Explaining the Education Gap Between Children of Immigrants and the Native Born: Allocation of Human Capital Investments in Immigrant Families

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Abstract

This paper seeks to understand the source of the well documented observation that second generation immigrants in North America are on average better educated than the remaining native born. This difference persists even after conditioning on parental education and ethnic origin. The gap is often ascribed to stronger preferences for education or higher ability among immigrant parents. I show, instead, how such a gap can arise in a standard human capital framework where parents choose both how much to invest in their own human capital, and the optimal level of schooling for their children. The key insight from the model is that the gap in education can develop even in the absence of differences between immigrants and the native born along unobservable dimensions such as ability, preferences or discount factors. Rather, it may arise as an optimal response to institutional factors such as imperfect transferability of foreign human capital and the presence of credit constraints among low educated individuals in general. The model yields several testable implications. I evaluate them using the Ethnic Diversity Survey, a relatively unexplored Canadian post-censal survey with a unique combination of information and sample design. Under reasonable assumptions, immigrant parents with low education are predicted to optimally invest in higher levels of education for their children than similarly educated, native born parents. In contrast, among children of well educated parents, the second generation – native born gap, if present at all, may be negative. Furthermore, we should not see any difference in educational attainment, conditional on parental education and ethnicity, between third generation immigrants and the remaining native born. These patterns are indeed present in the data. The model also has direct implications for the relationship between the amount of schooling of immigrant children and the slope of their parents' post-migration earnings profiles. We should see educational attainment falling as the slope of parental earnings rises among children of immigrants with low education levels, indicating a tradeoff in human capital investments in immigrant families. I find strong evidence of such a tradeoff occurring in families with low educated parents, but not in families where at least one parent has a post-secondary education.

1 Introduction

Immigrants are not a random draw from their source country population and typically differ from the host country population along observable and perhaps unobservable dimensions. The resulting immigrant–native born disparities in labour market experiences have attracted much attention in the literature and continue to do so as the characteristics and outcomes of immigrants to North America continue to change.[1] The contribution of immigrants to a host economy, however, extends beyond the impact of the migrant generation. Equally important are outcomes of their descendants. While intergenerational transmission of earnings among immigrants has been the subject of several studies, one of the key determinants of earnings – education – remains poorly understood in the immigrant context.[2] Second generation immigrants in Canada and the US are as a group better educated than the native born. The puzzling aspect of this result is that there remains a substantial gap even after conditioning on several socio-demographic characteristics including parental education and ethnic origin. My objective in this paper is to explore in an economic framework how such a systematic difference in educational attainment between children of immigrants and the native born could arise.

There have been previous attempts at explaining why children of immigrants are on average better educated than the remaining native born in Canada, e.g. Hansen and Kucera (2004), and the US, e.g. Chiswick and DebBurman (2004). They show that characteristics such as age, ethnicity, language skills, parental education, and geographic location fail to explain the entire difference in mean educational attainment and attribute the remaining gap to factors such as stronger preferences for education or higher ability among immigrant parents. I show that such a gap can arise even in the absence of differences in unobservables such as ability, preferences or discount factors. In a standard human capital framework where parents make simultaneous decisions about investments in their own human capital and education of their children, a gap in education may develop as an optimal response to institutional factors such as imperfect transferability of foreign human capital and credit constraints. This model yields testable implications that stand up in the data.

The key source of differences between immigrant and native born parents in this model is the standard assumption that human capital is not fully transferable between countries. I follow

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[1] As the source country composition of immigrants to North America has been shifting away from European countries over the past three or so decades, successive immigrant cohorts have also been experiencing declining entry earnings. This phenomenon is the subject of several studies in Canada, e.g. Baker and Benjamin (1994) and Green and Worswick (2004), and the US, e.g. Borjas (1995) and Duleep and Regets (2002).

[2] Aydemir, Chen and Corak (2005) study intergenerational transmission of earnings among immigrants in Canada, while Card, DiNardo and Estes (2000), Card (2005) and Borjas (1993, 1994) do so for the US, and Epstein and Lecker (2001) for Israel.

Duleep and Regets (2002) in assuming that foreign human capital is at least as useful in acquiring new skills as it is in generating earnings. I argue, however, that this is only true for immigrants with high education. As a result, well educated immigrants can be expected to invest more in their human capital than comparable native born, while immigrants with low education – less. Under the assumption of binding credit constraints among individuals with low education, the model predicts that children of immigrants will outperform their native born counterparts in educational attainment, while their parents spend more time in the labour market and less time investing in their own human capital. In contrast, children of immigrants with high education will acquire less schooling than comparable native born, if the present value of their parents' earnings is lower than that of similar, native born parents.

I test the model's implications using data from the Ethnic Diversity Survey (EDS), a Canadian post-censal survey from 2002. This data set contains information on parental education, crucial to testing the model's key predictions. Parental birthplace and rarely available information on the birthplace of grandparents allow me to apply a more precise definition of second generation immigrant status. I am also able to compare outcomes of second and third generation immigrants with those of the fourth-and-higher generation. Finally, oversampling on the basis of generation status and ethnic ancestry in EDS provides relatively large samples of each generation group, particularly the second generation. It also ensures that larger non-European ethnic minority groups are well represented in the sample. Given the changing ethnic composition of immigrant inflows, the future second generation will be an increasingly diverse group. This raises the need for analysis based on data reflecting that diversity. To my knowledge, the combination of sample design and information required for the analysis in this paper is not available in any other US or Canadian micro data set commonly used in immigrant studies.

I find that the gap in educational attainment of second generation immigrants, conditional on age, parental education and ethnic origin, is indeed driven by individuals from low education backgrounds. No such advantage is observed among children of well educated immigrants; if anything, their attainment is slightly inferior to that of comparable native born. Third generation immigrants are also on average better educated than the fourth generation. However, once age, parental education and ethnic origin are controlled for, there no longer is a significant difference between the two groups. This is consistent with the model's prediction since parents of third generation immigrants are educated in Canada and, therefore, do not experience problems with skill transferability. Further, I find direct evidence of a tradeoff between investment in parental human capital and children's schooling. The growth rate of parental earnings, indicative of investment in parental human capital within the context of a standard

human capital model, has a significant negative relationship to total years of schooling among children of immigrant parents who did not complete any post-secondary education. That effect is still negative but much smaller and not statistically significant among children of immigrants with a post-secondary education.

My results highlight areas of policy concern. The points system of immigration in Canada targets well educated immigrants. This policy contributes to high education levels among second and third generation immigrants, thus raising the overall education level in the country. However, the educational attainment of children of well educated immigrants from more recent cohorts may decline if the falling entry earnings faced by those cohorts also result in falling present value of their post-migration earnings. In contrast, children of immigrants with low education are outperforming their native born counterparts in educational attainment and will likely continue to do so.

The studies closest in spirit to the analysis in this paper are Epstein and Lecker (2001) and Caponi (2004). The former paper explains the higher earnings among second generation immigrants than the native born in Israel in the context of a model of bilateral altruism between two consecutive generations. This specific preference structure yields the prediction of higher investments in human capital among individuals with immigrant parents who earn less than the native born. Further implications of this model regarding outcomes of third generation immigrants do not match patterns observed in Canadian data, however. Caponi (2004) develops a general equilibrium model in which discounting of foreign human capital in the host country labour market and altruism towards children are shown to generate the observed U-shaped relationship between human capital and the decision to emigrate in the Mexican population. This study differentiates between parental human capital useful in generating earnings and that transferred to children, where the latter is not subject to discounting. Such distinction leads to the prediction that children of immigrants from more recent cohorts facing lower entry earnings due to higher discounting of foreign human capital in the labour market will be able to overcome their parents' disadvantage in earnings. In the context of this model, first generation immigrants would need to have sufficiently higher human capital levels than the native born, different preferences or different human capital production technology in order for their children to outperform the native born in educational attainment.[3] Neither of these studies, however, sets out to explain the observed gap in educational attainment between children of immigrants and the native born, which is the focus of my paper.

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[3]These appear to be the required conditions in the partial equilibrium version of the model presented in Caponi (2004).

The contributions of this study to the literature are as follows. The paper explores sources of the observed gap in educational attainment between children of immigrants and the native born in an economic framework. This gap while documented, has not been previously systematically explored. Further, no previous study of second generation immigrant outcomes, e.g. earnings, examines the consequences of parental post-migration human capital investments, although the presence of such investments lies at the core of the immigrant literature.[4] The approach I take reveals the presence of human capital investment tradeoffs in immigrant families which can give rise to a gap in educational attainment between second generation immigrants and the native born even in the absence of differences along unobservable dimensions, such as ability, preferences or discount factors. Finally, the data I use allow me to identify and study third generation immigrants, a group that has received very little attention in previous literature.

The paper proceeds as follows: Section 2 discusses the relevant literature. Section 3 presents the theoretical framework. Section 4 presents the data. Section 5 explores key patterns in educational attainment among the descendants of immigrants. Section 6 tests the relationship between the slope of parental earnings profiles and children's educational outcomes. Section 7 briefly discusses alternative hypotheses about the sources of the gap in educational attainment between second generation and the native population. Finally, Section 8 concludes.

2   Literature Review

The existing literature that documents earnings and educational attainment of the first and second generation immigrants in various countries reveals different patterns of intergenerational assimilation. Several European studies provide evidence of smooth assimilation in the second generation in terms of various measures of educational attainment. For example, Van Ours and Veenman (2001) find that in the Netherlands, second-generation immigrants close the gap between their parents' educational attainment and that of the native population. This is true of ethnic groups that are on average less and more educated in the first generation than the average Dutch native. They further show that the gap in attainment between second-generation males and their native counterparts is almost entirely explained by parental education differences, but this is not the case for women. Gang and Zimmermann (2000) also find convergence to the mean in educational attainment among the second generation immigrants in Germany. The gap that still separates that generation from the native Germans cannot be explained by differences

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[4]Lower entry earnings and steeper earnings profiles of immigrants relative to the native born have been explained frequently in the context of a human capital model, e.g. Chiswick (1978) and Duleep and Regets (2002) to name a couple of examples. The family investment hypothesis also explores the division of investment and borrowing functions between spouses in immigrant families, see e.g. Baker and Benjamin (1997).

in standard socioeconomic characteristics. In addition, parental education appears to have no predictive power for the second generation's outcomes. Riphahn (2003) further documents that the gap in educational attainment between children of immigrants and German natives has been growing over the past few decades, a fact that the author attributes to the changing ethnic composition of immigrants to Germany.

A different pattern is documented in studies on data from Canada, the US and Israel, where second generation immigrants are found to outperform the native born population in education and earnings. The source of these differences between the European and non-European countries is beyond the scope of this paper. It is possible that differences in education systems, ethnic composition and class of immigrant contribute to this cross-country variation in outcomes of immigrant children.

Hansen and Kucera (2004) analyze the educational attainment of second generation immigrant men in Canada as compared to Canadian natives (i.e. third and higher generations) using the Survey of Labour and Income Dynamics (SLID). They find that after controlling for several individual characteristics including parental education, visible minority status, English or French mother tongue and ethnic origin, there still remains a gap in educational attainment in favour of the second generation immigrants. Further, once indicators for parental education and mother tongue were included in regressions, ethnic origin had little additional predictive power. One drawback of the SLID data is that the second generation immigrant sample is composed predominantly of individuals of European origin. It is not obvious that results based on this sample will generalize to other ethnic groups that are becoming increasingly more prominent among second generation immigrants in Canada.

