Atlantic Metropolis Centre ~ Working Paper Series
Centre Métropolis Atlantique ~ Série de documents de recherche

# Do the Educational Credentials of Immigrant and Non-Immigrant Workers make them Perfect Substitutes for Each Other in Canadian Labour Markets? A Production Function Analysis

**Ather H. Akbari & Yigit Aydede**
**Saint Mary's University**

**2010**

**Working Paper No. 29-2010**
**Série de documents de recherche 29-10**


Centre Métropolis Atlantique
Atlantic Metropolis Centre

**The Atlantic Metropolis Centre's Working Papers Series**
**Série de documents de recherche du Centre Métropolis Atlantique**

*The views expressed in this paper are those of the author(s) and do not necessarily reflect the view of the Atlantic Metropolis Centre or its funders.*

*Les opinions contenues dans cet article sont celles des auteur(s) et ne sont pas nécessairement partagées par le Centre Métropolis Atlantique ou ses partnaires.*



AMC Working Papers Series / Série de documents de recherche du CMA
Attention: Robert Nathan
5670 Spring Garden Road, Suite 509
Halifax, NS B3J 1H6
E-mail / courriel: nathan.metropolis@ns.aliantzinc.ca
Website / site Web: http://atlantic.metropolis.net/

| We are pleased to acknowledge the AMC's partner organizations: | Le CMA tient à remercier chaleureusement les partenaires suivants pour leur soutien: |
|---|---|
| **Federal Government Partners:**<br>Atlantic Canada Opportunities Agency, Canada Border Services Agency, Canada Economic Development for the Regions of Quebec, Canada Mortgage and Housing Corporation, Canadian Heritage, Citizenship and Immigration Canada, FedNor, Human Resources and Social Development Canada, Department of Justice Canada, Public Health Agency of Canada, Public Safety Canada, Royal Canadian Mounted Police, The Rural Secretariat, Social Sciences and Humanities Research Council, Statistics Canada<br>**Three Lead Universities**:<br>Saint Mary's University, Dalhousie University, and Université de Moncton.<br>**Community Partners:**<br>Metropolitan Immigrant Settlement Association (MISA), Multicultural Association of Nova Scotia (MANS), New Brunswick Multicultural Council, PEI Association for Newcomers, Multicultural Association for the Greater Moncton Area, Association for New Canadians (ANC) of Newfoundland, Canadian Council for Refugees (CCR), Halifax Immigrant Learning Centre (HILC), YMCA Newcomer Service. | **Partenaires fédéraux:**<br>Agence de promotion économique du Canada atlantique, Agence des services frontaliers du Canada, Développement économique du Canada pour les régions du Québec, Société canadienne d'hypothèques et de logement, Patrimoine Canada, Citoyenneté et Immigration Canada, FedNor, Ressources humaines et Développement social Canada, Ministère de la Justice Canada, Agence de la santé publique du Canada, Sécurité Publique Canada, Gendarmerie royale du Canada, Le Secrétariat rural, Conseil de recherches en sciences humaines, Statistique Canada<br>**Les trois universités à la direction**:<br>Saint Mary's University, Dalhousie University et l'Université de Moncton.<br>**Nos partenaires communautaires**:<br>L'Association multiculturelle de Nouvelle-Écosse, Le Conseil multiculturel du Nouveau-Brunswick, L'Association multiculturelle du Grand Moncton, Association métropolitaine pour l'établissement des immigrants, PEI Association for Newcomers, L'association des nouveaux canadiens de Terre-Neuve, Conseil canadien pour les réfugiés, Halifax Immigrant Learning Centre, YMCA Newcomer service. |

# Do the Educational Credentials of Immigrant and Non-Immigrant Workers make them Perfect Substitutes for Each Other in Canadian Labour Markets? A Production Function Analysis

