Immigrant Earnings
Age at Immigration Matters

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Abstract. A correlation between age at immigration and earnings is observed in Canadian census data. The evidence supports three underlying sources of the effect; first, work experience in the source country yields virtually no return in the host country; second, the return to education varies with age at immigration, and, finally, an "acculturation" effect is observed for immigrants who are visible minorities or whose mother tongue is not English. Further, it is found that educational attainment, and relatedly earnings, vary systematically across age at immigration with those arriving around age 15 to 18 obtaining fewer years of education. JEL codes: J61, J31.

1. INTRODUCTION

A small number of studies exploring the labour market impact of age at immigration have been conducted in the United States, but the issue has almost always been addressed tangentially in studies looking at the rate of immigrant economic "assimilation" or integration.[1] The topic itself does not appear to have been given much attention, and it appears to have received almost no attention in the Canadian context.[2] This is particularly striking since the economic implications may be sizable and, unlike the large negative coefficients observed for recent entry cohorts in assimilation studies such

as Borjas (1985, 1995), Baker and Benjamin (1994), Bloom, Grenier and Gunderson (1995), and Grant (1999) do not attenuate with time in the host country but leave permanent legacies. Further, since 1967 Canada has employed a "points system" to determine the eligibility of applicants to immigrate and one of the variables for which points are awarded is age, which makes age at immigration an important variable to understand.[3] Using Canadian census data, this study looks at the impact of age at immigration on men's employment earnings and finds large effects.

There are a variety of reasons why one would expect that age at immigration might matter, either directly or indirectly, for labour market outcomes. For example, schooling obtained in the source country may not be (recognized as) equivalent to schooling in the host country, and thus yield a lower return. The same may be true for labour market experience. Older immigrants may also be less able to adjust to the linguistic and cultural challenges associated with entering a new country, and this may make it difficult for them to generate earnings commensurate with their formal educational and occupational skills. Each of these factors suggests that age at immigration may be an important determinant of an immigrant's earnings. Further, the examples above suggest that immigrant earnings, relative to an equivalent Canadian born person, will decline as age at immigration increases.

The seminal work of Chiswick (1978), and Borjas (1985), on the economic assimilation of immigrants do not include any specific consideration of the impact of age at immigration on earnings profiles. However, a number of subsequent American studies address aspects of the issue. Kossoudji (1989) allows the returns to experience and schooling to vary by whether the experience and schooling were obtained abroad or in the United States. Her results indicate near zero returns to labour market experience acquired abroad and very little difference in the returns to pre- and post-immigration schooling. While we can replicate her results in our data, we extend the analysis to allow for parameter heterogeneity and observe that the interpretation of the results changes substantially. Friedberg (1993) extends the analysis of Chiswick (1978) and Borjas (1985) by adding an age at immigration variable to the economic assimilation model. Using 1970 and 1980 United States census data she finds that age at immigration exerts a statistically significant negative effect on male immigrant earnings after controlling for education, experience, ethnicity, and years since immigration. Borjas (1995) using 1970, 1980, and 1990 census data obtains similar results. Neither paper seeks to determine why age at immigration matters, which is the focus of this paper. Schoeni (1998) uses the same data to examine the labour force participation of immigrant women. His results show that female immigrants who attended schools in the United States (i.e. women who immigrated at an early age) had higher labour force participation rates. Thus, if labour force participation is a measure of economic integration, the degree of integration varies inversely with age at immigration.

Kee's (1995) study of male immigrants living in the Netherlands also focuses on the returns to pre- and post- immigration labour market experience and schooling for a number of ethnic groups. His results indicate that the return to pre-immigration measures is higher for immigrants from school systems, and implicitly the cultural contexts, more similar to the Dutch one. Using Australian data, Chiswick

and Miller (1985) find that schooling obtained abroad yields a lower return than schooling obtained by the Canadian born, and that this difference is larger if the schooling was received in a non-English-speaking country. Their results also show that foreign labour market experience yields a much lower return than Australian labour market experience. Friedberg (2000) looks at foreign and native-born returns to education and experience in Israel and finds that the return to foreign experience is generally insignificant and that in many cases foreign education is valued less than that obtained domestically.

Analysis of the effect of age at immigration on subsequent earnings in Canada has been limited to sensitivity analyses as part of studies concerned with other issues and the results have been mixed. In their study of immigrant assimilation, Baker and Benjamin (1994) estimate a model for the subset of immigrants who were at least 16 years old at the time of immigration and find that their return to education is statistically insignificantly lower than that for all immigrants. Their return to labour market experience is about half of what it is for all immigrants, which is about two-thirds of that of the Canadian born. Grant (1999) updates Baker and Benjamin (1994) using 1991 census data, and also splits the male immigrant sample on the basis of whether immigration occurred before age 16, or later. No regression results are shown, but it is reported that they do not differ from those for the full sample. Bloom, Grenier and Gunderson (1995) report average age at immigration in their table of descriptive statistics but do not include this variable in their regression analysis of changes in the pattern of immigrant assimilation. In their analysis of the effect of macroeco-

nomic conditions on male immigrant earnings, McDonald and Worswick (1998) specify separate models for all male immigrants, and for those who immigrated as adults, and conclude that there is very little difference in the parameter estimates.

The current paper investigates the impact of age at immigration and finds a sizable correlation with earnings even after controlling for cohort effects and a range of demographics. The different mechanisms that might underlie this correlation are also explored. Work experience in the source country is found to yield virtually no return in the host country. Ascertaining the relative value in the labour market of education received in Canada compared to elsewhere is more complicated, however immigrants who arrive as young children have a return to education similar to that of the Canadian born, but the return to education declines as age at immigration increases until those who arrive as older adults have quite low returns. However, if the parameter heterogeneity across age at immigration groups is ignored and education is measured as either Canadian or foreign, then immigrants' return to education from foreign and Canadian schools appears to be quite similar, with returns slightly below the return to education for the Canadian born; these results are similar to the findings of Chiswick and Miller (1985) and Kossoudji (1989). Further, we find evidence that suggests, at least for visible minorities and for those whose mother tongue is not English, that age at arrival has an economic impact that may be thought of as "acculturation." Finally, and very interestingly, we observe that immigrants who arrive around age 15 to 18 complete fewer years of schooling than those who arrive either earlier or later.

