# Immigrant Source Country Educational Quality and Canadian Labour Market Outcomes

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Abstract

Immigrants from source countries with lower quality educational outcomes, as measured by international test scores, are observed to receive a lower average return to their schooling in the Canadian labour market than those from countries with higher quality results. In contrast to immigrants educated outside of Canada, source country school outcomes do not have an impact on those who immigrate at a young age. This reinforces the idea that it is educational quality that is at issue and not other factors. Moreover, this measure of quality is also seen to impact earnings within tightly defined educational categories (e.g., those with a bachelor's degree), demonstrating that quality matters both across, and within, credential groupings.

Keywords: Immigration, Quality of Education, Earnings

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## *I. Introduction*

One issue in the labour market integration of immigrants to Canada is the quality, or relative quality, of their pre-Canadian educational outcomes. Many studies of the labour market integration of immigrants, and the implementation of the points system for economic migrants, assume (either implicitly or explicitly) that a year of education is always of the same "quality" as far as the Canadian labour market is concerned regardless of where it is obtained. One of the few studies to mention differences in immigrant source country educational quality is by Reitz (2001); his survey states that there is little evidence on the issue, and it presents no direct evidence. However, there is evidence from international standardized tests that there is substantial disparity in average performance across national school systems. Recent examples of such tests are the Third International Math and Science Survey (TIMSS), the International Adult Literacy Survey (IALS), and the OECD's Programme for International Student Assessment (PISA) study. All find marked and persistent differences across countries in average test score outcomes. Older international tests, which are more relevant for this study given the age of those in the labour force, were conducted by the International Association for the Evaluation of Educational Achievement (IEA), and the International Assessment of Educational Progress (IAEP), with the first in 1965.

There is also evidence that these types of test scores are associated with labour market outcomes, in particular earnings, at the level of the individual. Green and Riddell (2002, 2003), for example, look at the Canadian IALS scores in relation to earnings and find a sizeable effect; the simple and limited test scores in the IALS account for a substantial fraction of the return to education. Perhaps more relevantly for this study, work using British data by Gregg and Machin (1998), and Currie and Thomas (2001), demonstrates that scores from standardized tests taken as early as age 7 are correlated with educational and labour market outcomes at ages 23 and 33 (even after controlling for other factors).

At the level of the nation, research in the endogenous growth literature by Barro (2001) suggests that national level average test scores have important impacts on productivity and national economic growth. Hanushek and Kimko (2000) have similar findings, but they also perform an analysis using data on immigrants to the United States in an effort to think about causality and whether source country average test scores have important implications for the return to education experienced by immigrants working in the United States. Their research is, however, only suggestive since they do not pursue the issue in any depth. Rather, this aspect of their work is simply a sensitivity test in research primarily addressing endogenous growth.

A related area of research is that on the relationship between educational inputs, such as pupil-teacher ratios, and labour market outcomes. In particular, Card and Krueger (1992), and Heckman, Layne-Ferrar and Todd (1996a, 1996b), use data from the United States 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, but closer to the current research, is a study by Bratsberg and Terrell (2002) who find that measures of source country educational inputs impact the return to education observed for immigrants to the United States. These are primarily contributions to the ongoing debate about the efficiency of the transformation of educational resources into outcomes that are valued in the labour market. In

contrast, the current paper focuses on the value of a particular educational output, not inputs, which has implications for interpretation.

The objective of the present study is to explore 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. This has implications for the way settlement and integration, including credential recognition, issues are perceived, and it is a topic regarding which there is currently much interest as evidenced by the recent Federal Innovation Strategy. "Knowledge Matters: Skills and Learning for Canadians", by Human Resources Development Canada (2002). It indicates that Canada is concerned with the rapid integration of immigrants into the labour market and wants to ensure that their human capital is fully utilized. This implies a need to understand the nature of that human capital.

Overall, the analysis finds that differences in the source country average "quality" of pre-Canadian 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. Further, the return to education observed for those immigrants who arrive in Canada before age 10 is not a function of their source country school quality. This reinforces the idea that it is the quality of the school system in which the person was educated that matters, and not source country per se. School quality is also seen to impact earnings within groups with the same tightly defined educational degree (e.g., a bachelor's degree) suggesting that the phenomenon occurs within and well as across schooling levels.

The remainder of this paper is structured as follows. Section II discusses the data and provides an initial descriptive analysis. Section III presents the multivariate regression analysis, first presenting the methodology and then the results, which include both the core findings and several extensions and robustness tests that help in confirming and describing the phenomenon under study. Section IV concludes and suggests options for future work. Additionally, an appendix is included that presents an alternative empirical approach. That the two approaches provide the same conclusions adds confidence regarding the robustness of the findings.

## *II. Data*

To undertake this analysis two sources of data are merged. One source is the 1986, 1991 and 1996 Canadian censuses, which provide individual-level data on immigrant demographics and labour market outcomes after migration. Also required are measures of source country educational quality; country-level average test scores from international standardized tests are used for this purpose. However, given the nature and frequency of these tests, it is not possible to use the unadjusted scores. Therefore, we use a single average score for each country that was derived by Hanushek and Kimko (2000). Their school quality measures are for 87 countries, but there are only sufficient immigrants (minimum 40 per country) to Canadian the census data to look at 81 of these source countries for males, and 79 for females. Individuals from other countries are not included in the analysis.

Addressing the census data first, a merged sample of immigrants from the 1986, 1991 and 1996 Canadian census 20% files is employed. In addition to basic demographics and labour market outcomes, these files contain information on detailed immigrant source country, which is crucial for the analysis. Combining the three provides a sufficiently large sample that more

countries may 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.) The selection rules that are employed for the sample for analysis are that the immigrants must have been born since 1945 (since the earliest international test is 1965) and be at least 25 years old and not currently attending school.[1] Further, those living in the Territories are omitted, as are those with missing relevant variables. 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.

Tables 1, for males, and 2, for females, present descriptive statistics by source country. Columns 1 and 2 in each table list the sample size for each country, and the percentage of the sample made up by that country. Immigrants from source countries with fewer than 40 observations are excluded from the sample. For both sexes, the U.K. is the source of the largest fraction of immigrants (just under 17%). For males it is followed by Italy (9.1%), India (7.5%) and the United States (6.2%); for females the next are the United States (8.1%), Italy (7.4%) and the Philippines (6.4%). The two subsequent columns present average years of school and its standard deviation. This measure is the sum of years of elementary and high school, university, and post-secondary non-university; it is top coded at 24.[2] That schooling is not truncated for low levels obtained, as in Card and Krueger (1992) and as is common in many Canadian public use data sets, has an impact on the rates of return to education that will be estimated later since the (ln)earnings education profile is, as will be seen in detail below (figures 3 and 5), somewhat "S" shaped. The increase in earnings with years of schooling is quite flat for very low levels of schooling. The intermediate profile is close to (ln)linear. Average years of schooling vary by over five across countries, which is equivalent to more than an undergraduate degree or senior high school and is quite substantial. Further, the standard deviations point to the large heterogeneity within countries. Of course, factors such as average age and time in Canada also cause a source country's average labour market outcomes to vary.

Annual earnings and standard deviations by country are presented in the subsequent columns.[3] As was the case with schooling, the averages vary quite substantially across source countries with the top few being more than two and a half times the bottom few. Appendix table 1 presents descriptive statistics for the census data, and provides a listing of the background variables employed in the regressions. Note that, with the exception of potential Canadian labour market experience and age, each variable is an indicator (sometimes called a dummy variable), that is, it takes on the value of one is the case is true, and zero otherwise (for example, the high school indicator is set to one if the respondent's highest level of education is high school graduation and zero otherwise). Of course, in the regressions one of each set is omitted and

[1] Limited experiments suggest that changing or removing the "born since 1945" restriction makes little difference to the results. It implies that the sample is aged from 25 to 51.

[2] An alternative approach was also attempted for the entire analysis. Years of school were mapped from the highest level of education attained based on a different set of census questions (e.g. high school graduation was assigned 12 years, a bachelor's degree 16 etc.). It made little substantive differences to the empirical results.

[3] Earnings are converted to 1996 dollars using the all goods CPI, are the sum of employment and positive self-employment income, and are top coded at $500,000.

Table 1 - Descriptive Statistics for Males by Country

| Country | Sample Size | | Mean Years of School | | Mean Earnings | | Test Score H&K | Test Score Norm |
|---|---|---|---|---|---|---|---|---|
| | Mean | % | Mean | Std Dev | Mean | Std Dev | | |
| Algeria | 643 | 0.2 | 16.19 | 3.95 | 31724 | 29566 | 28.06 | 0.18 |
| Argentina | 1297 | 0.4 | 14.01 | 3.85 | 34452 | 24524 | 48.50 | 0.56 |
| Australia | 1322 | 0.4 | 15.16 | 3.24 | 44728 | 32631 | 59.04 | 0.76 |
| Austria | 2003 | 0.6 | 14.60 | 3.11 | 48246 | 91965 | 56.61 | 0.71 |
| Barbados | 1358 | 0.4 | 13.69 | 3.10 | 34997 | 26819 | 59.80 | 0.77 |
| Belgium | 2063 | 0.6 | 14.23 | 3.35 | 42886 | 32538 | 57.08 | 0.72 |
| Bolivia | 119 | 0.0 | 15.11 | 4.03 | 29076 | 21849 | 27.47 | 0.17 |
| Brazil | 834 | 0.2 | 14.12 | 3.89 | 35774 | 32038 | 36.60 | 0.34 |
| Cameroon | 54 | 0.0 | 18.44 | 3.23 | 32133 | 25771 | 42.36 | 0.45 |
| China | 13315 | 3.8 | 13.38 | 4.62 | 31263 | 31319 | 64.42 | 0.86 |
| Colombia | 736 | 0.2 | 13.91 | 3.56 | 30762 | 31349 | 37.87 | 0.36 |
| Costa_Rica | 60 | 0.0 | 13.93 | 4.09 | 33692 | 26986 | 46.15 | 0.52 |
| Cyprus | 614 | 0.2 | 13.25 | 3.80 | 36457 | 37073 | 46.24 | 0.52 |
| Denmark | 1804 | 0.5 | 13.60 | 3.05 | 45786 | 43296 | 61.76 | 0.81 |
| Dominic_R | 224 | 0.1 | 12.20 | 3.78 | 21547 | 23233 | 39.34 | 0.39 |
| E_Salvador | 2467 | 0.7 | 11.86 | 4.20 | 19808 | 15221 | 26.21 | 0.15 |
| Ecuador | 889 | 0.3 | 12.43 | 3.43 | 28808 | 18770 | 38.99 | 0.38 |
| Egypt | 3144 | 0.9 | 16.84 | 3.16 | 46310 | 43535 | 26.43 | 0.15 |
| Falkland_I | 2443 | 0.7 | 14.13 | 3.36 | 29308 | 21879 | 24.74 | 0.12 |
| Fiji | 2137 | 0.6 | 12.51 | 3.00 | 29137 | 17691 | 58.10 | 0.74 |
| Finland | 1302 | 0.4 | 13.42 | 3.21 | 41736 | 27106 | 59.55 | 0.77 |
| France | 6328 | 1.8 | 14.81 | 3.46 | 39053 | 32266 | 56.00 | 0.70 |
| Germany | 14718 | 4.2 | 14.18 | 3.09 | 43641 | 35448 | 48.68 | 0.56 |
| Ghana | 336 | 0.1 | 13.92 | 3.88 | 27846 | 17243 | 25.58 | 0.14 |
| Greece | 7896 | 2.2 | 11.33 | 4.18 | 31361 | 25328 | 50.88 | 0.61 |
| Guyana | 7670 | 2.2 | 13.62 | 3.23 | 33062 | 23703 | 51.49 | 0.62 |
| Honduras | 163 | 0.1 | 12.17 | 4.33 | 20380 | 16365 | 28.59 | 0.19 |
| Hong_Kong | 17861 | 5.1 | 15.27 | 3.44 | 36559 | 32009 | 71.85 | 0.99 |
| Hungary | 3069 | 0.9 | 14.43 | 3.17 | 42104 | 43138 | 61.23 | 0.80 |
| Iceland | 48 | 0.0 | 14.25 | 3.21 | 40779 | 23949 | 51.20 | 0.61 |
| India | 22814 | 6.4 | 13.89 | 4.19 | 34437 | 33058 | 20.80 | 0.05 |
| Indonesia | 641 | 0.2 | 15.62 | 2.97 | 41250 | 29953 | 42.99 | 0.46 |
| Iran | 3236 | 0.9 | 15.77 | 3.31 | 29508 | 37746 | 18.26 | 0.00 |
| Iraq | 1027 | 0.3 | 14.24 | 3.92 | 27776 | 30266 | 27.50 | 0.17 |
| Ireland | 2424 | 0.7 | 14.75 | 3.23 | 51888 | 55895 | 50.20 | 0.59 |
| Israel | 1695 | 0.5 | 14.78 | 3.34 | 44817 | 63188 | 54.46 | 0.67 |
| Italy | 32106 | 9.1 | 11.84 | 3.92 | 40553 | 60530 | 49.41 | 0.58 |
| Jamaica | 9231 | 2.6 | 12.96 | 3.12 | 30638 | 21888 | 48.62 | 0.56 |
| Japan | 1210 | 0.3 | 15.14 | 2.87 | 43133 | 42403 | 65.50 | 0.88 |
| Jordan | 311 | 0.1 | 14.26 | 3.54 | 34057 | 29727 | 42.28 | 0.45 |
| Kenya | 1764 | 0.5 | 15.68 | 2.93 | 41926 | 35650 | 29.73 | 0.21 |
| Kuwait | 126 | 0.0 | 15.20 | 2.63 | 28296 | 33097 | 22.50 | 0.08 |
| Luxembourg | 47 | 0.0 | 13.53 | 2.72 | 36885 | 20253 | 44.49 | 0.49 |
| Malaysia | 1663 | 0.5 | 15.44 | 3.19 | 39841 | 32420 | 54.29 | 0.67 |
| Malta | 1214 | 0.3 | 12.43 | 3.31 | 42155 | 38013 | 57.14 | 0.72 |
| Mauritius | 737 | 0.2 | 15.10 | 3.55 | 38594 | 34004 | 54.95 | 0.68 |
| Mexico | 2119 | 0.6 | 10.49 | 4.84 | 28935 | 34697 | 37.24 | 0.35 |