**Ather H. Akbari & Yigit Aydede**
**Saint Mary's University**

**Abstract/Résumé:** An aging population and declining birth rates have raised concerns among Canadian policymakers over the future availability of skilled workers in Canada. Regional labour market impacts of this change in the demographic composition of the population have also been affected by the out-migration of population from smaller provinces and rural areas. At provincial and local levels, immigration is increasingly viewed as a tool to address these issues. While attracting skilled immigrants is the main focus of recent regional immigrant policy initiatives, lack of recognition of their credentials in Canadian labour markets is viewed as a significant barrier to their successful integration into the provincial and local Canadian labour force. This integration is necessary to obtain the desired economic outcomes of a wider geographic distribution of immigrants. As a result, federal and provincial governments, as well as non-governmental organizations, are now investing resources to remove this barrier to immigrant integration. While much has been argued in Canadian public and academic circles about the lack of foreign credential recognition in Canadian labour markets, no systematic investigation of this issue has yet been conducted in the literature. Using an economic framework, the present paper attempts to partially fill this gap. While immigrants arriving with high school or less education are found to be perfect substitutes for their non-immigrant counterparts, those arriving with a post-high school education are not.

**Keywords/Mots-clefs:** Education, Immigration, Elasticity of Substitution

***JEL* Classification:** J15, R31

---

[1] Both authors are members of the Department of Economics at Saint Mary's University and associated with the Atlantic Metropolis Centre. ather.akbari@smu.ca, yigit.aydede@smu.ca

## Introduction

An aging population and declining birth rates have raised concerns among Canadian policymakers over the future availability of skilled workers in Canada. Regional labour market impacts of the changing demographic composition of the population have also been affected by the out-migration of population from smaller provinces and rural areas. As a result, smaller provinces such as Nova Scotia, Saskatchewan, and New Brunswick are now adopting initiatives, at both government and non-government levels, to increase their share of annual Canadian immigrant inflows and also to retain new arrivals. While the importance of both family reunification and humanitarian reasons as bases for immigration remains intact, greater emphasis is now being placed on attracting skilled immigrants to meet skill shortages. A new deal for cities allows municipalities to partner with the Government of Canada and other stakeholders to attract to their towns and cities and retain internationally trained workers to improve productivity and build more prosperous communities.

While skilled immigrants are the focus of recent regional immigrant policy initiatives, lack of recognition of their credentials in Canadian labour markets is viewed as a significant barrier to their successful integration into the Canadian labour force. As a result, federal and provincial governments, as well as non-governmental organizations, are now investing resources to remove this barrier to immigrant integration. For example, the Government of Canada has introduced a Foreign Credential Recognition (FCR) Program whose objective is to "work with provinces, territories, regulatory bodies, sector councils, post-secondary institutions, and other partners and stakeholders to develop foreign credential assessment and recognition processes that are fair, accessible, consistent, transparent, and rigorous in both targeted regulated and non-regulated occupations and sectors."

Much has been argued in Canadian public and academic circles about the lack of foreign credential recognition in local labour markets. However, no systematic investigation of this issue has been conducted in the literature to date.[1] The present paper attempts to partially fill this gap. This study will also help assess the impact of immigration on the earnings of native-born labour in small area labour markets of Canada. This assessment is important in the light of both emerging public policy interest in the regionalization of immigration and concern over consequences for regional labour markets.

The rest of this paper is organized as follows: Section 1 provides the economic framework and methods that we used; econometric specifications and estimation results are explained in Section 2; and concluding remarks are given at the end.

## 1 Economic framework and method of analysis

The main hypothesis we wish to test in this study is that immigrant and native-born Canadians, having both attained a given educational level in their respective countries, are less

[1] For example, lower earnings of recent Canadian immigrants are often attributed by the literature to the possible lack of immigrants' credential recognition (for example, Bloom et al., 1995). However, no systematic evidence is provided.

than perfect substitutes for each other in production. The rationale behind this hypothesis is that native-born Canadians are relatively more intensive in "country-specific" skills. This is because they are more likely than immigrants to have the knowledge of local labour market customs, language and institutional features unique to Canada that enhance their productivity in Canada. For this reason, employers prefer the native born over immigrant workers. It is expected, however, that the substitutability of immigrants and the native born increases at a higher educational level for two reasons: 1) acquisition of higher education increases the adaptability and trainability of workers; and 2) in today's globalized world, higher education curricula around the world appear to be converging so that natives of other countries who acquire higher education in their country of origin have greater knowledge of the labour market norms of their country of destination.[2]

To assess the substitutability of immigrants and the native born, one must analyze the impact of immigration on the wages of the native born. This analysis will be conducted using a production function.[3] Separate analyses will be conducted for those who have acquired 1) high school or less education, 2) post-secondary but no university education, and 3) a university degree.

