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Quality of Work Experience and Economic Development—Estimates Using Canadian Immigrant Data.*

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Abstract

This paper presents a methodology to measure the contribution of human capital quality to economic development using immigrant data. We document the fact that immigrants from poor countries earn lower returns to schooling and work experience than immigrants from rich countries. We argue that this fact is most consistent with a model where a country’s human capital quality depends on its level of income. Then we use results from regressions of immigrants’ earnings to estimate the contribution of human capital quality to economic development. An important finding is that work-experience quality is more important than schooling quality for economic development.

Keywords: Quality of human capital, work experience, immigrant earnings, quality of schooling, economic development

JEL classifications: O15, J61, J24, O47, O57

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1. **Introduction**

It is now generally recognized in the economic development literature that differences in the stock of human capital are an important determinant of differences in economic development across countries (see, for example, the seminal contribution of Mankiw, Romer and Weil, 1992). In empirical development accounting studies, those differences are typically defined in terms of gaps in input-based education measures such as school enrolment rates (Mankiw, Romer and Weil, 1992) and years of schooling (Barro and Lee, 1993, 2001; de la Fuente and Doménech, 2006). However, as it is usually acknowledged that the quality and efficiency of the education process can vary substantially with the development level of a country,\(^1\) a growing trend has been to also account for differences in the quality of schooling when performing development accounting exercises.

In their development accounting exercises, Klenow and Rodriguez-Clare (1997) and Hall and Jones (1999) recognize that the quality of schooling varies across countries. In particular, Klenow and Rodriguez-Clare (1997) link quality of schooling to a country’s GDP per capita and—using Borjas’ (1987) analysis—estimate a quality-of-schooling elasticity of 0.12. Concretely, this means that a country whose GDP per capita is one-twentieth that of the U.S., would be 36 percent richer if it could increase its quality of schooling to the same level as that of the U.S. More recently, Schoellman (2012) finds that incorporating differences in schooling quality doubles the contribution of schooling in explaining cross-country differences in output per worker.

Despite the substantial amount of cross-country empirical research emphasizing differences in human capital, very little has been done on the role played by the quality of

\(^1\) For studies showing that quality of schooling significantly varies across countries depending on their level of economic development, see Hanuskek and Kimko (2000) and Coulombe and Tremblay (2009). As argued in Hanushek and Woessmann (2008), education has both a quantity (years of schooling) and a quality (skills) dimension.
work experience. There are indeed several reasons for the quality of work experience to vary across countries and to affect economic development, including differences in customs and managerial styles that may foster (or hinder) innovative thinking (as in Bloom and Van Reenem, 2007, 2010) and differences in learning-by-doing (as in Arrow, 1962 and Romer, 1986). One study was done recently, contemporaneously to ours, on that topic by Lagakos, Moll, Porzio and Qian (2013). The authors estimate earnings regressions using cross-sectional data from 36 countries and find that the returns to work experience are higher in rich countries than in poor countries; they conclude that human capital can explain a substantially larger fraction of cross-country income differences when the quality of work experience is taken into account than when it is not.

This paper addresses the same issue but with a different approach. We use the results obtained from regressions on immigrants’ earnings in Canada to measure differences in human capital quality across countries. The main advantage of using data on immigrants in one country as opposed to cross-sectional data from different countries is to allow isolating the impact of quality on returns to skills from other factors that can affect returns to skills and that vary across countries (e.g., the quantity of physical capital, the quantity of human capital, the technology, the industrial structure, the business cycle). Indeed, when an immigrant moves to another country, all those other factors are left behind and the immigrant brings only his or her human capital. Possible concerns with this approach though are that beside quality, immigrants’ returns to skills can be affected by other factors such as self-selection and skills not being transferable to the host country (see the discussions in Schoellman, 2012 and Lagakos, Moll, Porzio, Qian and Schoellman, 2014). We address these concerns the way it is generally done in the
immigrant earnings literature (see Friedberg, 2000 and the body of the text for more discussion on this subject) and to the extent that data allows.

Our contribution is threefold. First, we adapt standard Mincerian regressions to allow for schooling quality and work-experience quality to have different effects on returns to skills. Second, we show that the returns to schooling and work experience estimated through country of birth fixed effects are strongly correlated with GDP per capita and, through a more parsimonious model, we show that the returns to schooling and work experience statistically significantly increase with the GDP per capita of an immigrant’s country of birth. We examine alternative explanations for these facts and conclude that the most plausible one is that GDP per capita in an immigrant’s country of birth is a proxy for the quality of human capital acquired in that country. Third, on the more substantive side, using our earning regression results, we find that differences in human capital quality play an important role in explaining differences in economic development. For example, we estimate that a country whose GDP per capita is one-twentieth that of Canada (e.g., Kenya) would be almost 42 percent richer if it had the same human capital quality as that of Canada. Undoubtedly our most important finding, however, is that differences in work-experience quality play an even bigger role than differences in schooling quality in explaining differences in economic development. As a point of fact, we find that for a country like Kenya, the impact of work-experience quality on output per worker is almost thrice as large as that of schooling quality. Another interesting result that we find is that while between-country differences appear to be as important as within-country over-time differences for explaining differences in schooling quality, between-country differences are much more important than within-country over-time differences for explaining differences in work-experience quality.
Our study builds on Klenow and Rodriguez-Clare (1997), Hendricks (2002) and Schoellman (2012). Like Hendricks (2002) and Schoellman (2012), we use the results of Mincerian regressions on immigrants’ earnings to estimate country differences in human capital quality. Further, like Klenow and Rodriguez-Clare (1997) we assume that an immigrant’s quality of human capital is a function of the GDP per capita in his or her country of birth. However, unlike them, we differentiate between schooling quality and work-experience quality and allow for cross-country differences in on-the-job human capital accumulation.

The rest of this paper is organized as follows. Section 2 presents the analytical framework. Section 3 describes the data and provides some descriptive statistics. Section 4 presents empirical results of Mincerian regressions on immigrant earnings. Section 5 discusses alternative explanations for our results. Section 6 compares returns to skills across selected countries. The regression results are translated into comparative development accounting measures in Section 7. Section 8 concludes.

2. A development accounting framework

As in Klenow and Rodriguez-Clare (1997) and Hall and Jones (1999), assume that output $Y$ in country $j$ is produced according to the Cobb-Douglas production function

$$Y_j = K_j^a (A_j H_j)^{1-a},$$

where $K_j$ denotes the stock of physical capital, $H_j$ is the amount of skill-adjusted labour used in production and $A_j$ captures a labour-augmenting technology. In addition, assume that there are $L_j$ (homogenous) workers in country $j$ who are endowed with $s_j$ years of
schooling and $x_j$ years of work experience on average, and that the quality of schooling and of work experience varies across countries. More specifically, assume that

$$H_j = e^{\phi(s_j, x_j, q_{sj}, q_{xj})} L_j$$  \hspace{1cm} (2)

where $q_{sj}$ and $q_{xj}$ respectively denote schooling quality and work-experience quality indices for country $j$ and $\phi(s_j, x_j, q_{sj}, q_{xj})$ reflects the efficiency of $s_j$ years of schooling and $x_j$ years of work experience. For our purposes, we assume that all schooling and all work experience have been acquired in country $j$. We will refer to $\phi$ as the human capital generating function. Note that the derivatives $\phi_s$, $\phi_x$, $\phi_{qs}$ and $\phi_{qx}$ respectively correspond to the returns to schooling, work experience, schooling quality and work-experience quality in a Mincerian wage equation regression framework (Mincer, 1974).

Given (1) and (2), output per worker, $y \equiv Y / L$, can be expressed as

$$y_j = A_j \left( \frac{K_j}{Y_j} \right)^{a(1-a)} e^{\phi(s_j, x_j, q_{sj}, q_{xj})},$$

and the percentage difference between output per worker in country $j$ and output per worker in country $k$, $\Delta y(j,k) \equiv \ln y_j - \ln y_k$, can be decomposed into differences in technology, physical capital intensity (as a ratio of GDP) and human capital (in terms of both quantity and quality):

$$\Delta y(j,k) = \ln(A_j / A_k) + \{a / (1-a)\} \{\ln(K_j / Y_j) - \ln(K_k / Y_k)\} + \phi(s_j, x_j, q_{sj}, q_{xj}) - \phi(s_k, x_k, q_{sk}, q_{sk}).$$  \hspace{1cm} (3)
Thus, the share of the percentage difference between output per worker in country $j$ and output per worker in country $k$ that is due to the difference in human capital quality can be approximated by:

\[ \Delta y(j,k)_q = \phi_{qy}(q_{qy} - q_{qk}) + \phi_{qy}(q_{qy} - q_{qk}) \cdot (4) \]

The first part of (4) is the Schooling-quality effect while the second part is the Work-experience-quality effect. Supposing that country $k$ is the richer country, Equation (4) says that even if country $j$ had the same technology, the same physical capital intensity and the same quantity of human capital as country $k$, its output per worker would still be $\phi_{qy}(q_{qy} - q_{qk}) + \phi_{qy}(q_{qy} - q_{qk})$ percent lower than country $k$'s output per worker. Or, put another way, given its current technology, its current physical capital intensity and its current quantity of human capital, country’s $j$ output per worker would increase by about $\phi_{qy}(q_{qy} - q_{qk}) + \phi_{qy}(q_{qy} - q_{qk})$ percent if its quality of human capital increased to the level of that of country $k$.

