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Age at Migration, Language and Fertility Patterns among Migrants to Canada

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Abstract

This paper explores the fertility patterns of immigrant children to Canada using the 20 percent sample of the Canadian Census from 1991 through 2006. Fertility increases with age at immigration, with a sharp rise for those immigrating in their late teens and this pattern is similar for all countries of origin. Proficiency in official languages does not seem a key mechanism through which age at immigration affects fertility – fertility of immigrants with an official mother tongue also differs from that of natives. Formal education, however, matters as college graduates who arrived to Canada at any age before adulthood show similar fertility patterns as their native peers, whereas fertility of those who did not reach tertiary education rises with age at migration.

JEL: J13, J15

Keywords: Fertility, Migration, Age at Migration, Language

Executive Summary

In recent years, the number of immigrants arriving in OECD countries has increased considerably. At the same time, many of these countries face increased demographic pressure on social services, as the baby-boom generation retires. In this context, the contribution that immigrants can make to the welfare state has motivated a significant body of research examining differences in fertility between the immigrant population and the native born and whether these tend to converge over the medium to long term. Further, since childbearing decisions impact the well-being of households and are related to education and labor market participation choices, the analysis of immigrant fertility differentials helps to understand the socio-economic integration of immigrants, particularly women, and the changing shape of family structure in immigrant recipient countries.

In Canada as well, international migration was responsible for about two-thirds of total population growth (2006) and was the main contributor to Canadian labour force growth (70%). In the context of rising demographic dependency ratios due to low population growth and the aging of the baby boom generation, immigration is a key factor to sustaining current levels of public services in Canada. However, this strategy not only relies on the direct relief that new entering population provides to dependency ratios, but also on the ability of immigrants to economically assimilate into Canadian society. In this context, the interplay of fertility and immigration rates has also an important role in determining the future economic growth of Canada. Although high fertility rates among first generation immigrants may help boost overall fertility rates and sustain population growth, they could also hinder the economic assimilation of female immigrants and impact the economic wellbeing of immigrant families and the human capital investments of their children. On the other hand, highly educated immigrants may exhibit low fertility behaviour depressing the rate of population growth but will, presumably, integrate better in the economy. Our analysis highlights the importance of this trade-off in devising immigration policies.

Given the difficulties in analyzing the interplay between fertility and other decisions, such as education and labour market participation, we examine the fertility outcomes of those immigrating as children. Because child immigrants usually arrive with their parents, their decision to immigrate is plausible independent of other variables affecting fertility such as labor market participation, education or their own family formation. Further, for individuals who migrated as children, the link between migration and subsequent behavior should be less complicated by any short-term, disruptive effects of the migration experience. Overall, a child migration decision is bound to be less biased by selection and simultaneity bias than that of adult immigrants.

Our study shows that immigrant fertility is generally higher than that of Canadian born women, though not by much. We uncover an increasing relationship between fertility and age at immigration that accelerates in the late teens. This assimilation profile is present among immigrants coming from different cultural backgrounds, although their actual fertility levels vary by country of origin.

We further explore whether these fertility patterns are associated with language acquisition. This does seem unlikely as we find that fertility behaviour of immigrants with

an official mother tongue also differs from that of natives. This is contrary to previous literature in immigrant assimilation outcomes which finds strong correlation between speaking an official mother tongue and fertility convergence. Education appears as a much more promising channel through which fertility convergence occurs, as immigrants that achieve post-secondary education show fertility patterns that are almost identical to those of the Canadian-born regardless of their age of arrival. Child immigrants who do not pursue post-secondary education, however, show increasing rates fertility with age at immigration

1. Introduction

In recent years, the number of immigrants arriving in OECD countries has increased considerably. At the same time, many of these countries face increased demographic pressure on social services, as the baby-boom generation retires. In this context, the contribution that immigrants can make to the welfare state has motivated a significant body of research examining differences in fertility between the immigrant population and the native born and whether these tend to converge over the medium to long term. Further, since childbearing decisions impact the well-being of households and are related to education and labor market participation choices, the analysis of immigrant fertility differentials helps to understand the socio-economic integration of immigrants, particularly women, and the changing shape of family structure in immigrant recipient countries.

To date, the majority of the literature has focused predominantly on the fertility outcomes of adult migrants; the fertility behavior of women who migrated as children has received relatively less attention. However, a closer examination of this group of migrants has the potential to contribute to knowledge in ways that are methodologically, theoretically and policy relevant. As research on the socio-economic outcomes of migrants has shown, age at migration can be a powerful predictor of subsequent well-being (Chiswick 1991). Fertility outcomes constrain and are constrained by education and employment outcomes, and studies of the link between age at migration and subsequent fertility can contribute to this broad research endeavor. However, because adult immigrants are likely to make the decision to migrate in conjunction with education, labor market participation and other decisions affecting fertility, it is difficult to consider age at immigration as an exogenous determinant of their fertility outcomes. In contrast, child immigrants are likely to come with their parents and, as a result, their “decision” to immigrate is plausibly independent of other variables affecting fertility such as labor market participation, education or their own family formation.[1] Further, for individuals who migrated as children, the link between migration and subsequent behavior should be less complicated by any short-term, disruptive effects of the migration experience. Overall, a child migration decision is bound to be less biased by selection and simultaneity bias than that of adult immigrants.

In this paper we study the fertility behavior of immigrant women who arrived in Canada before adulthood and compare it to that of the native born using four Canadian census of population (1991, 1996, 2001, and 2006). We obtain samples that are large enough to consider

[1] The *parental* choice of immigration, however, may be partly influenced by the children’s age.

the influence of age at immigration and cultural background on fertility behaviour in a detailed manner. Canada, as one the OECD countries with the largest share of immigrants – around 20% of the population was born abroad according to the 2006 Census -- offers an interesting case of study. Unlike other major immigrant recipient countries (except recently Australia), Canada has developed policies that target educated immigrants. This produces an immigrant profile that is somewhat different to that of other countries, such as the US. These differences have important consequences for assimilation issues, including fertility assimilation. For instance, our results suggest that the relationship we find between age at immigration and fertility in our analysis for Canada is unrelated to the individual's language proficiency (contrary to what previous literature has found in other margins of immigrant assimilation) but it differs by educational achievement.

The next section of the paper briefly reviews recent stylized findings on fertility behavior and assimilation of immigrants in developed countries that inform our analysis. We then describe the data employed and the empirical strategy followed in the analysis. The following section studies the childbearing patterns of migrants who arrived in the country before adulthood by their age at migration as compared to those of the Canadian born and it explores different channels through which age at migration is likely related to their fertility behavior, mainly language acquisition and educational attainment. The last section concludes.

2. Fertility Behavior of Immigrants

Childbearing behavior plays an important role in many dimensions of immigrant well-being by shaping the socio-economic assimilation and mobility of women. Individual investments in human capital require time and may induce postponement of fertility. Women with a large offspring are bound to face worse employment opportunities and more difficult career advancement.[2] Therefore, high (and early) fertility may hinder the socio-economic integration of immigrant women by perpetuating more traditional gender roles within immigrant households. Improved economic opportunities in Canada compared to those in the country of origin and the interaction of immigrants with Canadian-born women may, on the other hand, affect their fertility preferences. Alternatively, even if childbearing preferences remain the same, the new environment that immigrants face in Canada, both in terms of opportunities and costs, mediates their ultimate fertility decision. Immigrant women facing better labor market prospects in Canada than in their countries of origin may decide to reduce/postpone fertility in order to work.

[2] Adsera (2004) shows the connection between labor market institutions and fertility using evidence from Europe.

Absence of informal child care provided by relatives and the need to resort to more expensive forms of formal daycare increases the incentives to trade off children for work (Galor and Weil, 1996). Furthermore, given the trade-offs faced in terms of time and resources within households, a choice of more children over more resources devoted to the rearing of each child may affect the well-being of the second generation of immigrants.[3] For instance, Blau et al. (2008) find that in the United States second-generation women's schooling levels are negatively affected by the average fertility of immigrants of the same cohort and descent than their parents.

Different models in the literature of fertility adjustment try to account for the childbearing patterns of adult immigrants. The *assimilation model* suggests that couples migrating from a country with relatively high fertility rates will initially follow their own country's fertility patterns and will only gradually adjust down to the fertility rates of the host country. Notwithstanding this long term pattern, the *disruption model* postulates that, in the short run, fertility may initially drop around the time of migration (due in part to moving costs) and it may experience a rebound later on (Blau 1992; Kahn 1994). The two models can be complementary: it may be possible to observe an initial drop in fertility at the time of immigration, followed by a subsequent rise in fertility surpassing that of natives and a gradual decline towards the host country levels.

These traditional models of immigrant fertility adjustment just described generally apply to adult immigrants. It is unclear what fertility patterns will follow those individuals who immigrate as children. Child migrants could behave either as first generation immigrants, the native born, or somewhere in between. As suggested in Fernandez and Fogli (2009), a complete assimilation process to native levels may take more than one generation to be accomplished. Even those arriving to the host country at very young ages may be influenced by their parents' cultural expectations and exhibit fertility patterns closer to those of their ancestors than to the native born. On the other hand, if child immigrants assimilate in the host country relatively fast through learning and peer interaction in schools, they may behave similarly to the native born. In this regard, the literature on immigrant assimilation has long recognized age at immigration as a decisive variable for understanding the process of assimilation of immigrants in many socio-economic dimensions (Chiswick, 1991).

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[3] The trade-off between quality and quantity of children is outlined in Becker (1981).

In our analysis we will focus on the fertility behavior of immigrants arriving to Canada before adulthood. In particular we are interested in assessing the importance of the age at immigration for fertility behaviour. Early arrival affords the person more time in the host country and increases the likelihood that the young migrant attends school and understands early in life the rules and institutions governing the socio-economic interactions in the receiving country. In addition, age at immigration also matters if there are critical ages at which individuals learn particular behavior or skills that are crucial for future social and economic outcomes (Bleakley and Chin, 2010 Schaafsma and Sweetman, 2001). The later mechanism suggests that we may expect to observe sharp discontinuities in fertility assimilation depending on age at arrival.