Assuming two types of labour, immigrant labour ($M$) and native-born labour ($N$), a "nested" production function that expresses output ($q$) as a function of labour and capital ($k$) is written as follows:

$$q = f(g(M, N); \bar{K})$$

where $K$ is assumed to be separable from $M$ and $N$ so that one can write $q = g(M, N)$. A Constant Elasticity of Substitution (CES) aggregate of the two labour inputs can be written as

$$L = (a_1 M^{\beta} + a_2 N^{\beta})^{1/\beta},$$

such that $a_i \geq 0$, $-\infty < \beta \leq 1$ are parameters. Using the assumption of profit maximization allows us to write $P_M / P_N = g_M / g_N$, where $P_M$ and $P_N$ are the wages paid to $M$ and $N$, respectively, and $g_M$ and $g_N$ are their respective marginal products. Based on the CES aggregate of labour specified above, the profit maximization condition can be rewritten as

$$P_M / P_N = (a_1 / a_2)(M / N)^{\beta - 1}.$$

Taking the natural logarithm on both sides of the above equation, we get

---

[2] For example, many universities in developing countries now have affiliations with universities in advanced western countries and offer similar curricula. One author of the present paper has himself taught at one such university in Pakistan that is affiliated with both McGill University in Canada and some prominent American universities. This author also knows, through anecdotal evidence, that university students from developing countries generally perform well in Canadian and American universities. However, no concrete evidence can be found in this regard.

[3] A production function analysis aimed at assessing the labour market impact of immigrants in production is standard in the literature. For example, three such studies (among many) are Chiswick, Chiswick and Miller (1986), Akbari and DeVoretz (1992), and Card (2001).

$$\ln(P_M / P_N) = \ln(a_1 / a_2) + (\beta - 1)\ln(M / N). \quad (1)$$

The elasticity of substitution is 1/((ß-1). This value increases as (ß-1) approaches zero. Equation (1) will be estimated to compute the elasticity of substitution between immigrant and native-born labour.

## 2 Data Used

Cross-sectional data from the 2001 Census are used to estimate equation (1). To assess the impact of immigrant labour on the wages of the native born, it is important to account for their distribution in labour markets across Canada. To conduct the 2001 Census, Statistics Canada divided the country into 289 provincially legislated census divisions (CDs), or smaller communities that are intermediate geographic areas between the province/territory level and the municipality (census subdivision). Hence, the use of data at the census division level allows us to capture comprehensively the distribution of immigrants across Canadian labour markets.[4]

The data were purchased from Statistics Canada and include labour market income (annual wages and salaries), numbers of non-immigrants and immigrants by period of arrival (before and after 1991), average hours and weeks worked, age, and average number of years of education in each of the CDs. These data have been grouped according to the four education levels described in Section 1. Within each education level, separate estimates were obtained using data on those immigrants who arrived before 1991 and those who arrived during 1991-99.[5] The 2001 Census did not collect information on where individuals obtained their education. Due to this lack of data, it is assumed that all native-born Canadians obtained their education in Canada or in a western country and do not face the issue of recognition of educational credentials. Finally, only those immigrants are considered who were aged 25 years and above at the time of arrival into Canada as there is a strong chance that most such immigrants finished their education in their country of origin before coming to Canada.

Our final data exclude the three territories: Yukon, Nunavut, and the Northwest Territories, and cover 256 CDs[6] and 10 provinces.

[4] Some divisions had to be excluded from the analysis due to lack of sufficient data. In all, 256 census divisions were considered.

[5] Immigrants who arrived during 1991-99 may be viewed as new immigrants at the time of the 2001 census. Since the 2001 census collected labour market information for the year 2000, those immigrants who arrived during 2000-01 were excluded from the analysis.

[6] To conduct a population census, Statistics Canada divided the country into 289 provincially legislated census divisions (CDs), or smaller communities that are intermediate geographic areas between the province / territory level and the municipality (census subdivision).

