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The Quality of Immigrant Source Country Educational Outcomes: Do they Matter in the Receiving Country?

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International test scores are used to proxy the quality of source country educational outcomes and explain differences in the rate of return to schooling among immigrants in Canada. The average quality of educational outcomes in an immigrant's source country and the rate of return to schooling in the host country labour market are found to have a strong and positive association. However, in contrast to those who completed their education pre-immigration, immigrants who arrived at a young age are not influenced by this educational quality measure. Also, the results are not much affected when the source country's GDP per capita and other nation-level characteristics are used as control variables. Together, these observations reinforce the argument that the quality of educational outcomes has explanatory power for labour market outcomes. The effects are strongest for males and for females without children.

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1. *Introduction*

It is increasingly recognized that it is beneficial for economic analyses to differentiate between the quantity of education attained (e.g., years of school or highest degree) and the quality of educational achievement (e.g., test score derived measures of cognitive ability).¹ Understanding the relationships between immigrants' formal schooling and source country-level average cognitive skills, as proxied by an index derived from multiple sets of international standardized tests, on the one hand, and labour market outcomes in the receiving country on the other, is relevant to a variety of topics. One issue involves the labour market integration of immigrants in destination country labour markets (Borjas and Friedberg, 2009; Borjas, 1995; Aydemir and Skuterud, 2005; Dustmann, Fabbri and Preston, 2005; Ferrer and Riddell, 2008). Inasmuch as the quality, or relative quality, of pre-immigration educational outcomes varies across source countries this may affect the labour market integration of immigrants and have implications for receiving countries' immigrant selection and settlement policies. This is a long-standing issue; Chiswick (1978) observed a gap in rates of return to education and hypothesized that educational quality might be at issue. More recently Chiswick and Miller (2010) explore source country school quality using American data. Immigration points systems such as those in Canada and Australia, and those being considered in other countries including the US, assume (either implicitly or explicitly) that a year of education is of the same "quality" regardless of where it is obtained. However, in complementary work to that here, Ferrer, Green and Riddell (2006) use individual-level test scores to explore immigrant labour market outcomes and find that these scores explain the entire immigrant-domestic born gap in the rate of return to education.

¹ Although we view test scores as reflecting the quality of general cognitive educational outcomes, it is important to note that such outcomes derive from a variety of inputs including the formal education system, but also including, for example, family inputs, nutrition, and cultural norms affecting student learning effort. That is, there are many inputs to the education production function.

Second, research on endogenous growth by, for example, Hanushek and Kimko (2000), Barro (2001), Erosa et al. (2010), and Barro and Lee (2012) suggest that the quality of educational outcomes as proxied by, for example, national-level average test scores, has very substantial impacts on national productivity and economic growth in contrast to measures of educational attainment or inputs – see Hanushek and Woessmann (2008) for a review. In a sub-section of their work exploring causality, using US data Hanushek and Kimko undertake an exercise similar in some aspects to that conducted here and they have broadly similar findings. Manuelli and Seshadri (2010) suggest the quality of human capital varies systematically with the level of development and find that effective human capital per worker varies substantially across countries. In accounting for differences in output per worker across countries, Schoellman (2012) demonstrates that “education quality” is roughly as important as quantity. Hanushek and Woessmann (2012) further explore this association by tracking the cognitive skill distribution within countries and over time. This paper builds on Hanushek and Kimko’s index of the quality of national-level educational outcomes. Since their index is found to have predictive power in a context other than that for which it was produced, this increases the credibility of the index and their approach.

A third related area of research focuses on the importance of educational outcomes, in contrast to school system resource inputs, for labour market productivity. One reading of the literature suggests that increased inputs are sometimes associated with improved labour market outcomes, especially when the initial level of inputs is low and/or the variation in inputs is large, but that in many situations the link between resource inputs and both cognitive outcomes (i.e., test scores) and labour market outcomes is tenuous (Hanushek, 1996; Betts, 1996). Card and Krueger (1992), and Heckman, Layne-Farrar and Todd (1996a, 1996b), use data from the US for the American born to look at the impact of educational inputs on labour market outcomes where

identification comes from individuals who migrate across states. They find some evidence that inputs matter, but observe that the connection is weak. In a related vein, Bratsberg and Terrell (2002) find that source country educational inputs impact the return to education observed for immigrants to the US.

It is clear that individual-level measures of educational achievement (i.e., test scores) have very substantial (conditional) correlations with labour market success. For example, Green and Riddell (2003) study individual-level IALS scores in relation to earnings and find a sizeable effect with these simple test scores accounting for a substantial fraction of the return to education. However, the origin of the correlation is less than clear. Plausibly, individual unobserved ability contaminates both measures' relationship with labour market success. In this paper, by using immigrants' source country average levels of educational outcomes we avoid individual-level cognitive ability capturing the effects of unobserved individual-specific variables with which they may be correlated. This is also closer to the policy question that may be posed by a government considering investing in improved educational quality. That is, is there a relationship between the nations' average level of test scores (i.e., cognitive skills), and labour market outcomes?

Exploring differences in the return to education of immigrants to Canada as a function of the average quality of educational outcomes in each immigrant's source country is the objective of the present study. Overall, we find that differences in the source country average quality of pre-immigration educational outcomes have substantial impacts on the Canadian labour market earnings of immigrants. The observed impact flows through the return to education, with those from source countries with higher test scores having much higher returns to education, so that the gap widens as years of schooling increases. Adding country-level controls, especially source country GDP per capita, does not appreciably alter the relationship so it is not a wealthy-country effect. Further, the

return to education observed for those immigrants who arrive before age 10 is not a function of their source country quality of educational outcome. This reinforces the idea that it is the quality of educational outcomes, and not source country effects *per se*, that is correlated with the return to education. Notably, the findings for the sample of all women differs somewhat from that for men, especially conditional on source country characteristics. However, in line with the literature on immigrant gender roles, when the sample is restricted to women who are unmarried or without children living in the household, the results are quite similar to those for men.

The remainder of this paper is structured as follows. Section II discusses the data and provides an initial descriptive analysis. Section III presents a random coefficient approach, including a test for the form of heteroscedasticity in the second stage and a feasible Generalized Least Squares strategy. Estimates from the core regression analysis are discussed in Section IV, as are those from sub-group analysis that helps in confirming and describing the phenomenon under study. Section V discusses the findings, draws conclusions and suggests options for future work.

2. Data and Descriptive Statistics

To undertake this analysis Canadian census data are combined with an index of the quality of source country educational outcomes derived from country-level scores from international standardized tests and related information. Hanushek and Kimko (2000) derived the index to allow international comparisons of economic growth. Their measure of the quality of educational outcomes is for 87 countries, but there are only sufficient numbers of immigrants in the Canadian census data to look at 81 of these for males, and 79 for females, with further reductions in some analyses using subsets of the sample. Further, since GDP per capita is not available for three of the countries the number in the regression analysis is reduced to 78 for males and 76 for females.

A merged sample of immigrants from the 1986, 1991, 1996 and 2001 Canadian census 20% files is employed. Combining the four increases the sample size sufficiently to allow more countries to be included in the analysis than would otherwise be possible. (A sensitivity test is conducted to see how robust the results are to the aggregation.) Census 2006 is excluded because the questions pertaining to education changed so substantially that the measurement of schooling is not comparable to that in previous censuses. The selection rules employed for the sample for analysis are that the immigrants must have been born since 1945, be at least 25 years old, and not currently attending school. Those living in the Territories are omitted, as are those with missing relevant variables. Further, immigrants from source countries with fewer than 60 observations are excluded, as are the domestic born. However, in the subgroup analysis we retain all countries with more than 10 observations, which balances several criteria including the desire to retain as large a set of countries as possible. The sample, however, contains the broadest possible set of people in the labour market; thus anyone with positive weeks of work and earnings in the year is included.²

Table 1, for males, and Table 2, for females, present descriptive statistics by source country. *Years of school* is measured as the sum of years of elementary and high school, university, and post-secondary non-university, and includes years from incomplete and/or multiple certifications; it is top coded at 24. Average years of schooling varies by over five years across countries, which is very substantial – equivalent to the difference between an undergraduate degree and senior high school.

Annual earnings, converted to 2001 dollars using the all goods CPI, are the sum of employment and positive self-employment earnings and are top coded at \$150,000. They are presented in the subsequent columns with the averages varying markedly across source countries with the top few being about two and a half times the bottom ones for males, and two times for

² The findings appear to be quite robust across alternative approaches to selecting the sample for analysis. Limited experiments suggest that changing or removing the “born in since 1945” restriction makes little difference. Also, sensitivity tests limiting the sample to those with strong labour force attachment produced remarkably similar results.

females. Appendix table 1 presents descriptive statistics for the census data and provides a listing of the background variables employed in the regressions. One note is that mother tongue, not current language spoken, is employed as a control variable since this is exogenous and is not influenced by the ability to learn new languages, which may be correlated with the quality of educational outcome variable that is the focus of the research. Also, note that the variables “age at immigration” and “domestic potential labour market experience” are used in the regressions rather than “years since migration” and “total potential labour market experience”. The former have more natural interpretations given the context and also fit the data slightly better. However, sensitivity tests were conducted using years since migration instead of age at immigration to ensure robustness and there were no substantive changes in the results.