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|---|---|---|---|---|---|---|---|---|
| Mozambique | 119 | 0.0 | 14.03 | 3.44 | 31593 | 19918 | 27.94 | 0.18 |
| N_Zealand | 988 | 0.3 | 14.90 | 3.20 | 49934 | 66314 | 67.06 | 0.91 |
| Netherland | 10845 | 3.1 | 13.64 | 3.21 | 43716 | 38737 | 54.52 | 0.67 |
| Nicaragua | 438 | 0.1 | 14.18 | 3.91 | 21249 | 14199 | 27.30 | 0.17 |
| Nigeria | 534 | 0.2 | 17.23 | 3.09 | 33174 | 29075 | 38.90 | 0.38 |
| Norway | 486 | 0.1 | 14.18 | 3.14 | 47325 | 31829 | 64.56 | 0.86 |
| Panama | 122 | 0.0 | 14.94 | 3.35 | 24328 | 17895 | 46.78 | 0.53 |
| Paraguay | 795 | 0.2 | 11.10 | 3.84 | 35687 | 24310 | 39.96 | 0.40 |
| Peru | 1013 | 0.3 | 15.23 | 3.69 | 28621 | 24225 | 41.18 | 0.43 |
| Philippine | 12839 | 3.6 | 14.79 | 3.02 | 29126 | 19152 | 33.54 | 0.28 |
| Poland | 12962 | 3.7 | 14.66 | 3.15 | 33087 | 43136 | 64.37 | 0.86 |
| Portugal | 19129 | 5.4 | 9.29 | 4.11 | 33073 | 20244 | 44.22 | 0.48 |
| S_Africa | 2446 | 0.7 | 16.16 | 3.23 | 55420 | 57362 | 51.30 | 0.61 |
| S_Korea | 2630 | 0.7 | 15.41 | 2.75 | 30174 | 31118 | 58.55 | 0.75 |
| Singapore | 583 | 0.2 | 15.58 | 3.06 | 46132 | 46419 | 72.13 | 1.00 |
| Spain | 1057 | 0.3 | 13.63 | 3.98 | 37269 | 26362 | 51.92 | 0.62 |
| Sri_Lanka | 3960 | 1.1 | 13.52 | 3.24 | 24084 | 18232 | 42.57 | 0.45 |
| Sweden | 728 | 0.2 | 15.05 | 3.07 | 51055 | 38876 | 57.43 | 0.73 |
| Switzerlan | 1710 | 0.5 | 14.66 | 3.07 | 39750 | 39360 | 61.37 | 0.80 |
| Syria | 1060 | 0.3 | 13.54 | 4.72 | 31371 | 30110 | 30.23 | 0.22 |
| Taiwan | 1398 | 0.4 | 16.16 | 2.87 | 34103 | 38406 | 56.31 | 0.71 |
| Thailand | 118 | 0.0 | 13.92 | 3.94 | 28502 | 21873 | 46.26 | 0.52 |
| Trin_Tobag | 5776 | 1.6 | 14.10 | 3.06 | 34247 | 26504 | 46.43 | 0.52 |
| Tunisia | 427 | 0.1 | 15.10 | 3.92 | 32404 | 30922 | 40.50 | 0.41 |
| Turkey | 1171 | 0.3 | 13.98 | 4.75 | 36285 | 31665 | 39.72 | 0.40 |
| UK | 59390 | 16.8 | 14.56 | 2.94 | 47059 | 35511 | 62.52 | 0.82 |
| Urugay | 609 | 0.2 | 13.18 | 3.44 | 31914 | 23750 | 52.27 | 0.63 |
| USA | 21922 | 6.2 | 15.20 | 3.46 | 41663 | 48768 | 46.77 | 0.53 |
| USSR | 2341 | 0.7 | 15.45 | 3.33 | 36030 | 34879 | 54.65 | 0.68 |
| Venezuela | 409 | 0.1 | 15.14 | 3.42 | 39969 | 45645 | 39.08 | 0.39 |
| Yugoslavia | 6009 | 1.7 | 13.11 | 3.16 | 38358 | 26587 | 53.97 | 0.66 |
| Zaire | 233 | 0.1 | 16.52 | 3.51 | 34666 | 30290 | 33.53 | 0.28 |
| Zambia | 150 | 0.0 | 15.99 | 3.08 | 41131 | 33278 | 36.61 | 0.34 |
| Zimbabwe | 306 | 0.1 | 15.97 | 2.91 | 53397 | 50131 | 39.64 | 0.40 |

Notes: Constant 1996 dollar values adjusted using the Canadian CPI.
Source: The combined 1986, 1991, and 1996 Canadian censuses,
with quality measures from Hanushek and Kimko (2000).

Table 2 - Descriptive Statistics for Females by Country

| Country | Sample Size | | Mean Years of School | | Mean Earnings | | Test Score H&K | Test Score Norm. |
|---|---|---|---|---|---|---|---|---|
| | Mean | % | Mean | Std Dev | Mean | Std Dev | | |
| Algeria | 256 | 0.1 | 15.31 | 3.68 | 21118 | 17775 | 28.06 | 0.18 |
| Argentina | 1013 | 0.3 | 14.06 | 3.67 | 22397 | 16630 | 48.50 | 0.56 |
| Australia | 1397 | 0.5 | 14.45 | 2.85 | 26032 | 19475 | 59.04 | 0.76 |
| Austria | 1601 | 0.5 | 13.80 | 2.83 | 26878 | 21033 | 56.61 | 0.71 |
| Barbados | 1553 | 0.5 | 13.50 | 2.69 | 25296 | 14447 | 59.80 | 0.77 |
| Belgium | 1742 | 0.6 | 13.78 | 3.20 | 25627 | 20594 | 57.08 | 0.72 |
| Bolivia | 81 | 0.0 | 14.14 | 3.57 | 16508 | 12911 | 27.47 | 0.17 |
| Brazil | 768 | 0.3 | 13.77 | 3.81 | 20488 | 15261 | 36.60 | 0.34 |
| China | 11947 | 3.8 | 12.16 | 4.34 | 20263 | 17008 | 64.42 | 0.86 |
| Colombia | 773 | 0.3 | 13.52 | 3.72 | 18527 | 14620 | 37.87 | 0.36 |
| Costa_Rica | 92 | 0.0 | 13.16 | 3.95 | 14056 | 10266 | 46.15 | 0.52 |
| Cyprus | 475 | 0.2 | 11.82 | 3.40 | 20266 | 15990 | 46.24 | 0.52 |
| Denmark | 1430 | 0.5 | 13.26 | 2.61 | 24469 | 18479 | 61.76 | 0.81 |
| Dominic_R | 164 | 0.1 | 11.96 | 4.26 | 14697 | 13254 | 39.34 | 0.39 |
| E_Salvador | 1564 | 0.5 | 11.56 | 4.16 | 13723 | 10215 | 26.21 | 0.15 |
| Ecuador | 771 | 0.3 | 12.31 | 3.26 | 18094 | 12611 | 38.99 | 0.38 |
| Egypt | 2130 | 0.7 | 15.73 | 3.00 | 27629 | 21825 | 26.43 | 0.15 |
| Falkland_I | 1813 | 0.6 | 13.61 | 3.22 | 18131 | 15408 | 24.74 | 0.12 |
| Fiji | 1922 | 0.6 | 11.84 | 2.72 | 19324 | 12416 | 58.10 | 0.74 |
| Finland | 1215 | 0.4 | 13.59 | 2.87 | 24665 | 19209 | 59.55 | 0.77 |
| France | 5051 | 1.6 | 14.76 | 3.17 | 25718 | 19377 | 56.00 | 0.70 |
| Germany | 12549 | 4.0 | 13.67 | 2.81 | 24619 | 23129 | 48.68 | 0.56 |
| Ghana | 215 | 0.1 | 12.94 | 2.62 | 21629 | 19932 | 25.58 | 0.14 |
| Greece | 6170 | 2.0 | 10.16 | 3.91 | 19858 | 17016 | 50.88 | 0.61 |
| Guyana | 7485 | 2.4 | 13.02 | 2.82 | 22814 | 14085 | 51.49 | 0.62 |
| Honduras | 139 | 0.0 | 12.43 | 3.84 | 14618 | 13281 | 28.59 | 0.19 |
| Hong_Kong | 16541 | 5.3 | 14.11 | 3.34 | 25260 | 21176 | 71.85 | 0.99 |
| Hungary | 2511 | 0.8 | 14.05 | 2.91 | 25386 | 21785 | 61.23 | 0.80 |
| Iceland | 53 | 0.0 | 14.19 | 2.16 | 24202 | 18917 | 51.20 | 0.61 |
| India | 18186 | 5.8 | 13.09 | 4.11 | 19641 | 17265 | 20.80 | 0.05 |
| Indonesia | 535 | 0.2 | 14.70 | 3.08 | 24829 | 20066 | 42.99 | 0.46 |
| Iran | 1569 | 0.5 | 15.31 | 2.95 | 19120 | 16552 | 18.26 | 0.00 |
| Iraq | 438 | 0.1 | 13.52 | 3.73 | 19434 | 19805 | 27.50 | 0.17 |
| Ireland | 2106 | 0.7 | 14.27 | 2.84 | 27297 | 22422 | 50.20 | 0.59 |
| Israel | 1165 | 0.4 | 14.66 | 3.05 | 27334 | 39672 | 54.46 | 0.67 |
| Italy | 22899 | 7.4 | 10.89 | 3.85 | 22748 | 16614 | 49.41 | 0.58 |
| Jamaica | 10969 | 3.5 | 13.01 | 2.93 | 22761 | 15178 | 48.62 | 0.56 |
| Japan | 1208 | 0.4 | 14.83 | 2.51 | 21027 | 18237 | 65.50 | 0.88 |
| Jordan | 160 | 0.1 | 13.61 | 3.24 | 21437 | 23094 | 42.28 | 0.45 |
| Kenya | 1752 | 0.6 | 14.63 | 2.69 | 26586 | 19665 | 29.73 | 0.21 |
| Kuwait | 84 | 0.0 | 15.17 | 2.84 | 22781 | 21475 | 22.50 | 0.08 |
| Malaysia | 1713 | 0.6 | 14.08 | 3.29 | 24831 | 18560 | 54.29 | 0.67 |
| Malta | 921 | 0.3 | 11.77 | 2.98 | 23182 | 17503 | 57.14 | 0.72 |
| Mauritius | 625 | 0.2 | 13.77 | 2.82 | 26133 | 18650 | 54.95 | 0.68 |
| Mexico | 1688 | 0.5 | 11.24 | 4.58 | 14275 | 14403 | 37.24 | 0.35 |