Most previous empirical research on immigrant fertility is focussed on adult immigrants. Two British studies find compelling evidence of differences in fertility levels of UK-born and immigrant mothers from minority groups. Coleman and Dubuc (2010) show that some groups, chinese, Indian and balck Caribbean are at or below the UK national average, whereas Pakistani and Bangladeshi women retain higher total fertility. Georgiadis and Manning (2011) further explore the relatively slower fertility assimilation of Pakistanis and Bangladeshis as compared to Chinese, Indians and Black Caribbean in Britain. Parrado and Morgan (2008) finds compelling empirical empirical suppot for the fertility assimilation for Hispanic women in the United States. Anderson (2004) shows large differences in fertility levels between different groups of migrants to Sweden. In Canada, fertility studies show that up to 1980 Canadian immigrants had lower fertility rates than the Canadian born (Kalbach 1970), but the trend has since reversed. A study by Belanger and Gilbert (2003) suggests that the increase in the share of Canadian immigrants from areas with traditionally high fertility rates such as the Middle East, Southern Asia and Latin America is likely responsible for the change in fertility patterns.[4]

3. Data and Empirical Approach

Both the number of children women have and their timing over the fertile life are important dimensions of any analysis of childbearing behaviour. In this paper we focus on the total number of children born to women aged 16 to 45, conditional on their migration status as well as on a set of additional independent variables.

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[4] Some studies focus on the short-term disruption of fertility at the time of migration. Blau (1992) provides evidence of fertility disruption for immigrants to the US. Ng and Nault (1997) and Ram and George (1990) find evidence of short lived fertility disruption upon immigration and quick convergence to domestic born fertility levels, along with socio-economic assimilation for immigrant to Canada.

Ordinary least squares are not the most appropriate method to estimate variation in event count dependent variables such as the number of children. Event count models, such as Poisson, that measure how often an event – in this case, having a child – occurs over a given time interval are more suitable. In our analysis we employ the following Poisson regression model to estimate the number of children born to a woman.

$$F_i = \exp\{\alpha X_i + \beta I_i + \varepsilon_i\}$$

where F is the measure of fertility of female i (in our case, total number of children), I is an immigrant indicator, X is a vector of individual characteristics, and ε is the error term. Since we observe respondents of different ages, we control for their exposure time to fertility (defined as age minus 15 years) in our models. In general, coefficients from non-linear models have no immediate interpretation. For this reason we report in the tables the incident rate ratios (IRR). In the most parsimonious model, we are interested in comparing the predicted fertility rate (or fertility incidence) between two observations that differ only in whether the variable I_i takes on a value of 1 for immigrants and 0 for the Canadian born. The ratio of these two incidence rates is given by

$$IRR(I_i) = \frac{E(F_i \mid I_i = 1) = \exp(\hat{\gamma}X + \hat{\beta}(1))}{E(F_i \mid I_i = 0) = \exp(\hat{\gamma}X + \hat{\beta}(0))} = \exp(\hat{\beta}) \qquad (2)$$

Equation (2) states the effect of a one unit change in the independent variable on the relative incidence rate of fertility. In the case of indicator variables such as our immigrant indicator I, the relative incidence rate can also be interpreted as the fertility rate for immigrants relative to the Canadian born.[5]

The data employed in the paper comes from the confidential files of the Canadian Census of Population (20% sample) for the years 1991, 1996, 2001, and 2006. Confidential census data provide samples that are large enough to allow multiple robustness analysis of the estimates. In addition they include more detailed information on individuals, as well as a richer categorization of relationships among members of the household than the more widely available data. With this detailed information, we are able to understand the links of individuals within the household and to compute the number of children of each woman living in a household. From each census year, we select all women between 16 and 45 years of age, except for aboriginal individuals, and

[5] In the case of a continuous variable such as age, the IRR can be interpreted as the increase in fertility rate when age increases by one year.

gather information on age, education, marital status, number of live-born children (available in the 1991 Census), number of children living in the household, province of residence and immigrant status. In addition, for immigrant women we collect their year of immigration, age at immigration and country of birth.[6] To reduce computing time to a reasonable length, for each census year we select all immigrants plus a 20 percent random sample of domestic born individuals and weight observations accordingly. The four censuses are then pooled, resulting in approximately 1,800,000 observations.

In general, vital statistics are the most accurate source of information for fertility records in developed countries. However, since they only contain little additional information about the individual and the household, they are inadequate for an in-depth analysis of fertility behavior. For this reason, an alternative method generally used is to indirectly estimate fertility from survey information such as Census data, which typically reports the number of children living in the household. The method, known as the "own children method", exploits the fact that the vast majority of young children live with their mother at the time of the census. Since the date of birth of both mother and children is known, it is possible to reconstruct each woman's fertility history.

In line with these studies, we use the number of children living in the household as our measure of fertility in the analysis that follows. To the extent that some children may not live with their mothers, our dependent variable may be measured with some error.[7] To reduce this problem, we restrict our sample to relatively young women (up to 45 years of age) whose children are more likely to live at home. Still, there are several caveats to the measure. First, the census questionnaire asks respondents to include children in joint custody who live most of the time in a household as household members. Therefore, our sample excludes all the children who are living only with their father. To the extent that young children are far more likely to live with their mothers, even after marriage disruption, this is not too important for our analysis.[8] Second, it may be difficult to properly capture the very early childbearing of older women in the sample as some of their children may have already left home. That should be a concern particularly if the

[6] We have grouped individuals by country of origin into 20 relatively homogenous groups as listed in Table B in the appendix.

[7] Belanger and Gilbert (2003) show that estimated fertility differentials for immigrants and domestic born individuals for the period 1996-2001 using both methods are not very sizeable – with a downward bias of the census for women younger than 30 and an upward bias for those aged beyond 30.

[8] In some instances, several women live in a household with children and we cannot be certain of which one is the mother of the children. This happens, for example, when the children are reported as grandchildren of the head of the household and there is more than one daughter of the head of the household living in the household. This is not, however, a common occurrence (less than 1% of the original sample).

departure of children from the household in their late teens or early adulthood (e.g., attending college far from home, earlier marriage or cohabitation) occurs at a differential rate between immigrants and the Canadian born.

To assess the importance of the potential bias introduced by our dependent variable, we undertake three types of robustness exercises. First, we use the total number of children ever born, available in the 1991 census, to re-estimate the models and compare the results with those obtained for the 1991 Census using our fertility measure. Second, we re-estimate the models using a restricted sample of women up to age 40. This reduces the likelihood that some children have already left home but it misses late childbearing, which in turn may be differentially important among groups (e.g., according to education, country of origin, etc).[9] Third, we re-estimate the models restricting the children included in our fertility measure to those aged 18 and under. Differences in the results when using these alternative samples and definitions of the dependent variable would indicate that the bias introduced by the own children method is important. The overall pattern of the results and the estimated coefficients are robust across these different samples and specifications. These are available upon request.

(Table 1 here)

Table 1 shows summary statistics of the main variables separately for Canadian born and for immigrants. The first two columns correspond to the whole sample over the 1991, 1996, 2001, and 2006 censuses. In order to provide a sense of the temporal variation in the data over the sample period, the table also includes statistics for 1991 and 2006 separately. On average, immigrants in our sample have more children than the Canadian born and for both groups the average number of children diminishes by approximately 15 percent between 1991 and 2006. Immigrants in the sample have higher educational attainment and are generally older than the Canadian born. The age difference may account for part of the gap in mean fertility observed between both groups. More immigrants are married -- or living together under common law (CL) -- than Canadian born. Between 1991 and 2006, the percentage of married/CL individuals fell for both groups (around 9 points for Canadian born and 4 points for immigrants), while the fraction of single individuals increased by a similar magnitude in each case. Finally, fewer immigrants with children live in households together with additional family members besides their spouse

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[9] In this regard, Vezina and Turcotte (2009), after comparing data from the Canada Census and from the General Social Survey, note that there is no appreciable bias in the characteristics (including immigrant status) of the fraction of women aged 40 to 44 who have a child aged five or over based on whether some of the children live with them or not.

than Canadian born (3 percent versus 8 percent, respectively). The average immigrant has been in Canada about 13.4 years and arrived at the age of 19.5. Around 50 percent of the individuals arrived in Canada as adults, past the age of upper secondary schooling. Figure 1 presents the distribution of ages at migration for the sample. After a small spike for toddlers, the fraction of entrants remains more or less flat until reaching its peak between the ages of 20 and 30.[10] The fraction of recent immigrants over the whole pool has increased in the latest Censuses and current immigrants arrive at a slightly older age than in the past. Further, immigrants are increasingly arriving from countries in Asia and Africa rather than from old traditional source countries in Europe. Consequently, the fraction of immigrants with a non-official mother tongue, or that of immigrants using a non-official language at home, has steadily increased over the period 1991-2006. These trends, which are likely to have an impact on fertility behaviour, are well documented in the Canadian literature of immigration. [11]

(Figure 1 here)

4 The Fertility of Immigrants

The estimates we report in the tables and graphs of the following subsections correspond to relative fertility rates of immigrant females as compared to those of Canadian-born females. All models include controls for age, province of residence and non census metropolitan areas of residence. In order to control for the decreasing trend in fertility over the period of study we also add indicators for census year. In some models we also control for marital status (single, married/CL, or divorced/separated), and highest educational attainment (less than high school, high school, non-university post-secondary education and university education). These control variables consistently show the same effect on fertility across all specifications. Fertility rates are higher for married/CL and previously married/CL women and for the least educated. Although we do not report all control variables in the tables, they are available upon request.

There is some controversy in the literature about whether or not it is appropriate to include controls for income in the analysis of fertility. Income measures reflect the respondents' decisions to enter the labor force. Fertility and labor market decisions (which ultimately affect income) are so intertwined that it is not realistic to regard them as exogenous to one another.

