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Findings for male immigrants in Norway

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Abstract:
Previous studies have identified an "immigrant paradox" in crime in which crime rates are highest among immigrants who are young when they arrive in the host country, even though social capital and integration in the labour market and social networks favour the young. We use Norwegian registry data to estimate the probability of committing at least one crime in any year after the year of immigration, and we include interaction terms between age and age at immigration to explore the troublesome temporal association between age, age at immigration and duration of residence. The results suggest an overall negative association between age at immigration and registered crime, which seems to be exaggerated by the residual effect of the omitted duration of residence variable. Comparability of results between studies depends crucially on how age at immigration is measured.

Keywords: Crime, Immigrants, Age at immigration, Duration of residence

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Sammendrag

Tidligere forskning har vist at innvandrere som ankommer mottakerlandet i ung alder begår mer kriminalitet enn innvandrere som ankommer senere i livet. Dette er noe overraskende, ettersom utdanningsnivå, yrkesdeltakelse, integrering i ulike sosiale nettverk og andre faktorer som assosieres med *mindre* kriminalitet har vist seg å være bedre for innvandrere som ankommer som barn. Det er foreløpig ikke gjort noen studier på sammenhengen mellom alder ved innvandring og kriminalitet i Norge, og vi ønsker derfor å kartlegge hvordan dette fenomenet fortegner seg i norsk sammenheng. Vi søker å imøtegå enkelte begrensninger ved tidligere studier, ved å bruke en kontinuerlig forklaringsvariabel som også inkluderer innvandrere som har ankommet etter fylte 20 år. I tillegg knytter det seg en del metodiske utfordringer til alder er lik summen av botid og alder ved innvandring slik at disse tre variblene ikke kan tas med som forklaringsvariabler i samme modell. Tidligere studier har utelatt variabelen for botid fra analysene, og det forblir uvisst i hvilken grad dette påvirker resultatene for nettopp alder ved innvandring. Vi undersøker dette nærmere gjennom en deskriptiv tilnærming, og estimerer alders-kriminalitetskurver som kan variare med alder ved innvandring. Logikken bak denne tilnærmingen er at botiden kan observeres i diskrepansen mellom alderen ved innvandring og alderen til samme individ på et gitt senere tidspunkt.

Analysene bygger på politiets siktelsesdata for alle lovbrudd begått mellom 1992 og 2007, som inkluderer både forbrytelser og forseelser. Utvalget består av alle mannlige innvandrere mellom 15 og 50 år, som har hatt lovlig oppholdtillatelse i hele eller deler av denne perioden. Disse følges år for år fra og med 1992 eller første oppholdsår og ut 2007. Vi estimerer andelen som begår minst ett lovbrudd i løpet av et gitt år, kontrollert for alder, landbakgrunn og innvandringsgrunn.

Resultatene viser at det samlet sett er en negativ, svakt konkav sammenheng mellom alder ved innvandring og kriminalitet blant mannlige innvandrere i Norge, med høyest andel årlige lovbruddstilfeller blant personer som innvandret da de var ti år. Samspillsmodellen indikerer imidlertid at variasjonen mellom personer som innvandret ved ulike aldere ikke er lik for alle deler av livsløpet. For personer som ankommer etter fylte 15 år er nivået svært lavt umiddelbart etter ankomst, før dette stiger med økende alder og deretter stabiliserer seg på et nivå tilsvarende det vi observerer blant innvandrere som ankom tidligere. Dette utypiske aldersmønsteret indikerer at den utelate botidsvariabelen har gitt inntrykk av større variasjoner i kriminell deltakelse mellom personer som ankom ved ulike aldere enn det som faktisk kan tilskrives nettopp alderen ved innvandring. Fra rundt 35 år er det ingen signifikante forskjeller.

1. Introduction

The relationship between immigration and crime has been a prominent topic in public, policy and scientific discourse for more than a century (Martinez and Lee, 2000). As in several other countries, Norway has experienced steadily increasing immigration (Henriksen, Østby and Ellingsen, 2010; OECD, 2011; The Urban Institute, 2006), and with immigrants and children of immigrants representing an expanding proportion of the population, questions about the relationship between crime and immigration become increasingly important.

At the intersection between research on the integration of immigrants and research on crime among immigrants, a so-called "immigrant paradox" seems to be emerging. It has been shown that immigrants who arrive in the host country as young children have advantages in language proficiency, participation in the education system, employment status, school performance, income level, risks of poverty and participation in various social networks, compared with those who arrive later (Bleakley and Chin, 2010; Böhlmark, 2008, 2009; Henriksen, 2009; Løwe, 2009; Myers, Gao and Emeka, 2009; Lee and Edmonston, 2011; Åslund, Böhlmark and Skans, 2009). These factors of social capital and integration are also known to be related to low rates of crime (Farrington, 2005; Galloway and Skarðhamar, 2009; Gottfredson and Hirschi 1990; Hirschi 1969; Junger-Tas, 2001; Sampson and Laub, 1993), and therefore a natural assumption would be that age at arrival in the host country is positively related to subsequent criminal behaviour.

However, recent studies from North American and European countries contradict this assumption. They indicate that immigrants who migrate in early childhood (as well as those born to immigrant parents in the host country) commit more crime than those who arrive later in life (Hagan, Levi and Dinovitzer, 2008; Martens, 1997; Morenoff and Astor, 2006; Rumbaut and Ewing, 2007). The only exception to this seemingly uniform pattern was found in Sweden, where young immigrants (as well as children born to immigrant parents) commit *less* crime than those who immigrate as adults (Ahlberg, 1996; Martens, 1997; Martens and Holmberg, 2005). Previous studies with Norwegian data show that children of immigrants commit slightly *more* crime than those who themselves immigrated (Skarðhamar, Thorsen and Henriksen, 2011), but the relationship between age at immigration and crime remains unexplored.

Our goal for this analysis is twofold. First, we wish to contribute to the rather limited body of literature assessing the association between age at immigration and crime. Most previous studies are primarily targeted towards generational differences in crime, with age at arrival playing a secondary role. This leads to a less thorough assessment of age at arrival, with categorical rather than continuous measures

and a widespread exclusion of those arriving after their early teens. We wish to address these limitations by applying a detailed measure of age at arrival, stretching well into adulthood.

Second, the temporal issues associated with age at immigration as an explanatory variable need more attention than they have previously been given in criminological studies. Age, age at arrival and duration of residence are relevant variables for both crime and other social issues. However, as Myers et al. (2009:212) and Oropesa and Landale (1997:436) point out, any two of these factors jointly define the third, and thus one variable must be omitted from regression models. It is not known to what extent the residual effects of such omitted variables (usually the *duration of residence* in studies of age at immigration (e.g., Hagan et al., 2008; Martens and Holmberg, 2005; Morenoff and Astor (2006)) affect the estimated association between age at arrival and crime. Therefore, we set out to explore this in a descriptive manner with a visual presentation of how this applies to crime among people arriving in a host country at different stages in life.