Turning next to the test score data, the “H&K” column presents Hanushek and Kimko’s (2000 - Appendix table C1) preferred QL2 measure. The underlying observed test scores from which this measure is derived are all in math and science and are only available for 37 countries. The tests were administered in the local language, which reduces concerns that QL2 is influenced by English proficiency across different countries. Further, those countries had different participation frequencies in the underlying six rounds of international testing conducted between 1965 and 1991. In particular, there are fewer observations from countries with very low scores, and wealthier countries tend to participate more often. Using these test scores as a base, Hanushek and Kimko use information regarding each country’s education system (e.g., the primary school enrollment rate and teacher-pupil ratios) and demographics (e.g., population growth rates) to generate their QL2 measure. For this analysis QL2 is normalized to range from zero to one to facilitate interpretation.³ For this paper an attempt was made to go beyond an index by mapping the score from each test to those age-specific set of individuals for whom the particular test was likely relevant (by using

³ Normalizing implies rescaling the data by subtracting the lowest value from each, and then dividing by the highest.

source country and a several year window around each test). This, however, was not fruitful since the sample sizes were too small. Also, no substantive changes to the results in this paper occurred in several experiments with Hanushek and Kimko's alternative measure, QL1.

Since it is derived from six sets of tests by two different organizations, QL2 provides a better proxy than any individual test. It also has the advantage of having been produced for previous work in the US, so it is independent of the current research and the Canadian labour market data employed. (In fact, significant results here add credibility to the index.) However, it cannot be said to be perfect for the purpose at hand. These scores are for students in grade school (up to the end of high school or its equivalent), and postsecondary educational quality may vary differentially across countries although the averages at these two levels are likely correlated. Also, the scores are a weighted average of those for males and females, and there may be appreciable gender gaps in some countries. Finally, there are issues regarding how well the source country average test scores represent the scores of those who immigrate. If immigrants are heavily selected based on unobservables, then they may be from particular parts of each source country's distribution. Of course, if selection is similar across countries the relative scores may still be appropriate measures. In short, although this measure is the best available, it is only a proxy for a broad concept. All of these issues can be thought of as sources of measurement error. Thus, if the quality index contains mostly noise and little signal, it will likely not be correlated with the variables of interest in the Canadian census data, and the coefficients estimated in this study will probably be biased towards zero. Note, however, that the endogenous growth literature discussed above finds that national average test scores have substantial information content and are predictors of a nation's economic and productivity growth. Moreover, Schoellman (2012) argues that differences in immigrants' return to schooling in the US derive from source country education quality, and not selection in

immigration or a lack of skill transferability.

One check on the QL2 measure is to compare it to subsequent international tests. In particular, QL2 is not based on the TIMSS (Third International Math and Science Survey). This is relevant since the TIMSS contains data on eight countries for which QL2 uses predictions. Hanushek and Kimko conduct a verification test and find that the measure in Tables 1 and 2 are highly correlated with the TIMSS country averages, even out of sample. This has two important implications: first, the QL2 estimates are reasonable, and second, the test score rankings are relatively stable over time. Substantial stability in rankings across the test years is also observed in the earlier data. Overall, while QL2 measures the underlying concept with error, it appears to be the best available measure of the quality of cognitive aspects of international relative educational outcomes and to contain an appreciable amount of information.

Interestingly, rank order correlations (using Kendall's tau statistic) between the test score and average years of schooling measures show no relationship for either sex (the associated p-values for males, and females, are 0.83 and 0.88, respectively). Therefore, among immigrants this piece of evidence does not suggest that countries with higher average years of completed schooling also have higher average quality as measured by these test scores. In interpreting this correlation, however, keep in mind that the standardized tests are taken in school and not at completion. In contrast, average schooling and the quality of educational outcomes are each positively correlated with average earnings by source country (as measured by Kendall-tau statistics with p-values of less than 1% in all cases). The upper plots of Figure 1 illustrate the relationship between QL2 and source country average earnings, demonstrating a substantial economic relationship. A shift from the 25th to the 75th percentile of the normalized QL2 distribution is associated with an approximately \$7,000 increase in unadjusted average annual earnings for the males, and about \$3,500 for the females.

3. Empirical Strategy

An approach similar to that in Card and Krueger (1992) – sometimes referred to as a random coefficient, or hierarchical linear, model – is pursued to explore differences in rates of return to education in Canadian labour markets as a function of our proxy for the quality of educational outcomes. It is less restrictive than the Mincer-type earnings equation approach on some dimensions though this comes at a cost. A first stage regression using individual-level data estimates each country's schooling slope coefficient and intercept as seen in equation (1).

$$\ln(w_{ij}) = \alpha'X_i + \sum_j \beta_j C_{ij} S_i + \sum_j \gamma_j C_{ij} + \varepsilon_{ij} \quad (1)$$

In this specification, α , β and γ are sets of coefficients to be estimated; $\ln(w_{ij})$ denotes the natural logarithm of annual earnings for immigrant i born in country j ; C_{ij} is an indicator which is set to unity if immigrant i is born in country j ; S_i is immigrant i 's years of schoolings, so $C_{ij}S_i$ is a set of country-specific measures of years of schooling; and γ_j captures the country-specific fixed effect. The control variables, X , are the natural logarithms of weeks and hours, an indicator for zero hours,⁴ marital status, a quartic in post-immigration potential labour market experience, three census indicators, up to nine age at immigration indicators (for certain subsamples some of the age indicators are not relevant), three indicators of mother tongue (English, French, and both, with neither English nor French omitted), nine provincial indicators, and an urban indicator.⁵ Statistics Canada's composite weight is used in the estimation of equation (1). a

The second stage regression, equation (2),

⁴ Hours in the Canadian Census refer to the actual number of hours that persons worked for pay or in self-employment at all jobs in the week prior to Census Day. An indicator for "zero hours" is needed since people who were in the labor force may be on vacation, sick leave, temporarily unemployed, etc.

⁵ Here and throughout the analysis, the post-immigration experience measure included in the regressions is the minimum of potential experience (age-years of school-5), and years since migration. Much work in the Canadian context, especially Schaafsma and Sweetman (2001), suggests that pre-migration labour market experience has zero or negligible returns. These regressions, therefore, control for Canadian labour market experience. The age at immigration categories are: 0-5, 6-10, 11-15, 16-20, 21-25, 26-30, 31-35, 36-40, and 41-45; 46-51 is omitted.

$$\beta_j = b_0 + b_1 \text{Quality}_j + b'Z_j + \mu_j \quad (2)$$

follows with the return to schooling coefficients from equation (1) serving as the dependent variable. *Quality*, Hanushek and Kimko's (2000) QL2, is an index of mean national educational outcomes that derives from the education system and other inputs such as parental and student effort. It might be argued that the quality indicators are proxying for source country characteristics, and in particular its level of income, which may affect both educational outcomes and immigration patterns. To explore this possibility, Z_j , a set of country-specific characteristics are employed, including source country GDP per capita from the Penn World Trade tables (Heston, Summers and Aten, 2013). We use purchasing power parity GDP per capita at 2005 constant prices and calculate the average of GDP per capita by country from 1970 to 1991 (in \$US adjusted for inflation) converted into an index with the US equal to 100. We believe an average number is useful since over short periods countries may be at different points in their business cycles or be subject to other short-term fluctuations that introduce measurement error. The ideal is a long-term measure of relative wealth/standards of living. We also explored short-term measures; they did not alter our substantial conclusions but had a lower partial R-squared in the second stage regression. Other country-level variables include: an indicator for the language of education in the source country commonly being English or French; Gini coefficients obtained from the World Bank database;⁶ and continent-level indicator variables for Asia and Africa. We explored nonlinear versions of the continuous regressors, but coefficients on the quadratic terms were not statistically significant.

If it is the source country quality of educational outcomes that is driving these results, and not factors such as receiving country racial or ethnic discrimination, then immigrants educated exclusively in their source country should have effects that differ from those educated primarily in

⁶ <http://data.worldbank.org/indicator/SI.POV.GINI/>

the Canadian system. The latter should not be directly affected by the source country quality index. Extensions looking at where each person's education was obtained are, therefore, presented for each sex to increase our confidence in the interpretation of the findings.⁷

Although we focus on the impact of source country test scores on the return to schooling, they could also have a direct effect on earnings as pointed out by, for example, Heckman, Layne-Farrar and Todd (1996a, b), building on work by Behrman and Birdsall (1983). Thus, in principle, it is possible for the effect of our quality measure to enter through variation in the intercept if its variation is (or a component of it is) relevant for earnings but independent of the amount of schooling obtained. We explore this possibility using a regression similar to equation (2) but with γ_j from equation (1) as the dependent variable. Such a relationship might, for example, reflect a selection effect in immigration, or systematic differences in selection within the education systems of source countries with different measured test scores. It could also reflect the differential attainment of basic skills across countries that are not highly correlated with years of schooling.