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|---|---|---|---|---|---|---|---|---|
| Mozambique | 73 | 0.0 | 13.42 | 3.14 | 25549 | 23854 | 27.94 | 0.18 |
| N_Zealand | 851 | 0.3 | 14.46 | 2.79 | 25946 | 19428 | 67.06 | 0.91 |
| Netherland | 7741 | 2.5 | 13.11 | 2.76 | 22425 | 18326 | 54.52 | 0.67 |
| Nicaragua | 335 | 0.1 | 13.72 | 3.62 | 14663 | 10788 | 27.30 | 0.17 |
| Nigeria | 199 | 0.1 | 15.92 | 3.10 | 21481 | 17830 | 38.90 | 0.38 |
| Norway | 338 | 0.1 | 13.83 | 2.48 | 25613 | 21909 | 64.56 | 0.86 |
| Panama | 81 | 0.0 | 15.25 | 3.06 | 19910 | 15936 | 46.78 | 0.53 |
| Paraguay | 554 | 0.2 | 10.95 | 3.34 | 18111 | 16094 | 39.96 | 0.40 |
| Peru | 968 | 0.3 | 14.34 | 3.27 | 19222 | 14900 | 41.18 | 0.43 |
| Philippine | 19898 | 6.4 | 14.73 | 2.99 | 22353 | 15173 | 33.54 | 0.28 |
| Poland | 10554 | 3.4 | 14.37 | 2.95 | 20688 | 18187 | 64.37 | 0.86 |
| Portugal | 14842 | 4.8 | 9.24 | 4.13 | 19751 | 12375 | 44.22 | 0.48 |
| S_Africa | 2147 | 0.7 | 15.00 | 2.86 | 27169 | 23749 | 51.30 | 0.61 |
| S_Korea | 2999 | 1.0 | 14.40 | 2.66 | 20673 | 19001 | 58.55 | 0.75 |
| Singapore | 677 | 0.2 | 14.56 | 3.11 | 27575 | 22459 | 72.13 | 1.00 |
| Spain | 697 | 0.2 | 13.12 | 4.01 | 22049 | 18829 | 51.92 | 0.62 |
| Sri_Lanka | 2122 | 0.7 | 13.47 | 2.95 | 18079 | 15266 | 42.57 | 0.45 |
| Sweden | 743 | 0.2 | 14.54 | 2.85 | 29081 | 23064 | 57.43 | 0.73 |
| Switzerlan | 1251 | 0.4 | 14.24 | 2.89 | 23008 | 20882 | 61.37 | 0.80 |
| Syria | 583 | 0.2 | 13.22 | 4.29 | 19871 | 19886 | 30.23 | 0.22 |
| Taiwan | 1484 | 0.5 | 15.47 | 2.94 | 24463 | 21454 | 56.31 | 0.71 |
| Thailand | 276 | 0.1 | 11.74 | 5.02 | 17575 | 14678 | 46.26 | 0.52 |
| Trin_Tobag | 6053 | 2.0 | 13.71 | 2.80 | 24224 | 15415 | 46.43 | 0.52 |
| Tunisia | 135 | 0.0 | 13.53 | 3.45 | 20106 | 17226 | 40.50 | 0.41 |
| Turkey | 699 | 0.2 | 13.25 | 4.46 | 22577 | 20134 | 39.72 | 0.40 |
| UK | 51982 | 16.7 | 13.81 | 2.62 | 25076 | 19733 | 62.52 | 0.82 |
| Urugay | 488 | 0.2 | 13.38 | 3.12 | 20431 | 15317 | 52.27 | 0.63 |
| USA | 24827 | 8.0 | 14.89 | 2.92 | 24441 | 22934 | 46.77 | 0.53 |
| USSR | 1930 | 0.6 | 15.06 | 3.26 | 22469 | 19428 | 54.65 | 0.68 |
| Venezuela | 387 | 0.1 | 15.17 | 3.34 | 24127 | 20905 | 39.08 | 0.39 |
| Yugoslavia | 5298 | 1.7 | 12.21 | 3.32 | 22458 | 16122 | 53.97 | 0.66 |
| Zaire | 151 | 0.1 | 14.66 | 3.70 | 21418 | 18454 | 33.53 | 0.28 |
| Zambia | 136 | 0.0 | 14.63 | 2.73 | 21028 | 14853 | 36.61 | 0.34 |
| Zimbabwe | 264 | 0.1 | 15.22 | 2.64 | 23255 | 18246 | 39.64 | 0.40 |

Notes: Constant 1996 dollar values adjusted using the Canadian CPI.
Source: The combined 1986, 1991, and 1996 Canadian censuses,
with quality measures from Hanushek and Kimko (2000).

becomes the reference group. One note is that mother tongue, not current language ability, is employed in the analysis since this is more clearly exogenous and is not influenced by one's ability to learn new languages, which may be correlated with the school quality variables that are the focus of the research. Also, note that age at immigration is used in the regressions rather than years since migration. Age at immigration is used since it has a more natural interpretation in the educational context. However, sensitivity tests were conducted using years since migration instead of age at immigration to ensure robustness and there were no appreciable changes in the results. Using them both raises identification issues since they contain essentially the same information, even though we use potential Canadian labour market experience, rather than total potential experience. (See Schaafsma and Sweetman (2001) for a detailed discussion of these issues.) Note also that the census data has independent measures of years of schooling and degree attainment that will be exploited later.

Turning next to the test score data; each country's average test score is presented in the final two columns of tables 1 and 2. The first simply replicates that from Hanushek and Kimko (2000 - Appendix table C1), and is their preferred measure, which they call QL2. The underlying observed test scores from which this measure is derived are all in math and science and are only available for 37 countries. Further, those countries had different participation frequencies in the six rounds of international testing, conducted by the IEA and the IAEP, that occurred between 1965 and 1991. In particular, there are relatively few 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. This index does not measure the test score, or related ability, of any individual, but is an average reflecting each country's educational outcomes. An attempt was made to map the test score measures from each test to those individuals for whom the test was relevant (by using source country and a several year window around each test). This, however, was not fruitful since the sample sizes were too small. No substantive changes to the results in this paper occurred in several experiments with Hanushek and Kimko's, alternative measure, QL1. The same scores are normalized to range from zero to one to facilitate interpretation - the normalized variable, or index, seen in the second column of test scores in tables 1 and 2, is used in the regressions.[4]

This index is the best available consistently defined measure of the quality of each national school system. Since it is derived from six sets of tests by two different organizations, it provides a better measure than any individual test. It also has the advantage of having been estimated for previous work in the United States, so it is independent of the current research and the Canadian labour market data employed. However, it cannot be said to be perfect. In addition to the issues mentioned above, these scores are for students in grade school (up to the end of high school or its equivalent). There are also issues regarding how well the source country average test scores represent those who immigrate to Canada. If immigrants are a heavily selected group, then they may be from the upper tail of each source country's distribution. Of course, if the distributions have a similar variance, and selection is similar across countries, the relative scores

[4] Normalizing implies rescaling the data by subtracting the lowest value, and then dividing the new set of numbers by their highest value. The new index then ranges from zero to one making the regression results easier to interpret.

may still be appropriate measures since it is not the actual score that matters, but the ranking (though this is unlikely to be completely satisfied). 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. Normally, any source of measurement error will serve to weaken the observed relationship relative to the "true" one. 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 be almost certainly biased towards zero. This implies that any observed relationship is likely an underestimate of the actual one and the estimates in this study are lower bounds on the impact of a less error prone measure of source country school quality. Note, however, that the endogenous growth literature discussed above finds that national average test scores have substantial information content and are extremely good predictors of a nation's economic and productivity growth.

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) international round of testing in 1996, which is too recent for those tested to be in the labour force. This is especially interesting since the TIMSS contains data on eight countries not previously tested, but for which QL2 estimates are made. Hanushek and Kimko conduct such a 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. Therefore, while QL2 undoubtedly contains some measurement error, it appears to be the best available measure of international relative educational outcomes.

Focussing on the scores, which are identical in tables 1 and 2, a wide range is observed. The non-normalized scores have a low just under 20, while the high is just over 70. Out of the 81 countries, a 30 point increase would move a country from a ranking of 15$^{th}$ to about 70$^{th}$; 18 points represents the difference between the 25$^{th}$ and 75$^{th}$ percentile. Interestingly, rank order correlations (using Kendall's tau statistic; see, Kendall and Gibbons, 1990) 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 0.92 and 0.78, respectively).[5] Therefore, there is no evidence that countries with higher average years of school also have higher average quality as measured by these test scores. In contrast, the average schooling, and school quality, measures 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). This can be seen visually in figures 1 and 2. They present scatter plots of the test scores versus earnings by sex for the country averages. A cubic spline is also fitted to the data and shown in the plots. For both sexes an upward slope is evident, but there are clearly a lot of other sources of variation in earnings (there are, for

[5] P-values (or probability values) indicate the level of statistical significance of the statistical test being performed. In this context, unless otherwise stated, the convention is that each is examining whether the estimate in question (e.g. a correlation or a regression coefficient) is different from zero. The lower the p-value the less likely it is that the estimate is equal to zero. A p-value of 0.050 indicates that there is a 95% chance that the estimate is different from zero; similarly, a p-value of 0.002 indicates the chance that the estimate being different from zero is 99.8%.

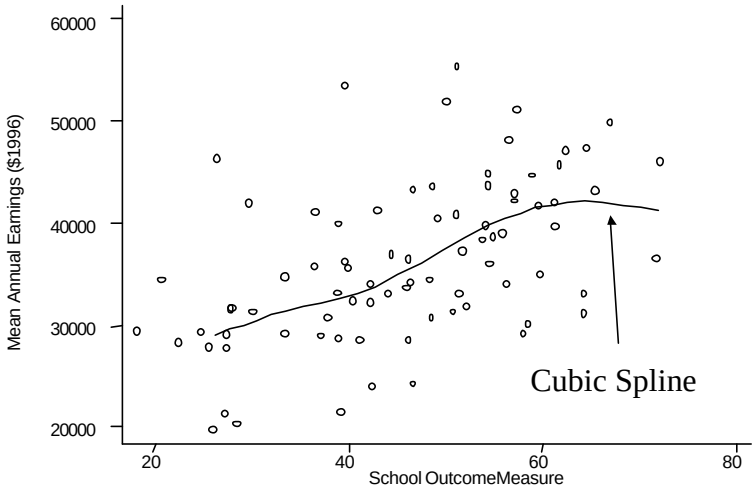


Figure 1 - Average Male Earnings and
School Outcome by Source Country

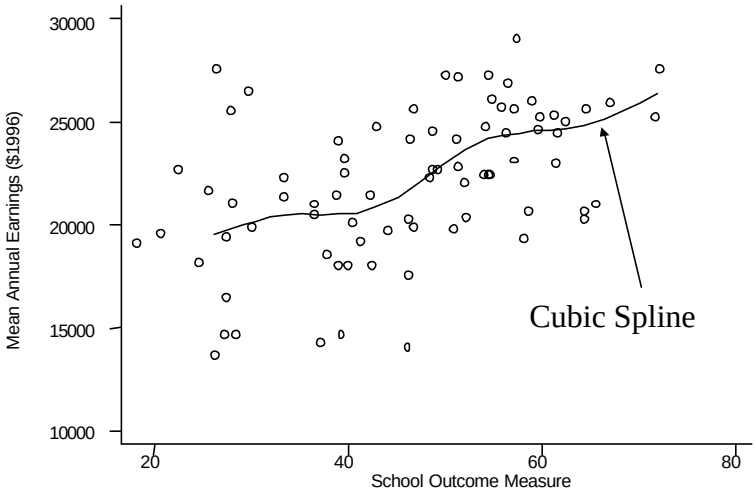


Figure 2 - Average Female Earnings and School Outcome by Source Country

example, differences in average age, and labour market experience across source countries). Nonetheless, on average, the aforementioned 30 point increase in test scores is associated with an approximately $10,000 increase in unadjusted annual earnings for the males, and about $5000 for the females.

## *III. Empirical Analysis*

Cross-sectional regressions that include the test scores as regressors in standard (ln) annual earnings equations using the census data and the source country school quality measures form the basis for the analysis.[6] This approach is quite flexible and nests two different specifications used previously in the literature. School quality's impact is allowed to affect wages both through the return to years of schooling (and later highest degree attained as well), and by shifting the level of wages directly (i.e., an intercept shift).

