, 2008, 2009), and differences in language skills related to age at immigration is often cited when interpreting patterns of school grades, educational attainment and/or labor market outcomes for childhood immigrants. The focus on age at migration and its relationship for the development of language ties this research in with the growing literature on the importance of critical or sensitive periods in child development and their relevance for social and economic outcomes (Knudsen et al., 2006, Cunha and Heckman, 2007, 2008). The critical period hypothesis of (first) language acquisition (Lenneberg, 1967, Pinker,

1994) suggests that there is a limited period in early childhood during which humans easily develop and acquire language. Language acquisition after this period will be more difficult and it is hypothesized that individuals will be less successful in obtaining mastery of all aspects of language if acquiring language at later ages. (There are important differences in what sort of aspects of language (grammar, vocabulary, syntax) is most affected by this. We need to look more closely at the literature from psychology.) Similar hypotheses have subsequently been proposed for second language acquisition Newport [1990]. (If I remember correctly, studies indicate that accent is most affected by age when exposed to second language, grammar is affected, but less so than accent, and vocabulary is least affected. Need to double-check the details in the relevant literature.) Hakuta et al. [2003] and Chiswick and Miller [2008] both use US data to examine whether the relationship between age at migration and (English) language skills exhibits the expected discontinuity suggested by the critical period hypothesis of second language acquisition, but neither find evidence of such a critical age or period. The results from both studies do, however, document a slow and steady decline in language skills with increasing age at migration. Studies on educational outcomes for immigrants provide mixed evidence on discontinuities or critical periods of migration for schooling results. Evidence from immigrant children in Sweden (Böhlmark [2008]) point to a possible critical age at migration around 9 years for school grades, i.e. there is little difference in school grades for ages under 9 years and a marked decline in school results for immigrants who migrate after that age. This pattern is not confirmed for educational attainment (measured in adulthood) among immigrants in Sweden (Böhlmark, 2009). Altogether, results which document the potential relevance of age at migration for understanding educational attainment and the human capital accumulation of childhood immigrants is sparce and far from conclusive.

2.2 Immigration and education in Norway

Schooling is compulsory between the ages of 6 and 16 in Norway and all children residing in Norway for more than three months are subject to compulsory education (Opplæringsloven § 2-1, 2. ledd). Immigrant children arriving before third grade, i.e. before the year they turn 8, are placed directly in the grade corresponding to their age. Children arriving in Norway at a older age are placed into "reception groups" for up to two years in order to accomodate their special needs for learning Norwegian while ensuring progression in other subjects. They can also be placed directly in regular classes at grade level if

the school and parents find it more suitable. Children in reception classes are transferred to regular classes with their agemates after their transition period in the "reception groups".

In general, children in Norway start and continue their education in the grade level corresponding to their age.[1] Grade retention due to poor academic achievement is not practiced in Norwegian schools, i.e. a pupil proceeds to the next grade level with his or her classmates even if his or her progress is well behind passing standards. Pupils can therefore also leave compulsory schooling with failing marks in all or many subjects. In Norway, the principle of age as a guidance for the grade level is firmly entrenched, so the vast majority of the students in a grade level belong to the same birth cohort. Immigrants have the right to be taught in their own language until their Norwegian skills is adequate to allow for satifatory academic progression with instruction in Norwegian. Immigrant children still faces the challenge of learning a new language at the same time as catching up with the curriculum, as language learning is a process that takes time.

After compulsory education (roughly age 16), most youths in Norway start some form of upper secondary (high school) education, which, depending on the track, generally consists of education lasting 3 or 4 years. There are two main tracks of upper secondary education: a general studies track meant to prepare students for higher education and a vocational track with a large number of different specializations (such as health and social care, building and construction and agriculture, fisheries and forestry). (The general studies track also encompasses offerings with specialization in sports or music/dance/drama on top of the general academic curriculum.) The vocational track generally takes longer to complete, because most vocational programs have a stucture of two years of schooling followed by two years of an apprenticeship. All students are guaranteed a place in upper secondary education, but there is competition for acceptance to schools/tracks, i.e. students are not necessarily granted their first choice of track or school. Competition for tracks/schools are based on transcript grades from compulsory schooling. After compulsory education (roughly age 16), most students start some form of upper secondary (high school) education. However, only about a third of the cohort has completed upper secondary

[1] In some cases, they can be placed in a lower grade level than what their age corresponds to (Opplæringsloven § 2-1, jf. Ot. prp. nr. 46 (1997-98) side 135, but this is unusual and is largely related to children born very early or late in the year starting school a year early or late.)

education within five years (roughly age 21) after compulsory schooling. Earlier studies indicate that the low completion rate is related to poor skills in basic subjects, such as reading and mathematics (Falch, Nyhus and Strøm, 2011).

3 Data and methods

3.1 Data

When studying the effect of age at migration on educational outcomes, Norwegian administrative register data are used. The population register is used to define full siblings, i.e. persons with the same mother and father. The population register also contain information about source country and year of immigration, as well as birth year.