3.1 Heteroscedasticity and feasible Generalized Least Squares

Heteroscedasticity is a concern in the second stage regression since the countries have different sample sizes and perhaps other unobserved common characteristics. For grouped data regression models, if each error term in the individual-level data in equation (1), regardless of which group it belongs to, is independently and identically distributed (i.i.d.) with mean zero and variance σ_ϵ^2 (that is, if there is no clustering as in the census), then the errors in the group level regression

⁷ Place of birth, which is reported in the census, is assumed to be the country in which education is received if the years of schooling (plus 5) are less than the age at immigration. If the years of schooling plus 5 are greater than the age at immigration, then some schooling is inferred to have been received post-immigration. Since gaps in educational attendance exist, but are not observed, some of those who are classified as receiving only source country schooling will have obtained some education post-immigration. This will serve to attenuate the coefficient. Errors in the other direction are probably much less common, though some immigrants who arrive in Canada at a young age undoubtedly go out of the country to receive some of their education.

will have mean zero and variance σ_ε^2/N . Using this logic, a traditional way to deal with the heteroscedasticity in the second stage (equation 2) is to use cell counts N as weights to generate efficient and unbiased estimates. In contrast, in the presence of country-level clustering this approach need not be appropriate as pointed out by Dickens (1990). If people within a group share unobserved common characteristics then the error term in equation (1) should have two components as in equation (3),

$$\varepsilon_{ij} = \gamma_j + u_{ij} \quad (3)$$

where γ_j and u_{ij} are group and individual error components respectively. If they are both i.i.d. (as well as independent of each other) with mean zero and variance σ_γ^2 and σ_u^2 respectively, then the variance of the aggregate level error term follows as:

$$Var(\mu_i) = Var(\bar{\varepsilon}_j) = \sigma_\gamma^2 + \left(\frac{\sigma_u^2}{N_j} \right) \quad (4).$$

Dickens argues that if σ_γ^2 exists and is sufficiently large, or if group sizes are large enough, then constructing weights exclusively based on cell counts (N_j) may increase heteroscedasticity rather than adjust for it, which generates biased estimates of standard errors. Hence, it may be not worth weighting. Solon et al. (2013) re-emphasize this issue and suggest that the practitioner perform a heteroscedasticity test, in particular, a simple regression of squared OLS residuals on a constant and the inverse group size (i.e., $\frac{1}{N_j}$). If the coefficient on $\frac{1}{N_j}$ is statistically significant, then this is evidence of heteroscedasticity from the grouped data structure and they suggest a feasible Generalized Least Squares (GLS) specification. An estimate of the source-country specific variance can be constructed based on equation (4) since the estimated intercept from the regression testing for heteroscedasticity consistently estimates σ_γ^2 while the coefficient on $\frac{1}{N_j}$ consistently estimates σ_u^2 . In a related context Brewer et al. (2013) emphasize the importance of the increased

statistical power from feasible GLS.

For completeness, we employ four weighting strategies. The first is simply OLS, which gives equal weight to all countries implying that the second term on the right hand side of equation (4) is set to zero, which is the preferred specification if the coefficient on $1/N_j$ is not statistically different from zero. Second, as is common in the literature we use source country sample sizes as weights, which emphasizes the second right hand side term in equation (4) and is appropriate if there is no clustering. Third, and in a similar vein to the second, we use as weights the inverse of the sampling variances of the estimated returns to schooling from the first stage, which is sometimes discussed in the literature. Finally, we use Dickens style weights based on the estimated two components in the variance of error terms, which is the preferred approach if the heteroscedasticity tests suggest that both components of equation (4) are different from zero. Also, in accord with Solon et al.'s (2013) recommendations, heteroscedasticity-robust standard error estimates are reported in all cases to account for any remaining heteroscedasticity.

4. Regression Estimates

4.1 First stage regression results

Country specific returns to education from the first stage are reported in Appendix table 2. Models are also estimated for selected subsamples of the data, as discussed below, but only the second stage results are presented for the latter. The range of estimates is clearly quite wide, and there are substantial differences across the sexes with females having larger coefficients 72.5% of the time. The correlation between the male and female coefficients is 0.476, which is statistically different from zero with a p-value of 0.0000, however, there are some source countries, such as Thailand, for which the estimated return to education for males is quite high (0.101), while that for

females is quite low (0.020). This may be related to the phenomena observed by Antecol (2000) who found a strong positive correlation between source country male-female wage gaps and those observed in the US for first generation immigrants. Also, in Canada the average return to education for females is larger than that for males.

Table 3 presents results from heteroscedasticity tests for the entire sample and various subsets of it. In all cases the evidence is in favor of an error component model with positive weight on both components. Clearly, the modest minimum country-level samples together with the substantial differences in cell sizes as seen in tables 1 and 2 generate appreciable heteroscedasticity, but there is also a group-specific (cluster) component. Compared to that for the entire sample, the coefficient on the $\frac{1}{N_j}$ term grows in magnitude for the subsamples, apparently because the smallest country samples are reduced, making the heteroscedasticity more serious. In the extreme, some countries are even lost when the number of individuals per country falls below our threshold for inclusion in the regressions.

4.2 Second stage regression results

Quality's coefficient is positive and highly statistically significant, empirically important in magnitude, and although our preferred specification is (4) using GLS it is robust across specifications in the male sample as shown in Table 4. Increasing the quality of source country educational outcomes, via the education system or by other determinants of such outcomes, appears to substantially augment the accumulation of skills that are relevant for earnings across years of schooling. After controlling for the full set of country level variables, many of which are individually statistically significant, the magnitude of the quality of educational outcomes is only slightly reduced, which implies substantial independent variation between earnings in Canada and

source country test scores. The fact that the quality relationship does not appear to be diminished by including GDP and other variables strengthens the central finding of this paper. Interestingly, the coefficient on the GDP per capita index is statistically significant, suggesting that, conditional on quality, immigrants from “high income” countries have higher returns to education, which is relevant to Manuelli and Seshadri’s (2010) interest in productivity and educational quality across nations. The same is true for immigrants from Asian and African countries, although the results for English and French being used in the home country school system and income inequality in the home country have coefficients that are statistically significant in some specifications, but not in the preferred model (4).⁸

Subgroup analyses of the lower panel of table 4 tell an interesting story. These results are from regressions identical to those in the upper panel, except that they are for various subsets of the sample.⁹ First, we select those immigrants who completed their education before immigrating. Next are those with mixed Canadian and source country education; this sample is the complement to the first. It explores a result observed by Friedberg (2000), which shows that obtaining domestic education increases wages and “undoes” some of the low return to foreign education in the Israeli context. Finally, those who arrive at a very young age – a subset of the second group – are examined in isolation since they have obtained almost all of their schooling in Canada and should not be directly affected by the source country test scores.

Looking at the results in the bottom half of table 4, those immigrants who arrive at an older age (for whom all their education is typically obtained in the source country) have a similar

⁸ It is worth noting that weighting by $1/N$ or $\text{Var}(\beta)$ generate smaller standard errors than the preferred specification; plausibly they over-reject by virtue of putting insufficient emphasis on the term “clustering” error component. See the discussion in Dickens (1990) and Solon et al. (2013).

⁹ One small difference from the earlier regressions is that some of the age at immigration indicators (which are not presented) are not relevant for some of the subgroups.

relationship between the quality of source country educational outcomes and Canadian labour market earnings as observed in the upper panel for all immigrants. In contrast, those who have Canadian and/or mixed source education are unaffected by the source country index. Apparently, in accord with Friedberg (2000), obtaining receiving country education seems to reduce or sever the relationship with home country test scores. Of course, there is endogenous selection into post-migration Canadian education. Finally, the earnings of those who arrive in Canada at a very young age are not statistically significantly affected by the index – in fact, the point estimates are frequently negative; source country educational outcome quality does not matter for those not educated in the source country. Also, although not displayed, for these groups the returns to years of schooling are quite large compared to those estimated in earlier regressions. This accords with Schaafsma and Sweetman (2001) who find that immigrants who arrive prior to age 10 have equal or greater returns to schooling than the Canadian born and immigrants who arrive later in life.

For the female sample, the coefficients on the quality measure are markedly larger than those for males unconditionally in all four specifications in table 5. However, unlike the males, the introduction of control variables substantially reduces the females' coefficient estimates making them slightly smaller than those for the males but with larger standard errors so that in the preferred specification they are statistically insignificant. It is not certain why there is such an appreciable difference between the conditional and unconditional coefficients across the genders, although it is quite normal for the standard errors in annual earnings regressions for females to be larger than those for males given the differences in their labour supply patterns; for example, many more females work part time. Beyond differences in female labour force attachment, one possibility, commonly discussed in the research and popular literature (e.g., Klasen, 2002; Behrman and Grant, 2010) has to do with quite different approaches to education for women compared to men in certain

nations, whereby historically females received less and/or lower quality education than males. Additionally, Blau, Kahn, and Papps (2011) focus on married women's labour supply assimilation profiles and find that they are a function of source country gender roles for an extended period post-migration. These gender differences may also have something to do with joint mobility decisions as discussed by Loprest (1992).

To explore the female coefficient gap further, we focus on females less affected by gender roles, Table 6 shows results for the subset of females with no unmarried children residing in their household. The unconditional estimates are very much like those for the males, although larger. More interestingly, the conditional coefficient estimates are remarkably similar to the unconditional ones. The patterns across the various subsamples in the lower half of the table are also similar to those for males. Although not shown, the results for females who are not married are broadly similar. Overall, it appears that the sub-samples of females who are either without children or not married yield results very similar to those for males, but once those who are married/with children are included in the sample, the patterns change appreciably, especially the gaps between the conditional and unconditional estimates. For female immigrants with limited marital/childcare responsibilities, the rate of return to education is clearly a function of source country test scores. Understanding more about the source of these findings, which adds an education quality dimension to the gender roles phenomena observed by Antecol (2000), and Blau, Kahn, and Papps (2011), is an interesting area for future research.