2. Previous studies and theoretical background

North American and European studies have fairly consistently shown a *negative* association between age at immigration and criminal behaviour, with immigrants who arrive as young children (as well as the more thoroughly researched second generation) committing more crime than those who arrive later in life (Hagan et al., 2008; Morenoff and Astor, 2006; Rumbaut and Ewing, 2007; Tonry, 1997). Morenoff and Astor (2006) examined youth violence in Chicago and found that children arriving in the U.S. before the age of six were more than four times as likely to commit violent crimes as those arriving after the age of 10 (p. 47). They used Segmented Assimilation Theory (e.g., Portes and Zhou, 1993) to explain the results, highlighting how a young age at immigration is a potential drawback if the child grows up in a disadvantaged neighbourhood, increasing the likelihood of crime (see also Beckley (forthcoming) and Martens and Holmberg (2005)).

Similar results have been reported by Hagan and colleagues (2008) and Rumbaut and Ewing (2007), and the over-representation in crime statistics of the so-called second generation (sometimes also comprising those who arrived as young children) has also been described by many researchers (see e.g., Killias, 1989; Tonry, 1997). Given the association between young age at immigration and other variables that are usually associated with *less* crime, such as attachment to the labour market and educational level, these findings can be seen as part of an “immigrant paradox”. This describes a situation in which people with (supposedly) better opportunities are outperformed by those who (presumably) are worse off (see Suáres-Orosco, Rhodes and Milburn, 2009). Such a pattern can be found in numerous social areas (see,

e.g., Suáres-Orosco et al. (2009) for education and Escobar (1998) for health), most commonly describing the relationship between the so-called first and second generations (Tonry, 1997).

To our knowledge, the only exception to this seemingly uniform, paradoxical pattern of criminality is found in Sweden. Here, individuals who arrive at a very young age (or who are born to immigrant parents in Sweden) commit *less* crime than those who migrated as older individuals (Ahlberg, 1996; Martens, 1997; Martens and Holmberg, 2005).[1] Martens and Holmberg (2005) examined the relationship between age at immigration (measured continuously from the age of 1 to 50) and the probability of being a prime suspect for crimes committed between 1997 and 2001. They found an inverted u-shaped relationship in which those who arrived before the age of three had the lowest risk; those who arrived at the age of 15 had the highest risk, with a decreasing risk thereafter as the age at immigration increased. The authors' conclusion, that young age at immigration was a "protection against crime" (Martens and Holmberg, 2005:38), stands in sharp contrast to the "risk" described in other studies. Beckley (forthcoming) provides the most recent study in this field, both in Sweden and elsewhere. Her sample was restricted to those who arrived before the age of 15, and she found the same curvilinear pattern (although with a culmination point at about the age of 11 rather than 15). However, it is worth noting that the association between age at immigration and crime was not significant in her most rigorous models that controlled for family context (including duration of residence; Beckley, forthcoming).

We are not aware of any Norwegian studies on the association between age at immigration and crime. However, studies on integration have shown a non-paradoxical pattern in which those who arrive before the age of seven perform better (and more like Norwegian-born children of immigrants) in many social areas than immigrants who arrive when they are older (Henriksen, 2009; Løwe, 2009). If the similarities between Norwegian-born with immigrant parents and immigrants who arrive as young children are similar for crime as they are for other social outcomes, we can due to higher crime rates among Norwegian-born than among immigrants (see Skarðhamar et al., 2011) expect to find the immigrant paradox also in Norway.

2.1. Previous limitations and the aims of this study

Although the relationship between age at immigration and crime has been highlighted in several studies, we find the current body of literature to be limited in several important ways. First, it is worth

[1] Kardell and Martens (unpublished) report some variation between different types and measures of crime, but the general trend is also reproduced in the latest data.

noting the limited number of studies on this topic. Most of the previously mentioned studies focused on *generational* differences in crime, or crime among immigrants more generally, not on age at arrival in particular. This leads to a somewhat limited use of the age at arrival variable (see, e.g., Hagan et al., 2008; Morenoff and Astor, 2006; Rumbaut and Ewing, 2007; Tonry, 1997) both with respect to methodological considerations and discussions of results. The most important limitations are the exclusion of immigrants who arrive after their late teens and the use of a few broad categories to measure age at arrival. To our knowledge, Martens and Holmberg (2005) are the only researchers who have used a continuous measure of age at arrival as well as included immigrants arriving at 18 years of age or older. This affects both the quality and comparability of results, an issue we will return to in the discussion of our findings. In sum, our first goal is to contribute to the limited body of literature on the relationship between age at arrival and crime and to address some of the shortcomings of the applied measures of age at immigration.

A second and more generally applicable problem or limitation of previous research relates to the temporal issues associated with age at arrival as an explanatory variable. As mentioned previously, we cannot include age, age at arrival and duration of residence as covariates in the same regression model, as two of these factors jointly define the third. The most common approach in facing this challenge is to include *either* duration of residence *or* age at arrival, used in combination with age (Myers et al., 2009:212). Neither Hagan et al. (2008), Morenoff and Astor (2006) nor Martens and Holmberg (2005) included controls for duration of residence in their models. These models implicitly assume that the variation in crime between people arriving at different stages in life remains constant during the life-course, or in other words, that there is no interaction between the covariates or between the covariates and the omitted variables. The extent to which this is true is not known, and therefore our second goal is to explore how the interplay between age, age at immigration and duration of residence might affect our results.

3. Data

The data for this study come from Norwegian registers provided by Statistics Norway. They enable us to associate acts of crime and other social and demographic events and characteristics of an individual's environment by tracing his or her unique personal identification number in all registers. Our sample consisted of all male immigrants to Norway who resided in Norway with a valid residence permit at any time between 1992 and 2007 (N = 253,721). The demographic variables were gathered from the population registers, including date of birth, date of immigration, country of origin and reasons for immigration (family establishment, employment, etc.), continued residency, etc.