### III.1 Methodology

When school quality is assumed to impact (the natural logarithm of) annual earnings through the rate of return to education, then the specification is:

$$r(Quality) = r_o + r_1 Quality$$

so that

$$\ln(Earnings) = b_o + r(Quality)E + Xb_1 + e \qquad (1)$$

or

$$\ln(Earnings) = b_o + r_o E + r_1(Quality)E + Xb_1 + e$$

where $r(.)$ is the return to education, which is a function of quality, and $r_0$ and $r_1$ are coefficients to be estimated (in principle the $r$'s and *Quality* measure could be vectors representing non-linear relationships). Education is represented by $E$, and is meant to be relatively general at this stage; various specifications will implement $E$ as years of schooling and/or the highest degree or certificate completed. The $b$'s are additional coefficients to be estimated, and $X$ is a vector of control variables. *Quality* measures the quality of the school system, and is proxied by QL2 described above. The interaction of quality and education, seen explicitly in the third line, implies that quality augments the rate of growth of knowledge in education.

Alternatively, some authors, such as Hanushek and Kimko (2000 - table 6), assume that school quality impacts earnings directly, rather than operating through the return to education such that

$$\ln(Earnings) = b_o + rE + wQuality + Xb_1 + e \qquad (2)$$

where w is the return to quality. This study nests the two and estimates equation (3), which is a more general specification. It allows school quality to operate both directly on earnings, and through the return to education. (Note that the coefficients in equations (1), (2) and (3) need not

[6] As a sensitivity test, an approach following Card and Krueger (1992) from the school quality literature is also presented in an appendix. This is a version of what is sometimes called a random coefficient, or hierarchical linear, model.

take on the same values.) In the versions of this model that are estimated, education ($E$) is initially specified, as it is in much of the literature, as a linear years of schooling measure $S$ as in equation (3).

$$\ln(Earnings) = b_o + r_o S + r_1(Quality)S + wQuality + Xb_1 + e \qquad (3)$$

However, in an effort to ensure the robustness of the findings, in some models the linear schooling term multiplying $r_0$ is allowed to be much more flexible than the conventional linear specification; it will be replaced by a set of indicator (i.e., dummy) variables, one for each year of schooling. Even more importantly, in subsequent models the implementation of $E$ is augmented by measures of the highest degree completed. This allows the return to education to take discrete (non-linear) steps that are associated with degree completion instead of (and sometimes in addition to) the simpler years of schooling measure. Moreover, degree completion is also sometimes interacted with the quality indicator. This permits us to see if source country school quality is particularly important in some portion of the education distribution. For example, in looking at the impact of school inputs on earnings for the American born, Heckman, Layne-Ferrar and Todd (1996) argue that quality matters most for university graduates, but has little importance for those who stop their education at or before the high school level. These more flexible specifications are preferred in that they better capture the "true" pattern in the data, and allow more subtle aspects of the issue to be observed, but there is a trade-off in that precision is lost making inference more difficult. That is, if the correct relationship is close to linear, then the biases induced by employing a linear specification may be small compared with the increase in variance from replacing it with a set of indicator variables. Using a set of dummy variables also affects the ease with which the results can be interpreted and compared with other studies.

Of course, the quality measure employed is an aggregate for each immigrant source country. Thus there are only 81, or 79 for females, unique quality measures. This implies that, unlike individual-level test scores that likely reflect family background and similar factors, these should be interpreted as reflecting the importance, on average, of the quality of source country educational system outcomes. Of course, educational outcomes arise not only as a result of the school system, but other societal factors that influence learning.[7] It also raises a statistical or econometric issue. Since there is only one score for each source country, there is much less information in the data than there appears to be from the sample size. Further, individuals from the same source country may be more alike, in ways that are unobserved, than would be a random sample of individuals from a variety of source countries. These issues imply that the standard ordinary least squares requirements are not satisfied. Ordinary least squares coefficient estimates remain consistent, but the standard errors are too small, and estimation may be inefficient. The latter results from the potential intra-class correlation from the common source country unobserved variables, as pointed out by Moulton (1990). The best approach in this case is to use ordinary least squares to obtain coefficient estimates and correct the standard errors for

[7] For some types of policies one might not care about the origin of the differences in the quality of educational outcomes, but only their ability to predict future labour market success. In that case individual-level test scores would be of interest. If one is interested in education policy and the impact of school systems, then the averages are probably more useful.

such correlations, which result from a form of clustering.[8] Adjusting the standard errors has important implications for inference. In regressions like those that will be presented in table 3, the t-statistics for the quality coefficient in the regressions for the males drop from in the region of 15 to 30, to about 2 or 3; this is a move from massive statistical significance to substantial, but more modest, levels. That there are only 81 countries for the males, and 79 for the females, imposes substantial constraints on the size of any effect that can be observed, even in a data set such as this with a remarkably large number of individuals.

A first set of models will be estimated where education is specified, in a very traditional way, as years of schooling. The preferred specification in this initial analysis will allow source country school quality to affect earnings both directly, and through an interaction with years of schooling. However, models that require it to operate through each of those paths independently will also be estimated to allow the change in the coefficient estimates to be observed. Further, a model without any quality measure will be estimated to allow the change in the schooling coefficient to be measured; this provides an indication of the fraction of the traditional return to education that is accounted for by the quality index. Moreover, to explore the robustness of the result, schooling will be estimated not using the linear specification that is normally employed, but using the most flexible specification possible - a set of 24 indicator variables; this set, plus the omitted group, provide one coefficient for each of the 25 years of schooling outcomes in the data (which goes from zero to 24). A second set of models test the robustness of the initial specification, and extend our understanding, by specifying schooling as the highest level completed (with and without the years of schooling variable). Subsequently, a series of sensitivity tests and extensions are conducted that look at subsets of the population based on where the education was obtained, census year, location of residence and education level. By observing how the quality measure operates in each subpopulation, it is possible to both develop a better understanding of the phenomena and greater confidence in its robustness.

### III.2 Results

For all immigrants, the regression results suggest intriguing patterns with the quality of source country school outcomes having a relatively strong impact of the return to education in Canada, and through it annual earnings. Regression results are presented in table 3, with males in the upper panel and females in the lower one. Regressions in all the columns except (2) contain the variables presented plus a fourth-order polynomial in potential Canadian labour market experience, indicator (dummy) variables for the 1996 and 1991 censuses, 9 age at immigration indicator variables, 3 indicators of mother tongue (English, French, and Both, with neither

[8] The issue is very similar to the well known problems encountered with heteroskedasticity or autocorrelation. Generalized least squares can be used to produce efficient estimates when the number of observations per source country is small, and there are a large number of source countries. However, this does not describe the current situation. Additionally, the relevant generalized least squares random effects regressions must assume that the unobserved elements are not correlated with the regressors. When these regressions are run, however, Hausman-type tests suggest that this assumption is false. This again suggests that the approach adopted is appropriate.

English nor French being the omitted group), nine provincial indicators and one urban one.[9] The second regression includes only the experience and census variables in addition to those presented to illustrate that the observed effect is robust to the absence of the other controls. Probability values are presented in brackets. In all of the regressions the quality indicator ranges from zero to one. Years of school is specified linearly in regressions (1) thru (5), but is allowed complete flexibility in regression (6), where 24 indicator variables are included. Visible minority status is not consistently defined across the three censuses, and is therefore excluded from the regressions. However, a version of the results using what is available in the censuses was run, and the coefficients of interest changed very little. Interestingly, the visible minority indicator's coefficient was close to zero and statistically insignificant for the females, but negative and statistically significant for the males. A version of the results using age instead of potential Canadian experience was also produced, and once again the coefficients of interest did not change in substantive ways. Second order polynomials in quality, and quality interacted with schooling, were explored initially, but they were not supported by the data so the simpler linear specification is employed.

Looking at those variables included in table 3, it is clear that the interaction between schooling and school quality is very statistically significant, empirically important in magnitude and robust across specifications and sexes. Source country school quality appears to substantially augment the accumulation of skills across years of schooling and the combination is relevant for earnings. When the quality index (normalized QL2) is both interacted with years of schooling and allowed to have a direct impact – in regressions (1), (2) and (6) – the direct quality measure's coefficient is always negative, but only sometimes statistically significantly different from zero, and that significance is only observed for the males. Since the quality-schooling

[9] Here and throughout the analysis the experience measure included in the regressions is the minimum of potential experience (age-years of school-5), and years since migration. Much work, including Schaafsma and Sweetman (2001), suggests that pre-migration labour market experience has zero or negligible returns in the Canadian labour market. These regressions, therefore, control for Canadian labour market experience. The age at immigration categories defining each indicator variable are: 0 to 5, 6 to 10, 11 to 15, 16 to 20, 21 to 25, 26 to 30, 31 to 35, 36 to 40, and 41 to 45; 46 plus is the omitted group (and no one is born before 1945).

Table 3 - Individual Level Regressions for All Immigrants by Gender

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| MALE REGRESSIONS | | | | | | |
| Years of Schl | 0.039*** | 0.043*** | 0.061*** | 0.060*** | 0.053*** | Figure 3 |
| | [0.001] | [0.000] | [0.000] | [0.000] | [0.000] | |
| Quality | -0.382** | -0.270 | | 0.157** | | -0.211* |
| | [0.024] | [0.112] | | [0.039] | | [0.067] |
| S*Quality | 0.037*** | 0.033** | | | 0.013** | 0.026*** |
| | [0.006] | [0.014] | | | [0.019] | [0.002] |
| Observations | 353985 | 353985 | 353985 | 353985 | 353985 | 353985 |
| R-squared | 0.131 | 0.122 | 0.128 | 0.13 | 0.13 | 0.137 |
| FEMALE REGRESSIONS | | | | | | |
| Years of Schl | 0.051*** | 0.052*** | 0.068*** | 0.068*** | 0.062*** | Figure 4 |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | |
| Quality | -0.295 | -0.25 | | 0.128* | | -0.124 |
| | [0.185] | [0.303] | | [0.073] | | [0.408] |
| S*Quality | 0.031** | 0.028* | | | 0.011** | 0.019* |
| | [0.047] | [0.078] | | | [0.033] | [0.053] |
| Observations | 311202 | 311202 | 311202 | 311202 | 311202 | 311202 |
| R-squared | 0.092 | 0.076 | 0.09 | 0.091 | 0.091 | 0.098 |

NOTES: P-values in brackets. * 10% significance; ** 5% significance; *** 1% significance. The dependent variable is ln(Annual Earnings). Also included in regressions (1) and (3) thru (6) are: a quartic in Canadian labour market experience; 2 census indicators; 9 age at immigration indicators; 3 mother tongue indicators; and 9 province of residence indicators. Regression (2) has only the first two of the above sets. Regression (6) replaces the linear years of schooling variable with 24 indicator variables; see figures 3 and 4.

interaction is positive, this can be interpreted as indicating that individuals (at least males) with low levels of education from source countries with high quality producing education systems have low earnings. This suggests that for immigrants from high test score receiving countries there may be greater selection and/or sorting according to innate ability in the educational system than among low scoring countries.

Columns (3), (4) and (5) look at alternative specifications. Regression (3) presents the return to years of schooling without controls for quality, and shows a marked increase in the return to education that is consistent with what might be obtained for an "average" level of quality. Comparing columns (1) and (3), it can be seen that introducing (or removing) the quality measures reduces (or increases) the return to education by about 25 to 30 percent for both sexes. Thus a substantial portion of the return to education is associated with the test score measures employed. That such limited tests, which measure only basic math and science (and perhaps implicitly literacy) skills, and not, for example, field specific or technological skills (e.g. those specific to, for example, graphic design or computer use), are associated with such a large fraction of the value of education is notable.

Importantly, when the quality*schooling interaction is removed, in regression (4), the direct return to quality is seen to be positive, not negative, and statistically significant. Once the interaction term is suppressed, increasing quality is seen to be associated with increasing earnings as expected. While this is an interesting contrast, this model forces the impact of quality to be the same across all years of schooling, whereas, as seen in model (1), the data suggests that its importance increases with increasing years of school. In (5) the interaction term is seen to be smaller, though still statistically and economically significant, than when quality is restricted to operating only through the return to education, which makes sense in the context of the results seen in this table given that the intercept is not permitted to shift down. Clearly, while these specifications all show quality to matter, the mechanism is quite complex.