Arriving near the transition out of high school appears to be associated with a permanent reduction in educational attainment, and this leaves a permanent scar on earnings.

We begin by outlining our methodology for estimating the effect of age at immigration on the immigrant age-earnings profile. Next, we present the data and provide descriptive statistics of the characteristics of Canadian born and immigrant males, and of the labour market outcomes for these two groups. Three sets of regression results are then presented: the first explores and quantifies the effect of age at immigration on subsequent earnings, the last two focus on why age at immigration matters. The paper ends with a brief summary and conclusion.

2. METHODOLOGY and DATA

Unlike previous studies, this paper does not focus on identifying assimilation profiles and cohort fixed effects, and we, therefore, do not use a quasi-panel method like that employed in the immigration context by, for example, Borjas (1985, 1995).[4] Further, an initial specification test rejects pooling the data since differences in the coefficient estimates across the census years are statistically significant. Baker and Benjamin (1994) obtain a similar result for the same test, and we, like them, therefore, treat each census year as a separate cross-section. Borjas (1995) does not report performing such a test, but he does interact many variables of interest with the period effects, which has a similar effect as running separate regressions. Throughout the analysis we present results for the three census years and consider stability, or changes, in coefficient estimates across years as being informative.

2.1 Identification and Estimation

An identification problem occurs when age at immigration, year of immigration (or equivalently, in cross-sectional data, years since migration) and age enter a regression equation as a set, since age is equal to age at immigration plus years since migration.[5] A common approach to this type of problem is to drop one of the three perfectly collinear variables, but that is not a satisfactory option in this case. Age at immigration is the focus of our paper, and although the rate of economic assimilation and cohort fixed effects are not, we believe that they are important and omitting them may bias our results. Similarly, we cannot ignore the age-earnings process, especially given that there is a substantial difference in the average age of immigrants and Canadian born individuals in our sample, without potentially biasing our coefficient estimates.

We employ multiple distinct empirical strategies. They are not nested in the sense of one being a restricted version of another, but are conceptually distinct approaches to closely related issues. Further, they each employ their own identification strategy, and as pointed out by Borjas (1999, p. 1720-21), each gives a different perspective on the data and has an interpretation that is a function of the restriction imposed. However, identification in the later approaches is straightforward and we do not discuss it in this section; rather, we focus on the first approach here, which requires a more detailed explanation. We address this identification problem with an empirical strategy consistent with the substantive economic question: are the observed differences in outcomes between immigrant and Canadian born workers of the same age (and in some cases other

observable characteristics as well) associated with age at immigration? Fundamental to the method is that it takes the Canadian born as a comparison group.[6] A portion of Borjas's (1995) paper faces the same identification question. He identifies his model by assuming that the age effect is "the same" (p. 227) for both groups. That is, in a single regression containing both the immigrant and host country born observations, he estimates a single age-earnings profile. The immigrant age-at-immigration coefficients can be interpreted, therefore, as deviations from this common profile, which is (in the presence of non-linearities) a mixture of the immigrant and Canadian born profiles.

We are reluctant to impose this common age-earnings profile on both groups. Our approach provides an analysis that we believe to be "cleaner." What defines an immigrant is not age, but age at immigration and year of immigration, and we want all of the immigrant/Canadian born differences to be assigned to those immigrant specific characteristics. Borjas (1999, p. 1720) recognizes the problem inherent in imposing the "same" age-earnings profile arguing that it "contradicts the notion of specific human capital". Our approach, in general, requires a two-step procedure. This is less efficient than Borjas's single equation, but given the sample size available the loss in precision does not appear to be important. Further, we believe that the potential gain in interpretive clarity is worth the cost.

We first estimate — as an auxiliary regression — the age-earnings profile for the Canadian born sample. The b's are coefficients to be estimated, age measures years since birth and is modeled as a fourth-order polynomial to allow a high degree of flexibility,[7] and ε is a classical random error term. The X's are additional regressors; they are in parentheses in equation 1 to indicate that they are included in some, but not all, of the models estimated.

$$\ln w^{cb} = b^{cb}_0 + \Sigma^4_{j=1} \text{Age}^j b^{cb}_j \left(+ X b^{cb}_x \right) + \varepsilon^{cb} \quad (1)$$

Then, equation 2 — the equation of interest — is estimated using only the immigrant sample. The dependent variable is the difference between each immigrant's (ln) earnings and the predicted earnings that the worker would earn were he (our sample is limited to male wage earners) Canadian born and the same age (and in some models having the same X's); the regression explains this difference as a function of immigrant characteristics.

$$\ln w^I - \left[b^{cb}_0 + \Sigma^4_{j=1} \text{Age}^j b^{cb}_j \left(+ X b^{cb}_x \right) \right] =$$
$$b^I_0 + \text{AgeImm} b^I_{\text{AgeImm}} + \text{ImmCohort} b^I_{\text{ImmCohort}} \left(+ X b^I_x \right) + \varepsilon^I \quad (2)$$

Equation 2 contains the immigrant specific variables age at immigration and immigrant cohort, and a set of other observable characteristics (X) that are employed in some, but not all of the models estimated. Both immigrant specific variables are specified as sets of indicator variables to maximize the flexibility of the functional form and to accord with the grouped census data employed. The superscript cb indicates Canadian born, and I immigrants. In this specification the immigration cohort coefficients in each cross-section do not have a well-defined interpretation since they are a mixture of assimilation and cohort fixed effects. In conjunction with similar coefficients and the intercepts from additional cross-sections they can, however, be used to identify both. The coefficients are presented in appendices for those who wish to pursue this issue. A

further complication arises for the two-step procedure since OLS standard errors are not appropriate in the second stage. We bootstrap (resampling the data 500 times in all cases) the standard errors in all the models estimated.

Note that, as mentioned, in equation (2) the effect of age on earnings for immigrants is specified to be the same as that for the Canadian born. This restriction serves to identify the model since it assigns each immigrant to the position we would expect him to have on the Canadian born age-earnings profile. This projection onto the Canadian -born age-earnings profile poses the economic question we wish to address: are the deviations between immigrant and Canadian born earnings for similar people a function of immigrants' age at immigration (controlling for cohort effects)?