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[10]The distribution varies somewhat by country of origin. If immigrants from Europe or the United States are removed from the sample, the distribution of immigrants by age at immigration resembles more a normal distribution centered at the early twenties.

[11] See Ferrer and Riddell (208) and the references therein

Females with strong preferences for work may also have low preferences for child rearing, and this may introduce selection bias in our estimates.[12] Overall, considerations of joint labor market and fertility decisions require special modelling that is beyond the scope of this paper. Since we do not have measures of income preceding birth, we do not include income controls in our analysis. Note, however, that the inclusion of education and marital status in the analysis captures some important dimensions of economic well-being and to some extent help us to control for income (or potential income).[13]

Our first estimate of immigrant fertility rates is reported in the first regression of panel A of Table 2.[14] The basic model only includes an indicator for immigrant status besides age, survey year and place of residence. Immigrant females have significantly higher fertility rates than the Canadian born – around 1.15 times higher. Adding the controls for education and marital status reduces the estimate of immigrant fertility to 10% percent higher than the Canadian born, after taking into account other factors.

(Table 2 here)

4.1 Understanding fertility assimilation: Age at Immigration

Studies on immigrant outcomes generally place significant emphasis on assimilation. The fertility behaviour of newly arrived immigrants may differ from that of the native-born population because they have different preferences, expectations or endowments. As immigrants spend time in the host country, those preferences and endowments may change and subsequently affect their fertility choices and (plausibly) make them more similar to those of the native born. Typically, in order to account for the extent of assimilation, researchers interested in immigrant outcomes include age at immigration as one of the covariates of their model. This variable measures how the outcome of interest varies depending on how long the immigrant has been exposed to the local environment. There are different mechanisms through which age at arrival may be relevant to immigrant outcomes. Early arrival affords the person more time in the host country and increases the likelihood that the young migrant attends school and understands early in life the rules and institutions governing the socio-economic life of the receiving country.

[12] The direction of the bias is not straightforward. To the extent that children are a normal good, females with more income may have more children, since they can afford to pay for the extra services involved in raising children. However, women may have higher incomes precisely because they reduced or postponed their fertility.

[13] We have computed all regressions without controlling for education or marital status and patterns remain unchanged.

[14] A Chi2 test to assess the null hypothesis that the data are indeed Poisson distributed fail to reject the null.

In addition, age at immigration may also matter if there are critical ages at which individuals learn a particular behavior or skill, such as the local language. Bleakley and Chin (2010) point to research that finds physiological changes in the children's brain at the onset of teenage years that hamper their ability to learn additional languages. In their paper, they identify a critical age, around 8 or 9 years of age, for achieving English fluency among migrants in the US. They show that the outcomes of immigrants from non-English speaking countries systematically differ from those of other migrants among those arriving after that "critical period". In the case of fertility, there could be an additional effect of the age at arrival if cultural norms regarding fertility formed at a particular age (for instance, the onset of puberty) are difficult to modify. This could be reinforced by the existence of taboos associated with sexual behaviour, contraceptive methods, or the role of women in the labor market, among others, that set hurdles for young migrants to learn alternative views regarding fertility behaviour.

In view of this discussion, we introduce age at immigration in our models to see whether such a discontinuity appears in the fertility behaviour of child immigrants. In our discussion we focus on immigrants arriving as children (18 years of age or younger) before the common ages of family formation. Individuals migrating before age 18 are likely to come with their parents and hence, their "decision" to immigrate is plausibly independent of other variables affecting fertility such as labour market participation, education or their own family formation. Those immigrating as adults, however, are more likely to be making all these decisions jointly. Nevertheless, the sample we use includes all migrants regardless of age at arrival. To compare the patterns of child immigrants to those of adults, the model includes yearly dummies for age at immigration up until age 18, plus an indicator for immigrants arriving after age 18.

(Table 3 here)

Table 3 shows the results of a set of Poisson regressions of the form

$$F_i = \exp\{\textstyle\sum_{j=0.5}^{18}(\beta_j A_{ji}) + \gamma Oldimm_i + \alpha X_i + \varepsilon_i\}$$

where we use a full set of indicator variables for each age at immigration A_i from under age 1 to age 18, an indicator for immigrants arriving after the age of 18 (*oldimm*) and a vector of demographic variables X that varies in different specifications

Fertility preferences are greatly influenced by social attitudes toward fertility, contraceptive measures, gender preferences, and out of wedlock childbearing, among others. Those norms or attitudes are part of an individual's cultural background and we try to account for these differences by controlling for each woman's area of origin. This variable has already been shown to be relevant in explaining variation in fertility outcomes in different contexts (Kahn, 1994; Anderson, 2004; Georgiadis and Manning, 2011 and Parrado and Morgan (2008), among others). The majority of these studies report substantial differences in fertility by ethnicity, although these tend to shrink among the second generation of migrants. It is important to note that policies in the country of arrival related to the extent and the pace at which newcomers are expected to become part of the local culture may play a role in the speed at which those behaviors adapt. For example, multiculturalist movements that encourage cultural continuity of newcomers potentially slow down assimilation to the receiving culture. In other instances, policies in the country of origin either pro-natalistic (e.g. Ceceascu's regime in Romania) or restrictive (e.g. China's one child policy) may have shaped the fertility of migrants before their arrival in such a decisive way that their subsequent behavior in the country of destination reflects a readjustment (if at all) of their individual preferences after breaking free of previous policy constraints. Finally, whether the neighbourhoods where immigrants live are more or less segregated may reinforce or weaken the relevance of ethnic human capital (i.e. the average education of the group) and cultural heritage in the individual's outcomes (as shown for education or earnings in Borjas 1992, 1995).

In column I of table 3 we show the basic model, without controls for education or marital status. Column II introduces controls for education and marital status. Column III includes indicators for the different places of birth. We choose immigrants from the US as the reference group. Since their country is relatively close to Canada in terms of language and institutions, it is plausible to assume that their fertility choices would be the most similar to the native born and they may serve as a lower bound on the distance to immigrant assimilation. In this regard, the estimates for the age of arrival dummies in the third column of table 3 are net of the influence of cultural preferences for fertility, as estimated through area of origin, and isolate the effect of the changing composition of the source country of immigration over the census years.

In the model without education and marital status controls, the fertility behaviour of individuals migrating up to age 6 is indistinguishable from that of natives. Adding education and marital status, only the fertility outcomes of individuals arriving before age 2 is indistinguishable to those of natives. Once place of birth indicators are included (column III), the estimated relative fertilities for all ages of arrival are significantly different from 1 (the baseline for native born). The three sets of estimated fertility rates are shown in Figure 2.[15] An IRR greater than one

[15] Table A1 in the appendix shows estimates of place of birth indicators included in the second column in Table 3.

would shift the line up above that of the US immigrants shown in the graph, whereas an IRRs lower than one will shift the line below that of US immigrants. However the shape of the fertility profile would remain the same.

(Figure 2 here)

An interesting feature of the estimates in Figure 2 is that while there is no evidence of a clear discontinuity by age at immigration in the fertility of immigrants, there are slight steps at years of arrival that roughly correspond to milestones in the schooling system (elementary school, junior high school and senior high school). Further, fertility increases more gradually with age at immigration until the early teens, and then proceeds at a faster pace during the late teens. This result does not seem to be driven by a higher probability of intermarriage among those arriving younger. In additional regressions, not shown here, we observe that immigrants in mixed marriages (married to native-born Canadians) show similar increasing fertility with age at immigration.

A natural question to ask is whether what we are observing are indeed differences in the timing of birth, rather than differences in total fertility. If immigrant women have their children earlier we may be estimating higher fertility among immigrants just because these women have completed their fertility whereas the native born have not. The inclusion of age controls somewhat mitigates such a concern. Ideally we would study only women who have already completed fertility. However this exercise would be unfruitful with Census data since, as we explained before, the Census does not include a complete fertility history of women and the use of the "own children method" would not be valid in older women. To get a closer measure of completed fertility the last column in Table 3 includes estimates of a similar model to that in column II but with the sample restricted to women aged between 35 and 45. Results in this restricted sample are very similar to the ones with the whole sample, with a fertility rising with age at arrival and peaking for the late teen arrivals.

Estimates of the age at arrival dummies in columns II and III (when place of birth is taken into account) are fairly similar suggesting that results in column II are not driven by compositional variation in the origin of migrants arriving at different ages. Nonetheless as shown in Table A1 in the appendix, there are differences between immigrants by source area of immigration. Immigrants from the Caribbean and Central America have high fertility rates. Fertility rates of immigrants from Mexico stand around 1.4 times higher than those of Canadian born. Other immigrant groups with high fertility rates are those originating in Africa (except

South Africa), the Middle East, and Southern Asia. Eastern European immigrants, as well as those from elsewhere in Asia, have relatively low fertility rates in comparison. Chinese immigrants exhibit the lowest fertility rate of all groups, only 0.76 times that of the Canadian born.[16] One question that arises from these estimates is whether the fertility of each immigrant group follows the age at immigration pattern of the general population or whether there are substantial differences between groups. To examine this we create a set of interaction dummies with place of birth and age at immigration. We avoid small cells problems by categorizing age at immigration into five groups corresponding roughly to different steps in the school system: those immigrating as pre-school children (aged five or less at the time of immigration), those immigrating as elementary school children (aged 6 to 11 at the time of immigration), those immigrating in their early teens (ages 12 to 15) who are likely to enter in junior high school and those immigrating in the late teens (between ages 16 to 18) who are still highly likely to receive some form of Canadian schooling, and finally those immigrating after 18 years of age. This categorization according to ages at which a child is more likely to attend a certain type of school is intended to avoid mixing in the same group children entering different school levels. While elementary schools tend to be small and local, high school institutions are often large and can be further away from the child's neighbourhood, particularly in large cities. In addition, social interaction among children changes with both age and the type of school institution they attend (Khmelkov and Hallinan, 1999). Source area of migration is also grouped into broader areas (US-Europe, Middle East, South Asia, Other Asia plus the Pacific, Africa, and South America - including Central America) to facilitate graphic representation. Both the estimated IRR for the interaction, as well as the cumulative effect of the area of origin group, the age at immigration group and their interaction are shown in Table 4. Table 5 presents the estimated IRR from a Poisson regression that includes more detailed areas of origin.