## 3 Some Issues in the Estimation of the Economic Model

Our use of cross-sectional data at the CD level requires us to consider four important econometric issues: (1) unobserved regional fixed effects cannot be removed with tools used in panel estimations; (2) using a geographical classification at the CD level may cause spatial correlations across neighbouring regions; (3) the density of immigrants in a local labour force can be endogenous —immigrants can move to places with better labour market opportunities; and (4) some researchers (Borjas et al., 1997) are critical of the so-called "area analysis" method in assessing the impact of immigration.[7] More specifically, they argue that studies using this approach cannot control mobility responses of the native born; that is, if local out-migration responses are significant, effects of immigration on local labour market outcomes are dispersed.[8] We can control region-specific fixed effects at the provincial level in all estimations. As a remedy for the second problem, we calculate robust standard errors clustered by provinces.[9] To address the third issue, we apply the two-stage least square (2SLS) estimator technique using the density of recent immigrants in the local labour force as an instrumental variable. This type of application is not new in the literature and is justified by the fact that recent immigrants choose their initial destination not based on local labour market opportunities but rather on their ethnic and cultural connections in the local population (for example, Borjas et al., 1997, and Saiz, 2007). Finally, at the end of this section, we discuss the mobility responses of the native born and their possible effects on the estimation results.

We use three different definitions of wage and labour supply ratios: annual, weekly, and hourly. The reason for this disaggregation is that workers who earn similar wages may work different hours/weeks on average, implying that a simple "head count" is an incomplete measure of the supply of labour in a particular education group (Card, 1997). Hence, for the first level, we use the ratio of annual labour income and the ratio of the number of immigrant workers over the number of native-born workers. At the second level, we calculate ratios of weekly incomes of immigrant and native-born earnings and of the corresponding average weeks worked during the year, within each education level. Lastly, we calculate the hourly income and density ratios.

Even though relative wages and the density of immigrants in local labour markets are specified in ratio forms with logarithmic transformation, the test results show that the existence of identically distributed error terms is strongly rejected. This fact, along with the spatial correlations across neighboring CDs, leads us to use robust standard errors adjusted by clusters in all estimations.[10] Moreover, as another potential source of heteroskedasticity, we consider the use of grouped data in which each observation is the average of microdata. Since means computed from larger samples are more accurate, it is possible that the standard deviation of the disturbance process is proportional to the size of the total workforce for each observation in a CD.[11] Therefore, in addition to ordinary least square (OLS) estimations, we also report weighted

[7] This method correlates economic outcomes (wage levels/employment ratios of native-born workers or local housing prices) in different regions with the density of immigrants in the local population. For an extensive literature review, see Friedberg and Hunt (1995).

[8] For the most recent discussion on the same issue, see Card and DiNardo (2000) .

[9] We assume that the observations are independent across provinces.

[10] It turned out that whether or not we adjust standard errors by provincial clusters makes little difference.

[11] We could consider this as a problem of non-random sampling. Unlike a rural CD, in a large CD (like Toronto), since millions of records are replaced by one CD record, an individual represents little weight in calculating the

least square (WLS) results in both Tables 1 and 2. So-called analytical weights[12] are calculated as the number of workers in annual estimations by the number of weeks and hours in weekly and hourly estimations proportional to the inverse of the observation's variance for each CD.