Worswick (2004) looks at the performance of immigrants' children in Canadian schools using data from the National Longitudinal Survey of Children and Youth covering the 1994-1999 period. He finds that children age four to six with an immigrant parent have lower performance on vocabulary tests than children of Canadian born parents. For children with an immigrant parent whose mother tongue is neither English nor French, this initial disadvantage is still evident in performance on reading tests at older ages, but disappears by age fourteen. There is no difference in performance on mathematics tests between children (aged seven to fourteen) with immigrant and Canadian born parents.

Chiswick and DebBurman (2004) find that second generation immigrants in the US who have only one immigrant parent have slightly higher education levels than those with two immigrant parents, controlling for several socio-demographic characteristics that do not include parental education. They attribute the overall higher education levels of second generation immigrants

(US born individuals with at least one immigrant parent) to on average higher ability parents (due to immigrant self-selection) who are therefore "more inclined to invest in their children's schooling than native-born parents" (p373).

The above average earnings of second generation immigrants have received more detailed attention in the literature than educational attainment directly. Aydemir, Chen, and Corak (2005) study the intergenerational mobility in earnings among immigrants in Canada and the possible channels of transmission. They take advantage of new information on parental birthplace in the 2001 Canadian Census to identify second generation immigrants. The Census does not contain information on parental education or earnings, hence the authors calculate average earnings and education of "potential fathers" from the 1981 Census. They find that although paternal earnings have a significant effect on years of schooling of children (particularly sons), the overall importance of this channel in the generational earnings elasticity is small. They also find that conditional on average education of potential fathers, second generation immigrants from low income ethnic groups become above average earners.

In the US, Card, DiNardo, and Estes (2000) find that controlling for differences in region of residence, age and ethnic composition, second generation immigrants also have the highest average wages compared to the rest of the US population. Furthermore, this advantage is apparent over the 1970 - mid-1990s period despite increasing wage inequality and the changing age and ethnic composition of the second generation. A study of intergenerational transmission of earnings reveals that education of the second generation is the main transmission mechanism. They find that potential fathers' earnings have a significant effect on education and earnings of second generation immigrants observed in the 1970 US Census. For second generation immigrants observed in the 1994-1996 Current Population Survey in contrast, it is paternal education that has a significant effect. Further, when the children's education is controlled for, fathers' outcomes no longer have a significant effect on earnings.

Using data from the 1995-2002 Current Population Survey, Card (2005) shows that the higher wages of second generation immigrants in the US can be explained to a large extent by their higher education levels relative to the US natives and by their geographic distribution. Children of immigrants obtain above average education levels even though their parents are on average less educated than the third and higher generation.

Borjas (1994) analyzes the intergenerational convergence of skill differentials, measured by education/literacy and earnings, among descendants of the Great Migration in the US (immigrants who arrived between 1880 and 1910). He finds that the skills differences between the various ethnic groups represented among those immigrants were still visible among their grand-

children. This study utilizes the General Social Survey to identify potential grandchildren of the Great Migration, third generation immigrants. The sample size of the individual GSS cross sections is very small, however. One could obtain an overall sample comparable in size to EDS by pooling the 25 cross sections spanning a 32-year period from 1972 to 2004. Further, there is no information on year of immigration of the respondent in this data.

Aydemir and Sweetman (2006) compare education and labour market outcomes of first and second generation immigrants in Canada and the US. They too show that current second generation immigrant outcomes in both countries are superior to those of the first generation, and at least as good as those of the remaining native born. Important differences exist, however, between the two groups which point to a divergence of outcomes between the two countries among future second generation immigrants, with a further improvement in Canada but a deterioration of outcomes in the US.

The earnings advantage of the second generation is also evident in data from Israel analyzed in Epstein and Lecker (2001). The authors are able to identify individuals whose parents immigrated to Israel as young children and treat them as third generation immigrants. They focus on immigrants from Asian and African origins and identify immigrants from the 1948-1952 period, their potential children and grandchildren from the 1995 Israeli Census data. The study finds that immigrants and third generation immigrants earn on average less than their native born counterparts, while the second generation earns more. The authors explain this pattern in the context of a model of bilateral altruism between two consecutive generations. This specific preference structure yields the prediction of higher investments in human capital among individuals with immigrant parents who earn less than the native born. The model therefore implies, that third generation immigrants will invest less in human capital and earn less than comparable native born. This pattern of education and earnings among third generation immigrants is not present in Canadian data, where third generation immigrants are on average better educated and earn more than the native born (Bonikowska (2005)).

Two further studies which seek to understand what factors affect the decision to migrate also have implications for human capital and/or earnings of second generation immigrants. In Borjas (1993) relative returns to skills between countries as well as the degree of intergenerational mobility play a crucial role in the migration decision. The model assumes that only skills valued in the host country labour market are passed on to children. This implies that highly educated immigrants whose credentials are not fully recognized in the host economy will have low earnings post-migration and so will their descendants. This model does not allow for the possibility that children of well educated immigrants will also be well educated. Further, having been educated

in the host country, they will not face the loss of human capital their parents did upon entry into the host country labour market and thus could earn higher incomes than their parents. The model also predicts that skilled parents will have no incentive to migrate to countries with relatively high intergenerational mobility since it will be more difficult for them to pass their skills, and hence earnings potential, to their children there. If one is willing to equate education level with skill level, however, this prediction is not easily reconciled with Canadian data. Canada has one of the highest rates of intergenerational mobility in earnings among developed countries, higher than the US and UK (Fortin and Lefebvre (1998), Grawe (1998), Aydemir, Chen, and Corak (2005)), yet it attracts many well educated immigrants.[5]

Caponi (2004) builds on the intergenerational model of migration in Borjas (1993) to explain the U-shaped relationship between human capital and the decision to migrate in the Mexican population. He differentiates between intrinsic human capital, which immigrants accumulate in their source country, and marketable human capital, the fraction of intrinsic human capital that is useful in generating earnings in the host country. It is intrinsic human capital of parents (as opposed to the marketable human capital as in Borjas (1993)) that is assumed to be transferred to children. Children's human capital accumulation is a function of parental human capital as well as schooling inputs purchased by parents, and an idiosyncratic shock. One prediction of the model which contrasts with Borjas (1993) is that the disadvantage faced by immigrant parents in the host country labour market due to imperfectly transferable human capital will not be passed on to the second generation. However, lower parental earnings due to foreign human capital discounting in the labour market leave less income to purchase children's schooling inputs with, all else equal. In the context of this model (or at least a partial equilibrium version thereof), we would have to assume differences in preferences, human capital production technology, or the average human capital of parents in order to obtain the prediction that second generation immigrants will acquire on average more schooling than comparable native born.

3   Theoretical Framework

The model presented in this section extends the basic human capital model to include an intergenerational dimension. Parents care about the outcomes of their children, specifically the level of human capital with which adult children enter the labour market. The key difference between immigrant and native born parents is that the former lose a portion of their foreign-

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[5]Grawe (1998) conducts a cross-country comparison of intergenerational transmission of earnings. He finds that estimates of intergenerational mobility in the US are sensitive to the data set used for the analysis. In particular, the difference in the average intergenerational mobility between Canada and the US is quite large when the US estimates are based on the Panel Study of Income Dynamics (PSID), but very small when based on the Original Cohort National Longitudinal Survey (NLS).

acquired human capital upon migration. Human capital is used in two types of activities: generating earnings and acquiring new skills. The relative degree of transferability of foreign human capital to these two activities will depend on the immigrant's initial level of human capital, shaping incentives to invest more or less in human capital than comparable native born. In contrast to existing models, I explore the tradeoffs and complementarities in investment that arise when immigrant parents choose how to allocate resources between two types of human capital investments simultaneously: their own and their children's.

There are three periods in the model. Period 0 represents childhood where individuals spend their entire time endowment acquiring human capital with schooling inputs purchased by their parents. In period 1, adult individuals decide how to divide their time endowment between working in the labour market, and investing in host country specific human capital, t. They also decide how to allocate period 1 income between schooling inputs for children, S, and their own consumption, C_1. In period 2, individuals spend their entire time endowment working, and collecting the benefits of previous investments in their own human capital. The price of consumption is normalized to 1 in each period. Time endowments in each period are also normalized to 1.

Period 1 and 2 budget constraints are given by:

$$C_1 + pS + x = a\tau_{m1}H_p(1-t) \tag{3.1}$$

$$C_2 = x(1+r) + a(\tau_{m2}H_p + H_p') \tag{3.2}$$

Labour market earnings per unit of time are a function of human capital, H_p. In case of immigrants, only a fraction τ_{m1} of the source country human capital is productive in the Canadian labour market in period 1. τ_{m2} is the equivalent proportion in period 2, and $\tau_{m2} \geq \tau_{m1}$ allowing for the possibility that initial human capital becomes more transferable with time spent in the host country labour market independently of any human capital investments. The return to a unit of productive human capital, a, is the same for immigrants and the native born. The wage is therefore given by $a\tau_{m1}H_p$. All individuals can save or borrow against future earnings (x) at an interest rate r. Parents cannot however accumulate debt that can be passed to children at the end of the second period.

The main input into the production of human capital in childhood is parental investment:

$$H_c = \gamma_c S^\xi \tag{3.3}$$

where γ_c is an individual-specific productivity factor and $\xi < 1$. Schooling inputs may represent anything from tuition (for private primary or high school, college or university), tutors, savings for child's post-secondary education, rent-free accommodation during university etc.

Human capital investments after entry into the labour market are the choice of the adult individual. The main inputs into the production of additional human capital, H_p', are assumed to be time and the individual's existing stock of human capital. Skills that an individual already possesses can increase his productivity in acquiring new skills. The production function for new human capital takes the following form:

$$H_p' = \gamma_p t^{\delta_1} (\tau_p H_p)^{\delta_2} \tag{3.4}$$

where τ_p is the proportion of initial (foreign-acquired in case of immigrants) human capital useful in the production of new skills, and γ_p is an individual-specific productivity factor or endowment. $\delta_1 < 1$ allowing for diminishing returns to time spent in investment activities, $0 < \delta_2 < 1$.

Immigrant parents maximize the following utility function subject to equations (3.1), (3.2), (3.3) and (3.4):

$$U = log C_1 + \beta(log C_2 + \alpha log H_c) \tag{3.5}$$

where α is an altruism parameter, or more directly, a preference parameter for the child's education, C_1 and C_2 are period 1 and 2 consumption, respectively, and β is the discount factor.

For native born individuals, τ_{m1}, τ_{m2} and τ_p are equal to 1. In evaluating the role of imperfect human capital transferability on optimal choices among immigrants, the degree to which foreign human capital is transferable to its two main uses, generating earnings and new human capital, is important. Imperfect transferability in the labour market may take the form of foreign credentials not being recognized in the host country, whether due to imperfect information about what skills these credentials represent, or because the actual skills are lower than or just different from those required in the host country labour market. It may also represent foreign experience being valued at a lower rate than Canadian experience or not recognized at all. Finally, insufficient host country language skills may prevent an immigrant from utilizing his or her other skills in the labour market.