Although not shown to save space, we explore correlations between the quality index and the country-specific intercepts from equation (1). That is, we estimate equation (2) using γ_i as the dependent variable. For males the point estimates are small, negative, and not statistically significant in the preferred specification. For females the coefficient in the unconditional regression

from the preferred model is negative and statistically significant, whereas conditional on the Z_i variables it is effectively zero and not statistically significant. It is feasible that the best way to interpret these results is to suggest that there is no relationship between the country-specific intercepts and the quality measure. However, since one of the four coefficients is statistically significant, and all the point estimates are negative, an alternative interpretation is to recognize that, combined with the findings in tables 4 through 6, individuals with very low years of schooling from source countries with very high test scores do poorly in terms of earnings. Potentially, the selection into higher years of schooling in high test score countries is such that those with very low years of schooling have low productivity for unobserved reasons.

While they are again not shown to save space, we performed a variety of sensitivity tests. We split the sample according to census year, and into those residing in one of three major cities, and found that the quality of source country educational outcomes has a similar effect on earnings across locations and time periods. Of course, some of these estimates are not very precise. The effects are still present when countries with a large number of observations such as the UK, the USA, or India are excluded. When weekly earnings were used as the dependent variable the statistical significance of the coefficients does not change appreciably, but the magnitude of coefficients increases. Also, restricting the sample to “full-year” workers did not alter the results substantially. Overall, the results with respect to earnings appear to be quite robust. Interestingly, we did not find any relationship between the quality measure and various measures of labour supply such as full-year status or labour force participation.

5. Discussion and Conclusion

Immigrants’ source country educational quality—measured by Hanushek and Kimko’s

(2000) index based on six sets of source country test scores in math and science—is seen to be strongly positively correlated with the rate of return to education in the Canadian labour market. The index does not measure the test score, or related ability, of any individual, but reflects the quality of national-level educational outcomes, although those outcomes may have sources beyond the education system. Simple correlations and graphical analyses by source country show a substantial positive relationship between the quality of educational outcomes and average Canadian labour market earnings among immigrants. Regression analysis finds that this measure of quality seems to operate primarily through the return to education (as opposed to having a direct association with earnings). For males, adding a range of country-specific controls, and especially source country GDP per capita, does not attenuate the coefficient on quality very much. In contrast, for females the gap between the conditional and unconditional coefficient estimates is greater, and the conditional estimate is not statistically significant for the entire population. However, when the female sample is restricted to those who are without children residing in their household or who are not married, then the labour market relationship between annual earnings and the quality measure looks very much like that for males. Sensitivity tests find that quality of educational outcomes matters for those educated pre-immigration, but not for those who immigrate at a young age and obtain their education in Canada. Taken together, these extensions reinforce the idea that it is the source country quality of educational outcome that is at issue and not some other source country factors such as the average level of source-country wealth or racial/ethnic discrimination. These findings provide plausible evidence that the quality of education, as measured by test scores, has a causal impact on the rate of return to education and through it earnings. However, it remains possible that some omitted country-level characteristic is correlated with both the country-specific rates of return to education and our test score index.

These findings suggest that immigrant economic integration and credential recognition are more complex than is allowed for by many analyses, which impose a common rate of return on years of schooling or some similar measure of educational attainment. In terms of credential recognition, the results in the lower half of tables 4 and 6 paint a picture of a labour market that values not only “years of school” and/or credentials, but the cognitive content of that education as measured by this index of test scores. Moreover, these results add support to Hanushek and Kimko’s (2000), and Hanushek and Woessmann’s (2008), claims that they have captured aspects of educational outcomes in their index that have substantial impacts in the labour market. In terms of both the endogenous growth and the educational outcomes literatures, this is consistent with the notion that the quality of national educational outcomes is associated with labour productivity.

In the future, expanding the information available on educational outcome quality would be valuable. This might include more refined indexes, for example one for sex-specific school quality, and expanding the countries for which the quality measure is available. It would also be useful to consider other aspects of quality that might affect immigrant labour market earnings. For example, advanced technologies, especially computers, are becoming increasingly important in the labour market. Undoubtedly the degree to which the most current technologies are employed varies across national education systems, even at the post-secondary level, and this may matter for labour market outcomes.

References

- Antecol, H., 2000. An examination of cross-country differences in the gender gap in labor force participation rates *Labour Economics* 7, 409-426.
- Aydemir, A., Skuterud, M., 2005. Explaining the Deteriorating Entry Earnings of Canada's Immigrant Cohorts: 1966-2000. *Canadian Journal of Economics* 38 (2), 641-71.
- Barro, R.J., 2001. Human Capital and Growth. *American Economic Review* 91(2),12-17.
- Barro, R.J., Lee, J.W., 2012. A New Data Set of Educational Attainment in the World, 1950-2010. *Journal of Development Economics* DEVEC-01721, 1-15.
- Behrman, J.R., Birdsall, N., 1983. The Quality of Schooling: Quantity alone is misleading. *American Economic Review* 73(4),928-946.
- Behrman, J.R., Grant, M.J., 2010. Gender Gaps in Educational Attainment in Less Developed Countries. *Population and Development Review* 36 (1), 71-89.
- Betts, J. R., 1996. Is There a Link between School Inputs and Earnings? Fresh Scrutiny of an Old Literature. In *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, eds. G. Burtless. Washington, DC: Brookings.
- Blau, F.D., Kahn, L.M., Papps, K.L., 2011. Gender, Source Country Characteristics, and Labor Market Assimilation among Immigrants. *Review of Economics and Statistics* 93(1), 43-58.
- Borjas, G.J., 1995. Assimilation and Changes in Cohort Quality Revisited: What Happened to Immigrant Earnings in the 1980s? *Journal of Labor Economics* 13 (2), 201-245.
- Borjas, G.J., Friedberg, R.M., 2009. Recent Trends in the Earnings of New Immigrants to the United States NBER Working Paper No. 15406.
- Bratsberg, B., Terrell, D., 2002. School Quality and Returns to Education of U.S. Immigrants. *Economic Inquiry* 40 (2), 177-198.

- Brewer, M., Crossley, T.F., Joyce, R., 2013. Inference with Difference-in-Differences Revisited
Institute for Fiscal Studies, mimeo.
- Card, D., Krueger, A.B., 1992. Does School Quality Matter? Returns to Education and the
Characteristics of Public Schools in the United States. *Journal of Political Economy* 100 (1),
1-40.
- Chiswick, B.R., 1978. The Effect of Americanization on the Earnings of Foreign-born Men. *Journal
of Political Economy* 86 (6), 897-921.
- Chiswick, B.R., Miller, P.W., 2010. The Effects of School Quality in the Origin on the Payoff to
Schooling for Immigrants, in G. Epstein and I. Gang, eds., *Migration and Culture*, (Frontiers
of Economics and Globalization 8), Emerald Group Publishing, 67-103.
- Dickens, W. T., 1990. Error Components in Grouped Data: Is It Ever Worth Weighting? *The
Review of Economics and Statistics* 72 (2), 328-333.
- Dustmann, C., Fabbri, F., Preston, I., 2005. The Impact of Immigration on the British Labour
Market. *The Economic Journal* 115 (November), 324-341.
- Ferrer, A., Green, D.A., Riddell, W.C., 2006. The Effect of Literacy on Immigrant Earnings.
Journal of Human Resources 41 (2), 380-410.
- Ferrer, A., Riddell, W.C., 2008. Education, Credentials and Immigrant Earnings *Canadian Journal
of Economics* 41(1),186-216.
- Erosa, A., Koreshkova, T., Restuccia, D., 2010. How Important Is Human Capital? A Quantitative
Theory Assessment of World Income Inequality. *Review of Economic Studies* 77, 1421-
1449.
- Friedberg, R., 2000. You Can't Take It with You? Immigrant Assimilation and the Portability of
Human Capital. *Journal of Labor Economics* 18, 221-251.

- Green, D., Riddell, W.C., 2003. Literacy and Earnings: An Investigation of the Interaction of Cognitive and Unobserved Skills in Earnings Generation Labour Economics 10 (2), 165-84.
- Hanushek, E.A., 1996. The Economics of Schooling: Production and Efficiency in Public Schools. Journal of Economic Literature 24 (3), 1141-77.
- Hanushek, E.A., Kimko, D.D., 2000. Schooling, Labor-Force Quality, and the Growth of Nations. American Economic Review 90 (5), 1185-1208.
- Hanushek, E.A., Woessmann, L., 2008. The role of cognitive skills in economic development. Journal of Economic Literature 46 (3), 607-68.
- Hanushek, E.A., Woessmann, L., 2012. Do Better Schools Lead to More Growth? Cognitive Skills, Economic Outcomes, and Causation. Journal of Economic Growth 17 (4), 267-321.
- Heckman, J., Layne-Farrar, A., Todd, P., 1996a. Human Capital Pricing Equations with an Application to Estimating the Effect of School Quality on Earnings. The Review of Economics and Statistics 78 (4), 562-610.
- Heckman, J., Layne-Farrar, A., Todd, P., 1996b. Does Measured School Quality Really Matter? An Examination of the Earnings-Quality Relationship. in G. Burtless ed., Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success (Washington, D.C.; Brookings Institution), 192-289.
- Heston, A., Summers, R., Aten, B., 2013. Penn World Table Version 7.1, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania, October.
- Klasen, S., 2002. Low Schooling for Girls, Slower Growth for All? Cross-Country Evidence on the Effect of Gender Inequality in Education on Economic Development. World Bank Economic Review 16 (3), 345-373.
- Loprest, P.J. 1992. Gender Differences in Wage Growth and Job Mobility. American Economic

Review 82 (2), 526-32.