**Table 1**: **Elasticity of Substitution by Education Levels**

| | | OLS—with robust SE | | | | WLS—with analytical weights | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Annual** | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | Labour Ratio | -0.044 | 0.008 | 0.004 | 0.115 | 0.005 | 0.031 | 0.050 | 0.139 |
| | | 0.023 | 0.016 | 0.028 | 0.038 | 0.014 | 0.009 | 0.025 | 0.036 |
| | Age Difference | 0.185 | 0.655 | 0.357 | 0.092 | 0.626 | 0.889 | 1.125 | 1.184 |
| | | 0.262 | 0.221 | 0.241 | 0.295 | 0.284 | 0.137 | 0.190 | 0.292 |
| | Difference in School Years | 1.063 | 0.108 | 0.103 | 0.353 | 1.025 | 0.275 | -0.052 | 0.581 |
| | | 0.360 | 0.359 | 0.362 | 0.471 | 0.332 | 0.181 | 0.351 | 1.012 |
| | # of observations | 248 | 257 | 216 | 247 | 248 | 257 | 216 | 247 |
| | R square | 0.128 | 0.198 | 0.078 | 0.248 | 0.328 | 0.272 | 0.335 | 0.626 |
| **Weekly** | | | | | | | | | |
| | Labour Ratio | -0.040 | 0.003 | -0.008 | 0.102 | 0.012 | 0.025 | 0.043 | 0.127 |
| | | 0.023 | 0.016 | 0.026 | 0.036 | 0.012 | 0.008 | 0.025 | 0.035 |
| | Age Difference | -0.140 | 0.456 | 0.283 | 0.011 | 0.289 | 0.642 | 0.833 | 0.970 |
| | | 0.233 | 0.189 | 0.238 | 0.272 | 0.214 | 0.164 | 0.169 | 0.252 |
| | Difference in School Years | 0.958 | 0.134 | 0.367 | 0.546 | 0.869 | 0.247 | 0.183 | 0.793 |
| | | 0.381 | 0.328 | 0.346 | 0.416 | 0.323 | 0.189 | 0.317 | 0.877 |
| | # of observations | 248 | 257 | 216 | 247 | 248 | 257 | 216 | 247 |
| | R square | 0.119 | 0.057 | 0.058 | 0.245 | 0.278 | 0.208 | 0.282 | 0.619 |
| **Hourly** | | | | | | | | | |
| | Labour Ratio | -0.007 | 0.032 | 0.075 | 0.088 | 0.020 | 0.026 | 0.053 | 0.113 |
| | | 0.024 | 0.002 | 0.029 | 0.028 | 0.016 | 0.008 | 0.025 | 0.036 |
| | Age Difference | -0.287 | 0.462 | 0.431 | 0.035 | 0.142 | 0.611 | 0.723 | 0.883 |
| | | 0.258 | 0.206 | 0.263 | 0.274 | 0.240 | 0.165 | 0.156 | 0.189 |
| | Difference in School Years | 0.938 | -0.532 | -0.054 | 0.471 | 0.867 | -0.153 | 0.092 | 0.936 |
| | | 0.441 | 0.335 | 0.407 | 0.328 | 0.424 | 0.268 | 0.274 | 0.572 |
| | # of observations | 248 | 256 | 214 | 246 | 248 | 256 | 214 | 246 |
| | R square | 0.103 | 0.136 | 0.065 | 0.162 | 0.236 | 0.223 | 0.287 | 0.589 |

Notes: The dependent variable is the relative wage of native-born workers. The labour ratio is the labour supply of immigrant workers over that of native-born workers. Standard errors (SE) are reported under coefficients. All regressions have a set of dummy variables to control provincial- level fixed effects. We calculated robust SE adjusted by clusters (provinces) in both OLS and WLS. Analytic weights in WLS are calculated by the sample size of the workforce for each CD. All variables are in natural log forms. Education levels are represented by 1, 2, 3, and 4 as described in the text. $R^2$ is adjusted $R^2$ in all OLS estimations.

average. Because we want to conduct inference for a national random sample, we must equalize those weights by putting heavier weights on larger CDs. The weighting also yields more precise coefficients. For further discussion about WLS estimations and the choice of weights in cross-sectional studies, see Borjas et al. (2008) and Ottaviano and Giovanni (2006).

[12] This term was made up by STATA Corp.

## 4 Econometric Results and their Discussion

The estimation results of Equation (1) are provided in Table 1. We use the relative wage of native-born workers instead of that of immigrants as the dependent variable. Thus, while the coefficient of the labour ratio gives information about the elasticity of substitution between the immigrant and native-born workforce, it also shows the effect of immigrant density in the local labour force on the relative wage of native-born workers. Moreover, to control for skill differences in a particular education group, which may affect the differences in relative wages, we introduce differences in average age and school years to our base model.

One immediate observation emerges from Table 1: both OLS and WLS estimations consistently show that the coefficient of the labour ratio is statistically significant for education level 4 (university degree), while it is insignificant for education level 1 (high school or less) with all definitions of income and labour supply, indicating an imperfect substitution between immigrant and native-born workers in labour markets for the skilled workforce but a perfect substitution for the unskilled. Because of the reason explained in the previous sections, the annual hourly labour supply and income values are the most commonly used measures in the recent literature (Card 1997, Card and DiNardo, 2000, Ottoviano and Giovanni, 2006, Borjas et al., 2008). Our results with hourly values indicate that except for education level 1, no perfect substitution exists for the skilled workforce. Next, we discuss the Two-Stage-Least-Square (2SLS) results, which are provided in Table 2.