The educational outcomes are defined from the registers of education. These registers contain information about grades from compulsory education, educational activities, and highest educational attainment for each year. A measure of GPA is constructed by taking the average of the performance in all compulsory subjects in 10th grade except from Norwegian. Since some immigrants will attend courses in Norwegian as a second language and the data do not always indicate this, we exclude grades in Norwegian from the analysis.

The sample used when analysing grades in compulsory education consists of graduates from Norwegian compulsory education between 2002 and 2011. We require that the students completed compulsory education ages 15 and age 18, i.e. that the students were not far ahead or behind their regular birth cohort in schooling. To be included in the sample, it is necessary to have migrated to Norway prior to age 14 or have been born in Norway. It is also necessary to have at least one sibling who have graduated from compulsory education within the same period and who fullfills the other requirements. These conditions gives a sample of 352 837 graduates. There are 13 176 immigrant in this sibling sample.

When analysing educational progression following compulsory education, data are available for a longer period. We exploit this by also including graduates from compulsory education back to 1996 (who fulfill the other requirements). The sample then increases to 634 645, with 17 843 immigrant children.

In the case of high school completion, the outcome is observed five years after compulsory education, and the sample is restricted to all those who graduated from high school between 1996 to 2006. This leaves us with a sample of 360 840 in total, with 12 416 persons who immigrated as children. The small number of immigrants in the high school completion sample is due to lower rates of

immigration in the past.

3.2 Econometric specifications

In order to study the relationship between age at migration (aam) and grades, we can first estimate a (cross-sectional) specification of the following form:

$$grade_i = \alpha + \sum_{k=0}^{13} \beta_k aam_{ik} + \gamma' X_i + \lambda' z_i + \epsilon_i \quad (1)$$

where $grade_i$ indicates the grade that student i received at the close of compulsory schooling (10th grade); α is a general constant term (to be estimated); aam_{ik} is a dummy variable indicating that the student arrived in Norway at age k, whereby $k = 0, 1, 2, ..., 13$; X_i is a vector of covariates that can vary between siblings in the same family; z_i is a vector of covariates that capture fixed characteristics of the family (i.e. are the same for siblings); $\beta = (\beta_0, \beta_1, ...\beta_{13})'$, γ, and $\lambda$are vectors of coefficients to be estimated; and ϵ_i is an error term.

We can also estimate a similar equation with family fixed effects for siblings from the same family j in the form of:

$$grade_{ij} = \alpha + \sum_{k=0}^{13} \beta_k aam_{ijk} + \gamma' X_{ij} + \phi_j + \epsilon_{ij} \quad (2)$$

In this case, all fixed observed and unobserved characteristics of the family (including the variables previously included in vector z_i in equation 1) are subsumed in the family-specific constant term ϕ_j, to be estimated.

Grades are normalized within each year to have a mean of zero, and a standard deviation of one. By normalizing grades, problems concerning year to year changes or trends in performance are avoided.

Sibling parity is indicated by dummy variables included in X_{ij} . Immigration background variables indicate whether a person immigrated as a child, was born to two immigrants in Norway or was born to Norwegian parents. These dummy variables are interacted with gender to allow the effect of being an immigrant to differ for men and women. School fixed effects are also included in X_{ij} , together with the decile of family income for ages 13 to 16. Included in z_i are dummies for the region of origin in five categories: EU and North America, Europe outside the EU, Asia, Africa, and the rest of the world.

The main variable of interest, age at migration, aam_{ijk}, is included as dummy variables interacted with gender. The effect of age at migration could

differ for men and women, and interacting gender and migration age allows for this. Persons born in Norway are assigned immigration age 0, and the effect of being born in Norway is thus a combination of the effect found at age 0 and immigrant category.

The effect of age at migration will be estimated for GPA, mathematics and P.E. GPA gives a measure of average performance in all subjects. Mathematics has a strong association with high school completion [Falch et al., 2010] and is therefore of particular interest. In addition, language skills are less important in mathematics than in other subjects. The same could be argued for P.E. Earlier schooling experiences should also not have a strong impact on performance in P.E.

Family fixed effects will include all variables and influences which do not vary between siblings. These can include reasons for migration, country of origin, parental education etc. Family fixed effects also solves possible endogeneity bias due to timing of migration. The difference between the migration age of siblings could be interpreted as exogenous.

The parity of the siblings has been shown to have an impact on educational performance (Black et al, 2005), and the effect is the greatest for the oldest sibling. In our analysis, controls for being first and second-born are included, with a higher parity being the reference category. The factors that could influence siblings differently are family income between 13 and 16 and school performance in the grade group investigated at the year of completion. Family income is expected to rise rapidly in the first years after migration, and the economic environment could be important for educational assimilation. By including school fixed effects, differences in student composition is also implicitly accounted for.