To facilitate interpreting these coefficients, consider, as an example, an individual from the source country with the highest school quality, which, as indicated above, is normalized to one. Further, consider equation (1) for males. The coefficient on the quality variable indicates that such an individual, with zero years of schooling, would have a -0.395 (ln)earnings deficit relative to someone from the source country with the lowest measured school quality. However, as years of schooling increase, the earnings of individuals from that highest school quality source country increase more quickly than those for someone from a country with a lower quality school system. Each year of schooling is worth more in the labour market for those from the higher quality system than for those from a lower quality system. At about 12 years of schooling the effects of the coefficients on the quality, and the schooling*quality, variables exactly counterbalance for males (i.e., the negative intercept is approximately equal to 12 times the coefficient on quality*schooling; given the specification, this is true regardless of source country). For females, they counterbalance at just under 10 years of schooling. So, comparing immigrants with very low *levels* of education, this specification suggests that those from countries with low quality systems have higher earnings. However, as years of schooling increase the gap narrows and, beyond 12 years of schooling those from countries with higher quality school systems have higher earnings. In part, the details of this result are an artifact of the specification, but they suggest the existence of some type of selection mechanism within school systems. Exploring its origin is beyond the scope of this paper, but it may result from greater sorting on innate ability among students in countries with higher quality school systems.

Canada's immigration system may also influence it, but it is not clear how this might work and studying it in the census, which does not identify immigrant classification, is not possible. Note, however, that the extreme case considered here is mostly illustrative since there are relatively few people with very low levels of education. The vast majority of the sample have more than 10 years of schooling.

It is clear that, independent of quality, years of schooling has a very statistically significant impact on earnings in all specifications. Figures 3, for men, and 4, for women, plot the coefficient estimates from regression (6), with the omitted group, those with 24 years of schooling, normalized to zero. The other indicator variable coefficients plotted, for those with zero to 23 years of school, indicate that these other groups all earn less than those with 24 years of school. Also plotted are a similar set of coefficients from a regression like (6), but without

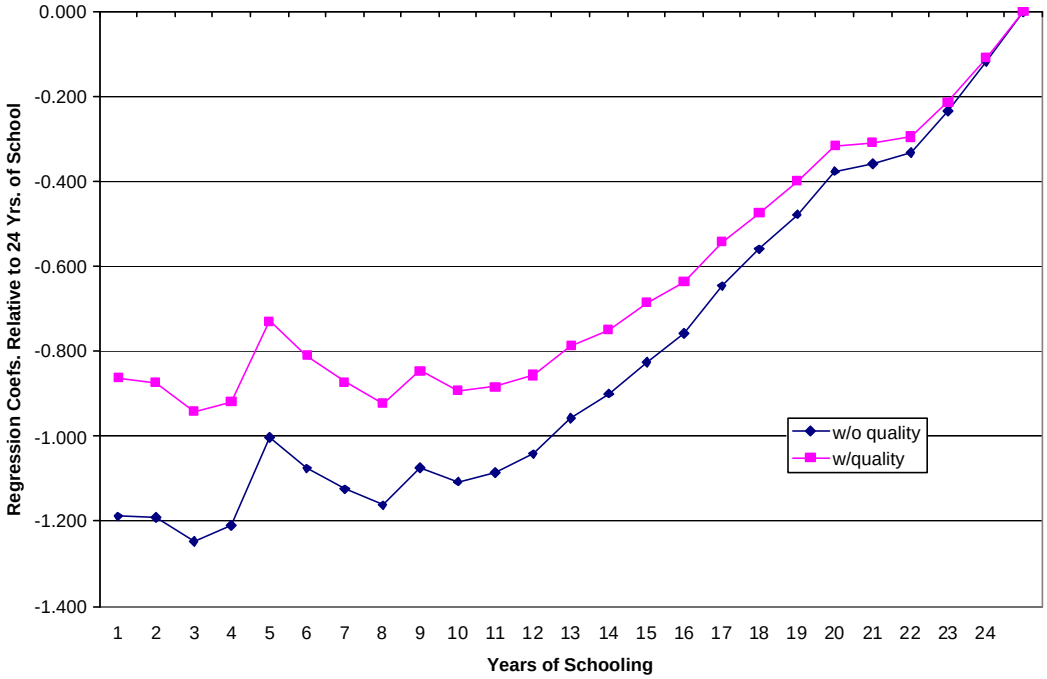


**Figure 3: Male Return to Education (from ln-earnings regressions - see table 3, col 6)**

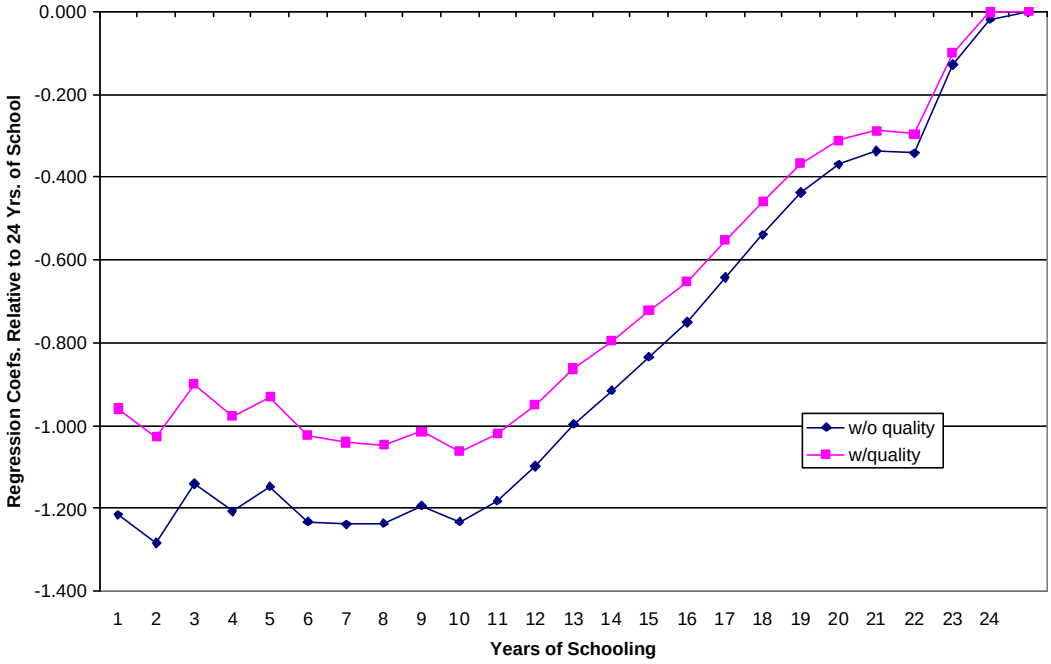


**Figure 4: Female Return to Education (from ln-earnings regressions - see table 3, col 6)**

the quality, and quality interacted with schooling, variables. It is clear that earnings, especially for women, do not start rising appreciably with years of schooling until grade nine or ten for this immigrant sample. There is also a discontinuity around 20 or 21 years of schooling. Of course, most of the sample populates the approximately linear portion of the curves. Still, a linear specification over the entire range will be somewhat flatter than the linear central portion of the plot. As will be seen, while the difference does not alter the conclusion, a comparison of columns (1) and (6) in table 3 shows that it does reduce the coefficient on the interaction term by about one third.[10] This flat profile accords with Card and Krueger (1992) who observe a similar phenomenon for the American born in census data from the United States. Plausibly, it derives from the social safety net, minimum wage legislation, and related policies placing a floor on wages and hence eliminating the return to education in this range.

Some researchers, notably Heckman, Layne-Ferrar, and Todd (1996a, b), and Ferrer and Riddell (2002a, b), argue that there are important non-linearities in the return to education that are associated with degree completion. That is, completing the last year of high school, university or some other degree granting year, is more valuable in the labour market than other years. Of course, in the United States census data employed by Heckman, Layne-Ferrar, and Todd degree completion must be inferred from years of education, and they then simply allow discontinuities at 12 and 16 years of schooling, which are assumed to be associated with high school and Bachelor's degree graduation. Using Canadian census data, which collects information on both years and degrees, Ferrer and Riddell show that these years are not particularly good proxies in the Canadian context.

Table 4 addresses these concerns by introducing indicators for degree completion into the regression. Column (1), for males, and (2), for females, simply adds nine indicator variables into regressions like those in column (1) of table 3, which is an augmentation of the specification of $E$ from equation (1) and (2).[11] These indicators are strongly statistically significant, and quite large in magnitude. Their introduction drives the years of schooling coefficient to zero for the males, and reduces it substantially for the females. In contrast, the coefficients on quality, and the quality*years interaction, while reduced to something akin to that seen in column (6) of table 3, remain quite large and statistically significant. Quality matters even in this highly flexible specification.

In regressions (2) and (5) the linear schooling and quality measures are dropped, and the quality linear measure is interacted with each of the certification indicators. These interaction terms are statistically significant and quite large in most cases, especially for the males. Interestingly, they are not significant for the males at levels of education beyond the bachelor's with certificate level, whereas they are not for females for college and trades. However, as can be seen in appendix table 1, most of the groups that are without statistically significant coefficients are extremely small and comprise only a small subset of the countries, making precision difficult. Nonetheless, finding economic returns to quality, measured as test scores, for the lower levels of education differs from Heckman, Layne-Ferrar, and Todd who observed economic returns only for those with 16 or more years of schooling using measures of school inputs. In equations (3)

[10] An attempt was made to specify the quality measure as a series of three indicator variables, but the standard errors are so large that the specification is not presented.

[11] These categories are described in appendix table 1, and simply follow those in the census.

Table 4 - School Quality and Highest Degree Obtained

| | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Years of Schl | 0.008 | | 0.023*** | 0.020*** | | 0.033*** |
| | [0.308] | | [0.000] | [0.003] | | [0.000] |
| Quality | -0.226** | | | -0.156 | | |
| | [0.042] | | | [0.339] | | |
| S*Quality | 0.027*** | | | 0.023* | | |
| | [0.002] | | | [0.050] | | |
| Highest Degree Received | | | | | | |
| high school | 0.062*** | 0.019 | -0.074* | 0.073*** | 0.186*** | 0.051 |
| | [0.000] | [0.575] | [0.089] | [0.000] | [0.000] | [0.200] |
| trade cert. | 0.159*** | 0.096 | -0.007 | 0.058*** | 0.254*** | 0.113* |
| | [0.000] | [0.108] | [0.917] | [0.000] | [0.000] | [0.095] |
| non-uni cert. | 0.216*** | 0.183*** | 0.039 | 0.195*** | 0.388*** | 0.196*** |
| | [0.000] | [0.000] | [0.497] | [0.000] | [0.000] | [0.001] |
| univ. below bachelor | 0.190*** | 0.181*** | 0.007 | 0.243*** | 0.439*** | 0.192*** |
| | [0.000] | [0.003] | [0.914] | [0.000] | [0.000] | [0.008] |
| bachelor's | 0.363*** | 0.337*** | 0.143*** | 0.366*** | 0.521*** | 0.252*** |
| | [0.000] | [0.000] | [0.003] | [0.000] | [0.000] | [0.000] |
| univ cert above bach | 0.421*** | 0.428*** | 0.212*** | 0.438*** | 0.596*** | 0.304*** |
| | [0.000] | [0.000] | [0.004] | [0.000] | [0.000] | [0.000] |
| prof deg e.g. med, dent | 1.123*** | 1.176*** | 0.910*** | 1.042*** | 1.274*** | 0.904*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| master's degree | 0.496*** | 0.611*** | 0.368*** | 0.474*** | 0.632*** | 0.300** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.044] |
| doctorate | 0.699*** | 0.932*** | 0.627*** | 0.773*** | 1.062*** | 0.634*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |

Continued

| | | | | | | |
|---|---|---|---|---|---|---|
| Quality * Highest Degree | | | | | | |
| Q * less high school | -0.030 | -0.070 | | 0.151*** | 0.089 | |
| | [0.667] | [0.261] | | [0.005] | [0.200] | |
| Q * high school | 0.163* | 0.161* | | 0.124* | 0.126* | |
| | [0.068] | [0.080] | | [0.081] | [0.068] | |
| Q * trade cert. | 0.215** | 0.208** | | 0.008 | 0.003 | |
| | [0.041] | [0.035] | | [0.948] | [0.977] | |
| Q * non-uni cert. | 0.228** | 0.227** | | 0.100 | 0.097 | |
| | [0.025] | [0.028] | | [0.349] | [0.338] | |
| Q * univ below bachelor | 0.247** | 0.245** | | 0.174 | 0.178 | |
| | [0.029] | [0.037] | | [0.148] | [0.126] | |
| Q * bachelor's | 0.309*** | 0.308*** | | 0.303*** | 0.292*** | |
| | [0.000] | [0.000] | | [0.001] | [0.002] | |
| Q * univ cert above bach | 0.280*** | 0.288*** | | 0.330*** | 0.325*** | |
| | [0.008] | [0.008] | | [0.000] | [0.000] | |
| Q * prof deg eg med, dent | 0.278 | 0.294 | | 0.316 | 0.332 | |
| | [0.132] | [0.116] | | [0.373] | [0.336] | |
| Q * master's degree | 0.146 | 0.156 | | 0.396* | 0.392* | |
| | [0.141] | [0.109] | | [0.094] | [0.081] | |
| Q * doctorate | 0.035 | 0.065 | | 0.314** | 0.335** | |
| | [0.620] | [0.380] | | [0.023] | [0.014] | |
| Observations | 353985 | 353985 | 353985 | 311202 | 311202 | 311202 |
| R-squared | 0.148 | 0.146 | 0.148 | 0.102 | 0.098 | 0.102 |

NOTES: P-values in brackets. * 10% significance; ** 5% significance; *** 1% significance.
The dependent variable is ln(Annual Earnings). Also included in regressions are:
a quartic in Canadian labour market experience; 2 census indicators; 9 age at immigration indicators; 3 mother tongue indicators; and 9 province of residence indicators.

and (6) the years of schooling variable is reintroduced to the models and the coefficients on the highest degree received are much reduced as expected given that they are highly correlated with years of schooling. However, and importantly, there is little change to the coefficients on the interactions between highest degree received and school quality. In regressions that are not reported, the linear quality and quality times years of schooling interaction are added to regressions like (3) and (6). All of the coefficients on the variables involving the quality measure are individually statistically insignificant with very large standard errors (though joint F-tests are statistically significant). There is not enough information in the data, given the small number of source countries, to support these highly collinear regressors' coefficients simultaneously. Overall, these results suggest that educational quality matters across all of the range of educational attainment.