It is worth highlighting the key source of the difference between Borjas's (1995) identifying assumption and our own. If all variables entered the model linearly then the coefficient estimates from the two procedures would, in large samples, be essentially identical, but our two-stage approach would be less efficient. The coefficients would be the same since, in a single equation like Borjas's, the identity would cause the immigrant portion of the combined sample to identify only two of the three variables in question in accord with the Frisch-Waugh-Lovell theorem. Intuitively, the Canadian born portion of the sample would identify the age profile, but obviously not the immigrant specific coefficients, and the immigrant portion of the sample would take the Canadian born age coefficients as given and then identify the age at immigration, and year of migration, coefficients. This is exactly what the two-stage procedure accomplishes.

However, if even one of these variables has a non-linear functional form, then the equivalence of the two approaches breaks down. The identity is a linear one, and does not apply to the higher order terms: for example, age squared does not equal years since migration squared plus age at migration squared. If the model is estimated in one step, then the age-earnings profile becomes a mixture of that of the two groups and the immigrant specific variables measure differences from the mixture. In contrast, the two stage approach continues to impose the Canadian born age-earnings profile (which is non-linear) on the immigrant sample. Of course, if the "true" profiles are not very different, or if the immigrant sample is very small relative to the Canadian born one, then the coefficients estimated by the two procedures will be similar, but it is difficult to assert their similarity beforehand. For comparability we estimate both a version of Borjas's model in addition to our own.

2.2 Data

We estimate the effect of age at immigration in the context of a set of distinct models fitted separately to data from the public use 1986, 1991, and 1996 Canadian census microdata files. In some models the (natural logarithm of paid and positive self employment) earnings are expressed as a function of: years of schooling, potential labour market experience, marital status, visible minority status (as defined by Statistics Canada), a binary variable for 40 to 48 weeks of work in the reference year, a set of binary variables for weekly hours worked in the census reference week, whether the person was living in one of the 1986 census metropolitan areas, region of residence,[8] and whether mother tongue is English, French, or both (neither English nor French being

the omitted group). In other models we include far fewer covariates. As will be seen, the changes in coefficient values as regressors are added to successive models point to interesting economic phenomena.

As in Baker and Benjamin (1994), the sample is limited to males who were 16 to 64 years old on the relevant survey date and who worked more than 40 weeks in the year before the census was taken. Some regressors, such as visible minority status and mother tongue, which have not been included in most economic assimilation studies are employed to address issues not previously explored in the Canadian context. Not all the regressors are measured consistently across the three censuses. In the 1996 data those who immigrated before age 20 are grouped into three age-at-immigration categories: 1 to 4, 5 to 12, and 13 to 19; whereas in 1986 and 1991 four categories are used: 1 to 4, 5 to 9, 10 to 14, and 15 to 19. Identification of visible minority status also changed. In 1996 the variable in the public use file is self reported, whereas that in the 1986 and 1991 file is imputed by Statistics Canada on the basis of a number of variables such as ethnic origin and language.

3. EMPIRICAL RESULTS

3.1 Summary Descriptive Statistics

Comparative descriptive statistics for the 16 to 64 year old Canadian born and immigrant males are summarized in the upper part of Table 1 for the 1996, 1991 and 1986 samples. A comparison of these sample statistics shows some interesting patterns. Immigrants on average are older than the Canadian born but with the aging of the Canadian male labour force this differential has declined from 5.2 years in 1986 to 4.2 years in 1996. At the same time, the differential in labour market experience between immigrants and Canadian born dropped from 4.9 years in 1986, to 3.9 years in 1996. The years of schooling reported by people born in Canada and immigrants increased by the same amount (0.9) from 1986 to 1996 so that immigrants continue to have more formal schooling (0.3 years). Immigrant annual earnings in 1986 and 1991 (converted everywhere into $1995 using the CPI) on average exceeded the earnings of Canadian born by some $2000 but fell short of Canadian born earnings by $442 in 1996 as a result of a much larger drop in the average real earnings for immigrants than for Canadian born. The proportion married is higher for immigrants than for the Canadian born and appears to be trending down for both groups.

Three substantial differences between the Canadian born and immigrant populations that have not previously been addressed adequately are urbanization, visible minority status, and mother tongue. In 1996, immigrants, at about 80 %, were about 58.5 % more likely to live in an urban area than the Canadian born, an increase from 52.8 % in 1986. Over the same period the urbanization of the Canadian born stayed roughly constant at about 51 %. One of the more notable differences between the Canadian born and immigrant samples, shown in Table 1, is that an immigrant is much more likely (thirty times in 1996) to belong to a visible minority. It is also interesting to note that for both Canadian born and immigrants there is a substantial percentage increase from 1986 to 1996 in the proportion that belongs to a visible minority. This increase occurs despite a change in the definition that, as can be seen in Table 2, appears to marginally decrease the observed fraction that is a visible minority in each and every immigrant cohort. The increase has two sources. First, as seen in Table 2, the most

recent cohort comprised a very high fraction of visible minorities and, second, there is attrition across the censuses as people near age 65, who are concentrated in the cohorts that arrived many years ago and had low proportions of visible minority, are more likely to leave the sample (retire). Similarly, the proportion of immigrants for whom neither English nor French is the mother tongue rose from 60.6% to 65.1 %.

Given the large difference in the age and visible minority distributions of immigrants and the Canadian born, age adjusted (ln) earnings and schooling levels are presented by visible minority status in the lower portion of Table 1. Four conclusions can be drawn from these results. First, for both immigrants and the Canadian born, the visible minority group has on average more years of schooling than those who are not members of a visible minority, but in both cases the average earnings of the visible minority groups are less. (Although for non-immigrants the earnings differences are extremely small.) Second, the Canadian born visible minority group has more years of schooling than visible minority immigrants, and also earns more. Third, of those who are not a member of a visible minority, immigrants have more years of schooling than the Canadian born but earn about the same. Fourth, age adjusted schooling rose for each group from one census year to the next except for visible- minority immigrants where it declined from 1991 to 1996.