3. Empirical framework

Our empirical approach to the estimation of the impact of human capital quality on economic development departs from the conventional literature in two important ways: first, we use immigrant data and, second, we use GDP per capita as an indicator of human capital quality.

3.1 Using immigrant data to estimate the impact of human capital quality on output per worker

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2 The use of a linear approximation for $\Delta y(j,k)_q$ is not absolutely necessary but greatly facilitates the development of the empirical model that follows.
According to (4), given some human capital quality indices \( q_s \) and \( q_x \), to estimate the impact of human capital quality on output per worker, one can specify a functional form for \( \phi \) and obtain \( \phi_{qs} \) and \( \phi_{qx} \) by estimating equation (3) by least-squares regression using data on a cross-section of countries. Another approach, which we follow in this paper, is to estimate \( \phi_{qs} \) and \( \phi_{qx} \) by comparing the wages of immigrant workers from different countries in the same competitive labour market using a Mincer-type regression model (thus following in the path of Hendricks, 2002 and Schoellman, 2012).\(^3\) Given that in such a market, workers have access to the same capital/output ratio, the same production function, and the same institutional framework, we should expect that immigrants with exactly the same human capital characteristics should earn the same wages (assuming that immigrant self-selection and skill transferability issues have been appropriately controlled for). However, if we observe that the returns to schooling and work experience of immigrants endowed with the same level of schooling and work experience vary systematically with their country of birth, then this may reflect differences in the quality of the schooling and work experience they acquired in their country of birth.

### 3.2 GDP per capita as an indicator of human capital quality

A measure of human capital quality that is frequently used in the development accounting literature is the average score of a country on cognitive tests conducted by the *International Association for the Evaluation of Educational Achievement* and the *International Assessment of Educational Progress* (see, for example, Hanushek and Kimko, 2000; Coulombe, Tremblay and Marchand, 2004; and Coulombe and Tremblay, 2006).

\(^3\) Still another approach would be to estimate the function \( \phi \) by running a separate regression for each country (such as in Lagakos et al. 2013). However, this approach has a number of drawbacks including the necessary data being unavailable for many countries and the absence of control variables for factors affecting earnings beside human capital variables such as differences in industrial structures and business cycles.
2006). There are a number of problems associated with the use of this measure in our context, however. One is that these tests are available for only 27 countries and for short periods of time (in Canada, the last one was conducted in 2003 and the previous one in 1994). This means that we would have to restrict our development accounting exercises to these 27 countries (most of them advanced economies, incidentally) and assume that human capital quality changes very little over time. Furthermore, and probably more importantly in our case, cognitive tests are not appropriate measures of work-experience quality—they really are measures of education quality.\footnote{For example, Cawley, Heckman and Vytlacil (2001) find that “measured cognitive ability and schooling are so highly correlated that one cannot separate their effects without imposing strong, arbitrary parametric structure in estimation which, when tested, is rejected by the data.”}

In this paper, we use GDP per capita (smoothed to eliminate business cycles) as an indicator of human capital quality. Specifically, setting Canada as the human capital quality benchmark country, we will use the index

$$q_j = \ln\left(\frac{GDPc_j}{GDPc_{Canada}}\right)$$

(5)

as a measure of human capital quality in a country $j$. There are several reasons for favouring this index. A practical one is that it is widely available: for example, Heston, Summers, and Aten (2009) provides data on GDP per capita for 188 countries and for as many as 55 years.

A more conceptual reason for using (5) as an index of human capital quality is that since countries with high GDP per capita generally have more monies to spend on schools, teachers and the like, one should expect that the quality of schooling in a country would increase with that country’s GDP per capita.
Another conceptual reason for using GDP per capita as an indicator of human capital quality is the link between the quality of work experience and economic development as an outcome of *learning-by-doing*. Across countries, differences in customs, in employer-employee relationships/labour relations and in managerial styles may foster (or hinder) innovative thinking as in, for example, Bloom and Van Reenen (2007, 2010). Further, following the seminal works of Arrow (1962) and Romer (1986), it could be that there is more *learning-by-doing* in rich countries because they use more physical capital, which would mean that the value of the work experience that an individual has acquired in his or her birth country is determined in part by the physical capital intensity of that country. Hence, a country’s GDP per capita, itself a function of capital intensity, is a straightforward proxy for that country’s quality of work experience.

It is well known that cross country GDP data are much more reliable than capital stock data.\(^5\)

Still another reason to assume that GDP per capita is a good proxy for human capital quality comes from the works of Erosa, Koreshkova and Restuccia (2010) and Manuelli and Seshadri (2010). In their Ben-Porath type models (see Ben-Porath, 1967), total factor productivity (TFP) and human capital accumulation are complementary: the higher the TFP in a country, the more incentive there is to accumulate human capital. As a result, according to these models, the quality of human capital varies systematically with the level of economic development.

Finally it is noteworthy that Lagakos *et al.* (2014) also conclude in their study of immigrant earnings in the U.S. that the most plausible explanation for the returns to work

\(^5\) The problems of comparability of capital stock data are well illustrated in Pritchet (2000).
experience being lower in poor countries than in rich countries is that individuals in poor
countries accumulate less human capital during their working years.

3.3 Data and summary statistics

Canada provides an ideal ground to calibrate our model for two major reasons. One
reason is that it has one of the largest and most culturally diverse intake of immigrants
among the world developed economies. For example, Statistics Canada estimates that in
2006, almost 20 percent of all Canadians were born abroad (Statistics Canada, 2009).
Canada receives annually more than 250,000 immigrants, distributed among three major
classes: economic immigrants, family reunification, and refugees.

The other reason why Canada is particularly well suited for this study stems from
its immigration selection policy. In Canada, economic immigrants (the majority of
immigrants) are admitted through a Point System, which evaluates candidates based on
their schooling, age, work experience, language skills and other factors. Because of that
particular policy, Canadian immigrants tend to be less economically self-selected than
immigrants in other countries, notably the U.S.

The data used for our analysis come from the Statistics Canada 2006 Census
Microdata Masterfile, which provides a very large sample of immigrants, with very
detailed information on their countries of birth. To eliminate as many extraneous factors
as possible, the sample is restricted to working age men who worked full-time full-year in
2005, who were not self-employed and who obtained their highest certificate, degree or
diploma in their country of birth. Working age is defined as ages 18 to 64, Full-time is
defined as 30 hours or more a week and Full-year is defined as 49 weeks or more. The
number of years of schooling is not available directly from the data and is defined on the
basis of the highest certificate, degree or diploma (see Table A1 in appendix). Potential work experience is defined as Age minus Years of schooling minus 6.

Data on GDP per capita come from Heston, Summers, and Aten (2009) and is adjusted for purchasing power parity. To eliminate the effects of business cycles, GDP per capita is first smoothed through a five-year moving average. Then, for a given immigrant, Relative GDP per capita is measured as the ratio of his country of birth’s smoothed real GDP per capita and that of Canada in the year when he obtained his highest diploma. Countries for which there are fewer than 50 observations are dropped from the sample. The final sample is comprised of 78 countries (see Table 4 for the complete list of countries included in the sample). Appendix A provides further details on the variables used in our analysis.

Table 1 provides summary statistics on Canadian born and immigrant workers in our sample. It is interesting to note that despite being endowed with more years of schooling and work experience, immigrants earn on average about 10 percent less than Canadian born individuals. A number of labour economists have argued that one reason for the existence of this gap is that the human capital quality of immigrants in Canada is lower than that of Canadian born individuals (see, for example, Bonikowska, Green and Riddell, 2008, and Coulombe, Grenier and Nadeau, 2014).

(Table 1 approximately here)

Table 2 illustrates the diversity of immigrant source countries in our sample. They are diverse not only in terms of geography but also in terms of level of economic development. Among the fifteen most important countries of origin, seven are Asian, six are European and two are American. Some are very rich (e.g., the U.S. and U.K.), while
some others are developing (e.g., India and China). No group of source countries clearly
dominates our sample, which means that our empirical results will not pick-up the effects
of only a few countries.

(Table 2 approximately here)

4. Estimating returns to human capital quality

In this section, we report estimates of nested versions of human capital generating
functions, from the most restricted to the least restricted. This allows for the examination
of changes in coefficient estimates following the removal of restrictions. The estimated
coefficients of the human capital generating function are reported in Table 3. As a point
of comparison, we also include the estimated coefficients of an earnings regression on
Canadian born individuals. A key finding is that an immigrant’s returns to schooling and
work experience are significantly positively correlated with his country of birth’s level of
economic development.