Information on registered crimes was gathered from police records on solved cases, in which most persons are convicted (Lyngstad and Skarðhamar, 2011). An advantage of this data source is that it includes the date of the offence rather than the date of conviction. This allowed us to correctly identify the timing of events, regardless of how long the investigation might have taken. We used data on *all* crimes, including misdemeanours[2] and more serious offences. Although using data on all crimes runs the risk of ignoring important variations between types of crimes and characteristics of the offenders, we wanted to provide as inclusive a description as possible because of the limited knowledge about the question at hand.[3]

The data on crimes were available from 1992 to 2007, and this constitutes the time frame for our dataset. We imposed two further restrictions by including only male immigrants between 15 and 50 years old. The upper age limit was necessary to ensure that we would collect enough observations for all combinations of variables, and it represents an age when criminal behaviour is negligible (Hirschi and Gottfredson, 1983; Thorsen, Lid and Stene, 2009). The lower limit of 15 years old is the minimum age of criminal responsibility in Norway. We restricted the dataset to men because there are gender differences in many of the key areas of our analysis, and separate analyses for men and women would be advisable rather than simply controlling for gender. However, for pragmatic reasons, separate gender analyses were not possible.

The data have a panel structure with one-year intervals, comprising between 1 and 16 observations each for 253,721 individuals, for a total of 1,499,627 observations. To be able to control for age at the time of offence, we maintained the panel structure and estimated the probability of offending at all ages, even though our main interest is in the age at immigration (which does not change with time). Hence, it is the observation or the person-year that constitutes the unit for our analysis, and crimes can be committed in none, one, or several of the years for each individual. This implies dependency between observations, and we discuss this further in our section on applied methods.

Before we move on to the applied methods, we will define some of the terms used in this article. *Immigrant* refers to a person born abroad to two foreign-born parents who has immigrated to and been granted a permanent residence permit in Norway. *Age at immigration* (or *age at arrival)* indicates the immigrant's age when the residence permit was granted, not necessarily the year of arrival in Norway.

[2] Misdemeanours are mainly shoplifting, serious traffic violations (drink-driving and excessive speeding), damage to property and environmental crimes.

[3] We have performed identical analyses using only felonies as the dependant variable, but differences are minor.

The same is true of *duration of residence*, *time spent in country*, etc. In a broad sense, *crime* can refer to all actions covered by Norwegian criminal law, but in this case, we refer only to those crimes that are registered by the police and have a known suspect with a Norwegian personal identification number. *Crime* and *criminal behaviour* are used interchangeably, as crime here refers to *any* registered offence, regardless of the type, severity, frequency, etc. of the acts.

4. Methods

Our empirical analysis has two main aims. First, we describe how the conditional probabilities of committing a crime vary by age at immigration. On the basis of analyses with one-year dummies for age at immigration, we defined this as a continuous variable with third degree polynomials. In this first section, we also wanted to control for any variation in crime associated with systematic differences in immigrant background. For instance, work migrants (as a group) commit less crime than refugees, and although work migrants do not arrive in the host country as children, many refugees do. This might lead to the appearance of consistently higher criminal behaviour among immigrants arriving as children, whereas the actual explanation may have more to do with immigrant background than with age at arrival.

To account for these and similar selection problems, we used several covariates in our models. To control thoroughly for age, *age* was used as a categorical covariate with one-year intervals. *Country of origin* was used as a categorical variable with single categories for countries with more than 4000 immigrants as of January 1, 2008 (21 countries), with the remaining countries grouped by world region (7 categories). *Reason for immigration* was used as a categorical variable, based on the Norwegian Directorate of Immigration's classification of immigration for asylum or protection, work, educational purposes, or family reasons such as establishment or reunification. Nordic citizens are not registered based on their reason for immigration or their country of origin, so individuals with missing values on these variables were grouped in categories labelled "unknown" to include them in the analyses.

Our second aim was to see whether the results of the first analysis would be affected by the omission of duration of residence from the model. We did this in an exploratory and descriptive manner, estimating the age–crime curve *depending* on age at immigration. This approach is based on the logic that the duration of residence can be determined by the difference between the age of an individual at a given time and his/her age at immigration. If duration of residence is of no importance, we expect to find consistent differences in crime at all ages for people who arrived at different ages. Any variation in the relationship between age–crime curves for people arriving at different ages implies that duration of residence is important and that it might have affected the age at immigration parameters in the first

model. We used *age at immigration* as a categorical variable based on ages as defined by the Norwegian school system, and we allowed the continuous *age* variable and its interaction terms to vary with quartic terms. We present results based on models with control variables, predicted for the mean population composition.

We constructed logistic regression models, estimating the probability of at least one crime committed in a given year. The previously described panel data imply dependency between observations, and a straightforward estimation of the model could lead to an under-estimation of the standard errors and an increased risk of Type-I statistical errors (Goldstein, 1995). One method of analysing correlated data is to use so-called generalized estimation equations (GEE), which has the advantage that only the correct specification of marginal means is needed to obtain consistent and asymptotic, normally distributed estimators (Højsgaard, Halekoh and Yan, 2006). The interpretation of GEE coefficients is population averaged and does not separate within-person and between-person variances as a random effects models would.

For the first model assessing the relationship between age at immigration and crime, we fit the following logistic regression model:

$$\mathrm{logit}(\pi_{it}) = \alpha + \beta_1(\mathrm{AGE}_{it}) + \beta_2(\mathrm{AGEIMG}_i) + \beta_3 \mathrm{X}_{it},$$

where π is the probability of having committed an offence for person *i* in year *t*. *X* is a vector of covariates (land of origin and reason for immigration) with regression parameters β_3. AGE is entered as a vector of one-year dummies and AGEIMG as a vector of one-year dummy variables indicating the age at immigration.

In the second analysis, we wanted to estimate the age–crime curve allowing it to vary by age at immigration. Therefore, we included interaction terms between age (and its polynomials) and age at immigration, resulting in the following model:

$$\mathrm{logit}(\pi_{it}) = \alpha + \beta_1(\mathrm{AGE}_{it}) + \beta_2(\mathrm{AGEIMG}_i) + \beta_3(\mathrm{AGE}_{it} \times \mathrm{AGEIMG}_i) + \beta_4 \mathrm{X}_{it}.$$