Average age at immigration by immigrant cohort is shown in Table 2 for the three census years. These averages are based on the midpoints of the age ranges available in the census data. Since fewer ranges are used in the 1996 census, the 1996 averages are not comparable with those for 1986 and 1991. Nevertheless, the data clearly show that, as expected given the data selection procedure, the average age at immigration rises the more recent the year of immigration. Thus, if age at immigration affects assimilation, not including it in empirical models will result in omitted variable bias in the estimated assimilation pattern. It is also interesting to note that age at immigration declined in the first half of the 1990's.[9]

The proportion of the immigrants in each cohort of our sample that belongs to a visible minority is also shown in Table 2. From 1945 to 1960 members of visible minorities comprised at most 5 % of newly arriving immigrants. This proportion rose dramatically over the next thirty-five years to 70 %, and this trend should not be ignored.[10] Table 2 also shows that, whereas in 1986 the most recent arrival cohort averaged 1.04 more years of education than the Canadian born, this differential had fallen to 0.52 years for the most recent cohort in 1996. Nevertheless, the average years of schooling for the most recently arrived cohort of immigrants rose steadily from 1986 to 1991 to 1996. While recent immigrants have more years of schooling than in the past, a smaller proportion than in the past have one, or both, of Canada's official languages as their mother tongue. As shown in Table 2, in 1986 65.0 % of the most recent immigrant cohort did not report either English or French as their mother tongue. This proportion increased to 80 % in 1996.

3.2 The Age-at-Immigration Effect

Our first set of regressions using the two-stage estimation strategy, in Table 3, focuses on the relative earnings of immigrants across age-at-immigration categories.[11] As discussed above, the dependent variable is the difference between

observed earnings and those predicted from the Canadian born age-earnings profile. This dependent variable is regressed, in columns 1, 4 and 7, only on the immigrant's age at immigration and year of immigration. Both explanatory variables enter as sets of dummy variables defined over age intervals and immigrant cohorts, respectively, in accord with the information available in the Canadian census microdata files. Additional controls are added in subsequent models. The immigrant cohort dummy variables (in Appendix Table 1) capture the combined impact on earnings from assimilation and cohort fixed effects — neither effect is independently identified in cross-section.

The 1996, 1991, and 1986 estimates for these base cases (columns 1, 4 and 7) show that immigrants' age-earnings profile generally shifts down when their age at immigration exceeds 35, and that those who immigrated between 45 and 64 earn substantially less than those who immigrated before age 5 (the omitted group). Quantitatively, the negative effect appears be quite substantial for those who arrive at an older age; from column 1 of table 4, in 1996 an average immigrant who arrived between the ages of 45 and 64 received about [(exp(-0.300)-1)*100=] 32% less than an immigrant who arrived between the ages of 0 and 4. This gap appears to have increased dramatically since 1991. Further, the profile is not monotonic. Across all three census years, those who immigrated in their late teens (13 to 19 in 1996; 15 to 19 in 1986 and 1991) have consistently lower earnings than both those who immigrated at a slightly younger, or slightly older, age.

Our second set of regressions, in columns 2, 5 and 8 of Table 3, add controls for a number of observable differences between Canadian born and immigrants that may account for differences in age adjusted earnings across the two groups and within each group. The dependent variable is now the difference between each immigrant's observed earnings and that predicted with an expanded earnings function for Canadian born that includes all the variables unrelated to immigration. These variables capture the effect on earnings of key socioeconomic characteristics that may be correlated with either age at immigration and/or immigration cohort. The returns to these variables for immigrants are for now constrained to be the same as those for the Canadian born, as estimated in the first stage regressions, and the Canadian born return to these characteristics from the first stage are presented in the lower part of each column.

Adding the additional control variables has two distinct impacts on the coefficients for the age-at-immigration dummy variables. First, in contrast to the previous regressions, starting at age 5, relative earnings now decline close to monotonically as age at immigration rises. In particular, the sizable, statistically significant negative coefficient in the base case for those who immigrated at the ages of 15 to 19 (13 to 19 for 1996) is now close to zero and not statistically significant. Second, for those older than 24 years at the time of immigration, it results in lower earnings relative to Canadian born than indicated in the base case. This suggests that the earnings of immigrants who migrate as adults are not commensurate with their human capital as valued by the Canadian born regression coefficients. Explanations for both of these effects are pursued below.

Next, we allow the returns to observed characteristics, other than age, to be different for the Canadian born and

immigrants by adding these variables to both the Canadian born (first stage) and immigrant (second stage) regression equations. The dependent variable remains the difference between the immigrants' observed (ln) earnings and the predicted (ln) earnings if the immigrant had been Canadian born. The results are shown in columns 3, 6, and 9, Table 3, for the 1996, 1991 and 1986 census years, respectively. Note that the estimated coefficients for the control variables have the interpretation of deviations from the Canadian born coefficients, and the latter are identical to the Canadian born estimates in the lower part of columns 2, 5 and 8. Allowing for heterogeneity across immigrants and the Canadian born in the return to observable characteristics, other than age, has only a small impact on the estimated effect of age at immigration on earnings. In particular, the noticeable deterioration from 1986 and/or 1991 to 1996 in the relative earnings of those who were more than 24 years old at the time they immigrated persists, although the profile is slightly less steep.[12]

Looking at the differences in the other observed characteristics, the parameter estimates indicate that the return to a year of schooling is 0.6 or 0.7 of a percentage point less for immigrants than for the Canadian born. The reduction in earnings as a result of belonging to a visible minority is about 9 percentage points greater for immigrants than for the Canadian born, and the return to living in an urban area is about 4 to 6 percentage points less for immigrants. The return to being married is less for immigrants than for the Canadian born. Having English as mother tongue yielded the same return for the Canadian born and immigrants in 1986 and 1991, but a 5 percentage point higher return for immigrants in 1996, relative to the omitted category of having

neither English nor French as mother tongue. The return to French as mother tongue is 12 percentage points lower for immigrants than for the Canadian born in 1986, but this negative differential disappeared in 1991 and 1996. In each of the three census years there is no statistically significant difference across Canadian born and immigrants in the return to having both English and French as mother tongues.

To allow comparability with previous work, in Table 4 we estimate the coefficients using an approach that is comparable to Borjas's (1995) paper, but we estimate each cross-section independently, which can be interpreted as fully interacting the census year indicator with the regressors. There are neither substantive changes in the regression coefficients, nor in their standard errors, relative to Table 3. One interpretation is that the two groups' "true" age-earnings profiles, conditional on the other regressors, are sufficiently similar that the two methods produce the same substantive results. Further the Canadian born sample is much larger than the immigrant one so that it dominates the combined profile.