We have estimated specification 1 separately on all students and on the population of siblings available for estimation with FFE to see if there were any important differences in results when we restrict our analysis to siblings only. We were unable to see any important differences with respect to our main variables of interest and therefore report cross-sectional results (specification (1)) from the same population of siblings included in the estimation of the FFE model in equation (2).

When analysing further progression through education at the upper secondary level, the outcomes are binary. In the case of both starting high school education and completing high school completion, linear probability models are used.

The probability to start directly in high school education after completed compulsory education is analysed both with a cross sectional specification as seen in equation 3and with family fixed effects, as in equation 4. The same control variables are included in X_{ij}as in the grade analysis, with the exception of school fixed effects. Information about school attendance in compulsory education is not available before 2002, and we therefore include municipality fixed effects instead. The municipality of residence at the time of completion of compulsory education is used. To account for trends and year to year fluctuations, year fixed effects are included.

$$P(start_i = 1) = \alpha + \sum_{k=0}^{13} \beta_k aam_{ik} + \gamma' X_i + \lambda' z_i + \epsilon_i \tag{3}$$

$$P(start_{ij} = 1) = \alpha + \sum_{k=0}^{13} \beta_k aam_{ijk} + \gamma' X_{ij} + \phi_j + \epsilon_{ij} \tag{4}$$

The same specifications are estimated when analysing completion. Completion is defined as having completed upper secondary education within five years after completion of compulsory education. Both a cross sectional specification (equation 5) and a specification with family fixed effects (equation 6) are included. The variables included in $X_{ij}$and z_i are the same as for the probability to start in education.

$$P(completion_i = 1) = \alpha + \sum_{k=0}^{13} \beta_k aam_{ik} + \gamma' X_i + \lambda' z_i + \epsilon_i \tag{5}$$

$$P(completion_{ij} = 1) = \alpha + \sum_{k=0}^{13} \beta_k aam_{ijk} + \gamma' X_{ij} + \phi_j + \epsilon_{ij} \tag{6}$$

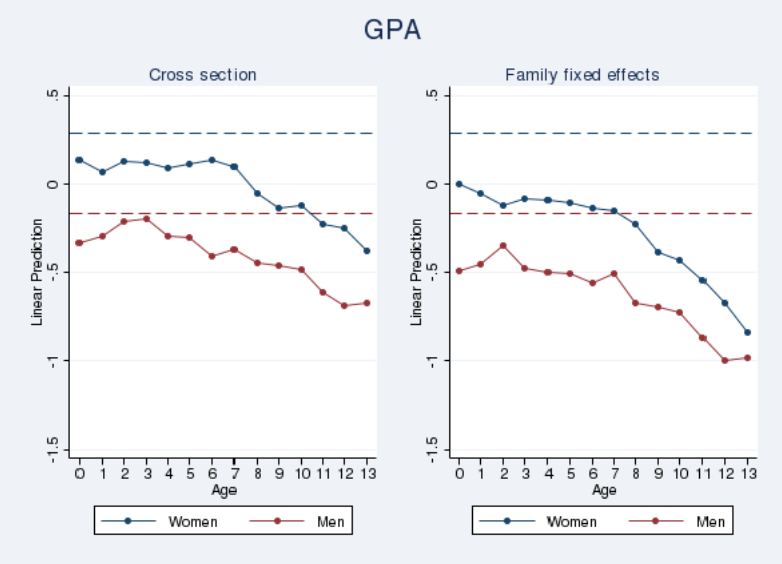
4 Results

4.1 Grades at close of compulsory schooling

Average Grades

Migration age has a strong effect on average grades at the end of compulsory education, see Figure 1 below and Table 1 in the Appendix. In the cross sectional specification, there is a sharp decline in the predicted performance after age 7 for women. For men, the same sharp decline is not observed, but there is a more gradual decline in average grades with increasing age at migration. With

Figure 1:



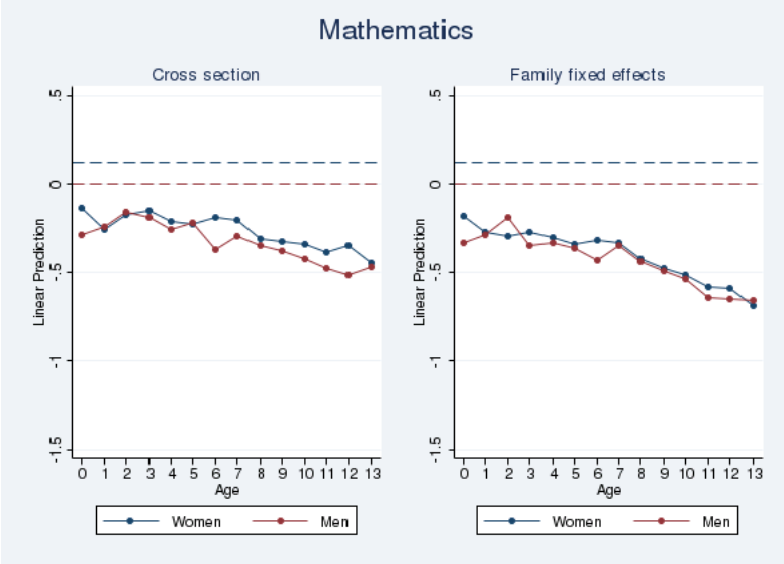
inclusion of family fixed effects, the expected performance is shifted downwards, and a stronger effect of migration age is revealed. With family fixed effects, the sharp decline in performance after age 7 is evident also for men. The effect of arriving at age 13 compared to arriving at age 0 (i.e. immigrating to Norway within the first year of life) is a reducation of .84 standard deviations for women, and .49 for men. These reducations are substantial, especially for women when including family fixed effects. This is an increase from the cross section, where the estimated effect for women at 13 is .52 and for men .34.