(Tables 4 and 5 here)

Figure 3 shows the cumulative effect of the interaction between the age groups and broad areas of origin specified in Table 4. Immigrants from all places of birth show the same increasing pattern of fertility by age at immigration that peaks in the late teens. The difference across country groups is one of levels of fertility. Immigrants from the Middle East and South America show high fertility rates even if arriving at a young age (approximately 20% higher

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[16] The predicted fertility of a representative mother in the most prolific groups is well above both the replacement level of 2.1, and that of the whole population of immigrants (1.85)

approximately than the native born), while immigrants from Africa and South Asia have relatively low fertility rates if arriving young (10% lower than the native born) and immigrants from the rest of Asia have very low fertility rates if arriving young (20% lower than the native born). These patterns seem to suggest that, unlike other types of immigrant assimilation, fertility assimilation is a relatively smooth process. However, cultural differences determine the extent of such assimilation. For most groups age at immigration implies assimilation in the usual sense, the younger they arrive to the country, the more similar their fertility is with respect to the native born. Asian immigrants from areas other than South Asia, exhibit relatively low fertility at all ages at immigration compared to other immigrants. As a result the fertility behavior of the older arrivals in this group is closer to that of the native born than that of young migrants. Exploration of the cultural differences in the intergenerational transmission of fertility is beyond the scope of this paper. However, a plausible explanation is that this group puts strong emphasis in educational outcomes of their children. To the extent that education and fertility are highly correlated, very young Asian immigrants will show lower fertility through the influence of their parents "push" towards higher education.[17]

(Figure 3 here)

4.2. How does age at immigration work? Language barriers

When examining educational attainment or labor outcomes of young immigrants, fluency in the language of the destination country plays a key role (see e.g. Kossoudji, 1988; Chiswick and Miller, 2001, 2004; Dustmann, 1994; Dustman and van Soest, 2002; Bleakley and Chin, 2004). Studies by Leslie and Lindley (2001) and Dustmann and Fabbri (2003) find that lack of fluency in English has a detrimental impact on the employment and earnings of ethnic minority men and women in Britain. In the case of fertility, mother tongue may also impact the ability of the child-migrant to form preferences about fertility using local cultural cues acquired through school and peer networks. Previous analyses have found greater English fluency to be associated with lower fertility in the US (Sorenson 1988; Swicegood et al. 1988; Bleakley and Chin 2010).

The Canadian census does not have a measure of an individual's fluency in the official language, but it asks whether the individual speaks one of the official languages. Further, because the ability to speak an official language is one of the criteria in the selection of

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[17] Note that even if the model controls for educational achievement, unfortunately it is not flexible enough to allow for differential effects of education by source area and age at immigration.

immigrants the variable is mostly uninformative.[18] There is, however, additional information that can be used to obtain a measure of fluency. The Canadian immigration literature has typically measured fluency by looking at mother tongue, the language that individuals first understood and they can still understand. The advantage of mother tongue relative to self-reported fluency is that it is a relatively exogenous variable. Further, mother tongue and its distance to the official tongue have proven to be important on explaining labor market and education assimilation. For example, immigrant men in Europe coming from a country where the language spoken belongs to the same linguistic family group as the one in the destination country experience a 9% earnings premium over other immigrants (Adsera and Chiswick, 2007).

We introduce an indicator for whether the individual had an official mother tongue (OMT) in a province that primarily uses that official mother tongue.[19] If language barriers difficult the assimilation of local norms governing fertility, we would expect that the fertility behaviour of immigrants whose first language was not one of the Canadian official languages would be farther from the native's than that of those whose mother tongue was English or French.

Model II in table 2 presents a basic estimate of the relevance of mother tongue in explaining fertility behaviour of immigrants. Among the native born, those who had an OMT have slightly higher fertility rates (3% higher) than native-born Canadians who do not. This later group is mainly composed of the Canadian-born children of immigrants. The result matches previous findings in the literature reporting that second generation immigrants in Canada have on average lower fertility levels than first generation immigrants (Ferrer and Adsera, 2010). Immigrants who do not have an OMT have higher fertility than similar Canadian born individuals who do not have an OMT (14% higher). To better understand the interaction between immigrant and mother tongue indicators, we report in the first column of Panel B how the relative fertility rates of immigrants with an OMT compares to that of the other groups. The z-statistic of a test of whether the difference between the groups is statistically significant is shown in column 2. Immigrants with an OMT have significantly higher fertility than the native born. More

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[18] Immigrants to Canada are admitted through three main categories (skilled, family and refugees). Skilled immigrants (currently around 60% of all new admissions) are assessed on the basis of their age, education, language ability. For additional details on the Canadian immigration system see Green and Green (2004)

[19] This is to account for the fact that although Canada recognizes two official languages (English and French), French is used mostly in Quebec, whereas English is generally used elsewhere. Our definition of OMT has the problem that we know only where individuals reside at the time of the census, rather than at the time of their arrival or the time of their children's births. However using a more general indicator of official mother tongue to include any "individual who first spoke either French or English as a child" yields similar results

importantly, they have only slightly lower fertility than other immigrants (2% lower) suggesting that having an OMT does not have a large impact on the fertility of immigrants.[20]

It is well recognized that fluency in the language of the destination country is strongly influenced by age at immigration among other things (Chiswick 1991; Espenshade and Fu 1997 Espinosa and Massey 1997; Stevens, 1992 and 1999). Akresh (2007) finds that the younger immigrants are when they arrive to the US and the longer immigrants have lived in the country, the higher their frequency of English use with friends, at work, at home, and with a spouse. Hence, the impact of having or not an OMT on fertility may depend on age at immigration. This will happen if there is an arrival age after which language acquisition becomes problematic and impairs the assimilation of cultural norms regarding fertility. If language is the channel through which age at immigration affects fertility, we expect to see immigrants who have an OMT behave differently than the rest and be more similar to Canadian born. Further, we expect that very young immigrants, those arriving before the age of 5 (or even in early elementary school), will behave similarly regardless of their mother tongue, as they are unlikely to experience language difficulties in the assimilation of fertility behaviour.

To study this possibility we estimate a model that includes a set of interactions of age at migration with an indicator for whether the language first spoken by the individual as a child was an official mother tongue (OMT). The Poisson regression we run is of the form:

$$F_i = \exp\{OMT_i + \sum_{j=0.5}^{18}(\beta_j A_{ji} + \phi_j A_{ji} * OMT_i) + \gamma_1 Oldimm_i + \gamma_2 \mathrm{OMT_i} * \mathrm{Oldimm}_i + \sum_k^N (\theta_k POB_{ki}) + \alpha X_i + \varepsilon_i\} \quad (4)$$

where we include a full set of interactions between age at immigration indicators and the OMT indicator. These estimates are shown in Table 6 and the results are presented graphically in Figure 4.

(Table 6 here)

Immigrants who do not have an OMT show the same increasing pattern in fertility with age at immigration described before (first column in table 6) and have higher fertility rates than the native born, even if they arrive at very young ages.[21]. The cumulative effect for immigrants who have an OMT is shown in the third column, together with the p-value of a test on the fertility

[20] 12.5% = (1.034)*(1.143) *(0.951))

[21] This result is robust to considering English and French mother tongues separately.

differences between immigrants and native born with an OMT. The p values indicate significant differences in fertility between the two groups for all ages of migration. The result suggests that language fluency, proxied by the first language the immigrant spoke as a child, is not a key barrier in the assimilation of fertility as has been found for the US data (Bleakly and Chin, 2010). Fertility does increase with age at immigration, regardless of mother tongue. More generally, this finding is in contrast with the literature that identifies language as a barrier in educational attainment and labour market performance of immigrants (Schaafsma and Sweetman, 2001; Bleakley and Chin 2004). If language was the key barrier in fertility assimilation, individuals with an OMT should exhibit fertility levels similar to natives instead of an increasing pattern of fertility with age at migration.

(Figure 4 here)

4.3 Age at Immigration and Education

Age at immigration is likely to influence other variables affecting fertility. For instance, late age of arrival may limit integration into the school system, increasing the cost of acquiring higher education. In turn, a lower educational attainment is usually associated with higher fertility. To assess this possibility we look into the fertility of immigrants arriving at different ages conditioning on whether or not they attained a university degree. We expect that if age at immigration affects fertility through education, immigrants with a given educational attainment will behave like similarly educated native born Canadians. Table 7 shows the results of interacting the age at immigration indicators with the university education indicator, based on the following equation:

$$F_i = \exp\{Univ_i + \sum_{j=0.5}^{18} (\beta_j A_{ji} + \phi_j A_{ji} * Univ_i) + \gamma_1 Oldimm_i + \gamma_2 univ_i * \mathrm{Oldimm}_i + \sum_k^N (\theta_k POB_{ki}) + \alpha X_i + \varepsilon_i\} \quad (5)$$

The estimated fertility by age at immigration for university and non-university educated immigrants is presented in Figure 5, relative to similarly educated native-born Canadians.[22] Immigrants without university education follow the same increasing pattern found in Table 3 (and Figure 2). Fertility is higher than natives with the same educational attainment even among

[22] Results are robust to different specifications of post secondary education that include college or other forms of post secondary. Further, when we interact age at immigration with three levels of schooling - less than high school, high school and college - the difference in fertility with respect to natives appears only among those who did not finish compulsory education.

those who migrated at very young ages. By contrast, university educated immigrants have a flat fertility profile along the age at migration. The last column in Table 7 shows the cumulative effect of university education and age at immigration on immigrant fertility together with the p-value of the F-test on the significance of the differences in fertility between immigrants and native born with university education. Results indicate that the differences between both groups are in general not significant for those migrating until age 17.