4. SOURCES OF THE AGE-AT-IMMIGRATION EFFECT ON EARNINGS

4.1 Educational Attainment

The explanation for the non-monotonic age-at-immigration earnings profile appears to be that the formal schooling of those who immigrated in their late teens ended prematurely. To explore the importance of the education variable in isolation, we performed an analysis where we introduced only schooling in addition to the age-at-immigration and cohort variables in regressions for each census year like those in columns 2 and 3 of Table 3, and the negative deviation was similarly

eliminated. Thus, in the absence of controls for education, immigrants arriving in their late teens are observed to earn lower incomes than expected, but when we control for years of schooling the earnings of this cohort conform to the expected, monotonic or smooth, pattern. The education deficit explanation is explored further in Tables 5 and 6.

The upper panel of Table 5 presents the unadjusted years of schooling and shows that those who immigrated between the ages of 15 and 19 (or 13 and 19 for 1996) have fewer years of schooling than those who immigrated at somewhat younger and older ages. To formalize this and allow for limited confounding effects, the lower panel presents regression coefficients that explore the same issue. These regressions use the two-stage approach described in the methodology section (and column 1, 4 and 7 of Table 3) without X variables. The intercept indicates that the omitted group (those who immigrated between ages 0 and 4 in 1946-1955) had between two-thirds and almost a full year more education than his Canadian born counterpart. However, the age at immigration coefficients suggest that those who immigrated in their prime working years had even more schooling than their counterparts who arrived younger. Those who arrived in their late teen years, and to a lesser extent early 20s, however, have substantial education deficits relative to those around them.

Table 6 further restricts the selected sample to immigrants older than age 25, to focus more on completed education, and tries to understand the process by which this deficit occurs. Only data for 1991 and 1996 are presented since the 1986 census has a slightly different set of education questions, however our informal analysis suggests very similar results.

In the top panel the unadjusted proportion of males in each age-at-immigration group with various educational credentials. The bottom panel presents regression coefficients from linear probability models using the immigrant subsample with controls for age at immigration and a quartic in age.[13]

Columns 1 and 6 present the fraction that had graduated high school in the 1991 and 1996 samples. A substantial dip is obvious for those who immigrate in their late teens, which is the group that also has the earnings deficit. Interestingly, immigrants who arrive as adults, especially over age 45, report lower levels of high school completion than those who arrive as young children. Columns 2 and 7 looks at the proportion who graduate from college among those with a high school degree, and columns 3 and 8 present college graduation rates for those without a high school degree.[14] A substantial fraction of both immigrant high school completers and non-completers obtain some type of college degree, but, perhaps surprisingly, in both cases and for both census years no obvious dip exists for the group in question. Conditional on high school graduation, college graduation by immigrants from the age-at-immigration group in question does not appear to deviate from other age-at-immigration groups.

University graduation is explored in columns 4 and 5, and 9 and 10. Columns 4 and 9 document the incidence of obtaining a bachelor's degree for the entire sample of immigrants. In both censuses a dip is obvious for the age-at-immigration group that arrived in its late teens. However, unlike for the college graduates, when, in columns 5 and 10, the sample is restricted to high school graduates, the probability of completing university is less

for the group of interest than those who arrive older or younger. Even among high school graduates, transitions to university appear to be less common for those who immigrated in their late teens.

4.2 Education and labour market experience split into foreign and Canadian components

We next turn to the reasons for the decline in earnings with increasing age at immigration. Our analysis thus far has established that age at immigration matters for subsequent earnings, even after controlling for years since migration and cohort fixed effects, for human capital and labour market activity variables, and for differences across Canadian born and immigrants in the returns to these latter variables. In 1996, 1991 and 1986 the annual earnings of someone who immigrated between the ages of 44 and 65 were [exp(b)*100%=] 75, 83, and 81 %, respectively (columns 3, 6 and 9, Table 3), of the annual earnings of an otherwise observationally equivalent immigrant who immigrated before age 5. Earlier we suggested three possible reasons: schooling received in the source country may yield a lower return than schooling obtained in Canada, pre-immigration labour market experience may yield a lower return than Canadian labour market experience, and the younger the age at immigration the more easily the person acculturates. In this section, the results for which are presented in Table 7, we examine the relative importance of the first two factors by estimating earnings functions that allow for different returns to foreign and Canadian education and experience. These regressions are not directly comparable to those in Table 3 or 4, but they explore a closely related issue. Rather than seeing age at immigration as being a variable of direct interest, they look at

what immediately follows: what difference does it make that immigrants who arrive at different ages obtain different portions of their human capital (schooling and/or job experience) in Canada. Chiswick and Miller (1985) and Kossoudji (1989) used this technique on Australian and US data, respectively.

The years of labour market experience are partitioned into three: those acquired in a foreign country, in Canada, and, because of Statistics Canada's groupings, in an "unknown" location. Years of schooling are similarly split into Canadian, foreign, and unknown education.[15] Since we only know total years of schooling, partitionings are predicated on the commonly used assumptions that there are no interruptions in school attendance, and that experience is the difference between age and years of schooling plus 5. Since not all immigrants arrive as adults, years of Canadian labour market experience is not equivalent to years since arrival and perfect multicollinearity, therefore, does not exist when immigrant cohort dummies and Canadian labour market experience enter a model fitted to a single cross-section of census data. Thus the identification issues are straightforward since age at immigration does not enter the regressions, and we do not employ the earlier two stage identification strategy. The regression results are shown in columns 3, 6, and 9, Table 7, for 1996, 1991 and 1986, respectively. For comparison purposes, the regression results for the Canadian born earnings function are shown in columns 1, 4, and 7, and the regression results for immigrant earnings without splitting experience and education are shown in columns 2, 5, and 8.

Regression results for immigrants are very similar across the three census years.

Foreign experience has a negligible impact on earnings whereas the return to an additional year of Canadian experience is positive, statistically significant, but only about 75 to 80 % of the return for the Canadian born. Experience of unknown origin can have a sizeable return. The return to pre- and post-immigration schooling are very similar and this specification suggests that it does not matter much where schooling was obtained. To the extent that it does matter, the return to post-immigration schooling is marginally the highest, but this return is only about 80 % of the return to schooling for the Canadian born. These results for the returns to foreign and Canadian experience and schooling are consistent with those obtained by Chiswick and Miller (1985), Kossoudji (1989) and Grant (1999). One phenomenon consistently observed in our results is that when education and experience are partitioned by source, each component of education yields a higher return than when experience and education are not split.[16]

Appendix Table 2 presents the cohort coefficients from the Table 7 immigrant regressions. There is, perhaps not unexpectedly, a substantial change in the slopes of the cross-sectional profiles (recall that they have different intercepts) depending upon whether the regression accounts for where immigrant education and labour market experience are obtained. Although it is beyond the topic of this paper, these results suggest it may be worthwhile to think about the problems inherent in controlling for years since migration and generating labour market earnings "assimilation" profiles. To say that assimilation is achieved after, say, 15 years does not make much sense when the sample contains child immigrants. Canadian education and labour market experi-

ence may have much more economic content.