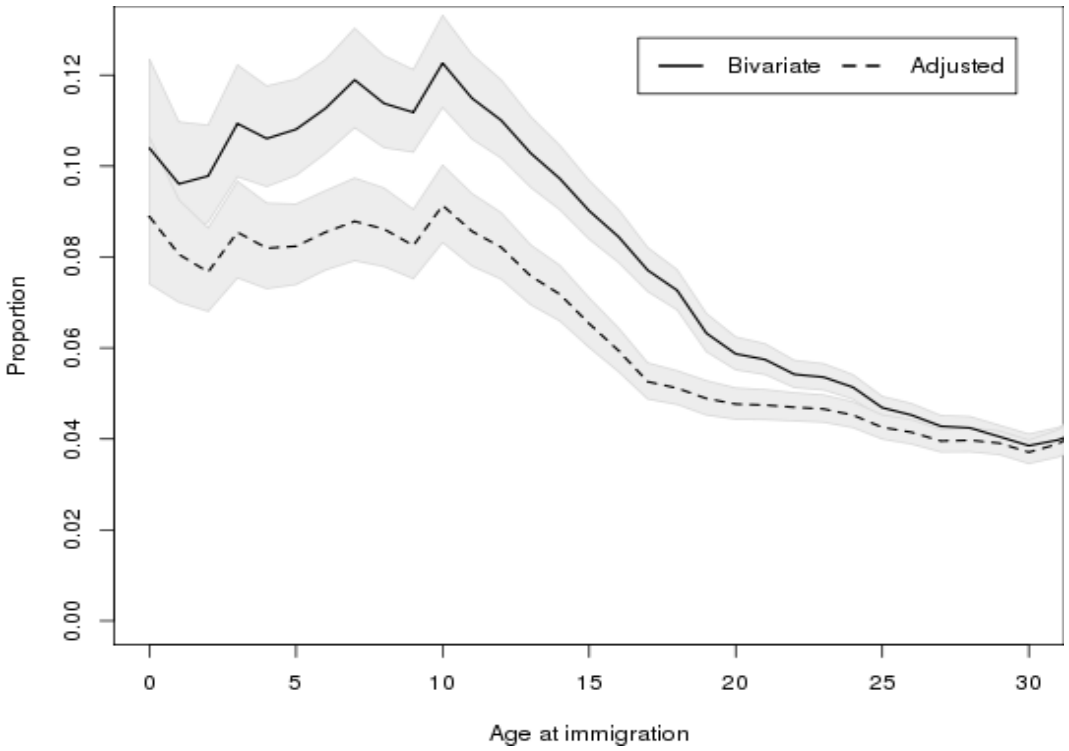
Because these models have many parameters and interaction terms, it is difficult to communicate the results effectively in tables. Therefore, all of the main results are presented as plots of the parameters

of interest.[4] Logits are relative sizes that are generally hard to interpret and we follow the advice of others regarding reporting on the probability scale (King, Tomz and Wittenberg, 2000). To remove differences in criminal behaviour between age at immigration-groups that are due to their respective composition on immigrant related characteristics, we present results as predicted probabilities at the population mean for the control variables.

5. Results

Figure 1 shows the predicted proportion of observations with at least one crime committed in any year after immigration and age 15, by the age at arrival in Norway. The upper line depicts the bivariate association between age at immigration and crime (logistic regression with no controls), and the dotted line shows the predicted probabilities when controlling for composition of the immigrant population. Both curves show the predicted values at the age of 30, which allows for a sufficient number of observations for all ages at immigration.

Figure 1. Predicted proportion of observations with at least one crime committed, by age at immigration. Age = 30



[4] The full results are available from the authors upon request.

As we see from the solid line in Figure 1, the proportion of offenders is around 10 per cent for those who arrived in Norway before the age of one. The general association between age at immigration and crime can be described as a concave, negative relationship that increases to a peak of around 12 per cent for those who arrived at the age of 10. Criminal behaviour then decreases rather steeply for those who arrived between the ages of 11 and 20, before it declines more slowly thereafter. Note that if the sample only included individuals who immigrated up to about the age of 10, this finding would contradict the "immigrant paradox" found in previous studies.

Controlling for age, land of origin and reason for immigration (dotted line), the overall level of the curve (predicted at average levels of covariates) is somewhat lower. Criminal behaviour remains stable at around 8–9 per cent until about the age of 10, when it decreases at a somewhat slower pace than in the previous model. Thus, this figure suggests that the variation in criminal behaviour associated with immigrant background is most apparent in those who immigrated up to the age of 10. A natural explanation of this pattern would be that different immigrant groups, arriving systematically at different ages, are present in crime registers in varying degrees. For instance, people who arrive as refugees commit more crime than those who immigrate for work or educational reasons. The first group is represented by people who migrate at all ages, whereas the latter group tends to arrive during a shorter (and older) age span (cf. Skarðhamar et al., 2011).
For the interaction models, we divided the age-at-immigration variable into categories to obtain a manageable number of parameters and to assess more easily interaction effects with age. The categories are based on school levels, which are assumed to represent important stages in child development. Re-running the above model with those categories, we obtain the logistic regression parameters shown in Table 1.

Table 1. Logistic regression coefficients for age at immigration. Likelihood of committing at least one crime, by age at immigration. With and without covariates. Ref = 19–24 years

	Without covariates		**With covariates**	
	B	**SE**	**B**	**SE**
Intercept	–2.834*	0.012	–2.693*	0.039
0–6	0.699*	0.027	0.594*	0.028
7–12	0.795*	0.023	0.637*	0.025
13–15	0.594*	0.027	0.426*	0.028
16–18	0.357*	0.024	0.143*	0.024
25–29	–0.251*	0.018	–0.147*	0.019
30–50	–0.461*	0.017	–0.183*	0.021

* = p<.01
Note: the covariates are not of central interest and are not included here. They are available from the authors upon request.

In the model without covariates, it is easy to recognize the curvilinear pattern depicted in Figure 1. The highest log odd for committing at least one crime is found in the group of immigrants who arrived during primary school (age 7–12), followed by those who arrived before school enrolment (age 0–6). From the age of 13–15 onwards, we see a negative association between age at immigration and crime, with log odds becoming gradually lower as age-at-immigration increases. We see that all coefficients are significant at a <.01 level, and this holds true irrespective of reference group.

As we can see from the coefficients in the right panel of Table 1, inclusion of the covariates described in the previous section had little impact on the relationship *between* the different age at immigration-groups. The highest log odd is still for those who arrived between the ages 7–12, followed by the younger group, and so on, as in the model without the covariates. The coefficients are slightly lower, indicating (as shown in Figure 1) that the differences between the groups in relative terms are smaller after the covariates are introduced. This also applies to all reference groups here, and overall these models give the impression of rather strong and statistically significant differences in crime among immigrants who arrive in Norway at different life stages. Generally, there is a negative association between age at immigration and crime, but because the relationship is non-linear, examinations of different parts of the age at immigration variable will lead to very different conclusions. We return to this matter in the discussion of our results and their relationship to previous research.