(Table 7 & Figure 5 here)

Taken together, our findings in this subsection suggest that education is an important determinant of fertility among child immigrants. Indeed, for child immigrants educational achievement is highly associated with their degree of fertility assimilation.[23] This, however, corresponds to a reduced form estimate, and though suggestive, it fails to account for the potential endogeneity of education decisions. Proper analysis of this channel needs to take into account the joint decision of schooling and fertility and how preferences regarding these variables are transmitted intergenerationally. Hence, unobserved heterogeneity may determine both education and fertility decisions and create a selection problem: women who have low preferences for child bearing choose high levels of education. This would give the appearance that education causes low fertility, even though the underlying cause is unobserved heterogeneity in preferences for fertility. This is a serious problem that plagues most research concerning the fertility decisions of women as most variables that determine fertility are likely to be choice variables themselves. Conventional treatments of selection bias require information that it is not available to us, such as longitudinal or panel data. Use of instrumental variables is also limited because these estimators are not commonly developed to use with count models such as Poisson.

Nevertheless, we have estimated a (linear) instrumental variable (IV) model with French and English mother tongue and three areas of origin (the Middle East, South America and Asia) as instruments of two immigrant educational choices (high school and post-secondary education).[24] Valid instruments should be strongly correlated with the endogenous regressors and uncorrelated with the error term. We include tests on the validity of the instruments in the same table. These

[23] The result appears robust to all source areas of immigration. In separate estimates, available upon request, we find that immigrants from non-western economies show large fertility differences between those who are educated (post-secondary education) and those who are not within the same country of origin. The largest differences correspond to Mexican and Central American immigrants, followed by those from the Middle East, Central and Eastern Africa

[24] A linear regression and a poisson model on the number of children lead to similar values for the age at immigration variables in the more parsimonious model. For instance the coefficient for age at immigration “less than 1 to 11” is 0.041 using a poisson model and 0.039 using a linear regression. These results are available upon request.

estimates are presented in table 8 together with statistical tests of the adequacy of the instruments. The results confirm that fertility increases with age at immigration even when we account for the endogeneity of educational choices, with the strongest increase occurring for the late teen age years. The specified model is, by necessity more parsimonious than the models estimated above and is meant only to offer raw support for the robustness of the results to the consideration of the endogeneity of education.

5. Conclusions

Our study shows that immigrant fertility is generally higher than that of Canadian born women, though not by much. We focus on the fertility behaviour of individuals migrating as children and uncover an increasing relationship between fertility and age at immigration that accelerates in the late teens. This assimilation profile is present among immigrants coming from different cultural backgrounds, although their actual fertility levels vary by country of origin. We rule out language acquisition as the mechanism through which fertility assimilation may happen. Contrary to previous literature in immigrant assimilation outcomes, we do not find a sharp discontinuity in fertility behavior relative to natives among migrants arriving around the age of entry into middle school and ages and whose mother tongue is different to that of the receiving country. Further, fertility behaviour of immigrants with an official mother tongue also differs from that of natives. This pattern of fertility assimilation, however, seems to occur only among less educated immigrants, those without tertiary education. University educated young immigrants behave like natives regardless of their age of arrival.

In 2006, international migration was responsible for about two-thirds of total population growth in Canada and was the main contributor to Canadian labour force growth (70%). In the context of rising demographic dependency ratios due to low population growth and the aging of the baby boom generation, immigration is a key factor to sustaining current levels of public services in Canada. However, this strategy not only relies on the direct relief that new entering population provides to dependency ratios, but also on the ability of immigrants to economically assimilate into Canadian society. In this context, the interplay of fertility and immigration rates has also an important role in determining the future economic growth of Canada. Although high fertility rates among first generation immigrants may help boost overall fertility rates and sustain population growth, they could also hinder the economic assimilation of female immigrants and impact the economic wellbeing of immigrant families and the human capital investments of their children. On the other hand, highly educated immigrants may exhibit low fertility behaviour depressing the rate of population growth but will, presumably, integrate better in the economy. Our analysis highlights the importance of this trade-off in devising immigration policies.

Many questions are left unanswered to unveil the mechanism through which fertility assimilation occurs. In particular, future research should focus on the endogeneity of educational choices and how they are tied up with labour market and fertility outcomes.

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Table 1. Summary Sample Statistics for Canadian Born and Immigrants

	All		1991		2006	
	CB	IMM	CB	IMM	CB	IMM
Number of children	0.84	1.10	0.89	1.18	0.77	1.03
Age	30.41	32.93	30.08	32.91	30.31	33.04
Education						
Less than HS	0.25	0.22	0.30	0.29	0.19	0.14
High school	0.28	0.26	0.30	0.28	0.27	0.24
Trades	0.09	0.08	0.09	0.08	0.11	0.08
Non-university post secondary	0.19	0.16	0.17	0.15	0.19	0.15
University-BA	0.16	0.23	0.12	0.16	0.20	0.31
Graduates	0.02	0.06	0.02	0.04	0.03	0.08
Marital Status						
Divorced	0.04	0.04	0.04	0.04	0.03	0.04
Married (+ common law)	0.54	0.64	0.59	0.67	0.50	0.63
Separated	0.03	0.03	0.03	0.03	0.02	0.03
Never married	0.39	0.28	0.34	0.25	0.44	0.29
Widowed	0.00	0.01	0.00	0.01	0.00	0.01
Mixed couples	0.12	0.20	0.11	0.23	0.12	0.18
Additional Family in Household	0.02	0.06	0.03	0.06	0.02	0.07
Years since migration	--	13.39	--	14.61	--	12.92
Arrived 0 to 5 years ago		0.27		0.25		0.28
Arrived 6 to 10 years ago		0.20		0.14		0.20
Arrived 11 to 15 years ago		0.17		0.16		0.20
Arrived 16 to 20 years ago		0.14		0.19		0.14
Arrived more than 20 years ago		0.23		0.27		0.19
Age at Immigration	--	19.56	--	18.32	--	20.14
Between 0 and 5 years of age		0.13		0.16		0.12
Between 6 and 11 years of age		0.13		0.13		0.14
Between 12 and 16 years of age		0.12		0.11		0.12
Between 17 and 19 years of age		0.09		0.10		0.08
Between 20 and 45 years of age		0.53		0.50		0.55
Country of origin						
US		0.05		0.06		0.04
Central and South America		0.15		0.15		0.14
Europe		0.30		0.41		0.23
Middle East		0.06		0.06		0.07
Asia		0.38		0.30		0.44
Africa		0.06		0.05		0.08
Pacific		0.01		0.01		0.01
Non official Mother tongue	0.05	0.68	0.04	0.60	0.05	0.74
Non official Language at home	0.01	0.42	0.01	0.34	0.01	0.46
Observations	914,386	920,940	204,170	198,090	242,596	260,790

Table 2

A. Relative Immigrant Fertility by Language Background	
	Relative Fertility Rate (P-values)
I. ***Basic Model***	
Immigrant	1.150
	(0.000)
II. ***Basic Model with education and marital***	
Immigrant	1.104
	(0.000)
II. ***Mother tongue***	
OMT (Official Mother Tongue)	1.035
	(0.000)
Immigrant	1.144
	(0.000)
Immigrant x OMT	0.950
	(0.000)
Observations	1,835,325

B. Comparison of Relative Fertility		
	(Cumulative) RFR	p-value
Immigrant OMT = NB non OMT	1.125	0.000
Immigrant OMT = NB OMT	1.087	0.000
Immigrant OMT = Immigrant non OMT	0.983	0.000

Panel A, shows the results of two Poisson regressions for the number of children living at home for a sample of women 16 to 45 years old. Both include controls for age, education, marital status, census year and location of residence.

In Panel B, the first column shows the relative fertility of each group relative to immigrants with an Official Mother Tongue. The second column reports the p-value of the test on the null hypothesis that both groups have similar fertility rates based on the results from model II in Panel A.

(***) indicates significant at 1%, (**) indicates significance at 5 percent.

Table 3. Fertility Rate by Age at Immigration relative to Native Born [1] (P-values)

	(I)	(II)	(III)	(IV) Age 35 +
Age at migration:				
Less than 1	0.96	1.01	1.03	1.03
	(0.00)	*(0.46)*	*(0.00)*	*(0.00)*
1	0.98	1.01	1.03	1.04
	(0.04)	(0.36)	*(0.00)*	*(0.00)*
2	0.99	1.02	1.04	1.06
	(0.52)	(0.01)	*(0.00)*	*(0.00)*
3	1.00	1.02	1.05	1.05
	(0.66)	*(0.00)*	*(0.00)*	*(0.00)*
4	1.99	1.03	1.05	1.05
	(0.11)	*(0.00)*	*(0.00)*	*(0.00)*
5	0.98	1.02	1.04	1.05
	(0.05)	*(0.00)*	*(0.00)*	*(0.00)*
6	1.01	1.04	1.06	1.07
	(0.16)	*(0.00)*	*(0.00)*	*(0.00)*
7	1.04	1.07	1.08	1.09
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
8	1.03	1.07	1.08	1.09
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
9	1.04	1.07	1.08	1.10
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
10	1.03	1.07	1.08	1.11
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
11	1.04	1.07	1.08	1.10
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
12	1.06	1.09	1.09	1.14
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
13	1.09	1.11	1.11	1.16
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
14	1.10	1.12	1.12	1.17
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
15	1.13	1.13	1.12	1.17
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
16	1.22	1.18	1.17	1.22
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
17	1.27	1.20	1.19	1.22
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
18	1.32	1.22	1.21	1.23
	(0.00)	*(0.00)*	*(0.00)*	*(0.00)*
Edu/Marital	**NO**	**YES**	**YES**	**YES**
Place of birth	**NO**	**NO**	**YES**	**NO**

[1] The table shows the IRR from a Poisson regression of the number of children in the household. Models include controls for age, census year and place of residence. Estimates from columns (I), (II) and (III) are shown in figure 2.