4.3 Stratifying on Age-at-Immigration

An alternative empirical strategy for analyzing why age at immigration affects subsequent earnings allows for parameter heterogeneity between the Canadian born and immigrants, and among immigrants who arrived at different ages. As seen in equation 3, the approach consists of pooling immigrant and Canadian born data, and fitting an earnings function with separate coefficients for the Canadian born and each of three age-at-immigration groups: less than 10 years old (1986/91) or less than 13 years old (1996), 20 to 29 years old, and 35 to 64 years old. The remaining regressions elements are defined as in equations 1 and 2, and *ImmCohort* is a vector of immigrant cohort indicator variables with the same groupings as seen in the Appendix tables. Note that the cohort variables are common across the age-at-immigration groups, and that the *X* vector does not contain an intercept.[17] The pooled data excludes immigrants who arrived at ages not used in this analysis.

$$\ln w = b_0 + X b^{cb} + (X * \text{ImmAge0} to 10/13) b^{I0to10/13} +$$
$$(X * \text{ImmAge20} to 29) b^{I20to29} + (X * \text{ImmAge35} to 64) b^{I35to64} \quad (3)$$
$$\text{ImmCohort} * b^I_{\text{ImmCohort}} + \varepsilon$$

Those who arrived before age 10 (13) clearly received most, or all, of their schooling, and all of their labour market experience, in Canada. This group will also be the most acculturated upon entry into the labour force and will likely continue to acculturate comparatively easily. Those who arrived after age 34 likely received all of their formal schooling abroad and upon landing will have a substantial amount of

experience in a foreign labour market. They will have looked for their first job in Canada as the process of acculturation began, and will have been the most challenged by this process. Those who arrived as 20 to 29 year olds likely received all, or most, of their schooling abroad but will have had only a minimal amount of foreign labour market experience. This group likely also looked for their first job as the process of acculturation began, but will probably have been less challenged by this process than the older immigrants. A comparison of the returns to schooling and experience across these three groups therefore provides very useful additional information about why age at immigration affects earnings. By pooling Canadian born and immigrant data, the returns earned by immigrants in the three age-at-migration groups can be readily compared to the returns earned by the Canadian born.

The parameter estimates, in Table 8, for each immigrant group can be interpreted as deviations from the returns earned by the Canadian born. The basic patterns exhibit remarkable stability across the three census years. The results for the labour market experience variables conform to expectations, but differ qualitatively from those in Table 7. For immigrants who arrived in the youngest age group the return to experience is by far the highest, and is even higher than for the Canadian born (statistically significantly so in 1986 and 1991). This contrasts with the results in Table 7 where even the return to Canadian experience was lower for immigrants than the Canadian born. The findings are consistent with the hypothesis that immigrant families are highly motivated to rebuild their lives,[18] and that this produces superior performance when acculturation barriers are minimal. The return to experience for

immigrants who arrived in the middle age group is positive, but only about two-thirds of the return to experience of the group arriving at the younger age, and lower than the Canadian born. This is partly because the average member of this group will have some foreign labour market experience, which we earlier showed yields a negligible return. It may also be due to greater difficulty with acculturation and thus not acquiring Canadian specific human capital on the job as rapidly as the younger age group. For those who arrived as 35 to 64 year olds the return to labour market experience is nonexistent (in 1991, for example, both the linear and quadratic terms are almost equal and opposite to the Canadian born returns from which they are deviations). On average, labour market experience obtained outside of Canada has no economic return in Canada.

The results for the years of schooling variable show that the return to schooling for immigrants in the youngest age-at-arrival category (i.e. the return to post-immigration schooling) is about the same as the return earned by the Canadian born. However, the return to pre-immigration schooling (i.e. the return earned by those who immigrated after age 19) is about two-thirds of the return to post-immigration schooling. This is a much larger difference in returns than shown in columns (3), (6) and (9) of Table 7. The estimated difference between the returns to pre- and post-immigration education shown in Table 8 is consistent with the difference between the returns to education for immigrants and Canadian born shown in columns (1) and (2), (4) and (5), and (7) and (8) of Table 7. These latter differences are somewhat smaller than those shown in Table 8; however, this is what one would expect since the estimated return to education for immigrants

shown in columns (2), (5) and (8) of Table 7 includes the return earned by immigrants educated in Canada. Overall, this stratified model suggests that important parameter heterogeneity exists that is not visible in the models in Table 7.

The observed decline in the return to education as age at immigration rises could conceivably be the result of an improvement in the quality of education over time. Immigrants who are currently in the labour force and arrived at a young age will be on average younger, and thus have received their education more recently than immigrants who are currently in the labour force and arrived at a much older age. If the quality of education has been improving over time, and the market rewards this improvement, immigrants who arrived at a younger age should on average be earning a higher return to years of schooling. We checked whether this explanation is driving our return to schooling results by re-estimating the earnings function for the Canadian born with the additional specification that the return to schooling can vary by age. The model was fitted to data for Canadian born more than 19 years old and the return to education was allowed to be different for 20 to 39 year olds, 40 to 49 year olds, and 50 to 64 year olds. The results are consistent across the three census years and indicate that the return to schooling is slightly higher, not lower, the longer ago the education was obtained.