Focussing on those with exactly a bachelor's degree as an example, consider the magnitude of the effects in table 4. As can be seen in column (2), males with a bachelor's degree have a baseline coefficient of 0.337 indicating an earnings difference between those with a bachelor's degree and those with less than high school, holding the other regressors constant, of approximately [(exp(0.337)-1)*100%=] 40.1%. For females the same difference is about 68%. On average this premium accrues to all those who hold a bachelor's degree, regardless of school quality. However, the economic return to the bachelor's degree is also a function of source country school quality; the interaction of the normalized quality measure with having a bachelor's certificate has a coefficient of just over 0.3 for both sexes. Relative to those from the source country with the lowest quality score, which is normalized to be zero, individuals from the highest scoring country, which is normalized to a score of one, have earnings that are, on average, 30% higher. Of course, these are the extremes. The average difference between those from a country with a normalized score of 0.20, and one with a score of 0.80, is about [(0.8-0.2)*30%=] 18%. As can be seen in table 1 or 2, of the 81 countries, there are 13 (10) with scores equal to or below (above) 20 (80). Thus this is a substantial quality premium, and it is relevant for a substantial portion of the population.

These findings, especially those in table 4, have implications for the ongoing policy issue of non-Canadian credential recognition for immigrants. (Although, to this point, the analysis has not distinguished where the education was obtained, this will be addressed shortly.) The regressions suggest that the labour market currently distinguishes between bachelor's degrees, for example, from source countries with different quality school systems and values those from higher quality systems more highly.

Sensitivity analysis and extensions looking at where each person's education was obtained are presented in table 5. If it is the quality of the education system that is driving these results, and not other factors, such as discrimination, then immigrants educated primarily in the Canadian system should not be affected by the source country school quality index. These results are from regressions identical to those in column (1) of table 3, except that they are for various subsets of the sample.[12] The first two of this set of regressions, in panel A, look at those

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

Table 5 - Individual Level Regressions for Selected Subgroups by Gender

| | Male | Female | Male | Female |
|---|---|---|---|---|
| Panel A | | | Panel B | |
| ONLY SOURCE COUNTRY EDUCATION | | | ONLY SOURCE COUNTRY SCHOOLING; COMPLETED GRADE 9 OR MORE | |
| Years of Schl | 0.024** | 0.039*** | 0.048*** | 0.056*** |
| | [0.039] | [0.000] | [0.000] | [0.000] |
| Quality | -0.387** | -0.103 | -0.308* | -0.212 |
| | [0.032] | [0.426] | [0.054] | [0.173] |
| S*Quality | 0.041*** | 0.017 | 0.035*** | 0.025** |
| | [0.007] | [0.145] | [0.003] | [0.024] |
| Observations | 190396 | 176215 | 165991 | 152630 |
| R-squared | 0.133 | 0.085 | 0.146 | 0.09 |
| Panel C | | | Panel D | |
| MIXED CDN AND SOURCE COUNTRY EDUC | | | ARRIVED IN CANADA AT AGE 10 OR EARLIER | |
| Years of Schl | 0.090*** | 0.086*** | 0.099*** | 0.096*** |
| | [0.000] | [0.000] | [0.000] | [0.000] |
| Quality | 0.02 | -0.411** | 0.187 | -0.155 |
| | [0.922] | [0.048] | [0.444] | [0.569] |
| S*Quality | 0.003 | 0.034*** | -0.01 | 0.017 |
| | [0.798] | [0.004] | [0.539] | [0.297] |
| Observations | 163589 | 134987 | 96104 | 79104 |
| R-squared | 0.115 | 0.089 | 0.115 | 0.088 |

NOTES: P-values in brackets. * 10% significance; ** 5% significance; *** 1% significance.
The dependent variable is ln(Annual Earnings). Also included in regressions are:
a quartic in Canadian labour market experience; 2 census indicators; 9 (or less) age at immigration indicators; 3 mother tongue indicators; and 9 province of residence indicators.

immigrants who completed their education before entering Canada.[13] For both sexes, the return to schooling decreases relative to that in table 3, consistent with other research such as Schaafsma and Sweetman (2001) and others, which finds that pre-immigration education has a lower rate of return in the Canadian labour market. For males the return to quality is larger, but very similar to that observed in table 3. That for the females, however, is much lower and not statistically significant. It is not entirely clear why this change occurs for the females, but a clue can be obtained from panel B where the statistical insignificance is not observed for the subsample of those from panel A who completed at least grade 9. In contrast to that for females, the return to quality for males is not much affected by this sample change. The anomaly appears to arise from that fraction of the sample of females with low levels of education.[14] Restricting the sample to those with at least grade 9 in panel B is also interesting because of the relatively flat return to education observed for those with few years of schooling in figures 3 and 4. As expected, for both sexes, the return to years of schooling increases quite a bit.

Panel C selects a sample of those with mixed Canadian and source country education; its sample is the complement to panel A. That is, there is some post-migration education (which Friedberg (2000) shows to increase wages and "undo" some of the low return to foreign education in the Israeli context). Both sexes' coefficients on schooling increase substantially, consistent with Friedberg and previous Canadian work. Source country school quality seems quite important for the female sample, but not for the males. Finally, in panel D, those who arrive at a very young age are examined in isolation since they have obtained almost all of their schooling in Canada. For this group the return to years of schooling is the highest observed in any regression in the paper. It is also equal to or higher than that normally observed for the Canadian born, and accords with Schaafsma and Sweetman (2001) who formally test the hypothesis that immigrants who arrive prior to age 10 have equal or greater returns to schooling than the Canadian born and find it to be the case. However, the source country school quality coefficients are effectively zero - source country school quality does not matter for those not

[13] Here, and throughout, the 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 are greater than the age at immigration, then schooling is inferred to have been received in Canada. 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 in Canada. 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.

[14] One explanation for this suggested by a seminar participant is that discrimination against females varies substantially across countries, and that some educational systems restrict females, on average, to much lower levels of schooling than males. This adds a source of unmeasured heterogeneity for women that is not present for men. Additionally, as seen in figures 3 and 4, the economic return to education is flatter for women for about three years of schooling beyond where it starts to increase for men. This probably follows from women having lower wages than men, which means that they are more impacted by minimum wage legislation and related policies.

educated in the source country. This suggests that it is the system that a person is actually exposed to that matters.

In terms of credential recognition, the results in table 5 for males paint a fairly clear picture. Source country school quality matters only for those with a foreign education. Those who arrive very young (panel D), and even those with mixed foreign and Canadian education (panel C), appear not to be affected by the quality of education in their source country. However, those with only source country education (panels A and B) are strongly affected by the quality of that education. On average, individuals from source countries with high quality school systems obtain quite respectable returns, but those from countries with lower quality systems receive a substantially smaller return. Further, these differences are increasingly important at higher levels of education since the impact of school quality is cumulative.

For females the picture is more complicated. Those with low years of source country schooling appear not to be strongly affected by school quality; this accords with females having low returns to schooling at low years of schooling as seen in figure 4. In contrast, the earnings of those with higher levels of exclusively pre-Canadian education, and those with mixed Canadian and source country education, are affected by the quality of their source country education. Like the males though, females who immigrated very early in life (panel D), that is age 10 or earlier, appear to be unaffected by the quality of education in their source country. This latter, as for the males, accords with those young immigrants having not been strongly influenced by their source country education systems. The actors in the labour market seem to differentiate among individuals according to the quality of the system in which they received their education and remunerate them accordingly, on average.

Table 6 performs further sensitivity tests by splitting the sample according to census year and city of residence. On the left-hand side of the table, results for each of Canada's three major cities are presented. It is increasingly argued (see Heckman, Layne-Ferrar, and Todd, 1996a, b) that local labour market conditions are crucial for labour market outcomes. Similarly, on the right-hand side of the table results for each census year can be found. McDonald and Worswick (1998) suggest that immigrants are particularly affected by business cycle conditions and that the year in which an observation occurs, therefore, has implications for some outcomes. However, these regressions all paint a picture that is broadly consistent with that seen previously, though some of the coefficients are not statistically significant for women. Apparently, source country school quality has a similar effect on earnings across locations and time periods. Of course, some of these estimates are not very precise since the country samples in each regression are quite small.

Table 7 conducts a final extension by focussing on three subsamples of the data; each contains individuals with exactly one of the following highest levels of education: a high school degree, a college diploma, and a bachelor's degree. Neither variables representing years of schooling, nor quality interacted with the same are included in these models since years of schooling do not vary sufficiently within each education category. Although the coefficients on the quality measure for the high school subsample are on the margin of statistical significance for males, and college is not for females (which is not surprising given the decreased sample size) most of the others are strongly statistically significant and quite large. This suggests that the school quality effect operates within tightly defined educational categories, as well as increasing in importance as time in school accumulates. Labour market remuneration for a particular certification, for example a bachelor's degree, appears to vary very substantially as a function of

Table 6 - Regressions by CMA and Census

| | City | | | Census | | |
|---|---|---|---|---|---|---|
| | Montreal | Toronto | Vancouver | 1986 | 1991 | 1996 |
| MALE REGRESSIONS | | | | | | |
| Years of Schl | 0.047*** | 0.031** | 0.037*** | 0.031*** | 0.037*** | 0.045*** |
| | [0.001] | [0.027] | [0.000] | [0.005] | [0.001] | [0.000] |
| Quality | -0.345 | -0.462* | -0.284*** | -0.482*** | -0.438** | -0.326* |
| | [0.145] | [0.059] | [0.003] | [0.004] | [0.015] | [0.059] |
| S*Quality | 0.033* | 0.042** | 0.030*** | 0.046*** | 0.041*** | 0.032** |
| | [0.069] | [0.014] | [0.000] | [0.000] | [0.004] | [0.020] |
| Observations | 33416 | 128697 | 41386 | 93618 | 114316 | 146051 |
| R-squared | 0.141 | 0.128 | 0.143 | 0.125 | 0.133 | 0.131 |
| FEMALE REGRESSIONS | | | | | | |
| Years of Schl | 0.046*** | 0.043*** | 0.063*** | 0.052*** | 0.053*** | 0.049*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Quality | -0.424*** | -0.363** | 0.220 | -0.159 | -0.242 | -0.353* |
| | [0.003] | [0.024] | [0.206] | [0.569] | [0.272] | [0.075] |
| S*Quality | 0.032*** | 0.036*** | -0.001 | 0.020 | 0.028* | 0.035** |
| | [0.008] | [0.002] | [0.937] | [0.325] | [0.064] | [0.013] |
| Observations | 26189 | 117979 | 37953 | 79862 | 100731 | 130609 |
| R-squared | 0.102 | 0.095 | 0.087 | 0.071 | 0.096 | 0.101 |

NOTES: P-values in brackets. * 10% significance; ** 5% significance; *** 1% significance.
The dependent variable is ln(Annual Earnings). Also included in regressions are:
a quartic in Canadian labour market experience; 2 census indicators; 9 age at
immigration indicators; 3 mother tongue indicators; and 9 province of residence indicators.