There are significantly negative effects from age 8 for both men and women in the cross section, and already from age 5 for women in the specification with family fixed effects. There is some indication that the effect of migration age is larger for women than what it is for men.

Math

The effect of age at migration found for mathematics is smaller than for GPA, as seen in figure 2. If less language skills are necessary to succeed in mathematics such a difference might be expected. A similar pattern is found in Swedish data [Böhlmark, 2008]. We can also further note that the relative difference between immigrant girls who arrived the year of their birth and Norwegian girls is roughly the same for GPA and math, but that the girls who arrived at later ages perform

Figure 2:



better relative to Norwegian girls in math compared to overall GPA.

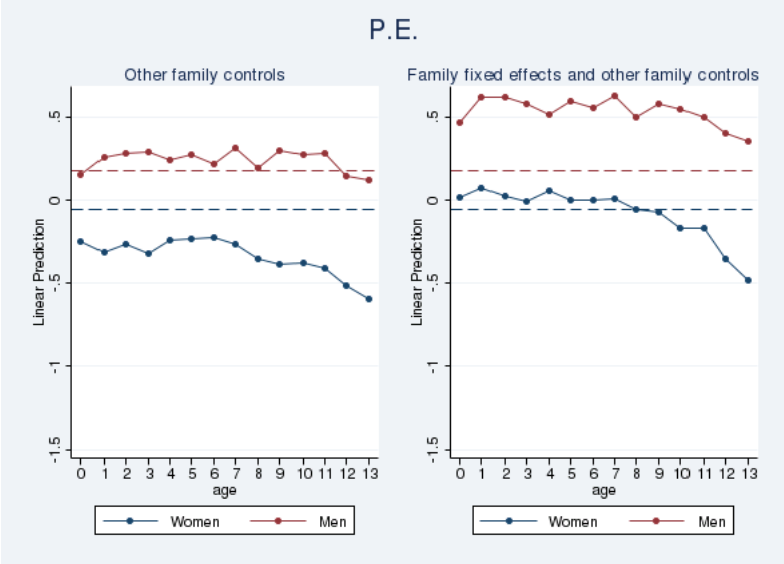
The pattern is similar in both specifications, but adding family fixed effects increases the magnitude of the estimates somewhat. In the cross sectional specification, the effect of age at migration is significantly negative from age 8 for women, and from age 10 for men. With family fixed effects, the effect is significant from age 9 for men at a 95% level, and from age 6 for women. The estimated effect of arriving at age 13 is in the cross section -.30 standard deviations for women, and -.18 for men. When including family fixed effects, the estimated effect becomes -.51 for women, and -.33 for men. These numbers are substantially lower than what is found for GPA.

The performance in mathematics is similar for men and women with immigrant background, whereas women have a higher performance than men in the Norwegian-born population. This is in contrast to the results for GPA, where immigrant men have a substantially lower performance than women. Immigrant children have on average a lower performance in mathematics than those born in Norway.

Gym

In figure3 we see the predicted performance in P.E. both with and without family fixed effects. The predicted performance is higher when adding family

Figure 3: P.E.



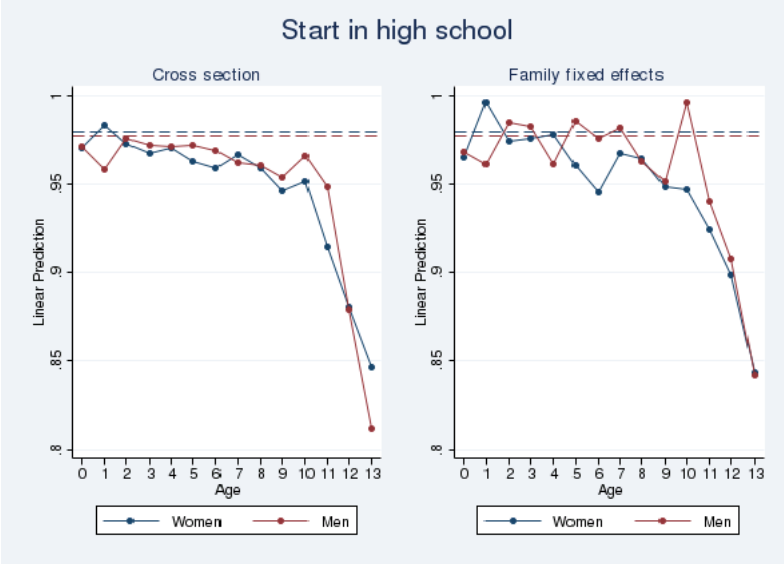
fixed effects. For men, no significant effect of migration age on performance is found. For women, there are some effects from age 9 and higher in the cross sectional analysis, and from age 11 when adding family fixed effects. The patterns in the two specifications are very similar.