The results for the visible minority indicator variables in Table 8 show an extremely interesting pattern and provide strong evidence of the effect of acculturation on earnings. In each of the three census years, members of a visible minority who immigrated before age 10 (13 in 1996) have essentially the same reduction in their earnings as members of Canadian born visible minorities, about 7 or 8%. However, visible minority immigrants who arrived as 20 to 29 year olds, or as 35 to 64 year olds, experience statistically significant, and large, additional reductions in earnings relative to visible minority Canadian born, and these reductions increase with increasing age at migration. Less acculturation may lead to discrimination, to a lower than normal rate of return to human capital, or to both. Note also that while the point estimates of the earnings deficit for Canadian born visible minorities remained roughly constant from 1986 to 1996, it increased for visible minority immigrants who arrived as adults. The overall pattern indicates that while, on average, Canadian born visible minorities have lower earnings relative to other Canadian born individuals, the deficit is smaller than that for visible minorities in the population as a whole since the latter includes the very large deficits of immigrant visible minorities that arrive late in life.[19]

Although bumpy, the results for the mother tongue variables in Table 8 show that having English as one's mother tongue boosts the post-immigration earnings profile substantially for those who immigrated after age 35, somewhat for those who immigrated as 20 - 29 year olds, and not at all for those who arrived before age 10 (13). Since the ability to learn a new language declines with age, and since acculturation in the job market is critically dependent on language skills, this pattern supports our earlier conclusion that ease of acculturation is inversely related to age at immigration and that it is an important factor in determining immigrant earnings. However, no such pattern is discernible for immigrants with French as mother tongue. These regressions include controls for province of

residence, so this lack of an effect for French as a mother tongue is conditional on provincial wage effects. We ran separate regressions for those residing in Quebec, and in the rest of the country, but did not find noteworthy differences relative to Table 8.

5. CONCLUSIONS

Our analysis is the first detailed study of the effect of age at immigration on earnings using Canadian data. The results suggest that age at immigration matters. Those who arrive later in life experience, on average, low returns to both foreign labour market experience and foreign education. Further, we present some evidence that age at immigration also matters because the young acculturate more easily. Visible minority immigrants who landed before their teen years do not have an earnings deficit relative to observationally equivalent Canadian born. Visible minority immigrants who landed at an older age experience an earnings deficit relative to otherwise equivalent Canadian born and this deficit grows with age at migration. We also find that the return to English as mother tongue is essentially the same for immigrants who arrived before their teens and the Canadian born, but is higher for immigrants who arrived at an older age. This again suggests that acculturation is an important reason why age at immigration matters for subsequent earnings. There is no statistically significant evidence that this is also true for immigrants whose mother tongue is French.

We also observe that immigrants who arrive in their late teens, near the high school to post-secondary transition, have lower earnings than those who arrive either slightly earlier or later. This deficit, however, disappears when we control for education and other variables. Further

examination shows that this age-at-immigration group appears to obtain less education than surrounding ones. It is plausible that entering a new society near this crucial transition induces those involved to obtain less schooling and that this has a life-long earnings impact.

Our results can be used, in conjunction with other criteria, to assess the design of the point system currently used (in 2000) in Canada to determine the eligibility of "skilled" applicants for immigrant status. In this system, 49 of the 100 points that can be earned are for four key variables in our analysis: age at immigration (10 points), education (16 points), work experience (8 points) and language ability (15 points). It is important to understand how these points align with immigrants' expected labour market outcomes.

For age, the system allocates the maximum number of points to applicants in the 21-44 year age group. This allocation is reduced by 2 points for each year below and above this range. Our results indicate that within the 21-44 year age group economic integration declines appreciably with age at immigration. A more appropriate allocation of points for age would take this into account, possibly by allocating 10 points to 21-24 year old applicants and lowering this amount by 2 points for each successive 4-year age cohort, so that no points are assigned for age to applicants older than 44 years, as opposed to 48 years as is currently the case.

The 16 points for education can be earned in a variety of ways, of which the basics are as follows: 5 points for completing a secondary education that does not to lead to a post-secondary education, 10 points for completing a secondary education that can lead to a post-secondary

education, 15 points for a first university degree, and 16 points for one or more graduate degrees. Our analysis measures education in terms of years of schooling and is not suitable for commenting in detail on this point allocation. However, our results in Table 7 do indicate that age-at-immigration and education interact in their effect on the economic integration of immigrants. Of course, since education and social programs are subsidized in Canada, issues other than earnings are required to understand the economic implications of the policy parameters.

A minimum of one year of work experience in the intended occupation is an essential requirement for admission as an immigrant under the point system. A maximum of 8 points can be earned for 4, or more, years of experience. Our results support this modest point allocation for labour market experience. Again, age at immigration is crucial. For immigrants who were more than 29 years old at entry, foreign labour market experience is not a marketable asset that yields a return in Canada (Table 7). However, immigrants who arrived in their twenties (i.e., few years of foreign labour market experience) earn about two-thirds of the Canadian born return for their foreign labour market experience. While our results are not sufficiently disaggregated to be definitive, they do suggest it may be worthwhile to explore whether the point system should consider foreign work experience an asset, and particularly, whether the lack of foreign work experience should bar an otherwise well-qualified candidate.

The current point system assigns a maximum of 15 points for being fluent in either of Canada's official languages. Our regression results indicate that as age-at-immigration rises having English as

mother tongue greatly assists economic integration. The substantial weight for fluency in English is therefore supported by our results. However, our results did not indicate that fluency in French facilitates the economic integration of immigrants who arrive at an older age.

Revisions to the current point system have recently been proposed by the Ministry of Citizenship and Immigration Canada (2000). The most notable proposed change is the substantial increase in the weight given to foreign labour market experience, from a maximum of 8 points out of a 100, to 25 points out of 100 for four, or more, years of skilled labour market experience. As noted earlier, our results indicate that foreign labour market experience yields little, or no, return in the Canada and thus do not support this increased emphasis. The exception would be if the negligible return to foreign labour market experience is the result of Canadian labour market imperfections, such as credential recognition, that can be corrected.

The proposed point system continues to assign a maximum of 10 points out of 100 to immigrants who are 21 – 44 years upon arrival, and has the same reductions as before for ages outside this range. Thus, as in the current point system, the proposal assumes that, *ceteris paribus,* economic integration is the same for immigrants who are 21 – 44 years old upon arrival. Our results do not support this assumption and, as noted earlier, suggest that points for age at immigration should decline rapidly as age at immigration rises above 30 years.

The proposed increase in the weight for language from 15 points to 20 points is supported by our finding that immigrants do substantially better if they have

English as mother tongue.[20] In fact, our results suggest that points for mother tongue should vary with age at immigration since mother tongue appears to be an especially important determinant of economic integration for those who arrive at an older age.