(Table 3 approximately here)

4.1 Base case: No difference in human capital quality across countries

Our starting point is the ubiquitous Mincerian human capital generating function

\[ \phi(\tilde{x}_j, \tilde{x}_j) = \alpha \tilde{x}_j + \beta_1 \tilde{x}_j + \beta_2 \tilde{x}_j^2 \]  \hspace{1cm} (6)

There is some debate in the literature as to whether one should include, in a Mincer-type regression, a
higher polynomial function (e.g., a quartic function) for work experience than just a quadratic one (see, for
example, Lemieux, 2006). Notwithstanding that debate, in this paper, we use the standard quadratic
function as it is simpler and significantly more parsimonious (in our case, in some regressions, modeling
work experience as a quartic function would increase the number of coefficients to be estimated by 25).
Furthermore, we do not believe that this simplification introduces major biases since a quadratic function
seems to be performing as well as a quartic function at estimating the returns to work experience at the
means of the distribution, which is really what we are interested in measuring in this study (as opposed to
estimating the returns to work experience at the tails of the distributions).
where the overscript ~ denotes variables measured in efficiency units and α and β are coefficient vectors. If we assume that individuals are paid their marginal product in efficiency units of human capital, then, following Mincer (1974), α and β can be estimated through a regression of the form

\[ \ln w_{ij} = \alpha_0 x_{ij} + \beta_1 x_{ij} + \beta_2 x_{ij}^2 + z_{ij} \theta + \epsilon_{ij} \]  \hspace{1cm} (7)

where \( w_{ij} \) denotes the earnings of immigrant \( i \) from country \( j \); \( z_{ij} \) denotes a vector of determinants of human capital other than years of schooling and years of work experience (e.g., language spoken, country of birth fixed effects); \( \theta \) is a coefficient vector and \( \epsilon \) denotes an error term with zero mean and constant variance.

When differences in human capital quality are ignored, then \( \tilde{s} = s \) and \( \tilde{x} = x \), and equation (6) simplifies to

\[ \phi(s_j, x_j) = \alpha s_j + \beta_1 x_j + \beta_2 x_j^2. \]  \hspace{1cm} (6a)

Accordingly, equation (7) simplifies to

\[ \ln w_{ij} = \alpha_0 x_{ij} + \beta_1 x_{ij} + \beta_2 x_{ij}^2 + z_{ij} \theta + \epsilon_{ij}. \]  \hspace{1cm} (7a)

The results of estimating Equation (7a) using Canadian immigrant data are reported in the column labelled Model 1 in Table 3. They show that if the assumption that the quality of human capital acquired outside Canada is the same as that acquired in Canada was correct, then the returns to human capital would significantly be lower for immigrants than for Canadian born individuals. For example, the Mincerian returns to years of schooling and years of work experience (evaluated at zero years of work experience) would respectively be 5.5 percent and 2.3 percent per year for immigrants compared with 8.5 percent and 5.2 percent per year for Canadian born individuals.
4.2 Work experience acquired in Canada vs work experience acquired abroad

Since Chiswick (1978), researchers in the labour market integration of immigrants’ literature have recognized that the quality of human capital acquired in an immigrant’s country of birth is different from that acquired in the host country. The next model is a first step towards allowing the quality of human capital to vary across countries. Following Chiswick (1978), we set \( \tilde{s}_j \equiv \delta^i s_{bij} + s_{hij} \) and \( \tilde{x}_j \equiv \omega^i x_{bij} + x_{hij} \) in (6), where \( \delta^i \) and \( \omega^i \) are unknown coefficients and the \( H \) and \( B \) subscripts respectively refer to host country (Canada in our case) and birth country, and estimate the regression equation

\[
\ln w_{ij} = \alpha s_{bij} + \beta x_{bij} + \gamma \tilde{x}_j + \delta s_{hij} + \gamma \tilde{x}_j + \epsilon_j + \theta + \epsilon_i.
\]  

(8)

The estimation results strongly support the notion that human capital quality varies across countries and in particular that the quality of work experience acquired outside Canada is perceived by Canadian employers to be lower than that acquired in Canada. Indeed, according to the estimated coefficients under Model 2 in Table 3, the marginal return on one additional year of work experience (evaluated at 10 years of work experience) is about 1.4 percent lower if it has been acquired outside Canada than if it has been acquired in Canada.

4.3 Allowing for human capital quality to vary freely across countries

Our preferred specifications of the human capital generating function bridge the development literature and the immigrant earnings literature in that regard. In particular, drawing from the immigrant earnings literature, we build on the development literature by assuming that not only the quality of schooling varies across countries, but also the quality of work experience. However, unlike what is typically done in the immigrant
earnings literature (e.g., Friedberg 2000), we assume that the quality of schooling and the quality of work experience vary across countries of birth. While the assumption that the quality of work experience varies across countries is quite novel in the economic development literature, it is highly intuitive. Indeed, just as the quality of work experience enhances human capital and, by extension, earnings at the individual’s level, one should expect that it would do the same at the aggregate level. We test two specifications: the first specification allows for the quality of human capital to vary freely across countries but not over time while the second specification imposes some structure on the way human capital quality varies both across countries and over time.

A flexible functional form for estimating the quality of human capital across countries

In this specification, we estimate the schooling quality and work-experience quality indices through country of birth schooling and work experience fixed effects. Explicitly, we set

\[ \tilde{s}_j \equiv s_{Bj} (1 + q_{sj}) \]  
(9)

and

\[ \tilde{x}_j \equiv x_{Bj} (1 + q_{sj}) + x_{Hij}, \]  
(10)

where we have further assumed for simplicity that immigrants acquire all their schooling in their birth country.\(^7\) Given this set-up and (6), and assuming that the curvature of the earnings’ growth profile is constant across all countries (to have a manageable number of coefficients in the regression), then the generating function for the human capital acquired in country \(j\) (different from the host country) is

\[^7\text{This assumption means that we have to restrict our sample to immigrants who have acquired all their schooling in their country of birth. It also means that we will not have an estimate of the return to schooling acquired by immigrants in the host county, but this is not something we need to have to carry out our development accounting exercise.}\]
\[ \phi(s_j, x_j, q_{sj}, q_{sj}) = \alpha_1 s_j + \alpha_2 s_j + \beta_1 x_j + \beta_2 x_j^2 + \beta_3 x_j, \]  

(11)

where \( \alpha_2 = \alpha_{q_{sj}} \) and \( \beta_3 = \beta_{q_{sj}} \).

Given (7), (9) and (10), the coefficients in (11) can be estimated through the regression equation

\[
\ln w_{ij} = \alpha_{s_{Bij}} + \sum_{m=2}^{78} \alpha_{2n} D_n s_{Bij} + \beta_1 x_{Bij} + \beta_2 x_{Bij}^2 + \sum_{m=2}^{78} \beta_{3n} D_n x_{Bij} \\
+ \beta_4 x_{Hij} + \beta_5 x_{Hij}^2 + \beta_6 x_{Bij} x_{Hij} + z_j \theta e_j
\]  

(12)

where \( D_n \) is a dichotomous variable that takes the value of one when \( n = j \) and zero otherwise. A major advantage of this specification is that it allows for the identification of the human capital quality indices from the data itself, without having to impose any functional form on the way human capital quality varies across countries. Indeed, given estimates of the coefficients in (12), then for country \( j \), the schooling quality index is \( \hat{q}_{sj} = \hat{\alpha}_2 / \hat{\alpha}_1 \) and the work-experience index is \( \hat{q}_{sj} = \hat{\beta}_3 / \hat{\beta}_1 \).

The results of estimating Equation (12) using the U.S. as the reference/benchmark country are reported in Table 3 under Model 3. The estimates of the \( \alpha_2 \)'s and \( \beta_3 \)'s in (12)—which in our model reflect differences in schooling quality and work-experience quality—are depicted in Figures 1a and 1b in relation with GDP per capita in the country of birth. Three observations are in order.

First, the hypotheses that the \( \alpha_{2n} \)'s and that the \( \beta_{2n} \)'s are jointly significantly equal to zero are strongly rejected (at levels of significance of less than \( 10^{-87} \) and \( 10^{-21} \) respectively). This is consistent with the theory that the quality of schooling and of work experience varies across countries.
Second, we observe that the $\hat{\alpha}_2$’s and $\hat{\beta}_2$’s are overwhelmingly negative. As a point of fact, 37 $\hat{\alpha}_2$’s (out of 77) and 50 $\hat{\beta}_2$’s (out of 77) are statistically significantly negative at the five percent level, while only four $\hat{\alpha}_2$’s and one $\hat{\beta}_2$’s are statistically significantly positive. According to our model, this suggests that Canadian employers perceive the quality of human capital (especially the quality of work experience) of immigrants from the U.S. to be significantly higher than that of immigrants from most other countries in the world.