Table 2 shows that when we use labour supply values of recent immigrant workers as instrumental variables, the coefficients for the labour ratio become statistically significant in both 2SLS and 2SWLS estimations. This can be explained by two factors at the same time: (1) we have removed a possible bias caused by the endogeneity of labour supply ratios in estimations; and (2) newcomers need time to become accustomed to their new labour markets in Canada; therefore, an imperfect substitution between unskilled recent immigrants and native-born workers should not be a surprise.

How reliable are these results? As we indicated before, several issues are related to the structure of our data. We believe that the heteroskedasticity and spatial correlation problems are well addressed by WLS estimations and robust standard errors clustered by provinces. We took care of unobserved regional fixed effects at the provincial level but not at the CD level. This problem, omitted fixed effects at CD levels, however, could cause our results to be positively biased. For example, omitted fixed effects, such as better schooling for children, health care and climate could lead to higher local labour market outcomes and attract more immigrants at the same time. Therefore, this possible positive bias does not diminish the robustness of the result that unskilled immigrants are perfect substitutes for native-born workers, as shown in Table 1. Finally, the instrumental variables technique was adopted to address the last problem, i.e., that the density of immigrants in local labour markets could be endogenous.

Table 2 results show that recent unskilled immigrants are not perfect substitutes for native-born workers, and, as we remove the endogeneity problem, the results for the other education levels improve.

**Table 2: Elasticity of Substitution by Education Levels with IV**

| | | 2SLS | | | | 2SWLS | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Annual** | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| | Labour Ratio | 0.034 | 0.033 | 0.059 | 0.146 | 0.043 | 0.042 | 0.062 | 0.134 |
| | | 0.018 | 0.016 | 0.025 | 0.029 | 0.007 | 0.004 | 0.274 | 0.043 |
| | Age Difference | 0.085 | 0.970 | 1.239 | 0.335 | 0.815 | 1.191 | 1.465 | 1.459 |
| | | 0.361 | 0.307 | 0.286 | 0.402 | 0.402 | 0.148 | 0.155 | 0.373 |
| | Difference in School Years | -0.043 | -0.312 | -0.103 | 0.272 | 0.206 | 0.174 | -0.073 | 0.192 |
| | | 0.295 | 0.563 | 0.377 | 0.659 | 0.216 | 0.154 | 0.533 | 1.025 |
| | # of observations | 160 | 167 | 124 | 156 | 160 | 167 | 124 | 156 |
| | R Square | 0.180 | 0.219 | 0.346 | 0.429 | 0.505 | 0.395 | 0.488 | 0.676 |
| **Weekly** | | | | | | | | | |
| | Labour Ratio | 0.030 | 0.304 | 0.061 | 0.157 | 0.045 | 0.036 | 0.057 | 0.123 |
| | | 0.018 | 0.173 | 0.023 | 0.031 | 0.006 | 0.004 | 0.024 | 0.041 |
| | Age Difference | -0.261 | 0.939 | 0.883 | 0.122 | 0.472 | 0.997 | 1.128 | 1.243 |
| | | 0.306 | 0.259 | 0.301 | 0.438 | 0.308 | 0.136 | 0.171 | 0.314 |
| | Difference in School Years | -0.137 | -0.758 | 0.463 | -0.089 | 0.144 | 0.067 | 0.294 | 1.279 |
| | | 0.261 | 0.597 | 0.354 | 0.842 | 0.199 | 0.134 | 0.444 | 0.918 |
| | # of observations | 159 | 164 | 122 | 154 | 159 | 164 | 122 | 154 |
| | R Square | 0.191 | 0.199 | 0.280 | 0.415 | 0.468 | 0.326 | 0.438 | 0.665 |
| **Hourly** | | | | | | | | | |
| | Labour Ratio | 0.064 | 0.049 | 0.064 | 0.171 | 0.058 | 0.039 | 0.068 | 0.119 |
| | | 0.018 | 0.021 | 0.027 | 0.035 | 0.005 | 0.004 | 0.025 | 0.037 |
| | Age Difference | -0.331 | 0.970 | 0.816 | 0.402 | 0.277 | 0.980 | 0.905 | 1.144 |
| | | 0.307 | 0.400 | 0.269 | 0.439 | 0.285 | 0.099 | 0.204 | 0.265 |
| | Difference in School Years | -0.088 | -1.290 | 0.063 | -0.866 | 0.191 | -0.307 | 0.321 | 1.117 |
| | | 0.261 | 0.818 | 0.385 | 0.974 | 0.217 | 0.494 | 0.444 | 0.924 |
| | # of observations | 156 | 160 | 119 | 149 | 156 | 160 | 119 | 149 |
| | R Square | 0.219 | 0.249 | 0.202 | 0.288 | 0.490 | 0.332 | 0.477 | 0.641 |