Duleep and Regets (2002) argue that we can assume foreign human capital to be at least as transferable to the production of new human capital as to the host labour market, i.e. $\tau_p \geq \tau_{m1}$, for the following reasons. At least some of the imperfect transferability is the result of imperfect information about foreign credentials and what skills they actually represent, or difficulty in verifying foreign experience. Another reason is that while occupation-specific skills may be difficult

to transfer between countries, skills used in acquiring new human capital of any kind should be easier to transfer. Finally, even if occupation-specific skills acquired in the source country do not meet the requirements of the host country labour market, they may make acquiring the host country human capital much easier due to similarities between the two sets of skills.

However, τ_p will still be less than 1 for immigrants if the skills they do possess are not as useful in acquiring new skills as human capital accumulated in the host country would have been. Difficulty with upgrading occupation-specific skills due to lack of proficiency in the host langauge is the most natural example.

The above argument works best for immigrants with high human capital at arrival, whom I will refer to as immigrants with high education. Immigrants with low education, on the other hand, may in fact have little or no human capital that could be subject to discounting in the labour market. For example, they may be providing unskilled labour services to the labour market identical to those provided by native born workers with little formal schooling. However, the human capital they do possess may still be less productive in the acquisition of new skills than that of comparable native born. Again, insufficient host country language skills are one example (assuming that unskilled labour services are much less language dependent than skilled labour services). Therefore, we could argue that for immigrants with low education, $\tau_{m1} \geq \tau_p$.

The implication of the above assumption is that the gap between entry earnings of immigrants and earnings of comparable, native born workers is larger among individuals with high education than among those with low education. I'm essentially assuming a higher compression of wages at the bottom of the wage distribution. This is also a way to prevent wages from falling arbitrarily low in the market. Although not necessary to achieve the results presented in the next two subsections, for ease of exposition I will assume that such a compression is achieved with a minimum wage, and that in fact, immigrants with low education face the same wage, the minimum wage, as native born workers with low education. Their period 1 earnings, therefore, can be written as $w_{min}(1-t)$.

Optimal investment decisions of immigrants compared to the native born will differ for individuals earning the minimum wage and those earning higher wages, i.e. differ by education level. I will consider these two groups separately.

3.1 Optimal investments with borrowing

The first order conditions for the individual's problem are:

$$\frac{1}{C_1} = \lambda_1 \tag{3.6}$$

$$\frac{\beta}{C_2} = \lambda_2 \tag{3.7}$$

$$\frac{\beta\alpha\xi}{S} = \lambda_1 p \tag{3.8}$$

$$0 = \lambda_1(a\tau_{m1}H_p) - \lambda_2(a\gamma_p(\tau_p H_p)^{\delta_2}\delta_1 t^{\delta_1-1}) \tag{3.9}$$

$$\lambda_1 = \lambda_2(1+r) \tag{3.10}$$

From 3.9 and 3.10 we can obtain the optimal amount of time devoted to investments in own human capital as:

$$t^* = \left(\frac{\gamma_p\delta_1(\tau_p H_p)^{\delta_2}}{(1+r)\tau_{m1}H_p}\right)^{\frac{1}{1-\delta_1}} \tag{3.11}$$

The optimal level of schooling inputs purchased for children is given by:

$$S^* = \frac{\beta\alpha\xi}{p(1+\beta+\beta\alpha\xi)}\left[a\tau_{m1}H_p(1-t^*) + \frac{a\tau_{m2}H_p}{1+r} + \frac{a\gamma_p t^{*\delta_1}(\tau_p H_p)^{\delta_2}}{1+r}\right] \tag{3.12}$$

From the above two equations, we can derive the comparative statics of interest, namely how optimal investments in parental human capital and children's schooling vary with the degree of transferability of foreign human capital of immigrant parents to its two uses, generating earnings and new skills (see details and caveats in Appendix A):

$$\frac{\partial t^*}{\partial \tau_p} > 0 \tag{3.13}$$

$$\frac{\partial t^*}{\partial \tau_{m1}} < 0 \tag{3.14}$$

$$\frac{\partial S^*}{\partial \tau_p} > 0 \tag{3.15}$$

$$\frac{\partial S^*}{\partial \tau_{m1}} > 0 \tag{3.16}$$

Transferability of foreign human capital to human capital production activities and the labour market, (3.13) and (3.14) respectively, has the opposite marginal effect on the optimal amount of time immigrants spend investing in their human capital. Time is the main input into production of new parental human capital in this model. Foregone earnings, therefore, are the

main cost of investment. I am assuming that there are no differences between immigrants and the native born in direct costs of investment in own human capital, and therefore their actual magnitude does not contribute to differences in optimal choices between immigrants and the native born. From (3.14), higher transferability to the labour market means higher marginal cost of investment, and therefore lower optimal amount of investment. From (3.13), higher transferability to the production of host country-specific human capital implies higher returns to investment, and hence higher optimal investment.

The effect of the two transferability parameters on optimal investment in children's schooling is working through their effect on the present value of post-migration earnings. Since expenditures on children's schooling are a fixed proportion of the present value of lifetime (post-migration) income in this model, from (3.16) and (3.15) the marginal effect of both τ_{m1} and τ_p on the optimal level of S will be positive, as long as improved transferability raises the present value of post-migration income.

The investment decisions of immigrants with high levels of human capital are influenced by the level of transferability of their foreign acquired human capital to both labour market and learning activities. They will be facing both lower marginal cost and marginal return to investments in new human capital than the native born. Given the assumption that $\tau_p \geq \tau_{m1}$, immigrants with higher levels of human capital will be making higher investments in their human capital than comparable native born, all else equal.[6] However, as long as the present value of lifetime (post-migration) earnings is lower among well educated immigrants than comparable native born, immigrants will invest less in their children's schooling. In this case, imperfect transferability of human capital leads to a tradeoff in human capital investments in immigrant families with well educated parents.

Among individuals with low human capital, both immigrant and native born workers will face the same marginal cost of investment in own human capital, the minimum wage. I am considering the case where investments in human capital raise period 2 wage above the minimum wage, so that the marginal benefit of investment is positive. Given that $\tau_p < 1$, immigrants will face lower marginal returns to investing in their own human capital than comparable native born. This implies that the optimal amount of investment in own human capital is lower for immigrants with low education than for their native born counterparts. Less time spent investing will lead to higher first period earnings but lower second period wage and hence earnings relative to the native born. Since the magnitude of τ_{m1} is not relevant for immigrants with low human capital

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[6]This also depends on the complementarity between foreign and host-country specific human capital. See for example Borjas (1998).

in the presence of a minimum wage, the comparative statics imply that a lower τ_p will lead to a lower present value of lifetime earnings. Therefore, in the absence of differences in discount rates, β, preferences for children's education, α, or productivity of schooling inputs, ξ, between immigrants and the native born, immigrants with low education will invest less in their own human capital and spend less on their children's schooling than their native born counterparts, if children's schooling is a normal good.

3.2 Optimal investments with borrowing constraints

The assumption that individuals can borrow freely against future earnings may be more applicable to individuals with high rather than low education, immigrant and native born alike. In a theoretical analysis of credit constraints, Bernhardt and Backus (1990) show that credit constrained individuals will invest less in their own human capital, and further will be choosing occupations with low potential for skill acquisition and therefore flatter earnings profiles. An implication of this is that individuals with lower human capital are more likely to be credit constrained, all else equal.

Consider then how optimal investments of immigrants and native born individuals with low levels of human capital would differ in the presence of binding credit constraints. In this case, optimal expenditures on children's schooling are financed with period 1 earnings only. For simplicity, I am assuming the most extreme version of such constraints, i.e. where there is no possibility of either borrowing or saving (except through investments in own human capital).[7] The details are again provided in Appendix A.

Once again, optimal investments of immigrants with low initial human capital are influenced by τ_p, but not τ_{m1}. The following expression summarizes the effect of τ_p on the relationship between optimal investments in parental and children's human capital:

$$\frac{\partial S^*}{\partial \tau_p} = -\frac{\beta \alpha \xi}{p(1 + \beta \alpha \xi)} a \tau_{m1} H_p \frac{\partial t^*}{\partial \tau_p} \tag{3.17}$$

It is clear from the above that loss of human capital upon migration induces a tradeoff between investments in parental and children's human capital in immigrant families. If the optimal time that individuals with low education levels devote to their own human capital investments versus work is relatively small, a reasonable assumption, then $\frac{\partial t^*}{\partial \tau_p} > 0$ and therefore $\frac{\partial S^*}{\partial \tau_p} < 0$.[8] Thus in the presence of credit constraints, immigrants with low initial human capital will optimally invest less in their own skills than similar, native born individuals. As a result,

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[7] In the benchmark model presented in the previous sub-section, it is always optimal to borrow in the first period.

[8] See Appendix A for details.

they will devote more time to the labour market and have higher period 1 earnings, resulting in higher expenditures on children's education.

The key insight from this result is that children of immigrants could outperform their native born counterparts in educational attainment even in the absence of any differences in preferences for education, ability and/or discount factors between the two groups. Rather, their achievement may be due to the optimal allocation of resources in immigrant families in response to institutional factors - imperfect transferability of foreign human capital in the presence of credit constraints.

The model does not give an unambiguous prediction for the relationship between investments in parental human capital and children's schooling among well educated immigrants relative to similar, native born individuals in the presence of credit constraints. A comparison of investments of credit constrained immigrants to native born individuals not facing such constraints does not yield clear predictions regarding optimal investments in parental human capital of the two groups either. However, since immigrants would only have their period 1 earnings available for purchasing their children's schooling inputs, these expenditures would necessarily be lower than those of comparable, native born parents.

In summary, it is reasonable to assume that individuals with low education are more likely to experience credit constraints than those with high education. Under this assumption, the model predicts that immigrants with low education will spend more time in the labour market and less time investing in their own human capital, but will spend more on their children's education than similar, native born parents. In contrast, well educated immigrants will spend more time investing in their own human capital (in the absence of binding credit constraints) but purchase fewer schooling inputs for their children if the present value of their earnings is lower than that of comparable native born. In the context of a standard human capital model, higher human capital investments are reflected in steeper earnings profiles. Therefore, we should see a negative relationship between the slope of the earnings profiles of immigrant parents and their children's schooling, especially among immigrants with low education.

4 Data and Definitions

4.1 The data

The empirical analysis in this study is based primarily on data from the master files of the Ethnic Diversity Survey (EDS).[9] The data were collected through telephone interviews

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conducted in ten Canadian provinces between April and August of 2002. EDS is a post-censal survey, i.e. respondents were selected from among those who answered the "long for" of the 2001 Canadian Census questionnaire. Answers of EDS respondents to several Census questions collected in 2001 were also included in the EDS data set. The target population for the survey includes individuals age 15 and older who live in private dwellings. Individuals living on Indian reserves and those who reported Aboriginal ancestry or identity on the 2001 Census were not within the target population, although a small number of EDS respondents still report Aboriginal ancestry or identity. The total EDS sample consists of 42,476 individuals.

Respondents in EDS were selected based on their answers to the 2001 Census questions regarding ethnic origin, birthplace and the birthplace of parents. This resulted in relatively large samples of the population groups of interest, particularly second generation immigrants. Further, the sample was constructed such that around two-thirds of the respondents report at least one ethnic origin other than British, French, Canadian, American, Australian or New Zealander. This ensured that a good mix of individuals with other European and non-European origins was selected. For example, the fraction of sampled second-generation individuals who report visible minority status is around 11.5 percent. Random sampling would have resulted in less than 7 percent visible minorities. To the extent that decisions about investment in education differ across ethnic groups, it is not obvious that results from an analysis based on a sample of second generation individuals from traditional European source countries will also hold for other ethnic groups. Given the changing ethnic composition of immigrant inflows, the future second generation in Canada will be an increasingly diverse group, raising the need for analysis based on data which reflects that diversity.