Table 7 - The Return to Quality within Narrow Education Categories

| | Highest Degree Completed | | |
|---|---|---|---|
| | HS | College | BA |
| MALES | | | |
| Quality | 0.164 | 0.273* | 0.307*** |
| | [0.122] | [0.051] | [0.001] |
| Observations | 68168 | 59803 | 55881 |
| R-squared | 0.107 | 0.106 | 0.152 |
| FEMALES | | | |
| Quality | 0.126** | 0.119 | 0.244** |
| | [0.035] | [0.219] | [0.024] |
| Observations | 75946 | 66228 | 48979 |
| R-squared | 0.062 | 0.055 | 0.100 |

NOTES: P-values in brackets. * 10% significance; ** 5% significance; *** 1% significance. The dependent variable is ln(Annual Earnings). Also included in regressions are: a quartic in Canadian labour market experience; 2 census indicators; 9 age at immigration indicators; 3 mother tongue indicators; and 9 province of residence indicators.

the quality of education in the immigrant's source country, which accords with the observations in table 4.

### *IV. Discussion and Conclusion*

Immigrants' source country educational quality – measured as an index based on six sets of source country test scores in math and science – are seen to matter for annual earnings in the Canadian labour market. This index does not measure the test score, or related ability, of any individual, but is an average reflecting each country's educational system's outcomes. Overall, the findings suggest that not all years of education at the same nominal level are equal. On average, immigrants from countries with high quality education systems have higher returns than those from countries with school systems that produce lower test score results.

Simple correlations and graphical analyses are used in an initial exploratory analysis and they show a substantial correlation between source country school quality and average Canadian labour market earnings by source country among immigrants using pooled data from three Canadian censuses. Of note is the substantial variance in both average earnings and the quality measure across the 81, for males, and 79, for females, source countries. Roughly speaking, a movement from a rank of 15$^{th}$ to 70$^{th}$ on the country quality index is associated with an expected increase in annual earnings of about $10,000 for males, and $5000 for females. Interestingly, the quality measure is not correlated with total years of schooling.

Multivariate regression analysis that controls for the demographics available in the censuses, such as age at immigration, and location of residence, are also conducted and show that this quality seems to operate primarily through the return to education (as opposed to having a direct association with earnings). Those from source countries with lower quality school outcomes receive a lower average return for their years of schooling. Comparing regressions with, and without, quality measures, the return to years of schooling is about 25 to 30% lower in those regressions with the quality measures. This implies that these relatively generic quality measures account for a substantial fraction of the return to education. Furthermore, the effect of quality seems to compound with increasing years of school. There also appears to be some type of selection process occurring with individuals who have very low levels of schooling, but who come from source countries with high quality education systems, having quite low earnings. The number of such individuals is, however, small.

Additional multivariate regressions interact quality with various educational credentials and substantial within-degree quality premiums are observed. For example, comparing those who hold exactly a bachelor's degree, for both sexes there is an 18% earnings gap, on average, between those from source countries at 0.20 and 0.80 on the normalized quality index. Overall, quality is seen to matter over a wide range of the highest level of education attained, although some of the results are imprecise as a result of the source country sample size being small for the less common categories. In contrast, the return to years of schooling (independent of quality) appears to be close to zero at very low levels of schooling. Females, for example, have no measurable earnings differences associated with education below about grade 9 (for males perhaps a year lower). Plausibly, minimum wage legislation and other social programs and labour market institutions keep the lower tail of the wage distribution sufficiently compressed that there is no substantial premium to education in this region.

Sensitivity tests and extensions find that, though there are some small deviations, school quality matters for those educated outside of Canada, but not for those who immigrate at a young age and obtain their education primarily in Canada. This reinforces the idea that it is source country school quality that is at issue and not some other source country factors. Moreover, similar effects were observed independently in tightly defined subsamples representing Canada's three major cities, and each of the three census years. School quality is also seen to impact earnings within tightly defined educational categories, such as those with exactly a bachelor's, and no subsequent, degree. So this is not only a phenomenon that occurs across levels of education.

This research informs the ongoing policy issue of immigrants' economic integration into the Canadian labour market. As indicated by Reitz (2001), little research has been done that attempts to measure differences in school quality, and without such a measure it is difficult to ascertain that degree to which immigrant educational credentials are undervalued in the Canadian labour market. While this study cannot provide all of the information required to evaluate immigrant credentials, it is a first step in using explicit criteria based on independent information to assess the impact of school quality on Canadian labour market outcomes. Previous work by, for example, Li (2002) has looked at differences in Canadian-born and immigrant earnings across groups defined by visible minority status, sex and other demographics for those who hold the same educational credentials (e.g., a bachelor's degree). But, these have been simple comparisons without any empirical allowance for the possibility that not all school systems, and hence credentials, are equal. Without understanding how school quality varies, policies to help recognize foreign credentials may not prove effectual if they do not recognize the heterogeneity of the skills embodied in the credentials in question. Interestingly, the existence of earnings differences that coincide with the quality measure used suggests that the Canadian labour market is currently able to recognize school quality, though it likely does so imperfectly. This nuances our understanding of the requirements of policies to improve foreign credential recognition.

Of course, more work is required on this topic if we are to have credible evidence for policy. One particularly valuable contribution would be to use the Longitudinal Immigrant Data Base (IMDB) to look at the labour market impact of school quality. It could verify the basic observations of this study, replication using an independent data source being a cornerstone of the scientific method. Moreover, while the censuses have some advantages, the IMDB has others, and the IMDB would allow important, but different, questions to be addressed. Especially, it could explore longitudinal, and immigration category/class, issues that cannot be addressed in the Censuses, and it has information on education at the time of immigration, in contrast to the censuses where that must be inferred, that would provide more accurate results that are more tightly tied to the immigration points system.

Expanding the information available on source country school quality would be particularly valuable. It would be useful to explore other aspects of school quality that might affect immigrant labour market earnings. For example, advanced technologies, especially computers, are becoming increasingly important in the labour market. Undoubtedly computer training (especially that using the most current technologies) varies across immigrant source country education systems, even at the post-secondary level. How important is this skill for Canadian labour market earnings? How does it impact the way an education credential is valued? Similarly, although it is difficult to do, it might also be worthwhile to attempt to generate sex-specific source country school quality indexes to improve upon the single measure for each

country used here. Perhaps more importantly, it would be worthwhile to try to expand the list of countries for which school quality proxies are available. Although data is available for a large number of countries, it is easy to list another 20 countries for which such data do not exist (e.g., Sudan and Guatemala). With a fuller set of countries the impact of source country school quality on trends in the Canadian labour market outcomes of immigrants, in particular the decline in the early part of the last decade, could be explored. If relative school quality has impacts on earnings, this also raises questions about the future since recent international testing programs, especially the OECD's PISA study, show Canada's education system to be improving relative to that in other countries.

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Appendix Table 1: Descriptive Statistics

| Variable | Male | | Female | |
|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev. |
| age | 37.479 | 6.763 | 37.258 | 6.786 |
| potential Canadian exp | 13.947 | 7.829 | 14.097 | 7.908 |
| annual earnings | 38399 | 38604 | 22965 | 18766 |
| ln(earnings) | 10.225 | 0.988 | 9.656 | 1.089 |
| | | | | |
| Immigrant Age at Arrival: | | | | |
| 0 to 5 | 0.158 | 0.364 | 0.149 | 0.356 |
| 6 to 10 | 0.114 | 0.318 | 0.106 | 0.308 |
| 11 to 15 | 0.090 | 0.287 | 0.086 | 0.280 |
| 16 to 20 | 0.136 | 0.342 | 0.159 | 0.366 |
| 21 to 25 | 0.210 | 0.408 | 0.228 | 0.419 |
| 26 to 30 | 0.156 | 0.363 | 0.147 | 0.354 |
| 31 to 35 | 0.078 | 0.269 | 0.074 | 0.261 |
| 36 to 40 | 0.038 | 0.191 | 0.036 | 0.186 |
| 41 to 45 | 0.017 | 0.128 | 0.015 | 0.120 |
| 46 to 50 | 0.003 | 0.055 | 0.002 | 0.050 |
| 51 to 65 | 0.000 | 0.005 | 0.000 | 0.003 |
| | | | | |
| Urban | 0.837 | 0.369 | 0.845 | 0.362 |
| | | | | |
| BC | 0.174 | 0.379 | 0.178 | 0.382 |
| AB | 0.093 | 0.290 | 0.093 | 0.290 |
| SK | 0.010 | 0.101 | 0.010 | 0.100 |
| MN | 0.033 | 0.178 | 0.034 | 0.180 |
| ON | 0.557 | 0.497 | 0.567 | 0.495 |
| PQ | 0.109 | 0.312 | 0.096 | 0.295 |
| NB | 0.006 | 0.076 | 0.006 | 0.078 |
| NS | 0.010 | 0.097 | 0.009 | 0.093 |
| PI | 0.001 | 0.031 | 0.001 | 0.030 |
| NF | 0.003 | 0.050 | 0.002 | 0.047 |
| | | | | |
| Monther Tongue: | | | | |
| English | 0.373 | 0.484 | 0.399 | 0.490 |
| French | 0.027 | 0.161 | 0.024 | 0.153 |
| Both | 0.036 | 0.187 | 0.035 | 0.185 |
| Neither | 0.563 | 0.496 | 0.542 | 0.498 |
| | | | | |
| Education: | | | | |
| Years of School: | 13.792 | 3.847 | 13.309 | 3.586 |
| | | | | |
| < High School | 0.236 | 0.425 | 0.245 | 0.430 |
| High School | 0.193 | 0.394 | 0.244 | 0.430 |
| Trade Certificate | 0.161 | 0.368 | 0.091 | 0.288 |
| Non Univ Cert | 0.143 | 0.350 | 0.179 | 0.383 |
| Univ < BA | 0.026 | 0.160 | 0.034 | 0.181 |
| Bachelors | 0.137 | 0.344 | 0.136 | 0.343 |
| Cert > BA | 0.020 | 0.142 | 0.021 | 0.144 |
| Med/Dental | 0.012 | 0.109 | 0.006 | 0.078 |
| Masters | 0.053 | 0.225 | 0.037 | 0.190 |
| PhD | 0.018 | 0.132 | 0.006 | 0.076 |
| | | | | |
| Census | | | | |
| 1996 | 0.413 | 0.492 | 0.420 | 0.494 |
| 1991 | 0.323 | 0.468 | 0.324 | 0.468 |
| 1986 | 0.264 | 0.441 | 0.257 | 0.437 |

Notes: Number of observations for males is 353985, for females 311202.
Dollars in 1996 equivalents. Source: 1986, 1991 and 1996 Canadian Censuses.

Appendix - Sensitivity Analysis Using a Random Coefficient Estimation Approach

It is important in empirical research to ensure that the observed results are robust and are not a feature of the particular specification employed. An alternative approach using the same data is, therefore, pursued here to ensure the validity of the findings in the body of the study. This approach follows Card and Krueger (1992) and estimates what is sometimes referred to as a type of random coefficient model. In it source country specific returns to schooling are first estimated from (ln)earnings equations using the census data; then, in a second step, these returns are regressed on the school quality measures. The idea is to see if variation in school quality can explain variation in the economic return to schooling in the labour market. Country-specific intercepts are also estimated for the wage equations and are regressed against the quality measures.

If it is the quality of school outcomes that matters, as opposed to other country specific factors, then we should expect to see a positive relationship between the quality measures and the return to schooling, but no relationship with the intercepts. Though others, such as Heckman, Layne-Farrar and Todd (1996a, b), building on work by Behrman and Birdsall (1983), point out that school quality may also be thought to impact earnings directly. Thus, in principle, it is possible for quality to enter through an intercept if it is (or a component of it is) independent of how many years of schooling one obtains. However, in a cross-national context, if the quality measures are primarily proxies for other factors, perhaps the wealth and/or average level of nutrition of the source country, inasmuch as these influence earnings in Canada then a correlation with the intercept will exist. Thus there is no unique interpretation for a correlation with the intercept, and an observed correlation between source country school quality and Canadian labour market earnings that does not operate through the return to education may reflect more than school quality.

This model is, in some dimensions, less restrictive than that estimated in the body of the paper in that, in the first stage, it allows each country to have its own return to education. Of course, it imposes linearity in the second stage. In contrast, the previous approach permits each country to have its own return, but forces a linear relationship between them from the start. However, this appendix approach is not sufficiently flexible to allow degree completion measures to be added to the regression. Also, precision causes there to be greater limits on the ability to look at subsamples, for example regressions by city, compared to the previous approach.