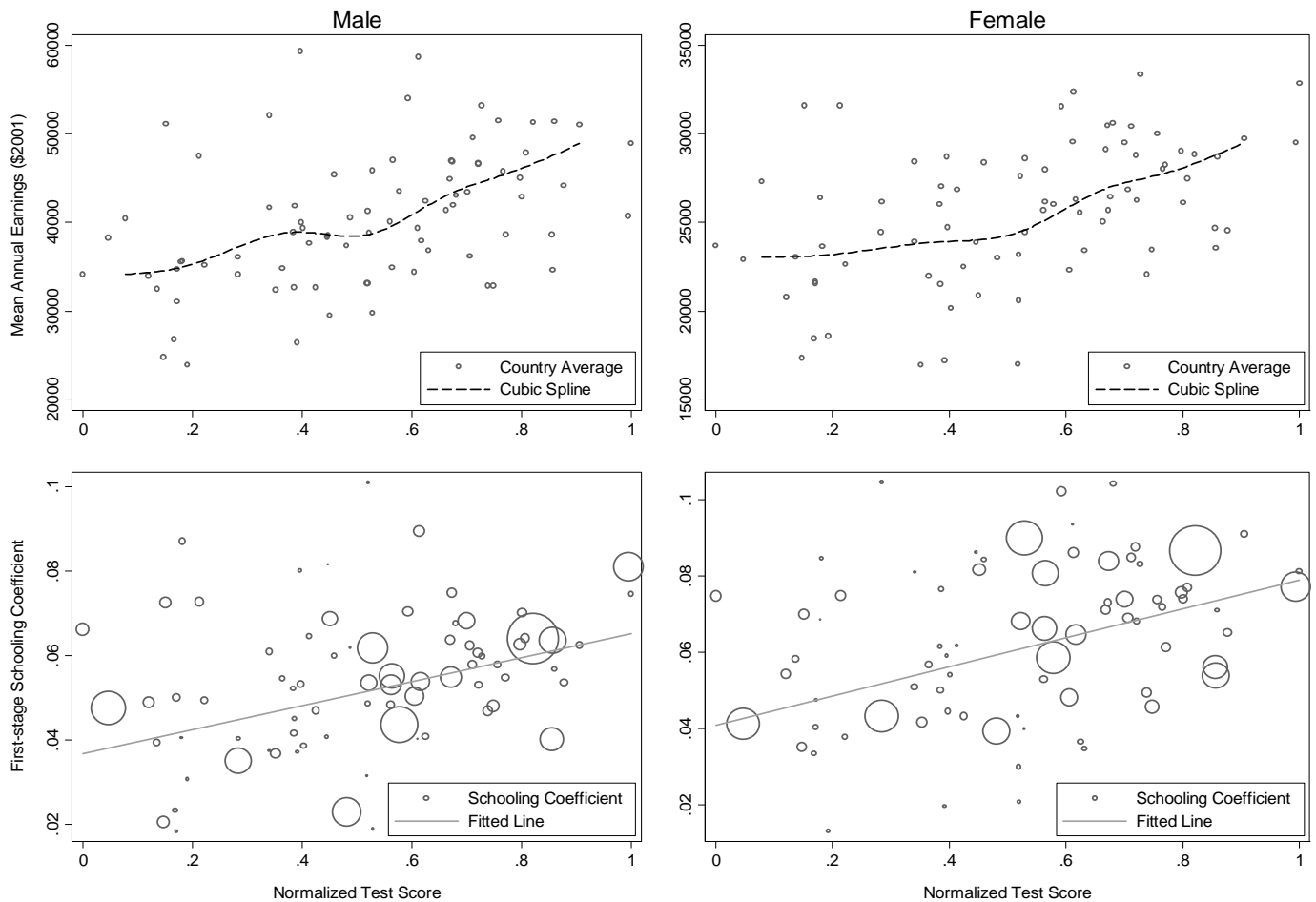
Manuelli, R. E. Seshadri, A., 2010. Human Capital and the Wealth of Nations, Mimeo, University of Wisconsin Working Paper.

Schaafsma, J., Sweetman, A., 2001. Immigrant Earnings: Age at Immigration Matters. Canadian Journal of Economics 34 (4), 1066-1099.

Schoellman, T., 2012. Education Quality and Development Accounting Review of Economic Studies 79 (1), 388-417.

Solon, G., Haider, S.J., Wooldridge, J., 2013. What Are We Weighting For? NBER working paper 18859.

Figure 1 – Average Annual Earnings / Return to Education and School Outcome by Source Country



Note: In the upper two panels we fit cubic splines using the unadjusted data. In the lower panel we fit a regression line based on the model (4) without controls from tables 4 and 5.

Source: Canadian census data and the Hanushek and Kimko (2000) index of the quality of educational outcomes.

Table 1 – Descriptive Statistics for Males by Source Country

Country	Sample Size		Years of School		Mean Earnings		Test Score	
	N	%	Mean	Std Dev	Mean	Std Dev	H&K	Norm
Algeria	6355	0.24	16.40	4.06	35608	26440	28.06	0.18
Argentina	9435	0.36	14.07	3.75	40130	26427	48.50	0.56
Australia	13475	0.52	14.57	3.14	49533	31399	59.04	0.76
Austria	9525	0.37	15.34	3.24	51420	33226	56.61	0.71
Barbados	9825	0.38	13.72	3.05	38649	24352	59.80	0.77
Belgium	13880	0.53	14.38	3.41	46717	29095	57.08	0.72
Bolivia	910	0.04	15.07	3.77	34698	23672	27.47	0.17
Brazil	6555	0.25	14.24	3.93	41690	28448	36.60	0.34
Cameroon	500	0.02	18.74	3.20	38610	25098	42.36	0.45
China	110130	4.24	13.64	4.72	34614	26907	64.42	0.86
Columbia	5710	0.22	14.15	3.68	34829	25002	37.87	0.36
Costa Rica	490	0.02	14.12	3.89	33169	24716	46.15	0.52
Cyprus	4370	0.17	13.48	3.87	41301	28808	46.24	0.52
Denmark	12035	0.46	13.69	3.10	47901	29712	61.76	0.81
Dominican R	1710	0.07	12.41	4.13	26526	22019	39.34	0.39
Ecuador	7095	0.27	12.76	3.36	32683	19790	38.99	0.38
Egypt	23210	0.89	16.90	3.16	51060	35374	26.43	0.15
El Salvador	21050	0.81	12.17	4.05	24832	16490	26.21	0.15
Falkland Is	18835	0.73	14.26	3.29	33980	22838	24.74	0.12
Fiji	16315	0.63	12.63	2.95	32878	20200	58.10	0.74
Finland	8625	0.33	13.54	3.12	45784	26909	59.55	0.77
France	45510	1.75	14.97	3.51	43383	29267	56.00	0.70
Germany	99150	3.82	14.26	3.10	47111	29991	48.68	0.56
Ghana	8670	0.33	14.59	3.66	32551	21747	25.58	0.14
Greece	53950	2.08	11.43	4.22	34481	24578	50.88	0.61
Guyana	58660	2.26	13.67	3.21	37893	23509	51.49	0.62
Honduras	1450	0.06	12.46	4.19	23915	17243	28.59	0.19
Hong Kong	134005	5.16	15.23	3.48	40764	29296	71.85	0.99
Hungary	20425	0.79	14.58	3.18	45040	31315	61.23	0.80
Iceland	315	0.01	13.81	3.27	39396	22677	51.20	0.61
India	182715	7.04	13.91	4.16	38292	26806	20.80	0.05
Indonesia	4410	0.17	15.63	3.01	45444	30303	42.99	0.46
Iran	29325	1.13	15.88	3.30	34199	28632	18.26	0.00
Iraq	9730	0.37	14.07	4.04	31061	26911	27.50	0.17
Ireland	16630	0.64	14.68	3.22	54031	33188	50.20	0.59
Israel	12085	0.47	14.87	3.34	46982	35624	54.46	0.67
Italy	221500	8.53	11.92	3.92	43534	25881	49.41	0.58
Jamaica	70970	2.73	13.08	3.13	34868	22629	48.62	0.56
Japan	8565	0.33	15.11	2.86	44185	28346	65.50	0.88
Jordan	2335	0.09	14.58	3.51	38395	28236	42.28	0.45
Kenya	13280	0.51	15.77	2.95	47500	32203	29.73	0.21
Kuwait	1435	0.06	15.64	2.76	40455	30686	22.50	0.08
Luxembourg	290	0.01	13.42	2.53	40568	23591	44.49	0.49
Malaysia	12070	0.46	15.46	3.32	44890	29294	54.29	0.67
Malta	8485	0.33	12.41	3.29	46589	25018	57.14	0.72
Mauritius	5405	0.21	15.18	3.55	43040	28934	54.95	0.68
Mexico	16440	0.63	10.66	4.79	32420	25182	37.24	0.35
Mozambique	775	0.03	13.85	3.37	35514	23556	27.94	0.18
N Zealand	6795	0.26	14.94	3.16	51027	33228	67.06	0.91
Netherland	73525	2.83	13.71	3.21	46893	27886	54.52	0.67
Nicaragua	4005	0.15	14.29	3.66	26813	18018	27.30	0.17
Nigeria	4095	0.16	17.11	3.26	38913	28793	38.90	0.38
Norway	3220	0.12	14.27	3.14	51375	33002	64.56	0.86