In describing the main patterns in educational attainment, I control for ethnic origin. In previous studies, ethnic or national origin of immigrants was often defined by the respondents' country of birth, and that of second generation immigrants, by their father's country of birth. Given that I am trying to create a measure of ethnic ancestry that I can apply to four generation groups, this method is not very useful. Instead, I classify individuals by the ethnic ancestry they report. Since up to eight ethnic ancestries can be reported in EDS, I use the self-reported importance ratings for each ancestry listed in assigning respondents with multiple ethnic ancestries to a single ethnic ancestry group. I assign them to the first-reported highest-rated ethnic origin group. I can identify 43 ethnic origins, or groups of origins, where each group represents at least 30 observations in each of the male and female samples.[10] Remaining ethnic origins reported

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Humanities Research Council and Statistics Canada.

[10]The 43 groups are: English, Irish, Scottish, Welsh, British other, French, Austrian, Belgian, Dutch, German, Swiss, Finnish, Danish, Norwegian, Swedish, Baltic Rep, Czechoslovakian, Hungarian, Polish, Romanian, Russian,

are grouped in an "other" category.[11] Individuals with multiple ancestries who did not give a valid importance rating for at least one of their ancestries, whose first-reported highest-rated ancestry was uncodeable, who reported a single ancestry which was also uncodeable, or who did not respond to the ethnic ancestry question at all were not assigned to any ethnic origin group. These observations are identified with a separate indicator variable in all regressions.

In addition to sample design, a major advantage of the EDS for the analysis in this paper is that it contains data on several crucial variables not commonly found together in data sets used in immigrant studies. The first one is information on parental education. Respondents were asked about the highest level of schooling of each of their mother and father. Responses were grouped into nine categories: graduate or medical degree, undergraduate university degree, college diploma or certificate, degree or diploma from university or college, some university, some college, some university or college, high school, and less than high school.[12] I construct a variable which represents the higher of the father's and mother's reported level of schooling and use it as a measure of parental education in all empirical analysis. Where education of only one parent was reported, I used that information as the highest parental education.

Two other variables crucial to the analysis are the birthplace of parents and rarely found in surveys information on birthplace of grandparents. Information on parental birthplace is necessary to identify the children of immigrants – second generation immigrants. Data on grandparents' birthplace allows a more detailed generation classification. The point is essentially to avoid classifying foreign born individuals who are Canadian by birth as immigrants, or individuals who are in fact third or higher generation with one or both of their parents born outside Canada as second generation immigrants.[13] The details of the generation status classification are given in the following subsection. It turns out that the classification which considers the birthplace of three generations to determine immigrant status makes little difference in the analysis at hand, because the number of individuals affected by this reclassification is not large enough to significantly affect results.

The EDS data set also contains respondents' answers to several questions from the 2001 Census. I use the derived variable for total years of schooling as the main measure of educational

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Ukrainian, Yugoslavian, Greek, Italian, Portuguese, Jewish, European other, Lebanese, West Asian other, East Indian, South Asian other, Chinese, Filipino, Japanese, East and Southeast Asian other, African (excluding North Africa), Jamaican, Caribbean other, 'Latin Central and South American', American, Canadian, Canadian (French)

[11]In probit estimation, 41 categories are specified.

[12]Respondents who were unable to provide the exact level of parental education were prompted for an approximate answer about whether they thought their parent completed a post-secondary degree or diploma at a university or college, has some post-secondary education at a university or college, graduated from high school, or did not graduate from high school. Responses to the first two options only were coded into separate categories.

[13]Card et al (2000) have previously excluded foreign born individuals with US parents from the immigrant group, classifying them instead as third and higher generation.

attainment in subsequent analysis. I update this variable using information collected in EDS on the respondents' main activity in the 12 months prior to the survey. Specifically, I add one extra year of schooling for respondents who reported attending school as their main activity, regardless of whether attendance was full or part time.

I also examine two other measures of educational attainment: the probability of graduating from high school or more (i.e. of not dropping out of high school) and the probability of completing university. These two variables are based on answers collected in the EDS. Educational attainment of EDS respondents was coded into 7 categories, corresponding to those reported for parental education, except for the two separate categories where the exact level of education was unknown.

4.2 Generation status

I define as second generation immigrants individuals born in Canada with at least one immigrant parent (i.e. parent who is foreign born and has at least one foreign born parent of his/her own)[14], but also children of immigrants who were themselves born outside Canada and immigrated at age 17 or younger. Some previous studies have considered children up to age 10 or 11 at arrival as second generation immigrants. I expand the definition to include all individuals whose parents are immigrants and who did not independently undertake the decision to migrate.[15] The reason for this is to capture all children of immigrant parents in order to analyze the effect of having a parent who experienced the post-migration assimilation process. In analyzing basic patterns in educational attainment in the data, I divide the entire second generation group into four subgroups: individuals who immigrated between the ages of 14-17, 6-13, 0-5, and those born in Canada, in order to account for the effect of age at migration on educational attainment. In some of the analysis, I also divide the Canadian born, second generation immigrants into those with one immigrant parent, and those with two.

For much of the analysis, I compare educational attainment of children of immigrants to that of the remaining non-immigrant population, as do most previous studies. In a further section, however, I divide the latter group into third generation immigrants and the fourth-and-higher generation. Within the sample of individuals who are neither first or second generation immigrants, the third generation is defined as individuals with at least one foreign born grandparent. The fourth-and-higher generation, or simply the fourth generation, are individuals with four Canadian born grandparents, regardless of their or their parents' place of birth. This split is

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[14]A more restrictive version of the definition used in some previous literature requires that both parents be foreign born.

[15]18 is the youngest age at which an individual can apply for immigration to Canada.

used to test further predictions of the theoretical model but also reveals information about third generation immigrants who to date have not received much attention in the literature.

4.3   The sample

The sample selected for this study is restricted to respondents age 25 and older at the time of the survey since most individuals may be expected to have completed their education by that age. There is no question in the EDS regarding current student status, only one about the respondent's main activity in the preceding 12 months. Since the EDS interviews were conducted in the summer, one cannot infer that individuals who reported their main activity in the previous year as "student" were still students at the time of the survey. Individuals who reported Aboriginal ancestry or identity were excluded from analysis, as were temporary residents and individuals with invalid information on residential status in Canada.

A further sample restriction resulted from the data requirements in assigning generation status and missing information. Observations with missing information on one or more of the birthplaces of the respondent, the parents, the grandparents or age at immigration (when applicable) were excluded from the sample if the available information was such that it was impossible to classify the respondent into one of the four generation groups. As a result 1,393 observations were dropped. Out of these excluded observations, 4.8 percent were dropped because of missing age at immigration, and the remaining due to missing birthplace information. Birthplace of at least one grandparent was the most common missing birthplace information, followed by the birthplace of at least one parent, and finally that of the respondent. Observations with missing information on birthplaces of family members or own age at immigration (when applicable) appear not to be a random draw from the population. In particular, they tend to have lower levels of education. Those excluded from the sample have 11.5 years of schooling on average, compared to an average of roughly 13 years for individuals in the sample. The final sample size is 25,143 (smaller in case of probit regressions given the higher incidence of missing information on highest level of schooling reported in EDS than years of schooling reported in the Census).

5   Empirical Evidence

5.1   Basic cross-generation patterns

I begin by presenting the basic patterns in educational attainment among the children of immigrants compared to all remaining native born individuals. I report OLS estimates of differences in years of schooling between second generation immigrants and the remaining native born, and marginal effects from probit analysis on the differences in probability of having com-

pleted high school or more, and the probability of having completed a university degree. These regressions are meant to be descriptive in nature, and to characterize the gap in educational attainment that this study seeks to explain.

In addition to presenting the unconditional mean educational outcomes, I report the "unexplained" gap in schooling, i.e. the difference in educational attainment conditional on three main factors which can be expected to influence children's schooling level but are exogenous to the outcome: age, parental education and ethnicity.

Family background is an important, if not the most important determinant of a person's educational attainment (e.g. Haveman and Wolfe (1995)). The positive correlation between parental education and that of their children is also well established. Given that the Canadian immigration system targets educated immigrants, and that in fact immigrants in Canada as a group are on average better educated than the rest of the population (see also Schaafsma and Sweetman (2001)), one might expect that their children would also be better educated than the native born.

Given the changing national origin mix of successive immigrant cohorts over the 20th century, the ethnic composition of the native born population, or third and higher generation, is vastly different from that of the first, and increasing so, the second generation. In the context of investment in education, ethnic origin can reflect several different factors like different returns to education (e.g. Sweetman and Dicks (1999), different fertility choices and family size (e.g. Chiswick (1988)), differences in unobserved skills due to the nature of self-selection of immigrants (e.g. Borjas (1994)), and potentially different attitudes towards or preferences for education. Ethnic origin indicators will capture these differences to the extent that they persist across generations and as long as the type of selection of immigrants from a given source country has not changed over time. If it has, the ethnic indicator may be representing very different things for the different generation groups.

I break down the second generation group into four subgroups by place of birth (in Canada versus outside) and age at arrival. As age at immigration rises, educational attainment falls (see also Schaafsma and Sweetman (2001)). One reason for this may be that some of the children's human capital acquired before migration is non-transferable. Worswick (2004) shows that children of immigrants attain lower scores on vocabulary tests than children with native born parents. Given that a certain period of time in the host country and school system are required for the child of immigrant parents to make up any loss in human capital, children who arrive in their teens may not have enough time to overcome this disadvantage. This may manifest itself in a lower probability of pursuing any post secondary studies. I therefore subdivide second

generation immigrants born outside Canada into three groups: those who arrived before age 6, those who arrived during grade school, age 6-13, and those who arrived in high school, age 14-17.

Table 1 presents the estimated differences in total years of schooling between second generation immigrants and the native born. Columns 1 and 4 report the unconditional relative means for males and females, respectively. In the population as a whole, children of immigrants who arrived between the ages of 0 and 5 have nearly one year of schooling more than the native born. This difference falls to roughly half a year for individuals who arrived in grade school, and disappears completely among those who arrived in high school. Canadian born children of immigrants have between a third and a half year of schooling more than the native born. After conditioning on age (five-year age groups), highest parental education and ethnic origin, columns 2 and 5, the difference between Canadian born children of immigrants and the native born rises to half a year for females and 0.6 of a year for males. This gap diminishes with age at immigration. Immigrants who arrived before the age of six also have a slight advantage, about 1/3 of a year, although this is only statistically significant among females. Those who arrived in primary or grade school are no different from the remaining native born in terms of total years of schooling. However, arriving in high school is associated with approximately a one-year disadvantage in years of schooling. This gap is larger among women than men.

A commonly known fact is that immigrants, particularly the more recent cohorts, tend to settle in large urban centers in Canada. This means their children live closer to colleges and universities. Geographic proximity to post-secondary institutions lowers costs of attendance and raises the probability of attending university (e.g. Frenette (2004, 2006)). To control for this effect, columns 3 and 6 of Table 1 include an indicator for residence in a census metropolitan area. Also included are province of residence controls. These account for differences in educational systems across Canada, specifically whether it takes 12 or 13 years to graduate from high school. On the other hand, geographic location could be endogenous if immigrant parents take the educational opportunities of their children into consideration when choosing where to settle. Also, geographic location indicators pertain to the respondent's residence at the time of the interview, which may be different from the place where the respondent completed his/her education. For these reasons, I present most of the results in this study both with and without controlling for geographic location. Columns 3 and 6 of Table 1 show that geographic location explains very little of the education gap, especially for the Canadian born, second generation immigrants.