The analysis of P.E. may serve as a sensitivity analysis. Performance in P.E. should be nearly unaffected by how long a person has stayed in the country, as skills are transferrable across countries, and language skills are only to a small extent necessary for succeeding.

4.2 Start and completion of upper secondary education

The effect of age at migration on the probability to start in high school directly after the end of compulsory education is shown in figure 4. There are only small effects in the cross sectional specification until age 11 for women and age 12 for men, and these are not significant, except from at age 9. The same is the case when including family fixed effects, with no significant effects of migration age except from for ages above 11 for women, and above 12 for men. The patterns are similar in both specifications, and also similar for men and women. It is clear from the figure that almost all – well above 95 percent – of both Norwegian and immigrant youths embark on some form of upper secondary education, with the only exception being immigrants who arrived in

Figure 4: Start



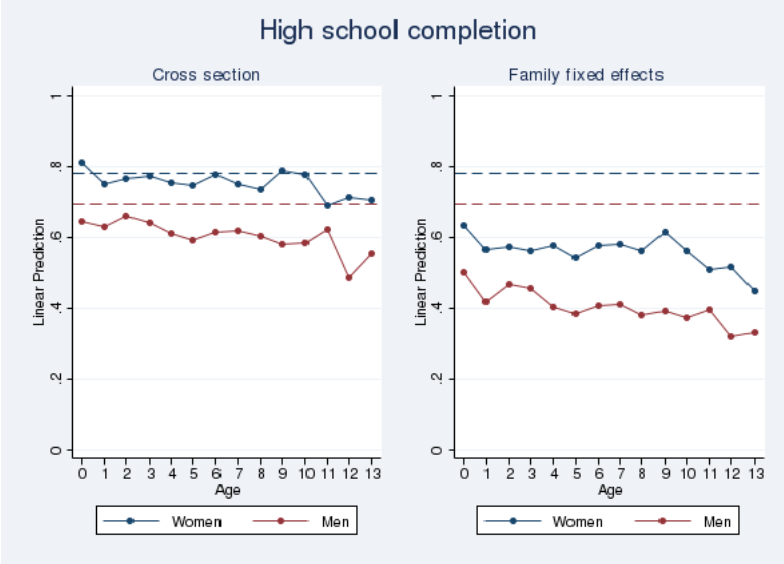
Norway shortly before the start of middle school, i.e. around age 11-13.

In the cross section, the effects of migration age is only statistically significant for the highest ages. For women, there is a significantly negative effect from age 11 at a 95 % level and for men the effect is found from age 12. Adding family fixed effects increases the effects somewhat, especially for men. There is an effect already from age 8 for men with family fixed effects, whereas for women, there is no statistically significant effect until age 11.

The reduction in the completion rate is 11 percentage points for women when arriving at age 13, and 9 percentage points for men in the cross sectional specification. With family fixed effects, the effects rises to 18 percentage points for women and 17 percentage points for men. At age 10, the effect is less than half of what is observed at age 10 for women, with only a percentage point decrease in the cross section, but a 7 percentage point decrease using the within-family estimator. For men, the effect of arriving at age 10 is a reduction in completion rate of 6 percentage points in the cross section, but 12 percentage points with family fixed effects.

The previous findings indicate a moderate to strong effect of migration age on grades in compulsory education, but the effect is much smaller when studying completion of upper secondary education. The effect in compulsory education is the highest for women, but for high school completion, the effect is larger for men

Figure 5: High school completion



than for women. Men have in general lower grades than women from compulsory education, which could partially explain the differences in completion rates as performance in compulsory education has been shown to predict high school completion (Falch et al. [2010]).

5 Preliminary Conclusions and Plans for Further Analysis

These results allow us to reach some preliminary conclusions, but we aim to develop the analysis further in the future.

The results presented here for average grades are broadly similar to the results obtained by Böhlmark [2008] for Sweden, and we also find important differences between school subjects. In particular, math appears less affected by age at migration than average grades. There appears to be little, if any, relationship between age at migration and grades in physical education. Moving from a cross-sectional analysis to sibling fixed effects does not change the main qualitative conclusions about the relationship between age at migration and school grades, but does generally lead to larger estimates of the marginal effects of an additional year in Norway. Significant effects also appear at somewhat earlier ages for girls when applying the sibling fixed effects, sometimes as low as

4-5 years of age, compared to 8 or 9 years of age with the cross-sectional results. In general, the results on grades at the close of compulsory schooling do not lend much support to the idea of a "sensitive" or "critical" period for migration outside of which school achievement would be markedly poorer. Rather, the results give the impression of a gradual but more or less smooth and continuous decline in school grades for older ages at migration. The year-to-year differences are individually small, but add up to quite profound differences in achievement over a larger interval of age at migration.