Third, the estimated regression lines suggest that the quality of human capital varies positively with the level of economic development. Indeed, we find that the correlation coefficient between this regression’s estimate of the schooling quality index and average GDP per capita over the time period studied is 0.56 ($t$-stat of 5.84) while the equivalent figure for the work-experience quality index is 0.50 ($t$-stat of 4.98). This result is striking—especially if we consider that the correlation coefficients between the “true” human capital quality indices and GDP per capita are probably even higher than those reported here because the human capital quality indices presented in Figure 1 are based on estimated regression coefficients, which are measured with errors.

There are however two shortcomings with this functional form. One is that the estimation results can be used to measure the impact of human capital quality on economic development only for the countries in the regression sample. Another shortcoming is that it assumes that the human capital quality of immigrants coming from a given country is the same irrespective of the time they immigrate. In other words, this specification assumes that human capital quality does not vary within a country over time, which is highly debatable. For example, most people would agree that a country’s
quality of schooling should improve as it gets richer. The next functional form we propose does not have these shortcomings.

A parsimonious functional form—GDP per capita as a measure of human capital quality

The estimation results of the previous functional (along with the works of Erosa et al., 2010 and Manuelli and Seshadri, 2010) suggest that we directly model human capital quality as a function of GDP per capita. Thus, assuming again that immigrants acquire all their schooling in their birth country, we set

$$\tilde{x}_{ij} \equiv s_{Bij}(1+\delta_{ij} q_{ij}) \quad (13)$$

and

$$\tilde{x}_{ij} \equiv x_{Bij}(1+\omega q_{ij}) + x_{Hij}. \quad (14)$$

where the quality index $q_{ij}$ is measured as the ratio of the GDP per capita in country $j$ and that of a benchmark country, Canada for instance (see Equation (5)). Given this set-up and (6), the generating function for the human capital acquired in country $j$ (different from the host country) is

$$\phi(s_j, x_j, q_j) = \alpha_j s_j + \alpha_s s_j q_j + \beta_1 x_j + \beta_2 x_j^2 + \beta_3 x_j q_j + \beta_4 x_j^2 q_j + \beta_5 x_j^3 q_j^2, \quad (15)$$

and it follows from (7), (13) and (14) that the coefficients in (15) can be estimated through the regression equation

$$\ln w_{ij} = \alpha_0 s_{Bij} + \alpha_1 s_{Bij} q_{ij} + \beta_1 x_{Bij} + \beta_2 x_{Bij}^2 + \beta_3 x_{Bij} q_{ij} + \beta_4 x_{Bij}^2 q_{ij} + \beta_5 x_{Bij}^3 q_{ij}^2 + \beta_6 x_{Hi} + \beta_7 x_{Hi}^2 + \beta_8 x_{Hi} x_{Bij} + \beta_9 x_{Hi} x_{Bij}^2 + z_{ij} \theta + \epsilon_{ij}. \quad (16)$$

The results of estimating Equation (16) are reported under Model 4 in Table 3. We find that the interaction effects of Relative GDP per capita are globally highly
statistically significant\textsuperscript{8} and the first order effects are of the expected (positive) signs. These results reinforce the notion that the returns to schooling and to work experience are higher for immigrants from rich countries than immigrants from poor countries.

While the flexible functional form of Model 3 is useful for giving us a sense of the wages-human capital quality relationship across countries, the parsimonious functional form of Model 4 is more convenient for several exercises that we perform in this paper (e.g., measuring the impact of human capital quality on economic development for countries not in the regression samples) and for comparing our results with those in the existing economic development literature. Also, the parsimonious functional form allows for the quality of human capital within a country to vary over time, as a country’s fortune changes, which seems reasonable. Thus in much of the remainder of the paper, we focus on the estimates of the parsimonious functional form of Model 4. We argue below that these estimates are most consistent with our maintained hypothesis that human capital quality acquired in poor countries is lower than that acquired in rich countries.

5. Alternative explanations

Other studies contemporaneous to ours have also found that the returns to immigrants’ human capital increase with the level of economic development in their countries of birth (see Schoellman, 2012 and Lagakos \textit{et al.}, 2014). However, in our context, the issue is whether this fact reflects lower human capital quality in poor countries or other

\textsuperscript{8} The null hypothesis that all interaction effects of \textit{Relative GDP per capita} are jointly equal to zero is rejected at a level of significance of less than $10^{-34}$ (using an F-test). While the cross-terms in Equation (16) are difficult to interpret, they show up to be statistically very significant and are therefore kept in the regression: the null hypothesis that $\beta_i = \beta_j = \beta_k = \beta_l = 0$ is rejected at a level of significance below $10^{-17}$ (using an F-test).
hypotheses. This section discusses possible alternative hypotheses. We conclude that on balance, they are more vulnerable to counterfactuals than our favoured interpretation.

5.1 The poorer the country an immigrant comes from, the less positively selected he is.

Self-selection is a perennial issue when estimating the returns to skills of immigrants. A popular belief is that immigrants are positively selected in the sense that they are more able and more ambitious than the typical inhabitant of their country of birth (see, for example, Chiswick, 1999). However, Borjas (1987) shows that under certain circumstances, immigrants could be negatively selected if they come from poor countries. In our context, if immigrants from poor countries are less positively selected than immigrants from rich countries, then that could explain their relatively lower returns on human capital after they move to Canada.

One way of dealing with this possibility is to follow Borjas (1987) and add GDP per capita in an immigrant’s country of birth relative to that of Canada (that is, add \( q_{ij} \)) as an explanatory variable to Model 4. The results of doing so are reported in Table 3 under Model 5. We find that the direct effect of \( q_{ij} \) (the \( \hat{\gamma} \) coefficient in Table 3 under Model 5) is not statistically significant at the 10 percent level and that the estimates of the interaction effects of \( q_{ij} \) are almost identical to those found under Model 4. Thus, strictly adopting Borjas’ interpretation of the \( \hat{\gamma} \) coefficient would lead us to conclude that Canadian immigrants are not self-selected according to the GDP in their country of birth.

As level of schooling can be informative about general ability, we next look at whether immigrants from poor countries are less educated (relative to the general population in their countries of birth) than immigrants from rich countries. If it turns out to be the case, then it could mean that immigrants from poor countries are less positively
selected, which could explain their lower returns on human capital after moving to Canada. Figure 2 plots this relationship. Two results stand out. First, except for one country (namely Greece), Canadian immigrants have on average completed more years of schooling than the general population in their birth countries, which would suggest that they generally are positively selected. Second, the level of schooling of immigrants (relative to that of the general population in their birth countries) actually decreases with the level of income in their birth countries. This test thus provides no evidence that immigrants from poor countries might be less positively selected than immigrants from rich countries (in fact, it provides evidence for the opposite).

Another possible reason why immigrants from poor countries may be less positively selected than immigrants from rich countries is that they immigrate at an older age. To test for this possibility, we add a Years of schooling-Age at immigration and a Years of work experience in birth country-Age at immigration interactive terms in regression (16) and examine if the inclusion of these variables reduce the explanatory power of our Income per capita interactive terms. We find that the estimated coefficients associated with the Income per capita interactive terms in this regression are almost identical to those estimated under Model 4 and that they are still highly significant. As for the previous tests, this test provides little support for the view that the lower returns on the human capital acquired by immigrants from poor countries are due to less positive selection.

5.2 Skills acquired in poor countries are less transferable to a rich country than skills acquired in rich countries.

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9 For example, the correlation coefficient between the average age at the time of immigration of individuals coming from a certain country and the GDP of that country is -0.48 with a t-statistic of -4.73.

10 Because of space constraint, the results of this regression are not reported in Table 3 but are available from the authors.
An alternative explanation for the fact that immigrants from poor countries earn lower returns on human capital than immigrants from rich countries is that skills acquired in poor countries may be less transferable than skills acquired in rich countries. There are at least three reasons why this could be the case. One is because the skills may simply be of the wrong type. For example, being an expert at shovelling may have some market value in a country where power shovels are uncommon but has very little market value in a developed economy. In the same way, skills acquired through education might be more transferable if they are acquired in a rich country than a poor country simply because they are more at the frontier of knowledge. For example, although the combined population of Africa and South America is about 35 times that of Canada, only seven universities in Africa and South America are among the top 400 universities in the world, compared with 18 in Canada (according to Times Higher Education, 2012). These are, however, forms of non-transferability that are quality related and are therefore part of what we want to measure.