While there are some gender differences in the magnitude of the education gap between

various subgroups of children of immigrants and the native born, the overall patterns are very similar. It is those overall patterns that I seek to explain in this paper. Since some of the analysis that follows would be difficult to conduct separately by gender for sample size reasons, in the analysis that follows I combine both samples and include a female dummy in all subsequent regressions. Columns 7 and 8 in Table 1 report the corresponding results (with and without geographic controls, respectively) for the joint sample.

Table 2 reports marginal effects from probit estimation (for the joint, males and females, sample) on the probability of having completed at least a high school diploma, conversely, the probability of not dropping out of high school (columns 1 and 2), and the probability of holding a university degree (columns 3 and 4). Column 1 shows that Canadian born, second generation immigrants have a 5 percentage points higher probability of not dropping out of high school, conditional on gender, age, parental education and ethnic origin. There is no significant difference between those who arrived before the age of 14, while those arriving in high school are over 12 percentage points more likely not to graduate from high school. Controlling for province of residence and residence in a census metropolitan area lowers the gap between Canadian born children of immigrants and the native born by 2 percentage points.

Column 3 in Table 2 shows the marginal effects on the probability of holding a university degree. This probability is 2 percentage points higher among Canadian born children of immigrants than the native born, and interestingly, controlling for geographic location does not affect this gap at all. There is again no significant difference in university attendance (and completion) between native born individuals and children of immigrants who arrived before the age of 14. Individuals arriving in high school however, are about 3 percentage points less likely to hold a university degree than the native born, and this gap increases to nearly 5 percentage points when geographic location controls are added.

5.2 Parental education

The specification in the previous subsection restricted the effect of highest parental education to be the same for second generation immigrants and the native born. One clear prediction of the theoretical model is that this is not the case. I re-estimate regressions with total years of schooling as the dependent variable, allowing the effect of parental education to vary by generation status. The interaction terms between generation status and parental education are jointly statistically significant for the subgroups of children of immigrants except for individuals who arrived between the ages of 6 and 13.

The first column of Table 3 shows the mean predicted years of schooling of the native born by

highest parental level of education, conditional on gender, age and ethnic origin. The remaining columns report the gap in predicted years of schooling between second generation immigrants and the native born by parental education. Canadian born second generation immigrants and those arriving before age 6 whose parents did not complete high school have around one year of schooling more than the native born with uneducated parents. No such difference is observed for immigrants who arrived at age 6-13, while those arriving during high school face a nearly 2 year disadvantage relative to their native born counterparts. For children of immigrants who arrived before age 6 and the Canadian born second generation immigrants whose parents have a high school education or less, the patterns in educational attainment are consistent with predictions obtained from the theoretical model under the assumption of binding credit constraints among individuals with low education.

At the other end of the parental education distribution, foreign born children of immigrants with completed post-secondary education have on average less schooling than comparable native born. The tradeoff appears smallest in families where at least one parent has a graduate degree, and the largest where the parent has an undergraduate university degree. In the latter group, the gap is about 0.6 years of schooling for those arriving before age 14, and 1 year for those arriving in high school. Canadian born immigrants, however, are essentially no different from their native born counterparts with educated parents.

The outcomes of foreign born children of immigrants appear to deteriorate with age at arrival, regardless of how much education the parents have (with the possible exception of parents with graduate degrees). The loss of years of schooling, however, is smaller when the parents are university educated than when they have less than a high school education.

5.3 Third generation immigrants

If loss of foreign human capital after arrival changes the human capital investment behaviour of immigrant parents relative to native born individuals, rather than or in addition to factors like preferences, then we should see a smaller difference, or none at all, in schooling outcomes between third generation immigrants and the remaining native born population conditional on age, parental education and ethnic origin. I divide the population thus far referred to as the native born into two groups: the third generation – individuals with at least one foreign born grandparent – and those with all four Canadian born grandparents.

Table 4 reports the estimated gaps in years of schooling between subgroups of second and third generation immigrants and the remaining native born, or the fourth generation. In order to highlight differences between the second and third generation, I present regression results

where I add the three sets of controls one by one. Column 1 shows the differences in mean years of schooling, controlling only for gender. Third generation immigrants have on average around 0.6 years of schooling more than the fourth generation, as much as the Canadian born, second generation immigrants. Column 2 adds age group indicators and the difference between third generation and Canadian born second generation becomes apparent – the gap is nearly twice as large for the latter group. Controlling for parental education reduces the gap between Canadian born, second generation immigrants and the fourth generation by about 20%, but reduces the gap between the third and fourth generations by about 70%. The addition of ethnic origin controls leaves no further gap between the third and fourth generations. In contrast, a half year gap remains between Canadian born, second generation immigrants and the fourth generation.

Table 5 shows predicted gaps in education by parental education. The set of interactions between parental education and the third generation is jointly statistically not significant. Conditional on gender, age, and ethnicity, there is no significant difference in the educational attainment of third generation immigrants and the fourth generation at any level of parental education. Comparing educational attainment of the second generation to that of the fourth, we see a similar pattern as in Table 3. Children of immigrants with less than a high school education have on average one year of schooling more than the fourth generation, if they were born in Canada or arrived before age 6. A negative gap of over half a year of schooling is evident among foreign born children of university educated immigrants. As before, we can reject the hypothesis of equality of parental profiles between the second generation groups and the fourth generation (with the exception of children of immigrants who arrived between the ages of 6 and 13).

5.4 Family composition

Another implication of the model is that immigrant parents who arrived as children and completed some or all of their education in Canada are not likely to face any or as much discounting of their skills in the Canadian labour market as those who completed their education prior to migration. While I do not have information on the period of arrival or age at arrival of immigrant parents, I can exploit the observation that immigrants who arrive as children are more likely to be married to a native born (potentially a second generation immigrant) than to another immigrant.[16] Therefore, we are likely to see less of a gap in schooling between

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[16]Aydemir, Chen and Corak (2005) find that among married immigrant men, 43.6% of those who arrived at age 11 or younger are married to a native (third and higher generation), and 30.6% are married to an immigrant (immigrant women who arrived young are more likely to marry another immigrant than are men). Among immigrant men who arrived at age 12 or older, only 10.8% are married to a native, and 82.3% are married to an immigrant.

second generation immigrants and the native born when the second generation individuals have one non-immigrant parent than if both parents are immigrants. On the other hand, family composition, or more specifically the number of foreign born grandparents, should not matter within the third generation group.

I subdivide Canadian born, second generation immigrants into those with one immigrant and one second or higher generation parent and those with two immigrant parents.[17] I further subdivide the third generation into individuals with one to three foreign born grandparents and those with four immigrant grandparents.[18] Among both second and third generation immigrants, some individuals do not provide birthplace of all parents and grandparents making it difficult to classify them into the subgroups defined above. They are therefore assigned a separate category (one for each of the second and third generation). I do not devote much discussion to these two groups, except to note that individuals who do not report birthplace information of their parents and/or grandparents, or education of parents, show consistently lower educational attainment than individuals who are able to provide that information.

Column 1 of Table 6 shows that second generation immigrants with two immigrant parents have 0.85 years of schooling more than the fourth generation, while the mean gap for individuals with only one immigrant parent is 0.58 years. These numbers are essentially reversed among the two categories of third generation immigrants. Once we condition on age, the gap between the two third generation groups becomes identical, at just over 0.6 years. Among second generation individuals, the gap is largest for Canadian born individuals with two immigrant parents, at just over 1 year of schooling. Conditioning on parental education and further on ethnic origin does not reveal much of a difference between third generation immigrants with four and those with fewer foreign born grandparents. In contrast, family composition makes a difference among Canadian born, second generation immigrants. Conditioning on parental education reduces the gap between second generation immigrants with one immigrant parent and the fourth generation by about 40%. Among individuals with two immigrant parents, this gap remains unchanged, and is now twice as large as that between individuals with only one immigrant parent and the fourth generation. It remains twice as large after controlling further for ethnic origin and finally geographic location, even though both sets of controls reduce the magnitude of both gaps.

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[17]Although according to the rule adopted for defining immigrant status in this paper, I consider a person to be an immigrant if he or she is foreign born and has at least one foreign born parent, in the current exercise, second generation immigrants with two immigrant parents are only individuals whose both parents and all four grandparents are foreign born.

[18]I also tried a subdivision where one or two grandparents are foreign born, versus three or four. The results were essentially unaffected.

6   Parental Earnings Profiles and Children's Schooling

The key testable implication of the model described in this paper is that there is a relationship between the amount of post-migration human capital investment of parents and their children's educational attainment. In the context of the standard human capital model, the slope of a person's earnings profile is a reflection of the amount of human capital investment undertaken by that person. Therefore, we should observe a relationship between the slope of earnings profiles of immigrant parents and their children's schooling. I construct earnings profiles of potential parents of the children of immigrants in EDS and include a measure of entry earnings, 10-year growth rate of earnings and the interaction of the two in a regression of years of schooling. In this part of the analysis I focus on the outcomes of children of immigrants alone, rather than in comparison to the native born.

6.1   Estimating parental earnings profiles

I use data from the public use files of the Canadian Census 1971, 1981, 1986, 1991, 1996, and 2001 to construct earnings profiles for synthetic cohorts of immigrants defined by region of origin, education level and period of arrival. There are seven arrival periods: 1961-66, 1967-70, 1971-75, 1976-80, 1981-85, 1986-90, and 1991-95, where 1967 is the beginning of the points system of immigration in place today.[19] I defined six groups of immigrants' country of birth: United Kingdom, continental Europe, Asia (including the Middle East), Africa, South and Central America and the Caribbean, and the USA.[20] Finally, I separate immigrants into two groups by education: those with a post-secondary diploma/certificate or a university degree (high education) and those without any completed post-secondary program (low education).[21]

To estimate earnings profiles of synthetic cohorts of immigrants, I select all immigrants age 20 to 50 at the time of immigration as the potential parents of immigrants age 0-17 at the time of arrival. I "follow" a specific origin-arrival-education cohort for up to 15 years, across two to four census years. I exclude immigrants residing in the Atlantic Provinces because their responses to several key questions are grouped into broader categories than is the case for immigrants residing

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[19]Year of immigration is not a continuous variable in the public use files, and the grouping of years changes across censuses. This leads to some inconsistencies in the years covered by a particular synthetic cohort. Thus the sample of 1981-1985 arrival cohorts in the 1986 census also include individuals who arrived in the first few months of 1986, prior to enumeration day, and similarly for the 1991-1995 cohorts. The sample of 1967-1970 arrival cohorts observed in the 1986 census exclude individuals who arrived in 1967.

[20]Immigrants from the central Asian, former USSR Republics are counted as part of Europe up until the 1991 census, but as part of Asia from 1996 census onwards.

[21]The 1971 census has vastly different education questions. Individuals are asked about completing high school or university in one question, and about other post-secondary training in a separate question. I classify individuals into the 'high education' group if they completed a university degree or a post-secondary training course 6 months or more in duration.

in the remaining six provinces. I may therefore gain or lose individuals across the census cross sections if they happen to move to or out of the Atlantic Provinces or the Territories between census years. I drop individuals for whom highest level of schooling, country of birth or year of immigration are unknown.