We believe that the findings here raise questions about the current, and proposed, allocation of points, in particular those for age and past labour market experience. However, since we cannot isolate immigrants who were assessed under the points system from those who were not, there is a need for further research using administrative data. Additionally, there may be a need for programs to help young immigrants who arrive in their mid to late teen years in making the transition to post-secondary education.

Notes

[1]See Smith (1992), Friedberg (1993), Borjas (1995), Funkhouser and Trejo (1995). Addressing age at immigration in cohort studies is important because the normal procedure for constructing a sample for analysis from (repeated) cross-sectional data induces a correlation between the year of immigration (arrival cohort) and age at immigration. To be of working age and, therefore, in the sample, the earliest cohorts must have immigrated as children, and the most recent cohorts must have arrived as adults.

[2]See Borjas (1993, 1994) for a survey of the economics of immigration and a comparison of Canada and the U.S.

[3]The points system, analyzed in Green and Green (1995), applies only to the principal applicants in the "skilled" (also called "independent") class of immigrants and not to their spouses and dependents, nor to refugees. Immigrants arriving as part of a family reunification have been subject to the points system only in certain policy regimes. An immigrant's entry category cannot be identified in the available data.

[4]Note that pooling the data across censuses is not required for a quasi-panel (time series of cross-sections) analysis (as in Baker and Benjamin 1994). Although not the focus of the paper, we did perform such an analysis to see if the addition of age-at-immigration variables affected the cohort assimilation profiles. We find that while their addition has a large effect on the cross-sectional profiles in each year, the effect is similar for the three years and the change in the assimilation profile (across censuses) is negligible. Borjas (1995), and Funkhouser and Trejo (1995), report the introduction of age at immigration as having a similar negligible effect on the assimilation profile. Interested readers can construct assimilation profiles from the coefficients presented in the appendixes.

[5]Note that, if years of schooling is a regressor, then the same problem occurs if age is replaced by potential experience.

[6]Baker and Benjamin (1994) explore the implications of using different comparison groups in a fairly standard specification. They find that the choice does not substantially alter their results.

[7]Murphy and Welch (1990) explore shape of the age-earnings profile and argue for a quartic.

[8]Quebec, Ontario, Prairies, Alberta and British Columbia: the Atlantic provinces and the Territories are excluded from the sample since their immigrant characteristics are severely grouped by Statistics Canada.

[9]We explored this in some detail to ensure it did not result from the revision of the age-at-immigration ranges in the 1996 census.

[10]Before 1962, immigration was tightly controlled by country of origin (primarily the United Kingdom, the United States, France, and north-western European countries). Between 1962 and 1967 these restrictions were removed and a point system was introduced to limit the entry of principal independent applicants on the basis of skills needed in Canada. This point system still exists today in a revised form but has never included country of origin as a category. The point system does not apply to sponsored immigrants and refugees. Green and Green (1995) contains a good summary of Canadian immigration policy in the post-war period, as well as an analysis of its impact on the composition of the inflow of immigrants. They conclude that over time the independent immigrant has become the residual immigrant, and that the initial positive impact of the point system on the skill set of new immigrants has subsequently been swamped by an inflow of immigrants to whom the point system does not apply.

[11]Since immigrants are more concentrated in urban areas, and there may be substantial parameter heterogeneity across urban and rural regions, this and all our subsequent models were also fitted to the data for the urban population only. The conclusions are very similar and the results are not reported in this paper.

[12]The substantial increase from 1991 to 1996 in the earning's deficit for immigrants may be partly due to the sharp recession of the early 1990's, when recent immigrants probably had relatively more difficulty finding employment. We are indebted to an anonymous referee for this point.

[13]We use linear probability models given the sample size and our restricted set of variables; see Moffitt (1999) for a discussion of the rationale for using the linear probability model.

[14]There are a wide variety of college programs in Canada, some of which do not require a high school diploma. We cannot distinguish between types in the census data.

[15]The category "unknown education" exists because age-at-immigration is not known exactly, but only by age intervals. Thus, minimally, the amount of post-immigration schooling is years of schooling plus five minus the upper limit of the age-at-immigration category, if this sum is positive, and zero otherwise. At most, the amount of post-immigration schooling is years of schooling plus five minus the lower limit of the age-at-immigration category, if this sum is positive, and zero otherwise. The lower estimate of post-immigration schooling is used for Canadian education. The years of foreign education is the years of schooling minus the upper estimate of post-immigration schooling. The years of schooling in the "unknown" category is the positive difference between total years of schooling and the sum of our estimates of Canadian and foreign years of schooling. The treatment of experience is essentially identical.

[16]We also estimate a version of the model where all years of education are assigned as Canadian, foreign or unknown based upon where we estimate that the education was *completed*. The results are substantially similar. Further, we estimated models in which schooling and experience were split in turn. Both sets of variables have effects that are in the same direction as those presented, but the experience effect is larger when schooling is not split.

[17]Since potential experience and years of school, which together implicitly define age, are included in the regression, if the age at immigration groupings were reduced to single years, then giving each it's own intercept would cause an identification problem. In our regressions the intercepts are be identified because of larger groupings (e.g. 20 to 29); that is because of the functional form restrictions. Our use of a single intercept is akin to Borjas's (1995) restriction that the year effects are common to immigrants and the native born. We have not had to make this restriction in the regressions in Tables 3 and 4 since we are not estimating assimilation profiles. An alternative approach to equation 3 is to include intercepts for each age at immigration grouping (e.g. 20 to 29), and drop the immigrant cohort variables. We did this exercise and found only very small differences in the estimated regression coefficients. Borjas (1999, Sect. 4.1) discusses identification in this context and points out the importance of recalling that alternative specifications lead to different estimates of the underlying parameters, and require different interpretations.

[18]Borjas (1987) examines self-selection and the earnings of immigrants in the wider context of economic and political conditions in the source and host countries.

[19]The increase across the census years in the earnings differential across the age-at-immigration groups for visible minorities may be partly due to the changes that have occurred in the country of origin for visible minorities that are not completely captured by the cohort indicator variables. For a given census year, visible minority immigrants who arrived at an older age will have arrived more recently, and thus from different countries of origin, than those who arrived at a younger age. We are indebted to an anonymous referee for this point.

[20]Of course, it is probably Canadian language skills at landing that matter, but we do not have a measure of that in the census data.

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