A second reason why human capital acquired in poor countries may be less transferable than human capital acquired in rich countries is that immigrants from poor countries may find it more difficult applying their skills into their new country because the language barriers they face and their lack of information about ways of doing things in the host country may be more serious than for immigrants from rich countries. However, over time, as immigrants become more proficient in the host country working language and more knowledgeable about the host-country-specific knowledge (that is, as they assimilate) their returns to skills should improve. In our regressions, the language skill effect should be picked-up by the Language spoken independent variable while the assimilation effect should be picked-up by the Experience in the host country
independent variable (the $x_H$ independent variable), which in reality is equal to the number of years since migration. If skill transferability is the reason why immigrants from poor countries earn lower returns on the human capital acquired in their country of birth than immigrants from rich countries, then we should also observe that immigrants from poor countries assimilate more slowly than immigrants from rich countries. One way to test this hypothesis is to add a Relative GDP per capita interacted with Experience in the host country term to Equation (16) and run the regression

$$
\ln w_{ij} = \alpha x_{Bij} + \alpha_2 x_{Bij} g_{ij} + \beta_1 x_{Bij} + \beta_2 x_{Bij}^2 + \beta_3 x_{Bij} g_{ij} + \beta_4 x_{Bij}^2 g_{ij} + \beta_5 x_{Bij}^2 g_{ij}^2 + \beta_6 x_{Hij}^2 + \beta_7 x_{Hij} x_{Bij} + \beta_8 x_{Hij} x_{Bij} g_{ij} + \beta_9 x_{Hij} x_{Bij} g_{ij}^2 + z_{ij} \theta + \epsilon_{ij}.
$$

(17)

The results of estimating Equation (17) are reported under Model 6 in Table 3. We find that the coefficient of interest, that is $\hat{\beta}_{io}$, is actually statistically insignificant. In other words, immigrants from poor countries seem to assimilate at the same speed as immigrants from rich countries. Thus, it seems unlikely that the facts on immigrants’ returns to human capital we document are simply explained by skill losses that especially affect immigrants from poor countries.

A third reason why it might be more difficult for immigrants from poor countries than immigrants for rich countries to be rewarded in the host country for the skills they acquired in their country of birth is because the difference in industrial structure is greater between poor and rich countries than between rich countries or that the host country has labour market barriers (e.g., professional accreditation) that result in credentials from poor countries not being recognized as easily as credentials from rich countries. The inclusion of country of birth fixed effects in the regressions should correct for these factors insofar as they are systematic and affect all immigrants from the same country in the same way. Providing convincing evidence that these problems are negligible would
require detailed information on the industrial structure of the 78 countries of birth of immigrants in our sample and on the professional accreditation processes across Canada, which is not available. It is however noteworthy that Lagakos et al. (2014) do not find that immigrants from poor countries suffer greater occupation mismatch than immigrants from rich countries after they migrated to the U.S.

5.3 Capital intensity vs human capital quality

Another possible explanation for our results is that the Relative GDP per capita interactive terms in the regressions may be picking up the effects of the complementarity between physical and human capital as a factor raising the rates of return on schooling and work experience. To test for this possibility, we add Relative capital intensity interacted with birth-country schooling and work-experience terms to the Model 4 regression. Specifically, we estimate the equation

\[
\ln w_{ij} = \alpha_1 x_{i,j} + \alpha_2 s_{i,j} + \beta_1 x_{i,j} + \beta_2 x_{i,j}^2 + \beta_3 x_{i,j} + \beta_4 x_{i,j}^2 + \beta_5 x_{i,j}^2
\]

\[
+ \beta_6 x_{i,j}^2 + \beta_7 x_{i,j}^2 + \beta_8 x_{i,j}^2 + \beta_9 x_{i,j}^2 + \beta_{10} x_{i,j}^2 + \lambda_1 x_{i,j}^2 + \lambda_2 x_{i,j}^2 + \lambda_3 x_{i,j}^2 + \lambda_4 x_{i,j}^2 + \lambda_5 x_{i,j}^2 + \lambda_6 x_{i,j}^2 + \lambda_7 x_{i,j}^2 + \lambda_8 x_{i,j}^2 + \lambda_9 x_{i,j}^2 + \lambda_{10} x_{i,j}^2 + \epsilon_i + \theta_i,
\]

where \( \kappa_{ij} \) is the natural logarithm of the capital-output ratio of country \( j \) relative to that of Canada, for immigrant \( i \). The results of estimating this equation are reported under Model 7 in Table 3 and support our interpretation of the role of income per capita as a measure of human capital quality. First, we observe that the inclusion of Relative capital intensity terms in the regression does not take away the power of Relative GDP per capita in explaining the returns to schooling and work experience: the estimated coefficients associated to the Relative GDP per capita interactive terms are very similar to those estimated under Model 4. Second, we find that the Relative GDP per capita interactive terms are much more statistically powerful than the Relative capital intensity
interactive terms in explaining the returns to schooling and the returns to work experience: the joint test that all the coefficients associated with the *Relative GDP per capita* interactive terms are equal to zero (that is, the test that $\alpha_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$) has a *p-value* that is virtually nil,\textsuperscript{11} while the test that all the coefficients associated with the *Relative capital intensity* interactive terms are equal to zero (that is, the test that $\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$) has a *p-value* of 0.011.

6. **Returns to skills across countries**

The tests presented in the previous section suggest that the relationship between the returns to immigrant human capital and birth country of birth income that we observe is most consistent with a model where the quality of human capital in a country is positively related with that country’s level of income. If we assume that immigrants are paid their marginal product of labour, we can use the coefficients estimated under Model 4 to infer the returns to schooling and work experience acquired in different countries at various points in time depending on their level of economic development. Accordingly, in this section, we apply our methodology to a few selected countries. Our objective is to put figures on the extent to which the returns to skills acquired in poor countries are lower than the returns to skills acquired in rich countries, and to see how these returns to skill evolve over time with the level of economic development.

Figure 3 and Figure 4 respectively present estimates of returns to years of schooling and to years of work experience in six countries relative to the U.S., and at two points in time: 1954 and 2004. The countries are Argentina, China, India, Japan, Kenya and South Korea. They were selected because they are fairly representative of the growth

\textsuperscript{11} The *p-value* is around $10^{-29}$. 

26
paths experienced throughout the world over the years: some countries grew relative to the U.S. (e.g., China, Japan and South Korea), some declined (e.g., Argentina and Kenya) and some remained about the same (e.g., Canada and India). These estimates provide four main insights. First, they show that, as expected, the returns to schooling and to work experience are lower in poor countries than in rich countries. Further, we find that our estimated returns to work experience are not completely out of line with those estimated by Lagakos et al. (2013). For example, they estimate that the average returns per year of work experience in China and India for 2005 (calculated over twenty years of work experience) are respectively approximately 70 percent and 35 percent that in the U.S., while we estimate that they are respectively 40 percent and 30 percent that in the U.S. for 2004.

(Figures 3 and 4 approximately here)

A second insight provided by our regression estimates is that the returns to work experience are more sensitive to the level of economic development than the returns to schooling, especially for poor countries. For example, we estimate that in 2004, the return on one year of schooling in Kenya was 72 percent that in the U.S. while the return on one year of work experience was at best 19 percent that in the U.S.

Third, according to our regression estimates, the rich-poor country differential return on years of work experience increases with the number of years of experience. For example, we estimate that in 2004, the average rate of return on five years of work experience in China was 47.2 percent that in the U.S. while on 30 years of experience, it was 31.9 percent that in the U.S.
A fourth insight is that our estimated rates of return on human capital are consistent with the existence of human capital cohort effects, which is simply another way of saying that a country’s human capital quality varies over time. In our model, because we assume that the quality of human capital depends on GDP per capita, we have that a country’s human capital quality will evolve over time with that country’s level of economic development. For example, between 1954 and 2004, Japan’s GDP per capita almost tripled relative to that of the U.S. As a result, we estimate that during that time period, relative to the U.S., schooling quality in Japan increased by about 11.5 percent, while average work-experience quality (calculated over 20 years of work-experience) increased by about 61.4 percent.

Between-country differences vs. over-time differences

An interesting question is whether or not in reality, human-capital quality differences should be dominated by between-country differences or by within-country over-time differences. An implicit assumption in Model 4 is that within-country over-time differences have as much of an impact on human-capital quality differences as between-country differences. In other words, whether the relative GDP per capita of a country A grows by \( x \) percent between \( t_1 \) and \( t_2 \), or its relative GDP per capita is \( x \) percent higher than that of country B, then the portion of the difference between GDP per capita at time \( t_1 \) and that at time \( t_2 \) explained by human capital quality is the same as the portion of the difference between its GDP per capita and that of country B. This is a strong assumption. One implication is that in a country that grows faster than some benchmark country, the U.S. for example, the quality of human capital of young workers (relative to the U.S.’ quality of human capital) will be above that of old workers while in a country that grows slower than the U.S., the quality of human capital of young workers (relative to the U.S.’
quality of human capital) will be lower than that of old workers. For example, for Japan, we estimate that the quality of schooling for those who graduated in 1954 is 87 percent that of the U.S. compared to 97 percent that of the U.S. for those who graduated in 2004 (see Figure 3).