Table 4. Fertility by grouped Age at Immigration and POB Relative to the Native Born

	(I)		(II)	
	Effect	P-value	Cum. Effect	P-value
USA-Europe	0.96	*(0.00)*		
USA-Europe*(0-5)	1.14	*(0.00)*	1.02	*(0.00)*
USA-Europe*(6-11)	1.04	*(0.00)*	1.06	*(0.00)*
USA-Europe*(12-15)	1.04	*(0.00)*	1.10	*(0.00)*
USA-Europe*(16-18)	1.10	*(0.00)*	1.20	*(0.00)*
Middle East	1.36	*(0.00)*		
Middle East *(0-5)	0.88	*(0.00)*	1.12	*(0.00)*
Middle East *(6-11)	0.82	*(0.00)*	1.17	*(0.00)*
Middle East *(12-15)	0.87	*(0.00)*	1.31	*(0.00)*
Middle East *(16-18)	1.06	*(0.00)*	1.64	*(0.00)*
South Asia	1.15	*(0.00)*		
South Asia *(0-5)	0.82	*(0.00)*	0.88	*(0.00)*
South Asia *(6-11)	0.85	*(0.00)*	1.03	*(0.04)*
South Asia *(12-15)	0.92	*(0.00)*	1.16	*(0.00)*
South Asia *(16-18)	1.04	*(0.00)*	1.36	*(0.00)*
Rest of Asia and the Pacific	0.89	*(0.00)*		
RoAsia/Pacific*(0-5)	0.90	*(0.00)*	0.75	*(0.00)*
RoAsia/Pacific *(6-11)	0.91	*(0.00)*	0.86	*(0.00)*
RoAsia/Pacific *(12-15)	0.96	*(0.01)*	0.95	*(0.00)*
RoAsia/Pacific *(16-18)	1.04	*(0.00)*	1.06	*(0.00)*
Africa	1.32	*(0.00)*		
Africa *(0-5)	0.73	*(0.00)*	0.90	*(0.00)*
Africa *(6-11)	0.69	*(0.00)*	0.96	*(0.02)*
Africa *(12-15)	0.72	*(0.00)*	1.05	*(0.02)*
Africa *(16-18)	0.85	*(0.00)*	1.28	*(0.00)*
South America	1.23	*(0.00)*		
South America *(0-5)	0.94	*(0.00)*	1.15	*(0.00)*
South America *(6-11)	1.06	*(0.00)*	1.31	*(0.00)*
South America *(12-15)	1.10	*(0.00)*	1.36	*(0.00)*
South America *(16-18)	1.14	*(0.00)*	1.40	*(0.00)*

[(1)] The table shows the IRR from a Poisson regression of the number of children in the household. Includes controls for age, education, marital status, census year and place of residence.

(I) Displays the IRR of the variables of interest: grouped place of birth and interaction of this and grouped age at immigration.

(II) Shows the cumulative effect of grouped place of birth and age at immigration together with the p-value of an F-test on the significance of the differences in fertility between immigrants from a given area and age at immigration and the native born. This column is shown in Figure 3.

Table 5. Fertility by Age at immigration and Place of Origin relative to the Native born [(1)] (*P-values in italics)*

	POB indicator		Age 0-5		Age 6-11		Age 12-15		Age 16-18	
	Effect	P-value	Effect	P-value	Effect	P-value	Effect	P-value	Effect	P-value
US	0.91	*(0.00)*	1.04	*0.00*	1.08	*0.00*	1.09	*0.00*	1.16	*0.00*
Caribbean	1.23	*0.00*	0.88	*0.00*	1.02	*0.29*	1.07	*0.00*	0.98	*0.38*
Mexico	1.37	*0.00*	1.24	*0.00*	1.21	*0.00*	1.13	*0.00*	1.32	*0.00*
Central Am	1.57	*0.00*	0.74	*0.00*	0.79	*0.00*	0.85	*0.00*	0.92	*0.03*
South Am	1.06	*0.00*	0.94	*0.00*	0.98	*0.25*	0.99	*0.82*	1.01	*0.76*
N. and C. Europe	0.92	*0.00*	1.05	*0.00*	1.00	*0.82*	1.06	*0.02*	1.04	*0.13*
Eastern Europe	0.91	*0.00*	0.94	*0.01*	0.91	*0.00*	0.92	*0.00*	0.97	*0.17*
UK-Ireland	0.98	*0.00*	0.96	*0.11*	0.93	*0.00*	0.95	*0.02*	0.94	*0.00*
South Europe	1.10	*0.00*	0.96	*0.00*	0.98	*0.09*	1.00	*0.94*	1.04	*0.02*
Middle East	1.36	*0.00*	0.80	*0.00*	0.80	*0.00*	0.88	*0.46*	1.04	*0.03*
China	0.80	*0.00*	0.87	*0.00*	0.88	*0.00*	0.92	*0.03*	1.00	*0.94*
North East As	1.02	*0.00*	0.55	*0.00*	0.68	*0.00*	0.62	*0.00*	0.68	*0.00*
South East As	0.97	*0.00*	0.72	*0.00*	0.86	*0.00*	1.01	*0.60*	1.03	*0.10*
South Asia	1.15	*0.00*	0.74	*0.00*	0.83	*0.00*	0.92	*0.34*	1.02	*0.21*
North Africa	1.21	*0.00*	0.87	*0.00*	0.87	*0.00*	0.88	*0.00*	1.03	*0.36*
Central Africa	1.64	*0.00*	0.44	*0.00*	0.52	*0.00*	0.59	*0.00*	0.67	*0.00*
Western Africa	1.42	*0.00*	0.52	*0.00*	0.59	*0.00*	0.67	*0.14*	0.78	*0.00*
South Africa	1.10	*0.00*	0.76	*0.00*	0.73	*0.00*	0.75	*0.00*	0.80	*0.00*
Easter Africa	1.46	*0.00*	0.47	*0.00*	0.52	*0.00*	0.76	*0.00*	0.77	*0.00*
Pacific	0.91	*0.00*	1.02	*0.59*	1.07	*0.06*	1.14	*0.00*	1.24	*0.00*

[(1)] The table shows the IRR from a Poisson regression of the number of children in the household. Includes controls for age, education, marital status, census year, place of residence, place of birth and indicators for age at immigration groups and their interaction with each place of birth. By default the place of birth indicator corresponds to immigrants arriving older than 18. The omitted immigrant reference category is the group of older immigrants from the US.

The total effect of fertility for an area of origin and given age at immigration is calculated as the cumulated effect of being in a particular age group in the reference area of origin, the indicator for area of origin and the interaction between these two (See footnote 23)

Table 6. Fertility Rate by Age at Immigration and OMT relative to Native Born [1] (P-values)

	(I)				(II)	
	Immigrant		**Immigrant*OMT**		**Cumulative effect**	
	Effect	P-value	Effect	P-value	Effect	F- Test (P-value)
OMT indicator	1.035	*(0.00)*				
Age at migration:						
Less than 1	1.118	*(0.00)*	0.916	*(0.00)*	1.060	*(0.01)*
1	1.108	*(0.00)*	0.938	*(0.00)*	1.075	*(0.00)*
2	1.129	*(0.00)*	0.921	*(0.00)*	1.076	*(0.00)*
3	1.124	*(0.00)*	0.933	*(0.00)*	1.085	*(0.00)*
4	1.133	*(0.00)*	0.915	*(0.00)*	1.073	*(0.00)*
5	1.120	*(0.00)*	0.935	*(0.00)*	1.084	*(0.00)*
6	1.130	*(0.00)*	0.944	*(0.00)*	1.104	*(0.00)*
7	1.180	*(0.00)*	0.906	*(0.00)*	1.106	*(0.00)*
8	1.140	*(0.00)*	0.960	*(0.01)*	1.133	*(0.00)*
9	1.156	*(0.00)*	0.938	*(0.00)*	1.122	*(0.00)*
10	1.138	*(0.00)*	0.965	*(0.03)*	1.136	*(0.00)*
11	1.134	*(0.00)*	0.979	*(0.218)*	1.149	*(0.00)*
12	1.160	*(0.00)*	0.959	*(0.01)*	1.151	*(0.00)*
13	1.191	*(0.00)*	0.946	*(0.00)*	1.166	*(0.00)*
14	1.189	*(0.00)*	0.954	*(0.00)*	1.174	*(0.00)*
15	1.192	*(0.00)*	0.963	*(0.02)*	1.188	*(0.00)*
16	1.273	*(0.00)*	0.903	*(0.00)*	1.189	*(0.00)*
17	1.299	*(0.00)*	0.888	*(0.00)*	1.194	*(0.00)*
18	1.317	*(0.00)*	0.888	*(0.00)*	1.210	*(0.00)*

[1] The table shows the IRR from a Poisson regression of the number of children in the household. Includes controls for age, education, marital status, census year, place of residence and place of birth.

(I) Displays the IRR of the variables of interest. Indicators for each age at immigration are shown in the first column ("Immigrant"), indicators for the interaction between age at immigration and OMT indicator are shown in the second column ("Immigrant*OMT")..

(II) Shows the cumulative effect of Official Mother Tongue and age at immigration on immigrant fertility together with the p-value of an F-test on the significance of the differences in fertility between immigrants and native born with OMT.

The column labeled "immigrant" can be interpreted as the effect of age at immigration on fertility for immigrants without an OMT. This column and column (II) are shown in Figure 4.