I do not exclude individuals based on their labour force status, therefore individuals with zero earnings remain in the sample. The reason for this is two-fold. First, unemployment among immigrants shortly after arrival is one reflection of imperfectly transferable human capital and likely influences human capital investment decisions. I believe that excluding individuals with zero earnings removes an important part of the variation I am trying to capture. Second, movements in and out of employment and/or the labour force over a person's lifetime imply that excluding anyone on the basis of labour force status means we're no longer "following" the same group of individuals across the census cross sections.

Earnings are measured by the sum of wages and salaries and self-employment income, deflated with the CPI to 1992 dollars. Ideally, I would like to be able to run a regression of the log of individual real earnings on the following sets of indicators: origin-arrival-education cohort dummies, years since migration and its square, and interactions of these two sets of variables. However, I drop information for a given cohort in a given census if there are fewer than 30 observations in that cell. Even when cell counts are not a problem, I cannot estimate quadratic earnings profiles for all cohorts because I cannot follow all cohorts through at least three census years. Instead, I estimate linear profiles for each cohort and a region-specific curvature parameter which is constant over time. I also control for the province of residence. Even with this more restrictive specification there are a number of cohorts which are dropped from the sample because I only observe them in one census year. These are: all origin groups other than UK and Europe with high education who arrived between 1961 and 1966, and individuals with low education who arrived from the UK or the US in 1991-1995.

The intercept term for each cohort is taken as a measure of entry earnings. Using the estimated coefficients, I construct the predicted 10-year earnings growth rate for each cohort, i.e. the difference in log earnings over a 10-year period beginning with the period of entry.

Matching EDS respondents to their potential parents in the census data requires information on period of arrival, region of origin and education level of the parents. Region of origin is determined by the father's birthplace. If the father is born in Canada and only the mother is an immigrant (from one of the six regions I am able to identify in the census data), it is the mother's birthplace. EDS respondents are separated into two groups, those with at least one parent who has completed a post-secondary program, and those without. The EDS does not

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contain information on the period of arrival in Canada of the respondents' ancestors. More specifically, I cannot tell when the immigrant parent(s) of Canadian born, second generation immigrants arrived in Canada. For foreign born children of immigrants, however, I can assume that their period of immigration coincides with their parents' period of arrival. For this part of the analysis, therefore, I look only at individuals born outside Canada who immigrated before age 18. Each EDS respondent can now be matched with parental earnings profiles predicted from census data by period of arrival, highest level of parental education, and region of origin.[22]

6.2 Empirical analysis

I use the following econometric specification:

$$S_{ica} = \mathbf{X_{ica}}\beta + \eta_1 ENTRY_{ca} + \eta_2 GROWTHRT_{ca}$$
$$+ \eta_3 ENTRY_{ca} * GROWTHRT_{ca} + \sum_{c=1}^{C}\kappa_c + \sum_{a=1}^{A}\gamma_a \qquad (6.1)$$

The control variables, X_{ica}, include a female indicator, 2 to 3-year age at immigration indicators, and an indicator for whether English or French was the respondent's mother tongue. κ_c represents region of origin effects, and γ_a period of arrival effects. This equation is estimated separately for the two parental education groups.

Beginning with Chiswick (1978), the stylized fact that immigrants face lower earnings than observationally equivalent native born shortly after arrival accompanied by faster earnings growth rate has been attributed in large part to imperfectly transferable human capital. Green and Worswick (2004) compare the earnings profiles of immigrants to Canada over the 1980s and 1990s. They find that about 40% of the documented decline in entry earnings of immigrants who arrived in Canada over the period 1993-96 compared to the 1980-82 cohort can be explained by falling returns to human capital acquired through foreign experience. This is in large part due to the different source country composition. Duleep and Regets (2002) show that lower immigrant entry earnings, conditional on education, are on average associated with steeper earnings profiles in the US. This observation may not hold for all immigrant cohorts, however. Green and Worswick (2004) find that in Canada, immigrant cohorts from the late 1980s had lower entry earnings but not steeper earnings profiles compared to the early 1980s cohort. The 1990s cohorts, on the other hand, had entry earnings that were lower still, but accompanied by faster growth. These studies suggest that there is considerable variation in the shape of earnings pro-

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[22]I was unable to construct earnings profiles for immigrants from Australia, New Zealand or Oceania; therefore, respondents with parents arriving from these countries are excluded from analysis.

files across both arrival cohorts and immigrants from different source countries. This variation will be used to identify coefficients on the parental human capital investment variables.

We can expect considerable variation in the degree of transferability of foreign acquired human capital across source countries, leading to different incentives to invest in host country human capital, and hence differently shaped earnings profiles. This may stem from differences in technologies between countries, differences in the level of host country language skills that immigrants from a given country/region arrive with on average and the ease with which they are able to acquire host country language skills, as well as the size of their co-ethnic community and opportunities for finding employment in ethnic enclaves, as some examples.

However, some of the variation in children's schooling across source countries may be due to other factors that vary with source country or ethnicity, like preferences. If low educated immigrants from a particular country or group of countries face systematically low human capital transferability and also have preferences that favour more schooling for their children, this could automatically result in a negative relationship between the growth rate of parental earnings and their children's education. To the extent that preferences in the source country are fairly constant over time, controlling for region of origin will soak up that variation.

The degree of foreign human capital transferability may also change over time in a way not related to the changing source country composition of immigrant inflows. For example, immigrants arriving in recession times may find it more difficult to transfer their skills to the host country labour market than those who arrive during economic recovery, across all source countries. Green and Worswick (2004) show that the overall drop in returns to foreign experience for immigrants arriving in Canada over the 1980s and 1990s is not entirely explained by the changing source country composition of successive arrival cohorts.

On one hand, such changes in host country labour market conditions create useful variation in parental choices regarding investments in their own human capital. On the other hand, changes in immigrant characteristics across immigrant cohorts not related to source country composition could influence both parental labour market outcomes and their children's educational outcomes. Immigrant class could reflect such unobserved characteristics. For example, the recessionary periods in the 1970s and 1980s were characterized by low inflows of immigrants, restricted mainly to the family class. Controlling for both time invariant origin effects and source country invariant arrival cohort effects leaves variation generated by the interaction of origin and arrival effects, i.e. changes in transferability of foreign human capital within a country of origin group across time, to identify the effect of parental earnings profiles on children's schooling.

Tables 7 and 8 present results from the estimation of Equation 6.1 on two separate samples -

children of uneducated and well educated immigrant parents, respectively. The standard errors reported in these two tables are robust and clustered on region of origin–arrival cohort groups. They are also adjusted for the fact that the parental human capital variables are generated regressors and a function of coefficients estimated from a different sample.[23]

6.3 Results

Results for the sample of second generation immigrants with low educated parents are presented in Table 7. Column 1 shows estimated coefficients from Equation 6.1 with controls for region of origin but not period of arrival. The results provide strong evidence that there exists a tradeoff in human capital investments of parents and children in immigrant families. The coefficient on the growth rate of parental post-migration earnings is negative and highly statistically significant.

The coefficient on the interaction term between log entry earnings and growth rate of earnings is positive and significant, indicating that the negative effect of increased investments in parental human capital on the children's schooling diminishes as entry earnings rise (for a given level of investment in parental human capital). Note that for a given earnings growth rate, higher entry earnings mean higher lifetime earnings, all else equal. The sign of this coefficient could imply, therefore, that children's schooling in low education families increases in parental income, and/or that as income rises, credit constraints become less binding and therefore the tradeoff in human capital investments within the family is no longer occurring.

These results are robust to the inclusion of period of arrival indicators in column 2. They are also unaffected by the inclusion of controls for province of residence and an indicator for urban residence in column 3.

The age at immigration indicators confirm the pattern observed in earlier results that educational attainment drops with age at arrival. This effect is particularly large for those who arrive at age 16 - 17. First language also has an important effect on educational attainment. Those whose first langauge is either English or French have on average 0.7 years of schooling more than the remaining immigrant children. These factors influence attainment through channels other than parental decisions about investments in their own human capital.

Table 8 presents regression results for individuals with at least one parent with a completed post-secondary program. The first striking difference between this table and the previous one is that regardless of the specification chosen, parental investment variables do not have a sta-

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[23]I assume that the first and second stage samples are in fact independent, i.e. that there are no common households in the two samples. Although the EDS sample was selected from among respondents to the long form questionnaire of the 2001 Canadian Census, it is unlikely that there are many, if any, individuals in both the public use Census data and the EDS that belong to the same household.

tistically significant effect on the schooling of children. The coefficient on parental earnings growth rate is negative, roughly half the size of that estimated for the sample with low educated parents, conditional on region of origin (comparing column 1 in the two tables), and not statistically significant. The magnitude of this coefficient suggests that a tradeoff in investments is still possible in immigrant families with high human capital, although it is not well defined. To the extent that such a tradeoff exists, it appears to be a function of the period or arrival. Column 2 shows that this coefficient declines in magnitude dramatically once arrival period indicators are included in the regression.

Note that in Table 3, only (foreign born) second generation immigrants with at least one parent with an undergraduate degree showed significantly lower years of schooling compared to the native born. The lack of a significant effect of the growth rate of parental earnings on children's schooling may be at least partly the result of combining in one sample individuals with parents with any kind of completed post-secondary education. This possibility needs to be investigated further.

7 Alternative Explanations

The model presented in this paper shows that it is possible for a gap in educational attainment to arise between children of immigrants and the native born in the absence of differences between the two groups in unobservable characteristics like ability, preferences, and/or discount factors. There is a notion in the immigrant literature, however, that such differences exist and underlie the unexplained portion of the educational gap between second generation immigrants and the native born. Below I briefly consider the leading alternative explanations for the observed educational gap, while a more detailed treatment is left to further research.

One common belief is that immigrants are on average positively selected on ability. Assuming that children inherit their parents' ability, second generation immigrants are also on average high ability individuals and this drives their above average educational attainment. In the context of Roy's model, immigrants should be positively selected only from countries with lower dispersion of earnings than the host country (Borjas (1987)). Immigrants from countries with more unequal distribution of earnings should be negatively selected. This means that we should see higher levels of schooling among descendants of European immigrants than those from many Asian countries for example. In fact we see the opposite. Further, in the context of Roy's model, the negatively selected low earners from countries with more unequal earnings distribution should also have low education levels. But it is children of low educated immigrants who outperform their native born counterparts. A further observation which is not consistent with an ability

story is that children with one immigrant parent have slightly less education on average than children with two immigrant parents (conditional on age, parental education, and ethnicity). If higher ability were the driving force behind the overall educational gap, we would have to make some rather non-standard assumptions about how ability enters the self-selection process by which some immigrants marry other immigrants, while others marry second or higher generation individuals. Therefore, ability differences are not a convincing explanation for the observed educational gap.