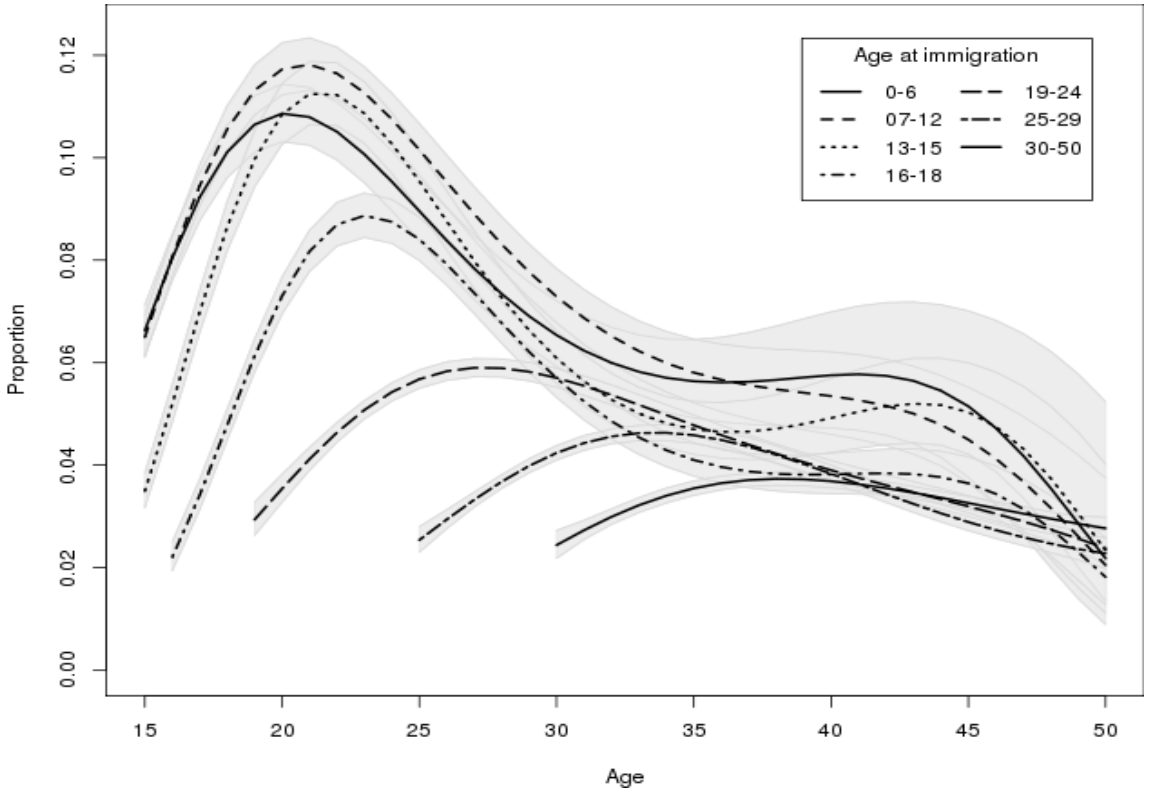
If we move on to the interaction models, which indirectly capture the impact of duration of residence, the picture is rather different. Figure 2 shows the predicted probabilities from the refitted model, as discussed above, in which the age–crime curves vary across age at immigration–groups (as defined in Table 1).

There are clear differences in criminal behaviour for the different age at immigration-groups at different stages in their lives. Immigrants who arrived before the minimum age of criminal responsibility (15 years) followed the typical age–crime curve we know from a range of earlier studies (e.g., Hirschi and Gottfredson, 1983). The curves increase sharply from the age of 15 to a peak of 15 per cent[5] around the age of 21, and then decrease steadily until about the age of 30, after which they decline more slowly. Immigrants who arrived after the age of 15 showed a somewhat different pattern. Their criminal behaviour was very low shortly after arrival, before it increased steadily over a period of about 10 years and stabilized at a level close to or slightly below the levels of the previously arrived groups. All curves

[5] This is a relatively high number compared with other Norwegian studies (e.g., Haslund, 2000, 2004; Skarðhamar et al., 2011). At least one of the reasons is that we only examine *male* immigrants in the most criminally active part of their lives.

have a similar pattern, although they increase more gradually and (quite naturally) culminate further to the right. We find the low starting levels and atypical age development especially noteworthy.

Figure 2. Predicted proportion of offenders for the different age at immigration-groups, by age at the time of offence. With covariates



The confidence intervals are also plotted in Figure 2, and as we see, they become highly overlapping, particularly after the ages 30–35. The purpose of plotting the confidence intervals in this way is to highlight the substantive differences between the groups up to the age when they intersect. For example, it is clear that those who arrived between age 19 and 24 committed substantially fewer crimes than the younger groups, up to about age 28. Therefore, the age at which we examine criminal behaviour is critically important, as it will influence the conclusions we draw. At age 20, there are large and statistically significant differences in criminal behaviour between all but the three youngest groups, whereas no clear pattern can be detected at age 40.

Overall, these results indicate that the rates of criminal behaviour for immigrants who arrived at different ages are *not* consistent across their post-migration lifespans. This implies that the results in our initial model are most likely affected by the omission of duration of residence from the model, and we suspect that the atypical age development for groups arriving after age 15 indicates a duration of residence effect. We encourage future analysis of this possibility (cf. Beckley, forthcoming).

6. Discussion

Theory suggests that those who immigrate at an early age are better integrated into society and hence can be expected to commit less crime than those who arrive later in life. Previous studies have found the opposite association in many countries, which has been referred to as the "immigrant paradox" in crime. We analysed criminal behaviour among all male immigrants to Norway who were resident (at some point) between 1992 and 2007 using GEE logistic regression models to estimate the probability of committing at least one crime in any given year. We found a slightly concave, negative relationship between age at immigration and criminal behaviour for this sample. The predicted probability of offending increased from a relatively high level of 10 per cent for those who arrived at age 0, with a peak of 12 per cent for arrival at age 10, and decreased until the end of the observation period at age 50. Based on this model we can conclude that, overall, there is a *negative* association between age at immigration and crime among male immigrants in Norway; thus, these data affirm the apparent "immigrant paradox" found in many previous studies (e.g., Hagan et al., 2008; Morenoff and Astor, 2006; Rumbaut and Ewing, 2007; Tonry, 1997) and contradict the "protection effect" found in Sweden (Martens and Holmberg, 2005). We believe that both General Strain Theory (Agnew, 1992, 2001) and Segmented Assimilation Theory (Portes and Zhou, 1993) are promising foundations for further examination and understanding of these results. This is because they focus on social bonds as potential burdens and incentives for crime, providing a framework for understanding the rather counter-intuitive scenario of integrated yet criminal individuals.