Table 7. Fertility by Age at Immigration and Education relative to Native Born [1] (P-values)

	(I)				(II)	
	Immigrant		Immigrant*University		Cumulative Effect	
	Effect	P-value	Effect	P-value	Effect	F-test (P-value)
University indicator	0.77	(0.00)				
Age at migration:						
Less than 1	1.05	*(0.00)*	0.91	*(0.00)*	0.736	*(0.02)*
1	1.05	*(0.00)*	0.93	*(0.00)*	0.747	*(0.16)*
2	1.05	*(0.00)*	0.97	*(0.07)*	0.779	*(0.32)*
3	1.06	*(0.00)*	0.93	*(0.00)*	0.757	*(0.49)*
4	1.07	*(0.00)*	0.91	*(0.00)*	0.744	*(0.09)*
5	1.07	*(0.00)*	0.90	*(0.00)*	0.737	*(0.02)*
6	1.08	*(0.00)*	0.91	*(0.00)*	0.751	*(0.25)*
7	1.11	*(0.00)*	0.90	*(0.00)*	0.765	*(0.93)*
8	1.11	*(0.00)*	0.86	*(0.00)*	0.733	*(0.02)*
9	1.11	*(0.00)*	0.86	*(0.00)*	0.733	*(0.02)*
10	1.09	*(0.00)*	0.90	*(0.00)*	0.758	*(0.60)*
11	1.10	*(0.00)*	0.89	*(0.00)*	0.750	*(0.26)*
12	1.12	*(0.00)*	0.88	*(0.00)*	0.753	*(0.39)*
13	1.14	*(0.00)*	0.87	*(0.00)*	0.762	*(0.78)*
14	1.15	*(0.00)*	0.84	*(0.00)*	0.740	*(0.07)*
15	1.15	*(0.00)*	0.83	*(0.00)*	0.737	*(0.05)*
16	1.21	*(0.00)*	0.80	*(0.00)*	0.742	*(0.11)*
17	1.22	*(0.00)*	0.84	*(0.00)*	0.782	*(0.27)*
18	1.23	*(0.00)*	0.85	*(0.00)*	0.801	*(0.01)*

[1] The table shows the IRR from a Poisson regression of the number of children in the household. Includes controls for age, education, marital status, census year, place of residence and place of birth.

(I) Displays the IRR of the variables of interest. The IRR for each age at immigration is shown in the first column (“Immigrant”), the IRR for the interaction between age at immigration and university indicator is shown in the second column (“Immigrant*University”).

(II) Shows the cumulative effect of university education and age at immigration on immigrant fertility together with the p-value of an F-test on the significance of the differences in fertility between immigrants and native born with university education.

The column labeled “immigrant” can be interpreted as the effect of age at immigration on fertility for immigrants without university education. This column and column (II) are shown in Figure 5.

Table 8. Instrumental variable estimation of the number of children relative to the native born [(1)] (P-values)

	Effect	P-value
Age at migration:		
Less than 1 to 11	0.03	*(0.00)*
12 to 16	0.06	*(0.00)*
16 to 18	0.22	*(0.00)*
Adequacy of Instruments		
Correlation with endogenous regressors		
	F –statistic [(2)]	P-value
High school	478	*(0.00)*
Post-Secondary	37753	*(0.00)*
Correlation with the error term		
	Chi-Squared [(3)]	P-value
	3292	*(0.00)*

The table shows the coefficients of a linear IV estimation model where immigrant choices of high school and post-secondary education are endogenous regressors. The first-stage regression uses area of origin and French/ English OMT as exogenous instruments.

[(2)] This is the value of the F-statistic on the joint significance of the instruments after controlling for other variables in the regression.

[(3)] This is the value of the chi-2 testing the correlation of the instruments with the error term

Other regressors in the main equation include age, year of survey, rural area of residence and education, immigrant status and their interaction. The interaction of education and immigrant status are the endogenous regressors.

FIGURE 1

Distribution of Immigrants by Age at Immigration, Census 1991-2006

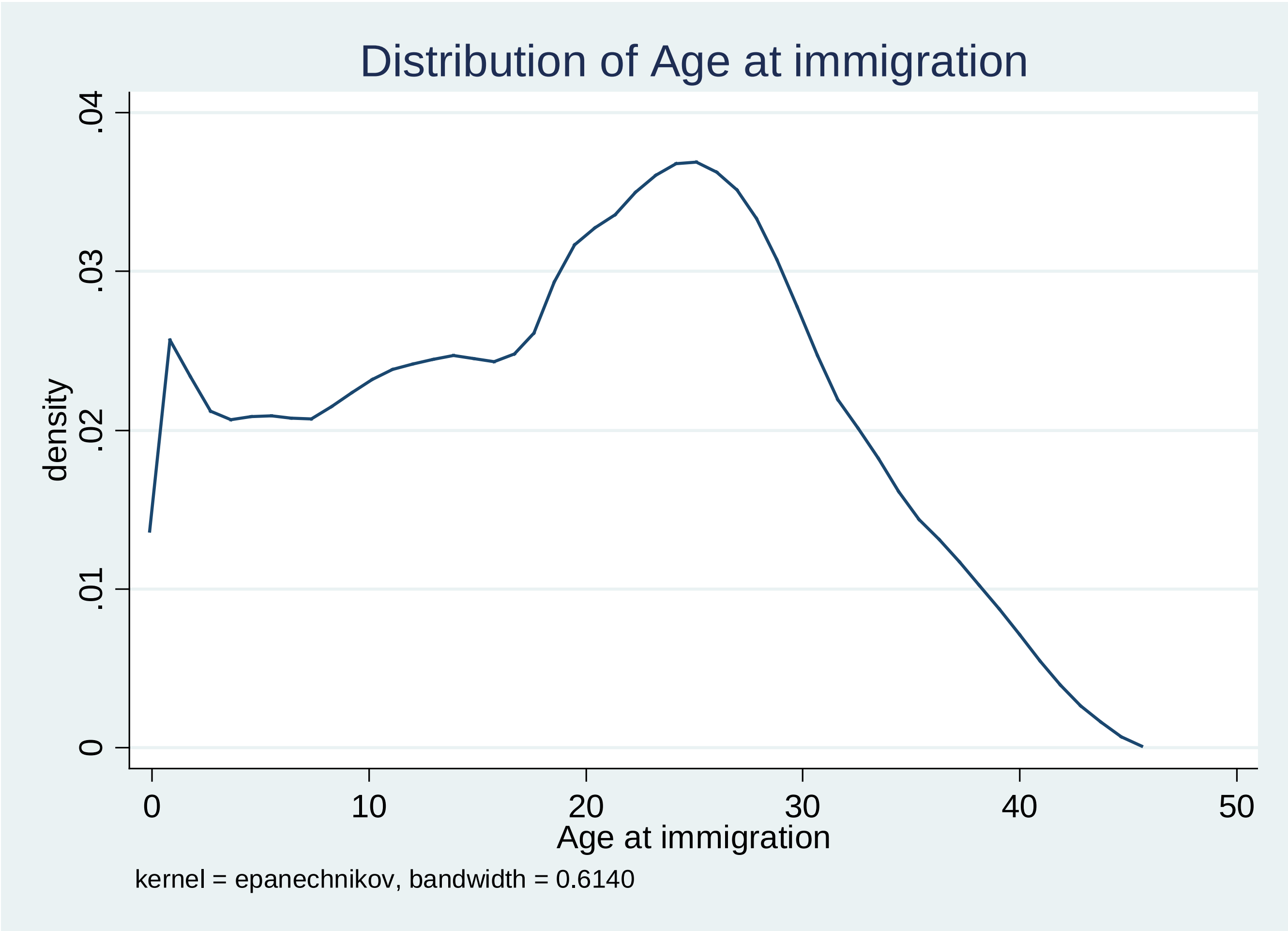
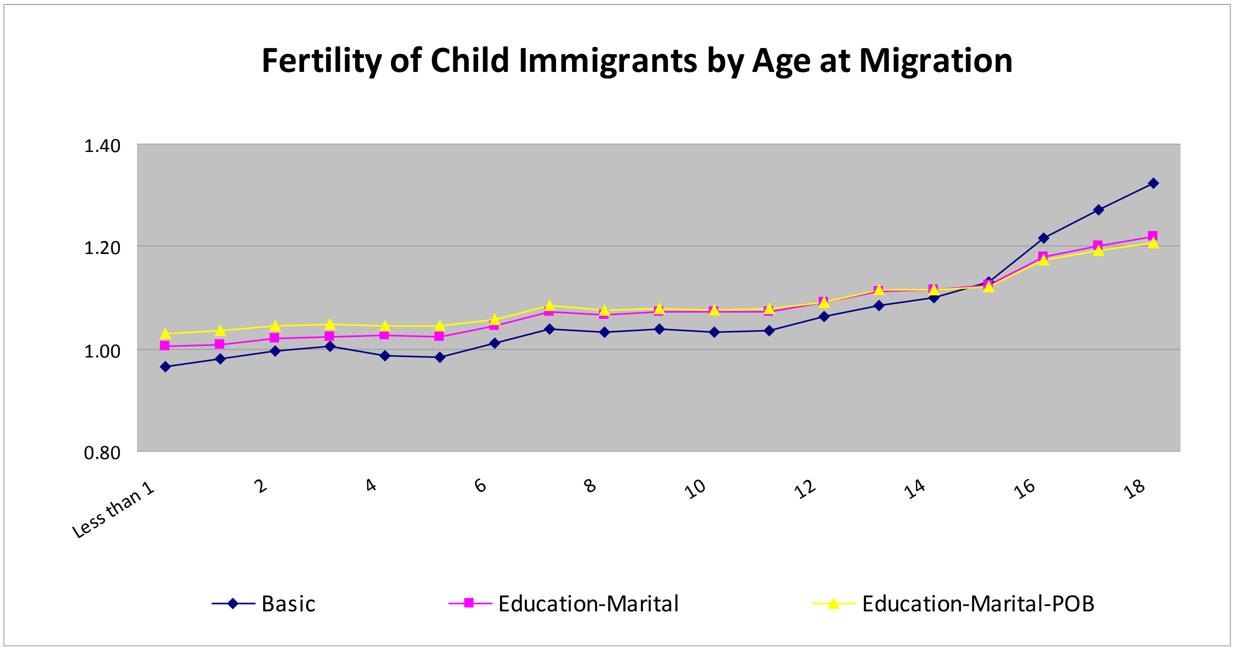