The most striking result thus far is the profound differences obtained for (most) grades from compulsory schooling on the one hand and completion of upper secondary school on the other. With the exception of PE, earlier age at migration appears to be related to better grades at the close of compulsory schooling, but that relationship appears much weaker when we study completion of upper secondary school. In other words, younger migrants do not complete secondary schooling at a higher rate than their older siblings (who arrived at a later age), despite having had the opportunity to attend Norwegian schools for a longer period *and* despite achieving better grades. This is particularly puzzling and demands further analysis. There are several plausible explanations which we will attempt to study as we continue with this work. In particular, we need to consider if grades impact on upper secondary progression differently for immigrants compared to native Norwegians in order to establish whether migrants who arrived at an earlier age are completing upper secondary education at a lower rate than expected given their grades or if the immigrants who arrived at a later age are overachieving relative to their (poorer) grades from compulsory schooling. To this end we will also consider whether certain grades are more important in determining success in upper secondary education for immigrant children. In particular, there is some indication [Falch et al., 2010] that math grades might be the best predictor of success in completing upper secondary education. Considering that both secondary school completion and mathematics grades exhibit "flatter" slopes than most of the other outcomes with respect to age at migration it may be the case that mathematics skills are more important than language skills and/or grades in more language-intensive subjects for the long-term educational success of immigrant children.

Table 1: GPA

	Cross section		Family fixed effects	
	Estimate	St.dev	Estimate	St.dev
Age 1, women	-0,0701	0,0587	-0,0553	0,0603
Age 2, women	-0,0096	0,0565	-0,1205 **	0,0561
Age 3, women	-0,0172	0,0575	-0,0833	0,0585
Age 4, women	-0,0443	0,0551	-0,0933	0,0571
Age 5, women	-0,0275	0,0545	-0,1106 **	0,0564
Age 6, women	0,0013	0,0546	-0,1379 **	0,0607
Age 7, women	-0,0403	0,0540	-0,1527 ***	0,0582
Age 8, women	-0,1896 ***	0,0549	-0,2269 ***	0,0617
Age 9, women	-0,2740 ***	0,0540	-0,3895 ***	0,0644
Age 10, women	-0,2613 ***	0,0535	-0,4334 ***	0,0633
Age 11, women	-0,3630 ***	0,0559	-0,5437 ***	0,0674
Age 12, women	-0,3888 ***	0,0577	-0,6771 ***	0,0683
Age 13, women	-0,5191 ***	0,0611	-0,8384 ***	0,0766
Age 0, men	-0,2934	0,0353	-0,1384	0,2697
Age 1, men	-0,2554	0,0663	-0,1006	0,2757
Age 2, men	-0,1732 **	0,0647	0,0048 **	0,2756
Age 3, men	-0,1544 **	0,0674	-0,1212	0,2786
Age 4, men	-0,2534	0,0658	-0,1440	0,2792
Age 5, men	-0,2600	0,0660	-0,1569	0,2777
Age 6, men	-0,3628	0,0648	-0,2092	0,2773
Age 7, men	-0,3254	0,0643	-0,1526	0,2778
Age 8, men	-0,4003 **	0,0639	-0,3211 ***	0,2778
Age 9, men	-0,4174 **	0,0642	-0,3407 ***	0,2784
Age 10, men	-0,4407 ***	0,0630	-0,3748 ***	0,2780
Age 11, men	-0,5710	0,0648	-0,5184 ***	0,2786
Age 12, men	-0,6452	0,0681	-0,6476 ***	0,2798
Age 13, men	-0,6286	0,0697	-0,6319 ***	0,2798
2. gen immigrant, women	0,1053 ***	0,0364	0,0448	0,0366
Non-immigrant, women	0,1635 ***	0,0353	0,3099	0,2697
1. gen immigrant, men	-0,1802 ***	0,0352	-0,3539	0,2700
2. gen immigrant, men	0,0115	0,0153	-0,1890	0,2682
Non-immigrant, men	0,0000	(omitted)	0,0000	(omitted)