One way of testing whether human-capital quality differences are dominated by between-country differences or by within-country over-time differences, is to add \textit{Country of birth schooling and work-experience fixed effects} to Model 4 to estimate the regression equation

\[
\ln w_{ij} = \alpha x_{Bi} + \gamma x_{Hi} + \beta x_{Bi} x_{Hi} + \sum_{n=2}^{78} \psi_{2n} D_{Bi} + \sum_{n=2}^{78} \psi_{2n} x_{Bi} + \gamma q_{ij} + \epsilon_{ij}, \tag{19}
\]

This equation is a mixture of equations (12) and (16) where we have assumed that the curvature of the estimated earnings’ growth profiles is constant across all countries of birth (in order to have a manageable number of coefficients in the regression). Since the estimates of $\alpha_2$ and $\beta_2$ capture both the between-country and the over-time effects, while the estimates of the $\psi$’s capture only the between-country effects, if the estimates of $\alpha_2$ and $\beta_3$ turn out to be statistically non-significantly different from zero in this regression, then it will suggest that the between-country effects are much more important than the within-country over-time effects. On the other hand, if the estimates of $\alpha_2$ and $\beta_3$ turn out to be statistically significantly greater than zero in this regression, then it will suggest that the within-country over-time effects is as (if not more) important than the between-country effects. The results of this regression are reported under Model 8 in Table 3. Interestingly, $\hat{\alpha}_2$ remains statistically (highly) significantly positive while $\hat{\beta}_3$ becomes statistically insignificant. This suggests that within-country over-time
differences are important for explaining differences in schooling quality, but between-country differences are much more important than within-country over-time differences for explaining differences in work-experience quality.

7. Human capital quality and economic development

In this section, we return to the macroeconomic development accounting framework outlined in Section 2 and use the coefficients estimated under Model 4 to estimate the impact of human-capital quality on economic development. To perform this task, we use the fact that if the *representative worker* in country $j$ is endowed with a level of schooling $s_j$ and a level of work experience $x_j$, then given (4) and (15), the portion of the percentage difference between output per worker in country $j$ and that in country $k$ explained by the difference in human capital quality from the point of view of country $j$ is

$$
\Delta \phi(j,k)_q = \phi(s_j, x_j, q_j) - \phi(s_j, x_j, q_k),
$$

$$
= (\alpha s_j + \beta x_j + \beta^2 x_j^2)(q_j - q_k) + \beta x_j^2(q_j^2 - q_k^2),
$$

which can be decomposed into two parts:

a *Schooling-quality effect*: $\alpha s_j (q_j - q_k)$, \hspace{1cm} (20a)

and

a *Work-experience-quality effect*: $(\beta x_j + \beta x_j^2)(q_j - q_k) + \beta x_j^2(q_j^2 - q_k^2)$. \hspace{1cm} (20b)

The figures in Table 4 show for 92 countries, how these countries’ output per worker would increase if these countries had the same schooling quality and work-experience quality as that of Canada. These countries were selected based on the availability of data on schooling in Morisson and Murtin (2009) and Barro and Lee
Further information on the definition of the variables and the sources of the data is provided in the footnotes to Table 4.

The figures in Table 4 clearly demonstrate that differences in human capital quality matter a lot for explaining differences in output per worker between rich and poor countries. For example, assuming that the *representative* worker in Kenya has 6.5 years of schooling and 21.9 potential years of work experience, we estimate that Kenya’s output per worker would increase by 41.1 percent if it had the same human capital quality as that of Canada. Under such circumstances the ratio of Canada’s output per worker to that of Kenya’s would decrease from 20:1 to 14.2:1.

It is also interesting to see that for more developed countries such as India and Argentina, differences in human capital quality also account for substantial differences in output per worker. For example, we estimate that India’s output per worker would increase by 33.1 percent if India’s human capital quality was the same as Canada’s. The equivalent figure for Argentina is 15.8 percent.

Of course the difference is much smaller for economies that are relatively similar to each other. For example, assuming that workers in both Canada and the U.S. have on average the same number of years of schooling and the same number of years of work experience, we estimate that if Canada had the same human capital quality as the U.S., Canada’s output per worker would increase by 4.8 percent (see Table 4). In other words,

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12 The number of countries listed in Table 4 (92) is greater than the number of countries in the regression sample (78). As pointed out earlier, an advantage of imposing some structure on the way human capital quality varies both across countries and over time (such as we do in *Model 4* by modelling human capital quality as a function of GDP per capita) is that we can perform economic development analyses for countries that are not included in the regression sample.
we estimate that human capital quality accounts for about 17 percent of the difference in standard of living between these two countries.

6.1 Decomposition of the impact of human capital quality

Table 4 also reports the decomposition of the impact of differences in human capital quality on output per worker into a Schooling quality effect and a Work-experience quality effect—as per equations (20a) and (20b). The results are striking. In all cases, the quality of work experience plays a much greater role than the quality of schooling in explaining differences in output per worker. For example, if we take the case of Kenya, the Work-experience quality effect is almost thrice as large as the Schooling quality effect. In the case of Japan, the Work-experience quality effect is almost 67 percent larger than the Schooling quality effect. Overall, on average, for the countries listed in Table 4, we find that the Work-experience quality effect is more than thrice that of the Schooling quality effect. These results are in some respect the most revealing of this study. Up to now, the economic development literature has focused primarily on schooling when studying the impact of human capital quality on standards of living. In this paper, we show that a country’s quality of schooling is indeed a key determinant of its standards of living. However, our bottom line is that the quality of work experience is an even more important determinant from a quantitative point of view. This might not be surprising ex-post since we know that the average number of years of work experience in a country is generally larger than the number of years of schooling. Nevertheless, normalizing our estimates for the number of years of schooling and the number of years of work experience, we find that on average for the countries listed in Table 4, the quality impact on output per worker of one year of work experience is still substantial compared to that of one year of schooling—about 94 percent of the latter in fact.
Clearly, further research is needed to better understand the factors that determine the quality of work experience in countries at different stages in their economic development. In the basic Mincerian framework (as in the Ben-Porath 1967 framework) returns to work experience are explained by the fact that workers invest in human capital on the job to become more productive later. Our results show that the return to such investment is higher if this investment is made in a rich country than if it is made in a poor country. An obvious explanation for this is that from an economic development point of view, on-the-job training is more valuable if it is acquired while working with sophisticated tools and within complex organizations than it is otherwise. For example, most would agree that from an economic development point of view, working with computers provides more valuable training than working with abaci. Another explanation could be that potential work experience in poor countries is less intensive than in rich countries because of higher unemployment and shorter working time.

6.2 How do our results compare?

It is noteworthy that we find that human capital quality has a greater impact on economic development than that reported in Klenow and Rodriguez-Clare (1997), but smaller than that estimated by Schoellman (2012). Klenow and Rodriguez-Clare find that Borjas’ (1987) estimates imply that the difference in human capital quality between Kenya and Canada would account for 36 percent of Kenya’s output per worker, while we estimate that it would account for 41.1 percent (see Table 4). For Canada compared to the U.S., our estimate of 4.8 percent is about 60 percent larger than what would be obtained using Klenow and Rodriguez-Clare (1997)’s methodology.

Comparing our results with those of Schoellman (2012) provides another perspective. Schoellman finds that controlling for differences in human capital quality
(which he totally assigns to differences in schooling quality) doubles the impact of differences in human capital on economic development. Using the parameter estimates of Model 4, we find that for a poor country (e.g., Kenya), accounting for the impact of differences in human capital quality almost double the impact of human capital quantity on output per worker. But this comes mostly from accounting for the quality of work experience: indeed, we estimate that for Kenya, taking into account quality increases the impact of human capital on output per worker by about 97 percent with about three-quarter of the increase due to the impact of work-experience quality. On the other hand, for a richer country, our estimate of the impact of human capital quality is much smaller than that found by Schoellman (2012): for Argentina, for example, we estimate that controlling for human capital quality increases the impact of differences in human capital on output per worker by about 58 percent (with about 72 percent of the increase due to the impact of work-experience quality).

The only study to which we can compare our estimates of the effects of work-experience quality on economic development is that of Lagakos et al. (2013). Our estimates of these effects are generally much smaller. For example, they estimate that GDP per capita in Argentina would be between 100 and 130 percent larger if Argentina’s work-experience quality was the same as that of the U.S., while we estimate that it would be approximately 11.4 percent larger (see Table 4). Figures for India are even more dramatic: they estimate that India’s GDP per capita would be between 300 and 400 percent larger if India had the same work-experience quality as that of the U.S., while we

13 Our estimates are based on the following formulas. Since Canada is the benchmark country, $q_k = 0$, and from (3) and (15), the contributions of the differences in schooling endowments, schooling quality, work experience endowments and work experience quality to the difference in income per capita between country $j$ and country $k$ respectively are:

$S = \alpha_j(s_j - s_k)$; \hspace{1em} $S_q = \alpha_j x_jq_j$; \hspace{1em} $X = \beta(x_j - x_k) + \beta_2(x_j^2 - x_k^2)$; \hspace{1em} and, \hspace{1em} $X_q = (\beta x_j + \beta_2 x_j^2)q_j + \beta_3 x_j^2q_j^2$. 


estimate that it would be approximately 26.4 percent larger. On the other hand, in a few cases, their estimates are quite similar to ours: for example, they estimate that Canada’s GDP per capita would be between 2.5 and 4.5 percent larger if Canada had the same work-experience quality as that of the U.S., while we estimate that it would be approximately 3.0 percent larger.