If we look more closely at the definitions and applications of the age at immigration variable in both this and the other studies considered here, it becomes evident that our initial conclusion needs to be revised. The measures of age at immigration vary greatly between studies, and their respective conclusions should therefore be compared only with attention paid to these differences. For example, if we defined age at immigration as Hagan et al. (2008) and Morenoff and Astor (2006) did, we would only look at those immigrants who arrived before the ages 10–12. As seen in Figure 1, this is where we observed an *increase* in criminal behaviour as age at immigration increase, and if we were to examine only this part of the curve, we would reject any signs of an "immigrant paradox" in male crime in Norway. To our knowledge, Martens and Holmberg (2005) is the only study of this type that includes a continuous measure of age at immigration that exceeds 15 years of age, and they found a concave relationship between age at immigration and crime that is similar to ours. Although our results show persistently higher criminal behaviour among those who arrived as young children, the Swedish data show a much slower descent after the peak age, with crime amongst adult immigrants never declining beneath the level of those who arrived when they were very young (Martens and

Holmberg, 2005). This leads us to draw different *overall* conclusions, but, again, if we focus only on those immigrants who arrived in their childhood, the patterns in the two studies would overlap almost perfectly (see also Beckley, forthcoming). Therefore, it seems clear that future researchers should pay close attention to variations in measurements of age at immigration to prevent erroneous conclusions. We encourage the use of a continuous measure that includes adult immigrants as well as children, whenever the data allow it.

Another and perhaps more profound problem in our initial results concerns the temporal interdependence of age, age at arrival and duration of residence. As seen in Figure 2, large differences in criminal behaviour between the age at immigration-groups are found immediately after the arrival of "new" groups. Observations from these points in time contributed variability to the first model, with information of sizeable differences in crime between different ages at arrival affecting both the age at immigration estimates and their standard errors. As age and duration of residence increase, differences diminish because of the atypical age–crime curves among the newly arrived groups. Therefore, we suspect that some of the variability in crime attributed to age at immigration in the first model was actually attributable to the residual effect of duration of residence. This is a troublesome temporal issue to address (cf. Oropesa and Landale, 1997; Myers et al., 2009), and Morenoff and Astor (2006) suggest sibling analysis as a promising approach to some of these issues. Beckley (forthcoming) found that age at immigration is insignificant in the most rigorous models in which family characteristics (including, in most cases, duration of residence) are controlled. She used data for serious offenders in Stockholm, and further research is needed to determine whether similar approaches would yield similar findings with Norwegian data.

7. Conclusion

We found that the association between age at arrival and criminal behaviour among male immigrants to Norway was negative and hence "paradoxical", as previously shown in North American and European studies. However, this finding requires two important caveats. First, different studies have used very different measures of age at immigration and thus a great deal of caution is needed when comparing their results. If we used the same restricted range of age-at-immigration that has been used in some studies, such as below ages 10–12, we would find a *positive* relationship between age at arrival and crime in Norway, suggesting the "protection" of young age at arrival as was found in Sweden rather than the "risk" reported in other studies. Second, and perhaps more importantly, we found that the inevitable omission of duration of residence as an independent variable most likely affected the parameters in the initial model. Differences in crime among people who arrived at

different ages were *not* consistent over the life-course, and exceptionally low levels of crime among newly arrived immigrants followed an atypical age pattern that left the differences between groups insignificant after about 8–10 years. We believe this can be attributed to the residual effect of the duration of residence, and if so, it has important implications for the interpretation of previous results. We encourage future researchers to pay close attention to these kinds of methodological issues when examining the association between age at arrival and various social outcomes, and to follow Beckley (forthcoming) and Morenoff and Astor (2006) in their recognition of sibling models (i.e., family fixed effects) as a promising way of doing so. We also encourage researchers to investigate the mechanisms that gradually increase the probability of offending during the first few years after immigration.

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Appendix: Full regression results

Table 1: Logistic regression model for Figure 1. Without covariates

		Estimate	S.E.	p
Intercept		-2,154	0,097	0,000
Age at immigration (ref=0 years)	1 year	-0,087	0,122	0,475
	2 years	-0,067	0,114	0,556
	3 years	0,057	0,116	0,623
	4 years	0,023	0,113	0,842
	5 years	0,044	0,112	0,694
	6 years	0,091	0,110	0,410
	7 years	0,152	0,110	0,168
	8 years	0,102	0,109	0,353
	9 years	0,082	0,107	0,445
	10 years	0,187	0,108	0,084
	11 years	0,113	0,107	0,293
	12 years	0,064	0,107	0,547
	13 years	-0,011	0,106	0,914
	14 years	-0,074	0,105	0,483
	15 years	-0,157	0,105	0,134
	16 years	-0,229	0,104	0,028
	17 years	-0,328	0,103	0,001
	18 years	-0,392	0,103	0,000
	19 years	-0,541	0,103	0,000
	20 years	-0,620	0,103	0,000
	21 years	-0,643	0,102	0,000
	22 years	-0,705	0,102	0,000
	23 years	-0,717	0,101	0,000
	24 years	-0,761	0,101	0,000
	25 years	-0,858	0,101	0,000
	26 years	-0,895	0,101	0,000
	27 years	-0,953	0,101	0,000
	28 years	-0,962	0,102	0,000
	29 years	-1,011	0,102	0,000
	30 years	-1,063	0,103	0,000
	31 years	-1,030	0,103	0,000
	32 years	-0,967	0,105	0,000
	33 years	-1,066	0,105	0,000
	34 years	-1,084	0,106	0,000
	35 years	-1,109	0,107	0,000
	36 years	-1,123	0,108	0,000
	37 years	-1,191	0,109	0,000
	38 years	-1,177	0,111	0,000
	39 years	-1,202	0,112	0,000
	40 years	-1,272	0,113	0,000
	41 years	-1,370	0,118	0,000
	42 years	-1,400	0,119	0,000
	43 years	-1,346	0,119	0,000
	44 years	-1,401	0,123	0,000
	45 years	-1,502	0,130	0,000
	46 years	-1,799	0,145	0,000
	47 years	-1,629	0,149	0,000
	48 years	-1,815	0,163	0,000
	49 years	-1,855	0,193	0,000
	50 years	-2,261	0,277	0,000