Table 2: Mathematics

	Cross section		Family fixed effects	
	Estimate	St.dev	Estimate	St.dev
Age 1, women	-0,1073 *	0,0604	-0,0868	0,0589
Age 2, women	-0,0337	0,0582	-0,1128 **	0,0567
Age 3, women	-0,0162	0,0595	-0,0895	0,0603
Age 4, women	-0,0857	0,0567	-0,1188 **	0,0590
Age 5, women	-0,0990	0,0562	-0,1541 ***	0,0577
Age 6, women	-0,0577	0,0563	-0,1340 **	0,0608
Age 7, women	-0,0730	-0,0730	-0,1467 **	0,0589
Age 8, women	-0,1814 ***	0,0560	-0,2394 ***	0,0612
Age 9, women	-0,2003 ***	0,0550	-0,2951 ***	0,0625
Age 10, women	-0,2147 ***	0,0540	-0,3316 ***	0,0628
Age 11, women	-0,2631 ***	0,0557	-0,4019 ***	0,0641
Age 12, women	-0,2298 ***	0,0569	-0,4047 ***	0,0662
Age 13, women	-0,3166 ***	0,0596	-0,5047 ***	0,0709
Age 0, men	0,0396	0,0365	0,3272	0,0679
Age 1, men	0,0769	0,0686	0,3740	0,0723
Age 2, men	0,1650 **	0,0667	0,4689 **	0,0698
Age 3, men	0,1291	0,0691	0,3111	0,0710
Age 4, men	0,0629	0,0675	0,3286	0,0685
Age 5, men	0,0964 *	0,0678	0,2956	0,0704
Age 6, men	-0,0521 *	0,0662	0,2315	0,0647
Age 7, men	0,0084	0,0659	0,3160	0,0639
Age 8, men	-0,0404	0,0655	0,2186 *	0,0599
Age 9, men	-0,0673 **	0,0657	0,1673 **	0,0596
Age 10, men	0,1084 ***	0,0639	0,1250 ***	0,0548
Age 11, men	-0,1683 ***	0,0655	0,0152 ***	0,0594
Age 12, men	-0,1979 ***	0,0678	0,0109 ***	0,0611
Age 13, men	-0,1636 ***	0,0684	0,0000 ***	(omitted)
2. gen immigrant, women	0,1545 ***	0,0375	0,0791 **	0,0392
Non-immigrant, women	0,1636 ***	0,0364	0,3261	0,2983
1. gen immigrant, men	-0,1851 ***	0,0363	-0,4782 ***	0,0679
2. gen immigrant, men	-0,0182	0,0158	-0,3233 ***	0,0760
Non-immigrant, men	0,0000	(omitted)	-0,1166	0,3064

Table 3: P.E.

	Cross section		Family fixed effects	
	Estimate	St.dev	Estimate	St.dev
Age 1, women	-0,0614	0,0595	0,0544	0,0703
Age 2, women	-0,0165	0,0576	0,0045	0,0653
Age 3, women	-0,0661	0,0587	-0,0276	0,0669
Age 4, women	0,0099	0,0560	0,0413	0,0636
Age 5, women	0,0152	0,0555	-0,0174	0,0636
Age 6, women	0,0252	0,0556	-0,0147	0,0680
Age 7, women	-0,0175	0,0546	-0,0094	0,0694
Age 8, women	-0,0982 *	0,0553	-0,0713	0,0708
Age 9, women	-0,1349 **	0,0542	-0,0906	0,0733
Age 10, women	-0,1281 **	0,0533	-0,1861 ***	0,0723
Age 11, women	-0,1615 ***	0,0549	-0,1827 **	0,0779
Age 12, women	-0,2615 ***	0,0563	-0,3695 ***	0,0772
Age 13, women	-0,3426 ***	0,0587	-0,5010 ***	0,0844
Age 0, men	0,4233	0,0361	0,1192	0,0831
Age 1, men	0,5281	0,0675	0,2709	0,0888
Age 2, men	0,5497	0,0658	0,2652	0,0858
Age 3, men	0,5590	0,0684	0,2265	0,0883
Age 4, men	0,5112	0,0664	0,1611	0,0853
Age 5, men	0,5456	0,0667	0,2478	0,0812
Age 6, men	0,4837	0,0651	0,2080	0,0782
Age 7, men	0,5802	0,0649	0,2790	0,0793
Age 8, men	0,4644	0,0643	0,1456	0,0756
Age 9, men	0,5691	0,0646	0,2314	0,0743
Age 10, men	0,5467	0,0629	0,1958	0,0704
Age 11, men	0,5530	0,0643	0,1489	0,0695
Age 12, men	0,4115	0,0669	0,0519	0,0791
Age 13, men	0,3917	0,0667	0,0000	(omitted)
2. gen immigrant, women	-0,0217	0,0371	0,0220	0,0418
Non-immigrant, women	0,2142 ***	0,0361	-0,0804	0,2574
1. gen immigrant, men	-0,0185	0,0358	0,3335 ***	0,0819
2. gen immigrant, men	0,0282	0,0155	0,3842 ***	0,0912
Non-immigrant, men	0,0000	(omitted)	0,0158	0,2707