Panama	1195	0.05	15.22	3.16	29785	21414	46.78	0.53
Paraguay	5400	0.21	11.13	3.73	39388	23543	39.96	0.40
Peru	8100	0.31	15.12	3.55	32707	24009	41.18	0.43
Philippines	102295	3.94	14.81	2.98	34190	19576	33.54	0.28
Poland	95310	3.67	14.72	3.09	38651	25026	64.37	0.86
Portugal	138220	5.32	9.49	4.15	37402	20562	44.22	0.48
S Africa	18820	0.72	16.21	3.20	58671	39504	51.30	0.61
S Korea	22205	0.86	15.61	2.78	32934	27203	58.55	0.75
Singapore	4625	0.18	15.67	2.93	48886	32609	72.13	1.00
Spain	7240	0.28	13.78	3.87	42406	27513	51.92	0.62
Sri Lanka	36770	1.42	13.49	3.42	29482	20909	42.57	0.45
Sweden	4920	0.19	15.19	3.05	53201	33850	57.43	0.73
Switzerland	12370	0.48	14.67	3.11	42891	29485	61.37	0.80
Syria	7850	0.30	13.76	4.71	35174	28752	30.23	0.22
Taiwan	13500	0.52	16.13	2.81	36159	30215	56.31	0.71
Thailand	910	0.04	13.86	3.97	33169	23245	46.26	0.52
Trin&Tobago	43855	1.69	14.13	3.07	38800	24339	46.43	0.52
Tunisia	3255	0.13	15.68	4.08	37615	29220	40.50	0.41
Turkey	8805	0.34	13.75	4.83	40040	29977	39.72	0.40
UK	410585	15.81	14.64	2.95	51323	30829	62.52	0.82
Uruguay	4620	0.18	13.33	3.44	36862	23885	52.27	0.63
USA	141655	5.45	15.34	3.43	45870	32118	46.77	0.53
USSR	23470	0.90	15.80	3.28	41907	29571	54.65	0.68
Venezuela	3280	0.13	15.05	3.60	41819	30465	39.08	0.39
Yugoslavia	41520	1.60	13.30	3.14	41379	24204	53.97	0.66
Zaire	2280	0.09	16.91	3.39	36098	26722	33.53	0.28
Zambia	1090	0.04	16.34	3.04	52072	36974	36.61	0.34
Zimbabwe	2275	0.09	16.10	2.86	59330	37495	39.64	0.40

Note: Census derived statistics use weights from Statistics Canada. Earnings are in constant \$2001 adjusted using the CPI. Canada's test score is 54.58, or 0.67 normalized.

Source: The combined 1986, 1991, 1996, and 2001 Canadian censuses, with quality measures from Hanushek and Kimko (H&K - 2000).

Table 2 – Descriptive Statistics for Females by Source Country

Country	Sample Size		Years of School		Mean Earnings		Test Score	
	N	%	Mean	Std Dev	Mean	Std Dev	H&K	Norm
Algeria	2740	0.12	15.74	3.49	23779	19375	28.06	0.18
Argentina	7145	0.32	13.95	3.71	25623	19305	48.50	0.56
Australia	9560	0.42	14.60	2.90	29668	22358	59.04	0.76
Austria	10590	0.47	13.96	2.90	30366	21767	56.61	0.71
Barbados	10435	0.46	13.62	2.71	28187	16721	59.80	0.77
Belgium	11720	0.52	13.93	3.19	28629	21185	57.08	0.72
Bolivia	670	0.03	14.17	3.56	21788	17665	27.47	0.17
Brazil	5815	0.26	13.99	3.80	23969	17831	36.60	0.34
Cameroon	--	--	--	--	--	--	42.36	0.45
China	98720	4.36	12.47	4.48	23545	18492	64.42	0.86
Columbia	6285	0.28	13.79	3.69	21782	16192	37.87	0.36
Costa Rica	730	0.03	13.58	3.74	16713	12543	46.15	0.52
Cyprus	3445	0.15	12.11	3.64	23156	16792	46.24	0.52
Denmark	9475	0.42	13.30	2.69	27324	20084	61.76	0.81
Dominican R	1405	0.06	11.85	4.34	17306	14133	39.34	0.39
Ecuador	6175	0.27	12.69	3.37	21596	14893	38.99	0.38
Egypt	14390	0.64	11.82	4.05	17367	12678	26.43	0.15
El Salvador	15605	0.69	15.85	2.95	31437	24374	26.21	0.15
Falkland Is	14245	0.63	13.85	3.24	20807	15845	24.74	0.12
Fiji	15065	0.67	12.02	2.60	22007	14543	58.10	0.74
Finland	8065	0.36	13.74	2.98	27750	21057	59.55	0.77
France	35355	1.56	14.96	3.23	29507	21694	56.00	0.70
Germany	84560	3.73	13.78	2.85	27794	21208	48.68	0.56
Ghana	5910	0.26	13.06	3.18	23169	17795	25.58	0.14
Greece	42260	1.87	10.26	3.96	22296	17946	50.88	0.61
Guyana	56450	2.49	13.10	2.86	26264	16760	51.49	0.62
Honduras	1345	0.06	12.57	4.03	18856	16463	28.59	0.19
Hong Kong	122855	5.42	14.18	3.37	29444	21813	71.85	0.99
Hungary	17425	0.77	14.21	2.95	28975	23721	61.23	0.80
Iceland	370	0.02	14.77	2.51	29510	21001	51.20	0.61
India	148715	6.57	13.22	4.09	22848	18376	20.80	0.05
Indonesia	3870	0.17	14.74	3.08	28155	22723	42.99	0.46
Iran	15305	0.68	15.47	3.02	23680	21041	18.26	0.00
Iraq	4270	0.19	13.51	3.82	21471	19685	27.50	0.17
Ireland	13950	0.62	14.29	2.85	31259	24080	50.20	0.59
Israel	8465	0.37	14.73	3.11	30443	24271	54.46	0.67
Italy	158160	6.98	10.99	3.85	25912	18446	49.41	0.58
Jamaica	81130	3.58	13.21	2.91	26143	17050	48.62	0.56
Japan	9125	0.40	14.82	2.53	24443	19731	65.50	0.88
Jordan	1285	0.06	13.75	2.89	23342	19054	42.28	0.45
Kenya	12720	0.56	14.78	2.80	31652	21451	29.73	0.21
Kuwait	945	0.04	15.69	2.80	27697	22309	22.50	0.08
Luxembourg	--	--	--	--	--	--	44.49	0.49
Malaysia	12415	0.55	14.13	3.34	28812	20631	54.29	0.67
Malta	6295	0.28	11.89	2.99	25923	18126	57.14	0.72
Mauritius	4550	0.20	13.89	2.91	30649	18928	54.95	0.68
Mexico	13055	0.58	11.61	4.60	16989	16198	37.24	0.35
Mozambique	585	0.03	12.91	3.73	26317	17796	27.94	0.18
N Zealand	5550	0.25	14.50	2.69	29376	23049	67.06	0.91
Netherland	52105	2.30	13.22	2.77	25562	20007	54.52	0.67
Nicaragua	3185	0.14	13.82	3.42	18537	15005	27.30	0.17
Nigeria	1850	0.08	15.84	3.14	25850	20426	38.90	0.38
Norway	2320	0.10	13.92	2.50	28538	22315	64.56	0.86

Panama	755	0.03	15.18	2.88	23949	16740	46.78	0.53
Paraguay	3865	0.17	11.03	3.24	20025	16054	39.96	0.40
Peru	7870	0.35	14.47	3.09	22412	17850	41.18	0.43
Philippines	145395	6.42	14.86	2.96	26507	16622	33.54	0.28
Poland	80800	3.57	14.51	2.92	24685	18416	64.37	0.86
Portugal	106635	4.71	9.52	4.18	22913	14672	44.22	0.48
S Africa	16180	0.71	15.10	2.86	32297	25069	51.30	0.61
S Korea	24505	1.08	14.65	2.66	23342	19412	58.55	0.75
Singapore	4745	0.21	14.68	3.08	32749	25346	72.13	1.00
Spain	4640	0.20	13.25	3.96	25604	18604	51.92	0.62
Sri Lanka	21735	0.96	13.45	2.98	20869	16627	42.57	0.45
Sweden	5145	0.23	14.69	2.96	33442	26397	57.43	0.73
Switzerland	8910	0.39	14.31	2.87	25994	21592	61.37	0.80
Syria	4520	0.20	13.30	4.22	22416	20198	30.23	0.22
Taiwan	13775	0.61	15.51	2.87	26664	23256	56.31	0.71
Thailand	2265	0.10	11.99	5.02	20528	17117	46.26	0.52
Trin&Tobago	45025	1.99	13.84	2.86	27638	17425	46.43	0.52
Tunisia	1165	0.05	14.21	3.88	26855	22360	40.50	0.41
Turkey	5140	0.23	12.99	4.62	24591	20838	39.72	0.40
UK	353905	15.63	13.91	2.62	28628	21120	62.52	0.82
Uruguay	3740	0.17	13.57	3.33	23300	16996	52.27	0.63
USA	160815	7.10	14.99	2.93	28486	23897	46.77	0.53
USSR	20745	0.92	15.53	3.21	26436	21135	54.65	0.68
Venezuela	3180	0.14	15.09	3.46	27126	22184	39.08	0.39
Yugoslavia	36205	1.60	12.51	3.33	25052	17859	53.97	0.66
Zaire	1520	0.07	14.94	3.56	24680	22071	33.53	0.28
Zambia	1100	0.05	15.18	2.84	28220	20817	36.61	0.34
Zimbabwe	1755	0.08	15.13	2.67	28408	20132	39.64	0.40

Note: Census derived statistics use weights from Statistics Canada. Earnings are in constant \$2001 adjusted using the CPI. Canada's test score is 54.58, or 0.67 normalized.