Table 2: Logistic regression model for Figure 1. With covariates

		Estimate	S.E.	p
Intercept		-1,5707	0,1021	0,0000
Age at immigration				
(ref=0 years)	1 year	-0,1070	0,1207	0,3754
	2 years	-0,1606	0,1137	0,1577
	3 years	-0,0433	0,1157	0,7085
	4 years	-0,0888	0,1128	0,4311
	5 years	-0,0833	0,1111	0,4535
	6 years	-0,0431	0,1094	0,6934
	7 years	-0,0128	0,1098	0,9069
	8 years	-0,0343	0,1090	0,7532
	9 years	-0,0812	0,1068	0,4474
	10 years	0,0300	0,1074	0,7801
	11 years	-0,0405	0,1069	0,7045
	12 years	-0,0863	0,1061	0,4161
	13 years	-0,1729	0,1053	0,1007
	14 years	-0,2319	0,1048	0,0269
	15 years	-0,3331	0,1044	0,0014
	16 years	-0,4346	0,1037	0,0000
	17 years	-0,5638	0,1027	0,0000
	18 years	-0,5928	0,1022	0,0000
	19 years	-0,6408	0,1032	0,0000
	20 years	-0,6675	0,1023	0,0000
	21 years	-0,6722	0,1019	0,0000
	22 years	-0,6830	0,1015	0,0000
	23 years	-0,6915	0,1014	0,0000
	24 years	-0,7220	0,1011	0,0000
	25 years	-0,7864	0,1012	0,0000
	26 years	-0,8132	0,1018	0,0000
	27 years	-0,8627	0,1016	0,0000
	28 years	-0,8584	0,1023	0,0000
	29 years	-0,8752	0,1028	0,0000
	30 years	-0,9296	0,1037	0,0000
	31 years	-0,8798	0,1042	0,0000
	32 years	-0,7833	0,1056	0,0000
	33 years	-0,8622	0,1063	0,0000
	34 years	-0,8664	0,1075	0,0000
	35 years	-0,8594	0,1080	0,0000
	36 years	-0,8581	0,1091	0,0000
	37 years	-0,8935	0,1106	0,0000
	38 years	-0,8456	0,1127	0,0000
	39 years	-0,8567	0,1140	0,0000
	40 years	-0,8931	0,1145	0,0000
	41 years	-0,9510	0,1199	0,0000
	42 years	-0,9403	0,1211	0,0000
	43 years	-0,8623	0,1213	0,0000
	44 years	-0,8377	0,1258	0,0000
	45 years	-0,8985	0,1327	0,0000
	46 years	-1,1687	0,1485	0,0000
	47 years	-0,9268	0,1525	0,0000
	48 years	-1,0581	0,1668	0,0000
	49 years	-1,0876	0,1965	0,0000
	50 years	-1,4370	0,2820	0,0000

Table 2 continued:

	Estimate	S.E.	p
Age (ref=30 years) 15 years	-0,4464	0,0364	0,0000
16 years	-0,1989	0,0341	0,0000
17 years	-0,0198	0,0325	0,5419
18 years	0,1094	0,0311	0,0004
19 years	0,2735	0,0298	0,0000
20 years	0,3243	0,0291	0,0000
21 years	0,2868	0,0288	0,0000
22 years	0,2511	0,0284	0,0000
23 years	0,2400	0,0279	0,0000
24 years	0,1885	0,0274	0,0000
25 years	0,1303	0,0270	0,0000
26 years	0,0785	0,0268	0,0033
27 years	0,0548	0,0263	0,0374
28 years	0,0713	0,0252	0,0046
29 years	0,0186	0,0244	0,4463
31 years	0,0071	0,0244	0,7704
32 years	-0,0114	0,0254	0,6532
33 years	-0,0295	0,0259	0,2549
34 years	-0,0235	0,0263	0,3716
35 years	-0,0429	0,0268	0,1090
36 years	-0,0427	0,0271	0,1157
37 years	-0,0882	0,0279	0,0016
38 years	-0,0884	0,0283	0,0018
39 years	-0,1015	0,0290	0,0005
40 years	-0,1324	0,0298	0,0000
41 years	-0,1436	0,0304	0,0000
42 years	-0,1864	0,0314	0,0000
43 years	-0,1937	0,0323	0,0000
44 years	-0,2823	0,0338	0,0000
45 years	-0,2866	0,0347	0,0000
46 years	-0,3326	0,0362	0,0000
47 years	-0,3787	0,0377	0,0000
48 years	-0,4282	0,0392	0,0000
49 years	-0,3887	0,0398	0,0000
50 years	-0,4191	0,0414	0,0000
Country of birth (ref=other african) BosniaHercegovina	-0,7405	0,0386	0,0000
Kosovo	0,0679	0,0339	0,0453
Poland	-0,5803	0,0485	0,0000
Netherlands	-1,2802	0,0863	0,0000
Russia	-0,1347	0,0514	0,0088
Great Britain	-1,1400	0,0519	0,0000
Germany	-1,0462	0,0569	0,0000
Afghanistan	-0,4311	0,0485	0,0000
Filipines	-0,8729	0,0708	0,0000
India	-0,7300	0,0567	0,0000
Irak	0,0791	0,0293	0,0069
Iran	-0,0491	0,0329	0,1350
China	-1,0297	0,0785	0,0000
Pakistan	-0,1979	0,0333	0,0000
Sri Lanka	-0,7081	0,0384	0,0000
Thailand	-0,5227	0,0912	0,0000
Turkey	-0,3089	0,0368	0,0000

Table 2 continued:

	Estimate	S.E.	p
Vietnam	-0,636	0,037	0,000
Morocco	0,245	0,044	0,000
Somalia	0,117	0,033	0,000
Chile	-0,199	0,041	0,000
Other Nordic	-0,740	0,034	0,000
Other Western Europe	-0,862	0,049	0,000
Other eastern Europe	-0,311	0,037	0,000
Asia	-0,368	0,039	0,000
South and Central America	-0,188	0,051	0,000
North America	-1,440	0,072	0,000
Oceania	-1,400	0,136	0,000
Reason for immigration (ref=Refugee) Work	-0,861	0,033	0,000
Family	-0,126	0,020	0,000
Education	-1,802	0,058	0,000
Unknown	-0,266	0,024	0,000

Table 3: Logistic regression model for Table 1. With control variables.

	Model 1		Model 2	
	Estimate	**S.E.**	**Estimate**	**S.E.**
Intercept	-2,8337	0,0124	-2,6927	0,0393
Age at immigration (ref=19-24 years) 0-6 years	0,6991	0,0266	0,5939	0,0284
7-12 years	0,7948	0,0230	0,6368	0,0245
13-15 years	0,5941	0,0265	0,4262	0,0277
16-18 years	0,3574	0,0236	0,1432	0,0243
25-29 years	-0,2507	0,0180	-0,1472	0,0189
30-50 years	-0,4614	0,0173	-0,1827	0,0205
Age (ref=15 years) 16 years			0,2539	0,0313
17 years			0,4298	0,0316
18 years			0,5536	0,0319
19 years			0,7191	0,0319
20 years			0,7703	0,0321
21 years			0,7327	0,0326
22 years			0,6957	0,0335
23 years			0,6828	0,0340
24 years			0,6258	0,0344
25 years			0,5729	0,0348
26 years			0,5228	0,0351
27 years			0,4944	0,0354
28 years			0,5072	0,0355
29 years			0,4504	0,0360
30 years			0,4274	0,0362
31 years			0,4344	0,0362
32 years			0,4231	0,0365
33 years			0,4050	0,0367
34 years			0,4103	0,0369
35 years			0,3909	0,0373
36 years			0,3917	0,0374
37 years			0,3451	0,0379
38 years			0,3463	0,0384
39 years			0,3336	0,0386
40 years			0,3009	0,0392
41 years			0,2857	0,0398
42 years			0,2399	0,0405
43 years			0,2333	0,0410
44 years			0,1464	0,0422
45 years			0,1413	0,0430
46 years			0,0860	0,0443
47 years			0,0387	0,0453
48 years			-0,0145	0,0466
49 years			0,0209	0,0471
50 years			-0,0198	0,0484