Figure 2

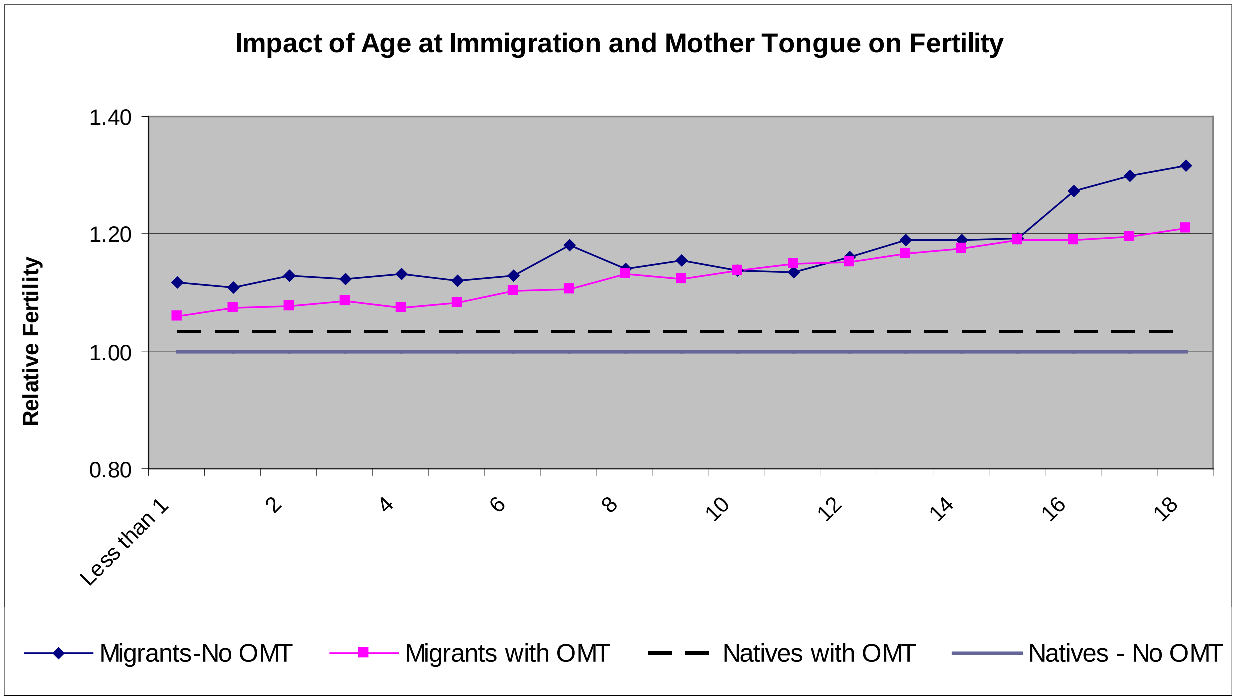


Note: Estimated fertility relative to Canadian Born from Poisson regressions in Table 3. All models control for age, location of residence and census year. Additional controls are mentioned in the caption. In the model with place of birth, the US is the reference group shown in graph.

Figure 3: Fertility by Grouped Age at Migration and Place of Birth

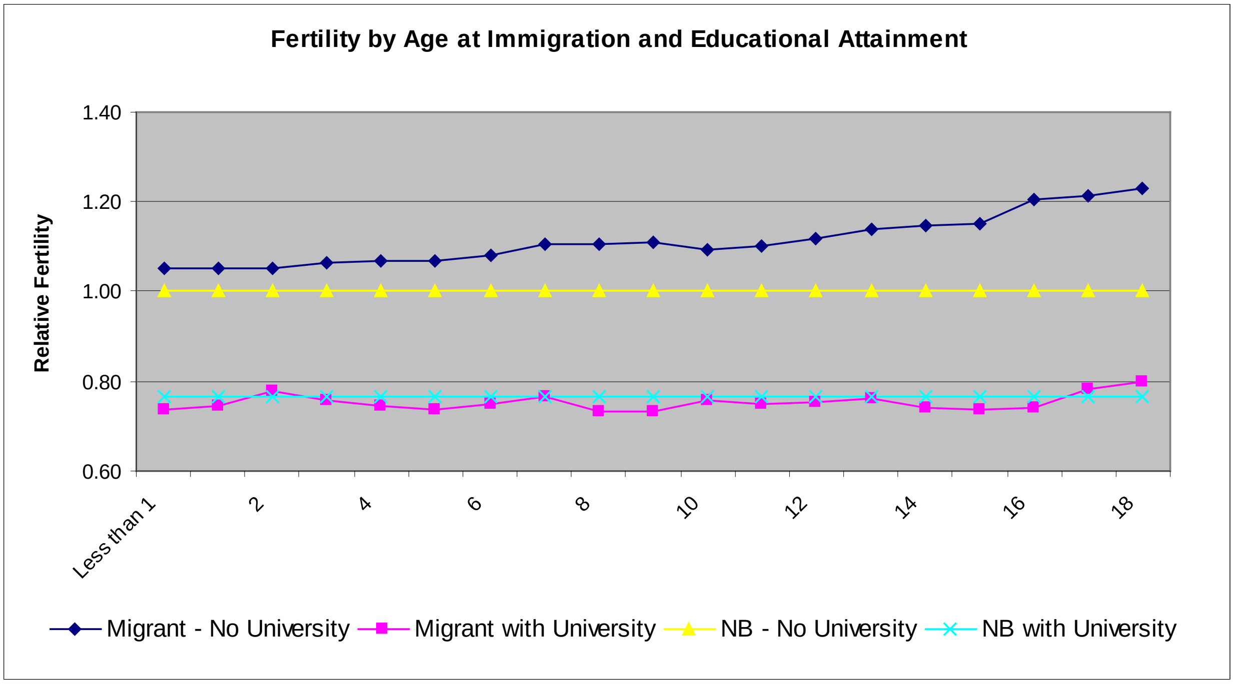
Note: Estimated fertility relative to Canadians from Poisson regression in Table 4. Controls for age, education, marital status, location of residence, census year and place of birth are included.

Figure 4:



Note: Estimated fertility relative to Canadians with no OMT from Poisson regression in Table 6. Controls for age, education, marital status, location of residence, census year and place of birth (re: USA) are included.

Figure 5:



Note: Estimated fertility relative to Canadians with no university education from Poison regression in Table 7. Controls for age, education, marital status, location of residence, census year and place of birth are included.

Appendix

Table A. Fertility Rates by Area of Origin

	I. Basic model
	Relative fertility rate
Native born	--
Immigrant	
US	--
Caribbean	1.15**
Mexico	1.37**
Central America	1.35**
South America	0.99
North and Central Europe	0.94**
Eastern Europe	0.88**
UK / Ireland	0.92**
Southern Europe	1.02**
Middle East	1.25**
China	0.76**
North Eastern Asia	0.92**
South East Asia	0.91**
Southern Asia	1.06**
North Africa	1.17**
Central Africa	1.33**
West Africa	1.27**
Southern Africa	0.97**
Eastern Africa	1.16**
Pacific	0.95**
Observations	1,835,326

The table shows the effect of place of birth on fertility from the basic model shown in table 3, column III. The Poisson regression also includes controls for age, education, marital status, census year, place of residence and a full set of age at immigration indicators.

(***) indicates significant at 1%, (**) indicates significance at 5 percent.

TABLE B. Classification of Countries by Region of Origin

Caribbean: Cuba, Dominican Republic, Haiti, Puerto Rico, Jamaica, Trinidad and Tobago, Guadeloupe, Martinique, Bahamas, Barbados, Netherlands Antilles, Saint Lucia, Saint Vincent and the Grenadines Virgin Islands, US Grenada , Antigua and Barbuda, Dominica, Cayman Islands, Aruba, Anguilla, Bermuda, Montserrat, Saint Kitts and Nevis Turks and Caicos Islands, British Virgin Islands

Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama

South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Falkland Islands (Malvinas), French Guiana, Guyana, Paraguay, Peru, Suriname, Uruguay, Venezuela.

Northern and Central Europe: Greenland, Denmark, Finland, Iceland, Norway, Sweden, Austria, Belgium, Germany, Liechtenstein, Luxembourg, Monaco, Netherlands, Switzerland, France..

Eastern Europe: Bulgaria, Czech Republic, Slovakia, Czechoslovakia, n.i.e., Hungary, Poland, Romania, Estonia, Latvia, Lithuania, Belarus, Moldova, Republic of Russian, Albania Federation, Ukraine, USSR., n.i.e., Bosnia and Herzegovina, Croatia, Slovenia, Yugoslavia

Southern Europe: Andorra, Gibraltar ,Greece, Italy, Malta, Portugal, San Marino, Spain, Vatican City State, Macedonia

UK Ireland: Ireland, Republic of (Eire) United Kingdom

Middle East: Afghanistan, Cyprus, Iran, Turkey, Armenia, Azerbaijan, Georgia, Kazakstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan, Bahrain, Iraq, Israel, Jordan, Kuwait, Lebanon, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, Yemen, Palestine/West Bank/Gaza Strip

China: People's Republic of China, Hong Kong, Macao, Mongolia

North Eastern Asia: Japan, Korea, North Korea, South Taiwan

South East Asia: Cambodia, Indonesia, Laos, Malaysia, Myanmar, Singapore, Thailand, Vietnam

Southern Asia: Philippines, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka

North Africa: Algeria, Egypt, Libya, Morocco, Tunisia, Sudan, Western Sahara

Central Africa: Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea, Gabon, Sao Tome and Principe, Zambia, Zaire

West Africa: Benin, Burkina Faso, Côte d'Ivoire, Cape Verde, The Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo

Southern Africa: Botswana, Lesotho, Namibia, Republic of South Africa, Swaziland

Eastern Africa: Eritrea, Uganda, Sudan, Kenya, Tanzania, Rwanda, Burundi, Somalia, Djibouti, Ethiopia, Comoros, Madagascar, Malawi, Mauritius, Mayotte, Mozambique, Reunion, Seychelles, Zimbawe

Pacific: American Samoa, Australia, Cook Islands, Fiji, Polynesia, New Caledonia, New Zealand