Another possibility is that immigrants have different preferences for how much education their children acquire. This is represented by the parameter α in the model. Assuming that these are cultural preferences that vary across ethnic groups but are fairly constant across time, controlling for ethnic origin should remove this effect. Instead, we still see a gap in schooling conditional on ethnic origin between second generation immigrants and the native born. Alternatively, this could mean that Canada attracts immigrants from societies that value education highly. It is not obvious though why parents who value education of their children would immigrate to Canada from countries where post-secondary education is essentially free, as it is in many European countries for example. Cultural preferences for education are not a convincing explanation for the conditional gap in schooling between children of immigrants and the remaining native born, either.[24]

Finally, immigrants may discount the future at a lower rate than non-migrants. The argument here is that individuals who self-select for migration are willing to bear the costs of immigration for higher returns down the road. Assuming altruism towards children, immigrant parents may be willing to migrate whether those higher returns accrue to them directly or to their children.

8 Conclusion

This paper seeks to explain in an economic framework why children of immigrants acquire on average more education than the native born, conditional on age, parental education and ethnic origin. This gap has been documented in the literature but not studied systematically. Uncovering the sources of this gap is important for at least two reasons. First, education is an important determinant of earnings as well as other individual outcomes. Understanding what motivates the education choices of children of immigrants will help inform research on the intergenerational transmission of earnings among immigrants and other outcomes of second

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[24]See also Chiswick (1988) for an argument that differences in preferences for education are not responsible for observed differences in schooling across ethnic groups in the US.

generation immigrants. Second, the changing characteristics and outcomes of immigrants to North America may have important consequences for the educational attainment of future second generation immigrants.

I present a simple model in which parents make simultaneous choices about investments in their own human capital and the amount of schooling inputs purchased for their children. I show that under the assumptions of imperfectly transferable foreign human capital, comparable wages for low educated immigrant and native born workers, and binding credit constraints among the low educated, immigrant children from low education backgrounds will outperform their native born counterparts in educational attainment, while their parents work more and invest less in their own human capital. Well educated immigrants, on the other hand, are likely to invest more in their own human capital than their native born counterparts, but will invest less in their children.

I use the Ethnic Diversity Survey to test the implications of the model. I find that it is indeed children of low educated immigrants who are driving the overall observed gap in education. Among individuals with educated parents, the gap, to the extent that it exists, appears to favour the native born, perhaps contrary to what one might expect a priori. Further, I find strong evidence of a negative relationship between the slope of parental earnings profiles, which in the context of the human capital model reflects the amount of investment in human capital, and schooling outcomes among children of immigrants with low education levels. This relationship is negative but not statistically significant among children of educated immigrants. Consistent with the implications of the model, there is no difference in educational attainment between third generation immigrants and the fourth-and-higher generation, once parental education and ethnic origin are controlled for. Third generation immigrants do have an advantage in unconditional mean years of schooling, however. This appears to be due largely to differences in the distribution of parental education between that group and the remaining native born.

My results hold potential policy implications. Targeting well educated individuals through the current points system in Canada contributes to higher education levels among descendants of immigrants, not just the second but also third generation, and therefore raises the education level in the population as a whole. However, it's not all bad news for immigrants with lower education levels. Their children outperform their native born counterparts in educational attainment and may continue to do so if earnings of low educated immigrants do not decline dramatically and there are no changes in unobservable characteristics across immigrant cohorts. Well educated immigrants stand to lose more on arrival than those with low human capital from the falling value placed on foreign human capital in the Canadian labour market. Declines in

their post-migration earnings (in present value), if indeed they occur, could lead to declining educational attainment among their children. This suggests that the current policy of attracting well educated immigrants should be accompanied by some process which would make it easier for them to transfer their foreign-acquired credentials and experience to the host labour market. Improved transferability would not only benefit the economy in the short run, to the extent that imperfect information is an important reason for the imperfect skill transferability, but also improve outcomes of the second and further generations.

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Appendix A Details of the Theoretical Framework

Comparative Statics with Borrowing

In the benchmark model, where individuals can borrow at an interest rate r against future earnings, the comparative statics are given by:

$$\frac{\partial t^*}{\partial \tau_p} = \frac{\delta_2}{(1-\delta_1)\tau_p} t^* > 0 \tag{8.1}$$

$$\frac{\partial t^*}{\partial \tau_{m1}} = -\frac{1}{(1-\delta_1)\tau_{m1}} t^* < 0 \tag{8.2}$$

$$\frac{\partial S^*}{\partial \tau_p} = \frac{\beta\alpha\xi}{p(1+\beta+\beta\alpha\xi)}\left(\frac{\delta_2}{(1-\delta_1)\tau_p}\right)\left[\frac{a\gamma_p(\tau_p H_p)^{\delta_2} t^{*\delta_1}}{1+r} - a\tau_{m1}H_p t^*\right] > 0 \tag{8.3}$$

$$\frac{\partial S^*}{\partial \tau_{m1}} = \frac{\beta\alpha\xi}{p(1+\beta+\beta\alpha\xi)}\left[aH_p(1-t^*) + a\tau_{m1}H_p t^* \frac{1}{(1-\delta_1)\tau_{m1}} - \frac{a\gamma_p(\tau_p H_p)^{\delta_2} t^{*\delta_1}}{1+r}\frac{\delta_1}{(1-\delta_1)\tau_{m1}}\right] \gtreqqless 0 \tag{8.4}$$

The sign of $\frac{\partial S^*}{\partial \tau_p}$ depends on the relationship between the total costs (foregone period 1 earnings, $a\tau_{m1}H_p t^*$ or $w_{min}t^*$ for individuals with low human capital) of parental investment in their own human capital to the present value of total benefits (period 2 earnings resulting from such investments). At the optimum, total benefits will exceed total costs, making $\frac{\partial S^*}{\partial \tau_p} > 0$.

Signing $\frac{\partial S^*}{\partial \tau_{m1}}$ is not as straightforward. The sign depends on whether a fraction of the present value of total benefits of investment in parental human capital is smaller than the total costs plus the first period earnings that a native born worker would earn at the optimal level of investment of an equivalent immigrant. Although the answer depends on the model's parameter values, this comparative static is likely to be positive.

Comparative Statics with Extreme Credit Constraints

Under the assumption of extreme credit constraints, where individuals can neither save nor borrow, a closed form solution cannot be obtained for optimal investment in parental human capital with the specific functional form chosen. The first order condition for optimal investment in parental human capital is given by:

$$\frac{a\tau_{m1}H_p}{a\tau_{m1}H_p(1-t) - pS} - \frac{\beta a\gamma_p(\tau_p H_p)^{\delta_2}\delta_1}{(a\tau_{m2}H_p + a\gamma_p(\tau_p H_p)^{\delta_2} t^{\delta_1})t^{1-\delta_1}} = 0 \tag{8.5}$$

By taking total derivatives of the above with respect to τ_p, the degree to which foreign human capital transfers to the production of host country specific human capital, we obtain the following expression:

$$\frac{\partial t^*}{\partial \tau_p} = \frac{(a\tau_{m1}H_p)(a\gamma_p\delta_2\tau_p^{\delta_2-1}H_p^{\delta_2}t^*)\left(\frac{\beta\delta_1}{1+\beta\alpha\xi}\frac{1-t^*}{t^*}-1\right)}{\left(1+\frac{\beta\delta_1}{1+\beta\alpha\xi}\right)(a\tau_{m1}H_p)(a\gamma_p(\tau_pH_p)^{\delta_2}) + (a\tau_{m1}H_p)(a\tau_{m2}H_p)(1-\delta_1)t^{*\delta_1}} \tag{8.6}$$

The denominator in the above expression is positive. The sign of the comparative static is therefore determined by the numerator. The numerator is positive when $\frac{\beta\delta_1}{1+\beta\alpha\xi}\frac{1-t^*}{t^*} > 1$. For this to occur, $\frac{1-t^*}{t^*}$ must be sufficiently greater than one, since $\frac{\beta\delta_1}{1+\beta\alpha\xi} < 1$. That is, when the fraction of time parents devote to investments in their own human capital versus working in period 1 is sufficiently less than $1/2$, then $\frac{\partial t^*}{\partial \tau_p} > 0$.

The marginal effect of τ_{m1}, the degree to which foreign human capital transfers to the production of host labour market, on the optimal amount of time parents spend investing in their own human capital is given by:

$$\frac{\partial t^*}{\partial \tau_{m1}} = \frac{aH_pt^*\left(a\gamma_p(\tau_pH_p)^{\delta_2}t^{*\delta_1}\left(\frac{\beta\delta_1}{1+\beta\alpha\xi}\frac{1-t^*}{t^*}-1\right) - a\tau_{m2}H_p\right)}{(1-\delta_1)a\tau_{m1}H_p(a\tau_{m2}H_p) + \left(\frac{\beta\delta_1}{1+\beta\alpha\xi}+1\right)(a\tau_{m1}H_p)(a\gamma_p(\tau_pH_p)^{\delta_2}t^{*\delta_1})} \tag{8.7}$$

The denominator of the above expression is positive. The sign of the numerator and therefore the entire expression depends on (1) the optimal fraction of time devoted to investments in parental human capital, and (2) the relative magnitude of period 2 earnings in the absence of any human capital investments, $a\tau_{m2}H_p$, and the additional earnings resulting from the optimal human capital investments, $a\gamma_p(\tau_pH_p)^{\delta_2}t^{*\delta_1}$.

The optimality condition for investment in children's schooling takes the following form:

$$S^* = \frac{\beta\alpha\xi}{p(1+\beta\alpha\xi)}a\tau_{m1}H_p(1-t^*) \tag{8.8}$$

The marginal effect of τ_p on the optimal amount of expenditure on children's schooling is given by:

$$\frac{\partial S^*}{\partial \tau_p} = -\frac{\beta\alpha\xi}{p(1+\beta\alpha\xi)}a\tau_{m1}H_p\frac{\partial t^*}{\partial \tau_p} \tag{8.9}$$

The direction of the effect of τ_p on the amount of investment in child's human capital is the opposite to its effect on the amount of investment in parental human capital. That is if $\frac{\partial t^*}{\partial \tau_p} > 0$, then $\frac{\partial S^*}{\partial \tau_p} < 0$.

The marginal effect of τ_{m1} on the optimal amount of investment in children's schooling is given by:

$$\frac{\partial S^*}{\partial \tau_{m1}} = \frac{\beta\alpha\xi}{p(1+\beta\alpha\xi)}aH_p(1-t^*) - \frac{\beta\alpha\xi}{p(1+\beta\alpha\xi)}a\tau_{m1}H_p\frac{\partial t^*}{\partial \tau_{m1}} \tag{8.10}$$

If $\frac{\partial t^*}{\partial \tau_{m1}} < 0$, then $\frac{\partial S^*}{\partial \tau_{m1}} > 0$ as in the case with no credit constraints. If $\frac{\partial t^*}{\partial \tau_{m1}} > 0$, $\frac{\partial S^*}{\partial \tau_{m1}}$ could be negative.

Table 1: Years of Schooling Gap

	Males			Females			Joint Sample	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Second Generation								
Arrived age 14 - 17	0.12	-0.67**	-0.91***	-0.41	-1.18***	-1.38***	-0.92***	-1.13***
	(0.30)	(0.29)	(0.29)	(0.33)	(0.25)	(0.25)	(0.20)	(0.20)
Arrived age 6 - 13	0.53**	0.01	-0.23	0.46**	-0.16	-0.31*	-0.08	-0.28**
	(0.22)	(0.21)	(0.21)	(0.20)	(0.17)	(0.17)	(0.14)	(0.14)
Arrived age 0 - 5	0.97***	0.30	0.07	0.87***	0.35**	0.18	0.3**	0.10
	(0.23)	(0.19)	(0.20)	(0.18)	(0.17)	(0.17)	(0.13)	(0.13)
Born in Canada	0.46***	0.58***	0.43***	0.33***	0.49***	0.37***	0.53***	0.40***
	(0.10)	(0.10)	(0.10)	(0.09)	(0.08)	(0.09)	(0.06)	(0.07)
Controls:								
Age Group		X	X		X	X	X	X
Parental Education		X	X		X	X	X	X
Ethnic Origin		X	X		X	X	X	X
Geography			X			X		X
R-square		0.26	0.28		0.33	0.34	0.29	0.31
Sample Size	11,546	11,546	11,546	13,597	13,597	13,597	25,143	25,143

Note: Female dummy included in regressions on the joint sample.