Source: The combined 1986, 1991, 1996, and 2001 Canadian censuses, with quality measures from Hanushek and Kimko (H&K - 2000).

Table 3 - Test for Heteroscedasticity and Estimates of the Variance of the Error Components

	All immigrants	Home Country Education	Mixed Education	Canadian Education
<hr/> Male <hr/>				
1/N	2.768* (1.532)	7.414*** (1.858)	6.123*** (1.353)	7.403*** (1.861)
constant	0.022*** (0.005)	0.032*** (0.010)	0.021* (0.012)	0.040 (0.033)
R ²	0.041	0.175	0.212	0.178
N	78	77	78	75
<hr/> Female <hr/>				
1/N	6.025*** (2.223)	11.109*** (2.133)	2.472* (1.174)	4.658*** (0.965)
constant	0.028*** (0.006)	0.034*** (0.011)	0.033*** (0.011)	0.035* (0.019)
R ²	0.090	0.268	0.057	0.252
N	76	76	76	73

Note: Standard errors in parentheses. *10% significance; **5% significance; ***1% significance.

Table 4 – Second Stage Regressions for Male Immigrants with Alternative Weighting Schemes

	(1)		(2)		(3)		(4)	
All Male Immigrants (N=78)								
Test score	0.194** (0.078)	0.171** (0.070)	0.252*** (0.092)	0.212*** (0.051)	0.285*** (0.099)	0.255*** (0.048)	0.182** (0.078)	0.154** (0.067)
GDP per capita		0.199*** (0.059)		0.228*** (0.051)		0.210*** (0.055)		0.218*** (0.055)
English/ French		0.013 (0.035)		0.090*** (0.028)		0.097*** (0.027)		0.011 (0.033)
Gini		0.149 (0.200)		0.283* (0.166)		0.263* (0.151)		0.188 (0.193)
Asia		0.193*** (0.044)		0.172*** (0.042)		0.186*** (0.047)		0.181*** (0.039)
Africa		0.260*** (0.060)		0.276*** (0.075)		0.294*** (0.077)		0.262*** (0.059)
R ²	0.074	0.383	0.202	0.627	0.234	0.673	0.074	0.388
Selected Subsamples								
Only Source Country Education (N=77)								
Test score	0.205** (0.091)	0.226** (0.095)	0.271*** (0.102)	0.224** (0.087)	0.299*** (0.093)	0.280*** (0.081)	0.183** (0.087)	0.149* (0.080)
R ²	0.046	0.359	0.164	0.544	0.202	0.584	0.050	0.387
Mixed Canadian and Source Country Education (N=78)								
Test score	-0.035 (0.099)	-0.000 (0.103)	0.055 (0.136)	0.135** (0.060)	0.042 (0.126)	0.136** (0.059)	-0.016 (0.088)	0.060 (0.076)
R ²	0.001	0.128	0.009	0.548	0.006	0.554	0.000	0.207
Those who Arrived in Canada at Age 10 or Earlier (N=75)								
Test score	-0.072 (0.191)	0.083 (0.183)	-0.116 (0.131)	-0.040 (0.054)	-0.098 (0.124)	-0.038 (0.053)	-0.065 (0.137)	0.085 (0.105)
R ²	0.003	0.107	0.027	0.527	0.021	0.487	0.004	0.242
Controls	NO	YES	NO	YES	NO	YES	NO	YES

Notes: Standard errors in parentheses. *10% significance; **5% significance; ***1% significance. Model 1 is unweighted OLS. Model 2 uses source country sample sizes as weights. Model 3 uses as weights the inverse of the sample variances of the estimated returns to schooling from the first stage. Model 4 weights with the estimated error term components from table 3. Heteroscedasticity-robust standard error estimates are reported in all cases. The first stage regressions include controls for: the natural logarithms of weeks and hours, an indicator for zero hours, marital status, a quartic in post-immigration potential labour market experience, three census indicators, up to nine age at immigration indicators (for certain subsamples some of the age indicators are not relevant), three indicators of mother tongue (English, French, and both, with neither English nor French omitted), nine provincial indicators, and an urban indicator. Experiments with various specifications for, for example, geography, hours, weeks and the like made little difference.

Table 5 – Second Stage Regressions for Female Immigrants with Alternative Weighting Schemes

	(1)		(2)		(3)		(4)	
All Female Immigrants (N=76)								
Test score	0.294*** (0.083)	0.094 (0.082)	0.381*** (0.103)	0.186*** (0.056)	0.376*** (0.103)	0.213*** (0.058)	0.293*** (0.079)	0.115 (0.080)
GDP per capita		0.381*** (0.080)		0.387*** (0.061)		0.387*** (0.081)		0.357*** (0.078)
English/ French		0.073* (0.038)		0.087** (0.036)		0.096** (0.042)		0.065* (0.036)
Gini		0.009 (0.186)		0.257 (0.193)		0.202 (0.195)		0.040 (0.176)
Asia		0.102** (0.050)		0.030 (0.045)		0.054 (0.055)		0.089* (0.047)
Africa		0.299*** (0.052)		0.232*** (0.055)		0.275*** (0.065)		0.286*** (0.050)
R ²	0.120	0.482	0.282	0.693	0.282	0.697	0.134	0.462
Selected Subsamples								
Only Source Country Education (N=76)								
Test score	0.233** (0.098)	0.020 (0.122)	0.330*** (0.092)	0.173* (0.087)	0.322*** (0.084)	0.220*** (0.077)	0.240** (0.091)	0.099 (0.106)
R ²	0.048	0.413	0.184	0.563	0.201	0.533	0.062	0.398
Mixed Canadian and Source Country Education (N=76)								
Test score	0.160 (0.103)	0.154 (0.108)	0.280*** (0.053)	0.209*** (0.036)	0.278*** (0.052)	0.214*** (0.037)	0.162* (0.092)	0.190** (0.092)
R ²	0.032	0.056	0.315	0.426	0.323	0.447	0.039	0.061
Those who Arrived in Canada at Age 10 or Earlier (N=73)								
Test score	0.156 (0.163)	-0.019 (0.218)	0.185** (0.087)	0.132** (0.063)	0.185** (0.084)	0.128 (0.082)	0.158 (0.130)	0.080 (0.142)
R ²	0.016	0.065	0.092	0.184	0.087	0.163	0.025	0.078
Controls	NO	YES	NO	YES	NO	YES	NO	YES

Notes: Standard errors in parentheses. *10% significance; **5% significance; ***1% significance. Model 1 is unweighted OLS. Model 2 uses source country sample sizes as weights. Model 3 uses as weights the inverse of the sample variances of the estimated returns to schooling from the first stage. Model 4 weights with the estimated error term components from table 3. Heteroscedasticity-robust standard error estimates are reported in all cases. The first stage regressions include controls for: the natural logarithms of weeks and hours, an indicator for zero hours, marital status, a quartic in post-immigration potential labour market experience, three census indicators, up to nine age at immigration indicators (for certain subsamples some of the age indicators are not relevant), three indicators of mother tongue (English, French, and both, with neither English nor French omitted), nine provincial indicators, and an urban indicator. Experiments with various specifications for, for example, geography, hours, weeks and the like made little difference.