8. Conclusion

In this paper, we present a methodology to analyze the effects of schooling quality and work-experience quality on economic development. We observe that the returns to immigrant schooling and work experience are positively related to the level of per capita income in their countries of birth and argue that this fact is most consistent with a model where a country’s human capital quality is positively related to its level of income. When this insight is incorporated into an economic development accounting exercise by allowing schooling quality and work-experience quality to vary across countries according to their GDP per capita, we find that combining quality adjustments for both schooling and work experience leads to human capital quality adjustments that are in between those previously found in the literature (e.g., Klenow and Rodrigues-Clare, 1997; Schoellman, 2012 and Lagakos et al., 2013). Perhaps more importantly though, we document a new fact: quantitatively speaking, work-experience quality plays a much more substantial role than schooling quality in explaining differences in output per worker. Another interesting result we find (and that probably needs to be further investigated) is that while between-country differences appear to be as important as within-country over-time differences for explaining differences in schooling quality,
between-country differences are much more important than within-country over-time differences for explaining differences in work-experience quality.

As emphasized by Hanushek and Woessmann (2008), one of the key facts revealed by recent economic development experiences is that improvements in the quantity of education have not always yielded the expected progress in terms of economic well-being. They convincingly argue that the quality of schooling should also be improved. The results of our analysis confirm their diagnostic: differences in the quality of schooling are substantial between rich and poor countries. However, our analysis also highlights another potential explanation for the weak impact of improving schooling on economic wellbeing in poor countries: the low quality of work experience in those countries. Indeed, while improving schooling quantity and quality certainly enriches the stock of human capital in poor countries, improving the quality of work experience might achieve even more. Our results thus introduce the notion that, ideally, from a human capital point of view, an economic development process should be balanced: it should be characterized by simultaneous improvements in both schooling and labour market experience.

Finally, our results might shed new light on our understandings of the international transferability of human capital (see for example, Chiswick and Miller, 2009). The returns to education and work experience of Canadian immigrants appear to be affected by the degree of economic development in their country of birth. The weak transferability of human capital (abstracting from language skills) might result from quality differences in the human capital formation process.

The next step for this study would be to replicate the methodology using data from other countries that have large and diverse populations of immigrants such as the
U.S. and Israel. The objective of such exercise would be to test whether the development accounting results obtained in this study are robust to changes in benchmark countries.

References


APPENDIX A
DATA DESCRIPTION

Dependent variable

Our dependent variable is the natural logarithm of hourly earning. Hourly earning is calculated as wages and salaries reported for 2005 divided by (the number of weeks worked in 2005 times the number of hours worked during the reference week in that year).

Some restrictions were applied to eliminate very small and very large values of earnings. Observations with hourly earnings less than $3 and more than $5,000 were removed. The sample was also restricted to men who had obtained their (post-secondary) highest certificate, diploma or degree in their country of birth according to the Location of study variable in the 2006 census. For individuals without post-secondary certificate, diploma or degree, we assumed that they had acquired their education in their country of birth except if they had immigrated to Canada before they turned 18, in which case we assumed they had completed their education in Canada (and were therefore excluded from the sample).

Independent variables

We allow earnings to vary by a fixed effect across Canada. We control for six regions: the Atlantic Provinces, Quebec, Ontario (the reference category), the Prairies, Alberta and British Columbia.

The 2006 census does not provide a value for Years of schooling. To compute this value we use the information provided on the highest certificate, degree or diploma obtained in the way described in Table A1. In the census, the variable location of study is
reported only for individuals who have completed a postsecondary certificate, diploma or degree.

*Potential experience* is defined as *Age* minus *Years of schooling* minus 6. *Foreign experience* is measured as potential experience minus *Years since migration*, where *Years since migration* is calculated as 2005 minus the year the individual’s year of immigration (that is, the year landed immigrant status was first granted). Work experience in the host country labour market is defined as potential experience minus *foreign experience*.

For language skill, we use the variable *Knowledge of the official languages* (as evaluated by the respondents). The categories are (1) English only (the reference), (2) French only, (3) Both English and French, and (4) None of English and French.

Data on real GDP come from Heston, Summers, and Aten (2009) and is available for 188 countries (including Canada). *Relative GDP per capita* is measured as the ratio of a *five-year moving average* of an immigrant’s country of birth real GDP per capita and of a *five-year moving average* of Canada’s real GDP per capita, at the year when individuals obtained their highest diploma. Countries for which there are fewer than 50 observations are dropped from the sample.
Table A1: Construction of Number of Years of Schooling Variable

<table>
<thead>
<tr>
<th>Highest certificate, degree or diploma obtained</th>
<th>Estimated years of schooling</th>
</tr>
</thead>
<tbody>
<tr>
<td>No certificate</td>
<td>8</td>
</tr>
<tr>
<td>High school certificate</td>
<td>12</td>
</tr>
<tr>
<td>Trade, apprenticeship, college or CEGEP certificates or diploma from a program of three months to less than one year</td>
<td>13</td>
</tr>
<tr>
<td>Trade, apprenticeship, college or CEGEP certificates or diploma from a program of one year to two years</td>
<td>14</td>
</tr>
<tr>
<td>University certificate or diploma below bachelor level</td>
<td>15</td>
</tr>
<tr>
<td>University bachelor level</td>
<td>16</td>
</tr>
<tr>
<td>University certificate or diploma above bachelor level</td>
<td>17</td>
</tr>
<tr>
<td>Masters</td>
<td>18</td>
</tr>
<tr>
<td>Doctorate (including medicine, dentistry and similar programs)</td>
<td>22</td>
</tr>
</tbody>
</table>
Table 1
Summary Statistics\textsuperscript{a}

<table>
<thead>
<tr>
<th></th>
<th>Canadian Born Individuals</th>
<th>Immigrants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hourly earnings</td>
<td>26.5</td>
<td>23.9</td>
</tr>
<tr>
<td>Ln weekly earnings</td>
<td>3.1</td>
<td>3.0</td>
</tr>
<tr>
<td>Years of schooling</td>
<td>13.2</td>
<td>13.7</td>
</tr>
<tr>
<td>Total potential experience (years)</td>
<td>21.6</td>
<td>27.0</td>
</tr>
<tr>
<td>Host country</td>
<td>21.6</td>
<td>14.2</td>
</tr>
<tr>
<td>Foreign</td>
<td>n.a.</td>
<td>12.8</td>
</tr>
<tr>
<td>Real GDP per capita ratio\textsuperscript{b}</td>
<td>n.a.</td>
<td>0.35</td>
</tr>
<tr>
<td>Sample size</td>
<td>550,995</td>
<td>50,965</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Full-time, full-year working males between 18 and 64. Immigrants are defined as having obtained their highest diploma in their country of birth.
\textsuperscript{b}Ratio of five-year moving averages measured at the time of obtention of highest diploma.

Source: Calculations from Statistics Canada 2006 census data.

Table 2
The Fifteen Most Common Countries of Birth of Canadian Male Immigrants in 2006\textsuperscript{a}

<table>
<thead>
<tr>
<th>Country of Origin</th>
<th>% of Immigrant Male Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>India</td>
<td>13.2</td>
</tr>
<tr>
<td>Philippines</td>
<td>10.7</td>
</tr>
<tr>
<td>China</td>
<td>9.3</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>9.0</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>3.7</td>
</tr>
<tr>
<td>Poland</td>
<td>3.4</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>3.4</td>
</tr>
<tr>
<td>U.S.</td>
<td>3.4</td>
</tr>
<tr>
<td>Romania</td>
<td>3.1</td>
</tr>
<tr>
<td>Pakistan</td>
<td>3.0</td>
</tr>
<tr>
<td>Portugal</td>
<td>2.2</td>
</tr>
<tr>
<td>France</td>
<td>2.0</td>
</tr>
<tr>
<td>Jamaica</td>
<td>1.8</td>
</tr>
<tr>
<td>Italy</td>
<td>1.8</td>
</tr>
<tr>
<td>Iran</td>
<td>1.4</td>
</tr>
</tbody>
</table>

\textsuperscript{a}Full-time, full-year working male immigrants between 18 and 64 who obtained their highest diploma in their country of birth.