Table 2: Highest Level of Schooling Gaps

	High School or More		University	
	(1)	(2)	(3)	(4)
Second Generation				
Arrived age 14 - 17	-0.125***	-0.134***	-0.033**	-0.048***
	(0.034)	(0.033)	(0.013)	(0.016)
Arrived age 6 - 13	-0.003	-0.021	-0.003	-0.014
	(0.022)	(0.020)	(0.012)	(0.014)
Arrived age 0 - 5	0.007	-0.012	0.018	0.011
	(0.022)	(0.021)	(0.014)	(0.016)
Born in Canada	0.053***	0.033***	0.020***	0.020**
	(0.011)	(0.009)	(0.007)	(0.008)
Controls:				
Age Group	X	X	X	X
Parental Education	X	X	X	X
Ethnic Origin	X	X	X	X
Geography		X		X
Obs. P	.766	.766	.219	.219
Pred. P (at x)	.799	.845	.114	.147
pseudo R-square	0.23	0.24	0.14	0.16
Sample Size	24,880		24,880	

Note: Female dummy included in all regressions.

Table 3: Years of Schooling By Parental Education

	(1)	(2)	(3)	(4)	(5)
	Native	Arrived	Arrived	Arrived	Cdn born
	Born	14-17	6-13	0-5	Second Gen.
Highest Parental Education					
Graduate Degree	14.27***	0.70	-0.32	-0.12	-0.04
	(0.24)	(0.69)	(0.55)	(0.50)	(0.28)
University	13.31***	-0.99*	-0.62*	-0.59**	-0.17
	(0.17)	(0.53)	(0.36)	(0.28)	(0.19)
Non-Univ Post-Sec	12.26 ***	-0.36	-0.53	-0.30	0.05
	(0.16)	(0.48)	(0.46)	(0.33)	(0.17)
Some University	*12.50****	*-1.48***	*0.22*	0.88	0.18
	(0.31)	*(0.59)*	*(0.79)*	(0.93)	(0.40)
Some Non-Univ Post-Sec	*11.78****	-2.30**	0.01	0.15	0.15
	(0.22)	(0.98)	(0.62)	(0.54)	(0.27)
Some University/Non-Univ Post-Sec	*10.43****	*1.27*	*1.12*	0.80	0.39
	(0.36)	*(1.68)*	*(1.42)*	(0.54)	(0.45)
High School	11.49***	0.17	-0.35	-0.22	0.30**
	(0.13)	(0.34)	(0.28)	(0.39)	(0.12)
Less Than High School	10.14***	-1.82***	0.09	0.85***	0.97***
	(0.13)	(0.30)	(0.21)	(0.20)	(0.10)
R-square	0.30				
Sample size	25,143				

Note1: Controls for 5-year age groups, highest parental education, ethnic origin
and a female dummy included in regression.
Note2: Numbers in italics represent cell counts of less than 30 observations.

Table 4: Years of Schooling - Second and Third Generation

	(1)	(2)	(3)	(4)	(5)
Second Generation					
Arrived age 14 - 17	0.08	-0.12	-0.42**	-0.91***	-1.17***
	(0.23)	(0.21)	(0.19)	(0.20)	(0.20)
Arrived age 6 - 13	0.73***	0.56***	0.30**	-0.07	-0.32**
	(0.15)	(0.14)	(0.14)	(0.15)	(0.15)
Arrived age 0 - 5	1.15***	0.91***	0.61***	0.31**	0.06
	(0.15)	(0.14)	(0.14)	(0.14)	(0.15)
Born in Canada	0.63***	0.94***	0.76***	0.54***	0.37***
	(0.08)	(0.07)	(0.07)	(0.08)	(0.09)
Third Generation	0.63***	0.52***	0.15**	0.02	-0.06
	(0.09)	(0.08)	(0.07)	(0.08)	(0.09)
Controls:					
Age		x	x	x	x
Highest Parental Education			x	x	x
Ethnic Origin				x	x
Geography					x
R-Square		0.16	0.27	0.29	0.31
Sample Size	25,143	25,143	25,143	25,143	25,143

Note: All regressions include a female dummy.

Table 5: Years of Schooling By Parental Education

	(1)	(2)	(3)	(4)	(5)	(6)
	Native Born	Arrived 14-17	Arrived 6-13	Arrived 0-5	Cdn born Second Gen.	Third Generation
Highest Parental Education						
Graduate Degree	14.56***	0.41	-0.61	-0.40	-0.32	-0.59
	(0.30)	(0.71)	-(0.58)	-(0.53)	-(0.33)	-(0.40)
University	13.40***	-1.08**	-0.71*	-0.68**	-0.26	-0.21
	(0.22)	-(0.55)	-(0.39)	-(0.31)	-(0.23)	-(0.24)
Non-Univ Post-Sec	12.28***	-0.37	-0.54	-0.31	0.04	-0.03
	(0.20)	-(0.50)	-(0.47)	-(0.35)	(0.21)	-(0.22)
Some University	12.36***	-1.35*	0.36	1.01	0.32	0.25
	(0.48)	-(0.69)	(0.87)	(0.99)	(0.54)	(0.58)
Some Non-Univ Post-Sec	11.88***	-2.39**	-0.08	0.06	0.06	-0.23
	(0.29)	-(1.00)	-(0.65)	(0.56)	(0.32)	-(0.38)
Some University/Non-Univ Post-Sec	10.52***	1.19	1.04	0.71	0.30	-0.22
	(0.53)	(1.73)	(1.47)	(0.67)	(0.60)	-(0.66)
High School	11.61***	0.04	-0.47	-0.34	0.18	-0.27*
	(0.16)	(0.35)	(0.29)	(0.40)	(0.15)	(0.15)
Less Than High School	10.06***	-1.74***	0.17	0.93***	1.04***	0.25*
	(0.14)	-(0.31)	(0.22)	(0.21)	(0.12)	(0.13)
R-square	0.30					
Sample size	25,143					

Note1: all regressions include controls for 5-year age groups, highest parental education, and ethnic origin.
Note2: Numbers in italics represent cell counts of less than 30 observations.

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Table 6: Years of Schooling - Family Composition

	(1)	(2)	(3)	(4)	(5)
Second Generation					
Arrived age 14 - 17	0.08	-0.12	-0.42**	-0.82***	-1.10***
	(0.23)	(0.21)	(0.19)	(0.20)	(0.20)
Arrived age 6 - 13	0.73***	0.56***	0.3**	-0.0005	-0.26*
	(0.15)	(0.14)	(0.14)	(0.15)	(0.15)
Arrived age 0 - 5	1.15***	0.91***	0.61***	0.36**	0.11
	(0.15)	(0.14)	(0.14)	(0.14)	(0.15)
Born in Canada - 2 Immig Parents	0.85***	1.11***	1.07***	0.82***	0.59***
	(0.09)	(0.09)	(0.08)	(0.10)	(0.10)
Born in Canada - 1 Immig Parent	0.58***	0.91***	0.52***	0.42***	0.28***
	(0.09)	(0.09)	(0.08)	(0.09)	(0.09)
Born in Canada - unknown	-0.79***	-0.06	-0.04	-0.12	-0.27
	(0.17)	(0.17)	(0.17)	(0.17)	(0.18)
Third Generation					
Third Gen - 4 Immig Grandparents	0.55***	0.63***	0.32***	0.17	0.08
	(0.13)	(0.13)	(0.11)	(0.12)	(0.13)
Third Gen - 1-3 Immig Grandparents	0.81***	0.64***	0.2**	0.09	0.01
	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)
Third Gen - Unknown	-0.18	-0.3*	-0.42***	-0.54***	-0.58***
	(0.17)	(0.16)	(0.15)	(0.15)	(0.15)
Controls:					
Age		x	x	x	x
Highest Parental Education			x	x	x
Ethnic Origin				x	x
Geography					x
R-square		0.17	0.28	0.29	0.31
Sample Size	25,143	25,143	25,143	25,143	25,143

Table 7: Years of Schooling and Parental Earnings Profiles - Low Parental Education

	(1)	(2)	(3)
Entry Earnings	-0.46	-0.94	-0.88
	(0.42)	(0.57)	(0.56)
10-year Growth Rate	-5.05***	-5.49***	-5.43***
	(1.72)	(1.90)	(1.94)
Entry X Growth Rate	0.86**	1.07***	1.09***
	(0.32)	(0.33)	(0.33)
Female	-0.08	-0.01	0.02
	(0.22)	(0.23)	(0.23)
Age at Arrival			
3 - 5	-0.18	-0.02	-0.16
	(0.60)	(0.57)	(0.57)
6 - 8	-0.39	-0.35	-0.35
	(0.39)	(0.42)	(0.41)
9 - 11	-0.68*	-0.75*	-0.84**
	(0.39)	(0.39)	(0.37)
12 - 13	-1.25**	-1.40***	-1.42***
	(0.46)	(0.43)	(0.45)
14 - 15	-1.71***	-1.81***	-1.89***
	(0.42)	(0.47)	(0.45)
16 - 17	-2.84***	-2.94***	-2.91***
	(0.65)	(0.65)	(0.65)
First Language Eng or Fr	0.72**	0.68**	0.70**
	(0.32)	(0.28)	(0.28)
Controls:			
Region of Origin	X	X	X
Arrival Cohort		X	X
Geography			X
R-square	0.19	0.22	0.24
Sample Size	776	776	776

Table 8: Years of Schooling and Parental Earnings Profiles - High Parental Education

	(1)	(2)	(3)
Entry Earnings	-0.59	-0.78	-1.16*
	(0.68)	(0.63)	(0.61)
10-year Growth Rate	-2.26	-0.66	-1.53
	(1.67)	(1.60)	(1.68)
Entry X Growth Rate	0.24	0.12	0.21
	(0.19)	(0.17)	(0.19)
Female	0.34	0.41	0.32
	(0.35)	(0.34)	(0.36)
Age at Arrival			
3 - 5	0.09	0.08	0.18
	(0.32)	(0.33)	(0.34)
6 - 8	-0.46	-0.50	-0.45
	(0.41)	(0.39)	(0.37)
9 - 11	0.25	0.15	0.29
	(0.53)	(0.49)	(0.56)
12 - 13	-1.54	-1.67	-1.74
	(1.00)	(1.01)	(1.05)
14 - 15	0.08	-0.03	0.05
	(0.60)	(0.63)	(0.61)
16 - 17	-0.46	-0.42	-0.44
	(0.55)	(0.63)	(0.62)
First Language Eng or Fr	0.45	0.38	0.30
	(0.54)	(0.53)	(0.54)
Controls:			
Region of Origin	X	X	X
Arrival Cohort		X	X
Geography			X
R-square	0.06	0.08	0.10
Sample Size	572	572	572