Table 3 continued:

	Model 1		Model 2	
	Estimate	**S.E.**	**Estimate**	**S.E.**
Country of Birth (ref=other African) Bosnia Hercegovina			-0,7379	0,0385
Kosovo			0,0687	0,0339
Poland			-0,5805	0,0486
Netherlands			-1,2776	0,0863
Russia			-0,1359	0,0515
Great Britain			-1,1401	0,0518
Germany			-1,0424	0,0569
Afghanistan			-0,4335	0,0485
Filipines			-0,8709	0,0708
India			-0,7272	0,0568
Irak			0,0772	0,0293
Iran			-0,0465	0,0329
China			-1,0274	0,0785
Pakistan			-0,1949	0,0333
Sri Lanka			-0,7041	0,0383
Thailand			-0,5216	0,0915
Turkey			-0,3068	0,0368
Vietnam			-0,6274	0,0371
Morocco			0,2456	0,0435
Somalia			0,1176	0,0327
Chile			-0,1937	0,0414
Oter Nordic			-0,7450	0,0336
Other Western Europe			-0,8592	0,0493
Other Eastern Europe			-0,3080	0,0367
Asia			-0,3672	0,0393
South and Central Amerika			-0,1886	0,0511
North Amerika			-1,4387	0,0719
Oceania			-1,4003	0,1358
Reason for immigration (ref=refugees) Work			-0,8704	0,0330
Family			-0,1267	0,0195
Education			-1,8075	0,0584
Unknown			-0,2584	0,0237

Table 4: Logistic regression model for figure 2. With control variables

		Estimate	S.E.	p
Intercept		-19,0740	1,8600	0,0000
Age at immigration (ref=19-24)	0-6 years	-0,0401	2,3742	0,9865
	7-12 years	-12,1619	2,6156	0,0000
	13-15 years	-17,5602	2,9706	0,0000
	16-18 years	-1,0455	3,2146	0,7450
	25-29 years	-0,4981	9,1022	0,9564
	30-50 years	-10,4842	27,6584	0,7046
Age		2,5166	0,2924	0,0000
Age^2		-0,1278	0,0165	0,0000
Age^3		0,0027	0,0004	0,0000
Age^4		0,0000	0,0000	0,0000
Country of Birth (ref=other African)	Bosnia Hercegovina	-0,7680	0,0387	0,0000
	Kosovo	0,0699	0,0339	0,0395
	Poland	-0,5656	0,0483	0,0000
	Netherlands	-1,2820	0,0863	0,0000
	Russia	-0,1043	0,0520	0,0448
	Great Britain	-1,1522	0,0519	0,0000
	Germany	-1,0295	0,0569	0,0000
	Afghanistan	-0,3688	0,0485	0,0000
	Filipines	-0,8860	0,0708	0,0000
	India	-0,7247	0,0568	0,0000
	Irak	0,0924	0,0293	0,0016
	Iran	-0,0690	0,0330	0,0365
	China	-1,0656	0,0787	0,0000
	Pakistan	-0,1617	0,0332	0,0000
	Sri Lanka	-0,7391	0,0385	0,0000
	Thailand	-0,5352	0,0913	0,0000
	Turkey	-0,2971	0,0368	0,0000
	Vietnam	-0,6044	0,0371	0,0000
	Morocco	0,2348	0,0435	0,0000
	Somalia	0,1233	0,0328	0,0002
	Chile	-0,2008	0,0414	0,0000
	Other Nordic	-0,7364	0,0334	0,0000
	Other West-European	-0,8591	0,0493	0,0000
	Other East-European	-0,2891	0,0366	0,0000
	Other Asian	-0,3628	0,0393	0,0000
	Other South and Central American	-0,1776	0,0511	0,0005
	North American	-1,4131	0,0718	0,0000
	Other Oceanian	-1,3725	0,1362	0,0000
Reason for immigration (ref=refugees)	Work	-0,7932	0,0329	0,0000
	Family	-0,1278	0,0195	0,0000
	Education	-1,7133	0,0584	0,0000
	Unknown	-0,1973	0,0235	0,0000

Table 4 continued:

	Estimate	S.E.	p
Age at imm.0-6*age	-0,0536	0,3718	0,8853
Age at imm.7-12*age	1,5428	0,4043	0,0001
Age at imm.13-15*age	1,9866	0,4379	0,0000
Age at imm.16-18*age	-0,5293	0,4398	0,2288
Age at imm.25-29*age	-1,1527	1,0399	0,2677
Age at imm.30-50*age	-0,3580	2,8180	0,8989
Age at imm.0-6*age^2	0,0062	0,0209	0,7654
Age at imm.7-12*age^2	-0,0697	0,0225	0,0019
Age at imm.13-15*age^2	-0,0810	0,0234	0,0005
Age at imm.16-18*age^2	0,0482	0,0224	0,0310
Age at imm.25-29*age^2	0,0914	0,0445	0,0402
Age at imm.30-50*age^2	0,0649	0,1072	0,5446
Age at imm.0-6*age^3	-0,0002	0,0005	0,6879
Age at imm.7-12*age^3	0,0013	0,0005	0,0126
Age at imm.13-15*age^3	0,0014	0,0005	0,0092
Age at imm.16-18*age^3	-0,0013	0,0005	0,0067
Age at imm.25-29*age^3	-0,0024	0,0009	0,0054
Age at imm.30-50*age^3	-0,0019	0,0018	0,2841
Age at imm.0-6*age^4	0,0000	0,0000	0,6509
Age at imm.7-12*age^4	0,0000	0,0000	0,0456
Age at imm.13-15*age^4	0,0000	0,0000	0,0520
Age at imm16-18*age^4	0,0000	0,0000	0,0029
Age at imm.25-29*age^4	0,0000	0,0000	0,0010
Age at imm.30-50*age^4	0,0000	0,0000	0,1302

B

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