Table 4: Start

	Cross section		Family fixed effects	
	Estimate	St.dev	Estimate	St.dev
Age 1, women	0,0079	0,0076	0,0312	0,0143
Age 2, women	-0,0020	0,0083	0,0093	0,0143
Age 3, women	-0,0080	0,0087	0,0101	0,0142
Age 4, women	-0,0051	0,0081	0,0125	0,0145
Age 5, women	-0,0120	0,0089	-0,0046	0,0145
Age 6, women	-0,0158 *	0,0092 *	-0,0196	0,0152
Age 7, women	-0,0084	0,0088	0,0018	0,0153
Age 8, women	-0,0157	0,0098	-0,0007	0,0161
Age 9, women	-0,0277 ***	0,0104	-0,0170	0,0177
Age 10, women	-0,0231 **	0,0105	-0,0181	0,0182
Age 11, women	-0,0587 ***	0,0131	-0,0413 **	0,0193
Age 12, women	-0,0939 ***	0,0154	-0,0668 ***	0,0215
Age 13, women	-0,1281 ***	0,0180	-0,1215 ***	0,0228
Age 0, men	0,1621	0,0189	0,0064	0,0159
Age 1, men	0,1439 *	0,0212	0,0000	(omitted)
Age 2, men	0,1618	0,0202	0,0229	0,0156
Age 3, men	0,1582	0,0204	0,0209	0,0153
Age 4, men	0,1569	0,0204	-0,0002	0,0162
Age 5, men	0,1581	0,0202	0,0239	0,0170
Age 6, men	0,1555	0,0203	0,0139	0,0164
Age 7, men	0,1486	0,0207	0,0201	0,0181
Age 8, men	0,1475	0,0207	0,0009	0,0177
Age 9, men	0,1403 **	0,0210	-0,0105	0,0179
Age 10, men	0,1528	0,0210	0,0341	0,0187
Age 11, men	0,1357 **	0,0211	-0,0219	0,0188
Age 12, men	0,0667 ***	0,0249	-0,0541 ***	0,0232 ***
Age 13, men	0,0000 ***	(Omitted)	-0,1195 ***	0,0243 ***
2. gen immigrant, women	0,0072 *	0,0026	0,0105	0,0107
Non-immigrant, women	0,0080 ***	0,0013	0,0133 ***	0,0046
1. gen immigrant, men	-0,1581 ***	0,0189	-0,0035	0,0160
2. gen immigrant, men	-0,1449 ***	0,0190	0,0108	0,0241
Non-immigrant, men	-0,1531 ***	0,0189	0,0043	0,0165

Table 5: High school completion

	Cross section		Family fixed effects	
	Estimate	St.dev	Estimate	St.dev
Age 1, women	-0,0583 **	0,0450	-0,0676 *	0,0528
Age 2, women	-0,0439 *	0,0434	-0,0611	0,0521
Age 3, women	-0,0384	0,0434	-0,0710	0,0528
Age 4, women	-0,0541 **	0,0420	-0,0558	0,0498
Age 5, women	-0,0628 *	0,0430	-0,0901 **	0,0517
Age 6, women	-0,0335	0,0428	-0,0547	0,0515
Age 7, women	-0,0581 *	0,0423	-0,0529	0,0513
Age 8, women	-0,0734 **	0,0430	-0,0720	0,0522
Age 9, women	-0,0214	0,0429	-0,0169	0,0533
Age 10, women	-0,0322	0,0436	-0,0709	0,0534
Age 11, women	-0,1188 ***	0,0442	-0,1230 **	0,0544
Age 12, women	-0,0974 **	0,0454	-0,1165 **	0,0558
Age 13, women	-0,1056 **	0,0471	-0,1848 ***	0,0586
Age 0, men	-0,1398	0,0367	0,0813	0,0544
Age 1, men	-0,1541	0,0578	0,0000	(omitted)
Age 2, men	-0,1258	0,0555	0,0498	0,0399
Age 3, men	-0,1453	0,0567	0,0383	0,0402
Age 4, men	-0,1724	0,0557	-0,0171 *	0,0407
Age 5, men	-0,1927	0,0553	-0,0336 **	0,0401
Age 6, men	-0,1692	0,0556	-0,0131 *	0,0395
Age 7, men	-0,1667	0,0557	-0,0065 *	0,0402
Age 8, men	-0,1812	0,0557	-0,0381 **	0,0417
Age 9, men	-0,2038	0,0557	-0,0261 *	0,0426
Age 10, men	-0,2001	0,0558	-0,0453 **	0,0433
Age 11, men	-0,1641	0,0565	-0,0210 *	0,0436
Age 12, men	-0,2971 ***	0,0573	-0,0989 ***	0,0487
Age 13, men	-0,2301	0,0576	-0,0863 ***	0,0476
2. gen immigrant, women	0,0466	0,0371	-0,0063	0,0439
Non-immigrant, women	-0,0538	0,0367	0,1367	0,2225
1. gen immigrant, men	-0,0250	0,0365	-0,2147***	0,0527
2. gen immigrant, men	0,0132	0,0098	-0,2585***	0,0692
Non-immigrant, men	0,0000	(omitted)	-0,0323	0,2300

Appendix

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