Methodology

The alternative approach to looking at the data, akin to that employed by Card and Krueger (1992), is to run a first stage regression that allows each country to have both its own intercept and return to schooling (i.e., a set of country indicators is included in the regression, and also interacted with the schooling variable) as seen in equation (4).

$$\ln(Earnings)_i = X_i\gamma + \sum_{c=1}^{N} [S_{ic}r_c + C_{ic}b_c] + \varepsilon_i \qquad (4)$$

In this specification $i$ indexes individuals, and $c$ countries; N is the total number of countries - either 81 or 79. The coefficients to be estimated are $\gamma$, $r$ and $b$. They, respectively, capture the

effects of the control variables, *X*, years of schooling *S* by source country, and source country intercept, *C*. Note that each source country has its own intercept and return to schooling, so there are 81, or 79 for females, *r*'s and *b*'s estimated. As with the specification of the regressions in (1) of table 3, the control variables are a quartic in experience, two census indicators, up to nine age at immigration indicators (for certain subsamples some of the age indicators are not relevant), three language indicators, nine provincial indicators, and one urban indicator. The equation's random error term is ε.

Two second stage regressions, seen in equation (5), follow from the first. The return to schooling and the intercept coefficients (the *r*'s and *b*'s respectively) from this first stage regression serve as dependent variables and are regressed on the school quality measures with no additional regressors.[15]

$$r_c = a_o + a_1 Quality_c + h_c$$
$$b_c = d_o + d_1 Quality_c + n_c \qquad (5)$$

In these regressions the *a*'s and *d*'s are coefficients to be estimated, and ?, and ?, are error terms. The coefficients on the Quality measures indicate its relationship with, first, the source country return to years of schooling and, second, the source country intercept. In contrast to the previous specifications, which forced each country to have the same coefficient on schooling, quality, and interaction between the two, this allows any coefficient heterogeneity in the return to education and in intercepts to be observed. It is a more flexible specification in the first stage, but is also less precise.

A positive relationship in equation (5) suggests that source country school quality "explains" differences in the return to education across immigrant groups. The country specific intercepts from the first stage are also regressed against the school quality measures. If school quality operates only through the return to education, then the intercepts should not be correlated with school quality. However, if quality operates directly on wages, or there is some other country specific factor that increases both wages and school quality, then a correlation with the intercept should be observed in the second step.

Results

Country specific returns to education from the first stage are reported in appendix table 2 along with their p-values (from a test that the coefficient is equal to zero) for regressions using the entire sample for each sex. Similar models were also estimated for selected subsamples of the data, but only the second stage results are presented for the latter. A wide range of first stage return to education coefficient estimates can be observed in appendix table 2. They range from a low of about 0.02, to highs over 5 times larger. Estimates of the return for each sex are clearly

[15] Since the countries have different sample sizes, the second step uses weighted least squares where the weights are the inverse of the sampling variances of the estimated returns to schooling. As a sensitivity test, similar regressions were run using the source country sample size for the weight. While the standard errors were larger, and the level of significance reduced, the results conform to those presented.

not the same; indeed it would be surprising if they were since many studies have observed that the return to education for females is greater than that for males in the Canadian labour market; see, for example, Riddell and Sweetman (2000, figure 1). Indeed, this is the most common pattern in appendix table 2. However, there are some source countries, such as Thailand, for which the estimated return to education for males is quite high (0.114), while that for females is quite low (0.037). Using data from the United States, Antecol (2001) presents evidence that there is a correlation in the male-female wage gaps observed in immigrant source countries and those observed in the American domestic economy for first, but not subsequent, generation immigrants. Source country sex-based occupational, employment and/or educational patterns appear to have post-migration implications. Nevertheless, there is a correlation of 0.47 (based in the 79 common countries), which is statistically different from zero at the 0.0000 level, between the male and female returns demonstrating a sizeable commonality.

Second stage regression results are in appendix table 3. For each sex the return to schooling coefficients are on the left, and those for the intercept shift on the right. Both stages are run for the entire sample and each of two subsamples. For both sexes the upper panel, which is for all immigrants, shows a sizeable and statistically significant relationship between source country school quality and the return to education obtained in the Canadian labour market. The $R^2$ for these regressions is between 15 and 18%. When the country-specific intercepts are regressed on the quality measures, however, there is a statistically significant relationship for the females, and the point estimates are both negative. Thus the results from the earlier, simpler, regressions receive support.

The first subgroup examined in appendix table 3 comprises those individuals with no Canadian, or only source country, education. A very similar pattern of coefficients is observed as for the entire sample. Finally, those who immigrated before age 10 are examined. For neither sex is there a statistically significant relationship between school quality and the return to education. This is as one would expect, and is consistent with the results in table 5, if it is school quality that matters and not other source country attributes. Those who arrive young enough so that they are primarily educated in the Canadian school system are not influenced by the quality of schooling in their source country.

Appendix Table 2 -- Country Slopes by Gender

| | Males | | Females | | | Males | | Females | |
|---|---|---|---|---|---|---|---|---|---|
| | Coef | P-Value | Coef | P-Value | | Coef | P-Value | Coef | P-Value |
| Algeria | 0.073 | [0.000] | 0.075 | [0.000] | Kuwait | 0.131 | [0.008] | 0.084 | [0.016] |
| Argentina | 0.051 | [0.000] | 0.062 | [0.000] | Luxembrg. | 0.039 | [0.090] | na | |
| Australia | 0.073 | [0.000] | 0.090 | [0.000] | Malaysia | 0.071 | [0.000] | 0.080 | [0.000] |
| Austria | 0.071 | [0.000] | 0.107 | [0.000] | Malta | 0.064 | [0.000] | 0.075 | [0.000] |
| Barbados | 0.068 | [0.000] | 0.084 | [0.000] | Mauritius | 0.078 | [0.000] | 0.105 | [0.000] |
| Belgium | 0.079 | [0.000] | 0.110 | [0.000] | Mexico | 0.048 | [0.000] | 0.078 | [0.000] |
| Bolivia | 0.018 | [0.369] | 0.094 | [0.030] | Mozambique | 0.044 | [0.094] | 0.057 | [0.182] |
| Brazil | 0.078 | [0.000] | 0.065 | [0.000] | N_Zealand | 0.083 | [0.000] | 0.103 | [0.000] |
| Cameroon | 0.119 | [0.022] | na | | Netherland | 0.063 | [0.000] | 0.095 | [0.000] |
| China | 0.062 | [0.000] | 0.047 | [0.000] | Nicaragua | 0.035 | [0.009] | 0.021 | [0.142] |
| Colombia | 0.061 | [0.000] | 0.049 | [0.000] | Nigeria | 0.049 | [0.001] | 0.095 | [0.002] |
| Costa_Rica | 0.071 | [0.000] | 0.024 | [0.382] | Norway | 0.062 | [0.000] | 0.080 | [0.000] |
| Cyprus | 0.053 | [0.000] | 0.039 | [0.003] | Panama | 0.024 | [0.275] | 0.055 | [0.159] |
| Denmark | 0.074 | [0.000] | 0.094 | [0.000] | Paraguay | 0.041 | [0.000] | 0.063 | [0.000] |
| Dominic_R | 0.064 | [0.001] | 0.032 | [0.204] | Peru | 0.069 | [0.000] | 0.055 | [0.000] |
| E_Salvador | 0.024 | [0.000] | 0.022 | [0.000] | Philippine | 0.043 | [0.000] | 0.047 | [0.000] |
| Ecuador | 0.054 | [0.000] | 0.039 | [0.000] | Poland | 0.042 | [0.000] | 0.059 | [0.000] |
| Egypt | 0.087 | [0.000] | 0.072 | [0.000] | Portugal | 0.030 | [0.000] | 0.040 | [0.000] |
| Falkland_I | 0.052 | [0.000] | 0.057 | [0.000] | S_Africa | 0.116 | [0.000] | 0.094 | [0.000] |
| Fiji | 0.063 | [0.000] | 0.064 | [0.000] | S_Korea | 0.050 | [0.000] | 0.032 | [0.000] |
| Finland | 0.039 | [0.000] | 0.087 | [0.000] | Singapore | 0.094 | [0.000] | 0.075 | [0.000] |
| France | 0.078 | [0.000] | 0.085 | [0.000] | Spain | 0.042 | [0.000] | 0.034 | [0.000] |
| Germany | 0.077 | [0.000] | 0.094 | [0.000] | Sri_Lanka | 0.072 | [0.000] | 0.073 | [0.000] |
| Ghana | 0.030 | [0.021] | 0.059 | [0.044] | Sweden | 0.078 | [0.000] | 0.113 | [0.000] |
| Greece | 0.055 | [0.000] | 0.061 | [0.000] | Switzerlan | 0.073 | [0.000] | 0.065 | [0.000] |
| Guyana | 0.061 | [0.000] | 0.072 | [0.000] | Syria | 0.054 | [0.000] | 0.063 | [0.000] |
| Honduras | 0.025 | [0.229] | 0.030 | [0.185] | Taiwan | 0.073 | [0.000] | 0.069 | [0.000] |
| Hong_Kong | 0.089 | [0.000] | 0.083 | [0.000] | Thailand | 0.116 | [0.015] | 0.037 | [0.004] |
| Hungary | 0.088 | [0.000] | 0.082 | [0.000] | Trin_Tobag | 0.065 | [0.000] | 0.079 | [0.000] |
| Iceland | 0.098 | [0.016] | 0.149 | [0.008] | Tunisia | 0.060 | [0.000] | 0.066 | [0.045] |
| India | 0.052 | [0.000] | 0.050 | [0.000] | Turkey | 0.059 | [0.000] | 0.050 | [0.000] |
| Indonesia | 0.075 | [0.000] | 0.108 | [0.000] | UK | 0.083 | [0.000] | 0.104 | [0.000] |
| Iran | 0.075 | [0.000] | 0.088 | [0.000] | Urugay | 0.025 | [0.008] | 0.030 | [0.126] |
| Iraq | 0.058 | [0.000] | 0.048 | [0.000] | USA | 0.089 | [0.000] | 0.119 | [0.000] |
| Ireland | 0.087 | [0.000] | 0.129 | [0.000] | USSR | 0.058 | [0.000] | 0.047 | [0.000] |
| Israel | 0.085 | [0.000] | 0.092 | [0.000] | Venezuela | 0.053 | [0.000] | 0.082 | [0.000] |
| Italy | 0.057 | [0.000] | 0.070 | [0.000] | Yugoslavia | 0.038 | [0.000] | 0.045 | [0.000] |
| Jamaica | 0.065 | [0.000] | 0.079 | [0.000] | Zaire | 0.047 | [0.012] | 0.132 | [0.000] |
| Japan | 0.054 | [0.000] | 0.054 | [0.000] | Zambia | 0.043 | [0.305] | 0.020 | [0.542] |
| Jordan | 0.057 | [0.001] | 0.109 | [0.001] | Zimbabwe | 0.099 | [0.000] | 0.052 | [0.056] |
| Kenya | 0.089 | [0.000] | 0.083 | [0.000] | | | | | |
| Obs. | | | | | | 353985 | | 311202 | |
| R-sq. | | | | | | 0.148 | | 0.103 | |

NOTES: P-values in brackets. Other variables as table 6, but with a full set of source country intercepts.

Appendix Table 3 -- Regression of Source Country Coefficients on School Quality

| | Male | | Female | |
|---|---|---|---|---|
| | Slope | Intercept | Slope | Intercept |
| ALL IMMIGRANTS | | | | |
| Quality | 0.060*** | -0.216 | 0.069*** | -0.513* |
| | [0.014] | [0.224] | [0.019] | [0.300] |
| P-Value | 0.000 | 0.340 | 0.001 | 0.091 |
| R-squared | 0.190 | 0.012 | 0.146 | 0.037 |
| | | | | |
| ONLY SOURCE COUNTRY EDUCATION | | | | |
| Quality | 0.055*** | -0.128 | 0.049*** | -0.312 |
| | [0.016] | [0.245] | [0.018] | [0.311] |
| P-Value | 0.001 | 0.602 | 0.008 | 0.319 |
| R-squared | 0.139 | 0.004 | 0.089 | 0.013 |
| | | | | |
| ARRIVE AGE 10 OR BEFORE | | | | |
| Quality | -0.017 | 0.054 | 0.032 | -0.394 |
| | [0.021] | [0.633] | [0.021] | [0.651] |
| P-Value | 0.417 | 0.932 | 0.125 | 0.547 |
| R-squared | 0.008 | 0.000 | 0.030 | 0.005 |

Notes: Robust Standard Errors in brackets
* 10% significance, ** 5% significance, *** 1% significance
There are 81 observations in the male sample, and 79 in the female one.