Table 6 – Second Stage Regression for Female Immigrants without Children

	(1)		(2)		(3)		(4)	
All Female Immigrants without Children (N=76)								
Test score	0.229*** (0.083)	0.269** (0.104)	0.340*** (0.083)	0.236*** (0.037)	0.332*** (0.074)	0.247*** (0.029)	0.223*** (0.072)	0.231*** (0.086)
GDP per capita		0.023 (0.112)		0.185*** (0.049)		0.195*** (0.05)		0.052 (0.094)
English/ French		0.095** (0.040)		0.100*** (0.026)		0.103*** (0.023)		0.095** (0.037)
Gini		0.139 (0.244)		0.103 (0.146)		0.084 (0.130)		0.083 (0.215)
Asia		0.091 (0.055)		0.066** (0.033)		0.070** (0.033)		0.088* (0.048)
Africa		0.152* (0.085)		0.231*** (0.043)		0.242*** (0.045)		0.174** (0.077)
R ²	0.066	0.218	0.334	0.632	0.321	0.642	0.078	0.254
Selected Subsamples								
Only Source Country Education (N=75)								
Test score	0.229* (0.127)	0.304** (0.146)	0.445*** (0.097)	0.310*** (0.045)	0.385*** (0.093)	0.333*** (0.048)	0.256*** (0.096)	0.260** (0.103)
R ²	0.028	0.223	0.312	0.641	0.237	0.592	0.053	0.288
Mixed Canadian and Source Country Education (N=75)								
Test score	0.059 (0.170)	0.170 (0.165)	0.178* (0.097)	0.172** (0.069)	0.123 (0.083)	0.141** (0.059)	0.069 (0.146)	0.189 (0.140)
R ²	0.002	0.064	0.077	0.208	0.042	0.157	0.003	0.072
Those who Arrived in Canada at Age 10 or Earlier (N=68)								
Test score	-0.148 (0.285)	-0.179 (0.414)	-0.016 (0.093)	0.009 (0.083)	-0.029 (0.077)	0.007 (0.089)	-0.114 (0.243)	-0.105 (0.343)
R ²	0.007	0.104	0.000	0.085	0.001	0.054	0.005	0.080
Controls	NO	YES	NO	YES	NO	YES	NO	YES

Notes: Standard errors in parentheses. *10% significance; **5% significance; ***1% significance. Model 1 is unweighted OLS. Model 2 uses source country sample sizes as weights. Model 3 uses as weights the inverse of the sample variances of the estimated returns to schooling from the first stage. Model 4 weights with the estimated error term components from table 3. Heteroscedasticity-robust standard error estimates are reported in all cases. The first stage regressions include controls for: the natural logarithms of weeks and hours, an indicator for zero hours, marital status, a quartic in post-immigration potential labour market experience, three census indicators, up to nine age at immigration indicators (for certain subsamples some of the age indicators are not relevant), three indicators of mother tongue (English, French, and both, with neither English nor French omitted), nine provincial indicators, and an urban indicator. Experiments with various specifications for, for example, geography, hours, weeks and the like made little difference.

Appendix Table 1: Descriptive Statistics of First Stage Regression Variables

Variable	Male		Female	
	Mean	Std. Dev.	Mean	Std. Dev.
Annual earnings	41992	28294	26317	19870
ln(earnings)	10.348	0.969	9.806	1.082
Weeks of work in the census year	46.83	10.32	44.26	12.86
Hours of work census week	39.65	17.61	31.05	17.45
Zero hours of work (census week)	0.099	0.299	0.153	0.360
Currently Married	0.750	0.433	0.754	0.431
Age	39.469	7.779	39.267	7.753
Potential Canadian experience	15.605	8.447	15.778	8.488
Immigrant Age at Arrival:				
0 to 5	0.152	0.359	0.142	0.349
6 to 10	0.112	0.315	0.104	0.305
11 to 15	0.092	0.289	0.087	0.282
16 to 20	0.135	0.342	0.158	0.365
21 to 25	0.203	0.402	0.221	0.415
26 to 30	0.153	0.360	0.144	0.351
31 to 35	0.082	0.274	0.077	0.267
36 to 40	0.043	0.202	0.041	0.199
41 to 45	0.022	0.145	0.019	0.136
46 to 50	0.006	0.078	0.005	0.070
51 to 65	0.001	0.025	0.000	0.020
Urban	0.855	0.352	0.859	0.348
BC	0.178	0.382	0.181	0.385
AB	0.090	0.286	0.091	0.287
SK	0.009	0.095	0.009	0.096
MN	0.030	0.171	0.031	0.173
ON	0.567	0.495	0.577	0.494
PQ	0.108	0.310	0.095	0.293
NB	0.005	0.071	0.006	0.074
NS	0.008	0.092	0.008	0.088
PI	0.001	0.029	0.001	0.029
NF	0.002	0.047	0.002	0.042
Mother Tongue:				
English	0.358	0.479	0.378	0.485
French	0.027	0.161	0.024	0.152
Both	0.031	0.174	0.031	0.173
Neither	0.584	0.493	0.568	0.495
Years of school	13.897	3.850	13.451	3.606
Census				
2001	0.343	0.475	0.364	0.481
1996	0.270	0.444	0.249	0.432
1986	0.210	0.407	0.213	0.409
1981	0.177	0.381	0.174	0.379

Notes: The descriptive statistics are weighted and the number of weighted observations for males is 2,596,680, for females 2,264,710. Dollars are in 2001 equivalents.

Source: 1986, 1991, 1996 and 2001 Canadian Censuses.

Appendix Table 2: Rate of Return to Education in Canadian Market by Country of Birth

Country	Males		Females			Males		Females	
	Coef	Std error	Coef	Std error		Coef	Std error	Coef	Std error
Algeria	0.087	0.011	0.084	0.010	Kuwait	0.090	0.025	0.084	0.020
Argentina	0.048	0.005	0.053	0.007	Luxembourg	0.062	0.028	na	
Australia	0.058	0.007	0.071	0.007	Malaysia	0.064	0.006	0.068	0.005
Austria	0.058	0.005	0.086	0.007	Malta	0.053	0.006	0.065	0.011
Barbados	0.055	0.006	0.062	0.008	Mauritius	0.068	0.008	0.103	0.013
Belgium	0.061	0.004	0.087	0.006	Mexico	0.037	0.004	0.042	0.005
Bolivia	0.018	0.015	0.047	0.028	Mozambique	0.041	0.020	0.070	0.024
Brazil	0.061	0.007	0.052	0.007	N Zealand	0.062	0.007	0.094	0.010
Cameroon	0.082	0.026	na		Netherland	0.055	0.002	0.083	0.003
China	0.064	0.001	0.053	0.002	Nicaragua	0.023	0.007	0.036	0.014
Colombia	0.055	0.007	0.055	0.008	Nigeria	0.052	0.010	0.060	0.017
Costa Rica	0.031	0.024	0.045	0.025	Norway	0.057	0.010	0.069	0.015
Cyprus	0.049	0.009	0.030	0.011	Panama	0.019	0.021	0.034	0.023
Denmark	0.064	0.007	0.078	0.008	Paraguay	0.039	0.007	0.052	0.010
Dominic R	0.037	0.013	0.020	0.016	Peru	0.047	0.009	0.045	0.008
E Salvador	0.021	0.004	0.035	0.005	Philippine	0.035	0.002	0.045	0.002
Ecuador	0.042	0.008	0.050	0.011	Poland	0.040	0.002	0.057	0.003
Egypt	0.072	0.004	0.069	0.006	Portugal	0.023	0.001	0.039	0.002
Falkland I	0.049	0.006	0.054	0.008	S Africa	0.090	0.004	0.086	0.006
Fiji	0.047	0.007	0.049	0.008	S Korea	0.048	0.005	0.045	0.006
Finland	0.023	0.007	0.071	0.008	Singapore	0.075	0.010	0.080	0.010
France	0.068	0.003	0.074	0.003	Spain	0.041	0.007	0.036	0.009
Germany	0.055	0.002	0.080	0.003	Sri Lanka	0.069	0.004	0.080	0.006
Ghana	0.039	0.007	0.057	0.013	Sweden	0.060	0.009	0.083	0.009
Greece	0.050	0.002	0.048	0.003	Switzerland	0.070	0.007	0.074	0.008
Guyana	0.054	0.003	0.063	0.003	Syria	0.049	0.007	0.037	0.011
Honduras	0.031	0.013	0.011	0.015	Taiwan	0.063	0.007	0.068	0.007
Hong Kong	0.081	0.002	0.078	0.002	Thailand	0.101	0.050	0.020	0.008
Hungary	0.063	0.004	0.079	0.005	Trin&Tobag	0.053	0.003	0.068	0.004
Iceland	0.040	0.020	0.097	0.024	Tunisia	0.065	0.009	0.062	0.019
India	0.048	0.001	0.041	0.002	Turkey	0.053	0.005	0.045	0.008
Indonesia	0.060	0.009	0.083	0.012	UK	0.064	0.001	0.086	0.001
Iran	0.066	0.004	0.074	0.007	Uruguay	0.025	0.007	0.033	0.012
Iraq	0.050	0.008	0.040	0.009	USA	0.062	0.002	0.090	0.002
Ireland	0.070	0.005	0.097	0.007	USSR	0.042	0.005	0.045	0.004
Israel	0.075	0.005	0.073	0.006	Venezuela	0.045	0.017	0.077	0.014
Italy	0.044	0.001	0.058	0.001	Yugoslavia	0.030	0.003	0.045	0.003
Jamaica	0.053	0.002	0.066	0.003	Zaire	0.040	0.013	0.103	0.027
Japan	0.054	0.008	0.066	0.010	Zambia	0.038	0.051	0.081	0.018
Jordan	0.041	0.010	0.084	0.022	Zimbabwe	0.080	0.016	0.060	0.017
Kenya	0.073	0.006	0.074	0.006					
Obs.						2596680		2264710	
R ²						0.274		0.348	

Notes: Also included in the regression are the control variables Appendix Table 1, and a full set of source country intercepts.