Source: Calculations from Statistics Canada 2006 census data.
<table>
<thead>
<tr>
<th>Immigrants</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(no difference in human capital quality—Equation (7a))</td>
<td>(Model 1 + birth country work experience—Equation (8))</td>
<td>(Flexible functional form—Equation (12))</td>
<td>(Parsimonious functional form—Equation (16))</td>
<td>(Model 4 + direct effect of $q$)</td>
<td>(Model 4 + host country work experience interacted with $q$—Equation (17))</td>
<td>(Model 4 + $\kappa$ effects—Equation (18))</td>
<td>(Model 4 + Country of birth schooling and work experience fixed effects—Equation (19))</td>
</tr>
<tr>
<td></td>
<td>$\alpha_1$ ($s_B$)</td>
<td>$\alpha_2$ ($s_Bq$)</td>
<td>$\beta_1$ ($x_Bq$)</td>
<td>$\beta_2$ ($x_Bq^2$)</td>
<td>$\beta_3$ ($x_Bq$)</td>
<td>$\beta_4$ ($x_Bq^2$)</td>
<td>$\beta_5$ ($x_B$)</td>
<td>$\beta_6$ ($x_B^2$)</td>
</tr>
<tr>
<td></td>
<td>0.085 (286)</td>
<td>0.054 (53.)</td>
<td>0.055 (53.)</td>
<td>0.070 (16.)</td>
<td>0.063 (41.)</td>
<td>0.065 (36.)</td>
<td>0.064 (40.)</td>
<td>0.064 (41.)</td>
</tr>
<tr>
<td></td>
<td>$\beta_7$ ($x_B^2q$)</td>
<td>$\beta_8$ ($x_Hx_Bq$)</td>
<td>$\beta_9$ ($x_Hx_Bq^2$)</td>
<td>$\gamma$ ($q$)</td>
<td>$\lambda_1$ ($s_B$)</td>
<td>$\lambda_2$ ($x_B$)</td>
<td>$\lambda_3$ ($x_B^2$)</td>
<td>$\lambda_4$ ($x_Hx_Bq$)</td>
</tr>
<tr>
<td></td>
<td>-0.034 (1.5)</td>
<td>-0.007 (2.3)</td>
<td>-0.004 (1.9)</td>
<td>-0.034 (1.5)</td>
<td>-0.007 (2.3)</td>
<td>-0.006 (1.3)</td>
<td>-0.006 (1.3)</td>
<td>-0.006 (1.3)</td>
</tr>
<tr>
<td></td>
<td>$\lambda_5$ ($x_Hx_Bq^2$)</td>
<td>$R^2$</td>
<td>$n$</td>
<td>$\alpha_1$</td>
<td>$\alpha_2$</td>
<td>$\beta_1$</td>
<td>$\beta_2$</td>
<td>$\beta_3$</td>
</tr>
<tr>
<td></td>
<td>0.278</td>
<td>0.078</td>
<td>0.028</td>
<td>0.234</td>
<td>0.254</td>
<td>0.270</td>
<td>0.257</td>
<td>0.257</td>
</tr>
</tbody>
</table>

a Absolute t-ratio in parentheses. The dependent variable is ln (hourly earnings). Also included in regressions are six region of residence indicators, three language spoken indicators and 77 immigrant country of birth dummy variables. The estimated returns to variables in $x^2$ have been multiplied by 100.

b In Model 1, the return to foreign work experience is assumed to be the same as the return to domestic work experience.

c In Models 3 and 8, in order to have a manageable number of coefficients in the regressions, we assume that the curvature of the estimated earnings’ growth profiles is constant across all countries of birth.

d As the U.S. is the reference/benchmark country for Model 3, the estimates of $\alpha_i$ and $\beta_i$ for that model respectively correspond to the returns to schooling and work experience acquired in the U.S. of a U.S. immigrant to Canada.
### Table 4
Impact of Differences in Human Capital Quality on Output per Worker

<table>
<thead>
<tr>
<th>Country of Birth</th>
<th>GDP per Capita (relative to Canada) (^a)</th>
<th>Average Number of Years of Schooling (^c)</th>
<th>Average Number of Years of Work Experience (^d)</th>
<th>Quality Effects of Schooling (^e) (as a percent of GDP)</th>
<th>Quality Effects of Work Experience (^e) (as a percent of GDP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan (^e)</td>
<td>0.02</td>
<td>3.7</td>
<td>23.7</td>
<td>8.2</td>
<td>37.1</td>
</tr>
<tr>
<td>Algeria</td>
<td>0.20</td>
<td>7.2</td>
<td>23.1</td>
<td>6.3</td>
<td>18.7</td>
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<tr>
<td>Argentina</td>
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<td>8.8</td>
<td>23.1</td>
<td>4.4</td>
<td>11.4</td>
</tr>
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<td>Australia</td>
<td>0.99</td>
<td>13.3</td>
<td>20.3</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Austria</td>
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<td>22.5</td>
<td>-0.1</td>
<td>-0.2</td>
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<tr>
<td>Bangladesh (^e)</td>
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<td>5.9</td>
<td>23.9</td>
<td>8.5</td>
<td>28.6</td>
</tr>
<tr>
<td>Barbados (^e)</td>
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<td>23.9</td>
<td>2.8</td>
<td>7.1</td>
</tr>
<tr>
<td>Belgium</td>
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<td>11.4</td>
<td>23.0</td>
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<td>1.0</td>
</tr>
<tr>
<td>Benin (^f)</td>
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<td>25.1</td>
<td>4.6</td>
<td>32.3</td>
</tr>
<tr>
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<td>8.2</td>
<td>23.3</td>
<td>5.9</td>
<td>15.9</td>
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<tr>
<td>Bulgaria (^e)</td>
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<td>23.6</td>
<td>7.9</td>
<td>15.6</td>
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<tr>
<td>Cambodia (^f)</td>
<td>0.02</td>
<td>4.8</td>
<td>24.1</td>
<td>10.3</td>
<td>36.7</td>
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<tr>
<td>Cameroon (^f)</td>
<td>0.09</td>
<td>4.9</td>
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<tr>
<td>Chile</td>
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<tr>
<td>China (^c)</td>
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<td>8.1</td>
<td>22.0</td>
</tr>
<tr>
<td>Costa Rica (^f)</td>
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<tr>
<td>Cote d'Ivoire (^f)</td>
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<td>24.5</td>
<td>4.9</td>
<td>26.9</td>
</tr>
<tr>
<td>Croatia (^e)</td>
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<tr>
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<td>-0.4</td>
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<tr>
<td>Dom. Republic</td>
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</tr>
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<td>7.7</td>
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<tr>
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<td>2.6</td>
<td>25.4</td>
<td>5.1</td>
<td>35.7</td>
</tr>
<tr>
<td>Finland (^d)</td>
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<td>22.4</td>
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<tr>
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<td>9.2</td>
<td>20.6</td>
<td>10.0</td>
<td>20.9</td>
</tr>
<tr>
<td>Haiti (^f)</td>
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<td>23.5</td>
<td>7.1</td>
<td>27.6</td>
</tr>
<tr>
<td>Honduras</td>
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<td>8.0</td>
<td>23.2</td>
<td>8.5</td>
<td>22.2</td>
</tr>
<tr>
<td>Iran</td>
<td>0.23</td>
<td>6.7</td>
<td>23.5</td>
<td>5.4</td>
<td>17.8</td>
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<td>20.4</td>
<td>1.4</td>
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<td>21.9</td>
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<tr>
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<td>33.6</td>
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<tr>
<td>Mauritius (^c)</td>
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<td>Country</td>
<td>Schooling-quality effect</td>
<td>Work-experience-quality effect</td>
<td>Model 4 Multiplied by -100</td>
<td></td>
<td></td>
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<tr>
<td>------------</td>
<td>--------------------------</td>
<td>-------------------------------</td>
<td>-----------------------------</td>
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<td>22.2</td>
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<td>26.2</td>
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<tr>
<td>Mozambique</td>
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<tr>
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<td>21.0</td>
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<td>23.1</td>
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<tr>
<td>Paraguay</td>
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Figures in the table are natural logarithm percentage points and correspond to the sum of the Schooling-quality effect (equation (20a)) and the Work-experience-quality effect (equation 20b) estimated using the coefficients of Model 4 in Table 3 and multiplied by -100.

Ratio of five-year moving averages; 2004 figures.


Calculated as the difference between the estimated Average age of the workforce minus the Average number of years of schooling minus 6. The Average age of the workforce is estimated from the age structure provided in Central Intelligence Agency (2013) for the age groups 15-24, 25-54 and 55-64.

The source for the variable Average number of years of schooling for this country is Barro and Lee (2013).

This country was not part of the regression samples because there were too few observations.
Figure 1a: Country of Birth Schooling Fixed Effects
(Estimates of the \( \alpha_2 \)'s in Equation 12)

Figure 1b: Country of Birth Work Experience Fixed Effects
(Estimates of the \( \beta_3 \)'s in Equation 12)
Figure 2: Immigrant Schooling Relative to Birth-Country Population Schooling*

Figure 3: Returns to Years of Schooling  
(per-year of schooling, U.S. = 1, selected countries)

Figure 4: Returns to Work Experience  
(per year of work experience, U.S. = 1, selected countries)