Notes: The dependent variable is the relative wage of native-born workers. The labour ratio is the labour supply of immigrant workers over that of native-born workers. The instrumental variable is the labour supply of recent immigrants over that of native-born workers for three different definitions. Standard errors (SE) are reported under coefficients. We calculated robust SE adjusted by clusters (provinces) in both 2SLS and 2SWLS. All regressions have a set of dummy variables to control provincial level fixed effects. Analytic weights in WLS are calculated by the sample size of the workforce for each CD. All variables are in natural log forms. Education levels are represented by 1, 2, 3, and 4, as described in the text.

As we expressed before, the displacement effect of immigration can offset its labour market outcomes. A simple demand-supply analysis suggests that if for each new immigrant one native born individual leaves the region, the core assumption that immigration leads to an increase in the supply of labour in local labour markets is violated. While this is true in most area studies that use wage levels and employment rates for native-born workers as dependent variables, it becomes more difficult to predict the impact of out-migration on our regression results when relative wages are used. For example, in the presence of imperfect substitution, if there is no out-migration of natives, as the density of immigration increases, the relative wage of native-born workers should rise because the negative effect of new immigrants on the wage level of all

immigrants will be greater than that of native-born workers. Therefore, when a significant displacement of the native-born population occurs in response to local immigrant inflows, the relative wage of immigrants will rise even more. This brings us to the common issue in all elasticity of substitution studies: unless local crowding-out effects are controlled, the coefficients of labour ratios in cross-sectional studies reflect a positive bias, which depends on the significance of native-born mobility responses. As long as the bias is positive, however, this issue does not discredit the result that unskilled immigrant workers are perfect substitutes, as shown in Table 1.

## 5 Concluding Remarks

This study is the first to investigate whether the educational credentials of immigrants (foreign born) and native-born Canadians are perfect substitutes for each other in Canadian labour markets. Using data from the 2001 census, we estimated the elasticity of substitution between immigrant and native-born workers at four different education levels. All results consistently indicate the presence of perfect substitution in the workforce with the lowest level of education (high school or less) and imperfect substitution if the workers have at least a university degree. When we use hourly values for labour supply and income, the results show a robust imperfect substitution for all education levels, except for the lowest level. When we estimate the same regressions by using data only for recent immigrants, the results imply imperfect substitution at all education levels, indicating that even immigrants with the lowest level of education are imperfect substitutes when they are new in Canada. Based on this evidence, we conclude that while workers who arrive in Canada with only high school or less education are not treated differently in Canadian labour markets from their non-immigrant counterparts, those who arrive with post-high school education are treated differently from their non-immigrant counterparts. This conclusion points to the possibility of a lack of recognition in Canada of foreign education credentials at the post-high school level. In present day labour markets, when educational curricula around the world appear to be converging, this result could be attributed to 1) Canadian employers' lack of knowledge of foreign educational systems, 2) employers' perceived understanding of the education and training that immigrants bring with them, or 3) employer discrimination against immigrants originating from certain countries. All these issues should be investigated in a future study if an appropriate public policy response to this issue of foreign credential recognition is to be designed.

## References

Akbari, A.H. and DeVoretz, D. 1992. "Substitutability of Foreign-Born Labour in Canadian Production." Canadian Journal of Economics Volume XXV, No. 3.

Akbari, A.H. and Aydede, Y. 2009. "Effects of Immigration on Housing Prices in Canada." Atlantic Metropolis Centre Working Paper 24-2009.

Bloom, D.E., G. Grenier and M. Gunderson. 1995. "The Changing Labour Market Position of Canadian Immigrants." Canadian Journal of Economics 28:987-1005.

Borjas, G., Freeman, R.B., Katz, F.L., DiNardo, J., and Abowd, M.J. 1997. "How Much Do Immigration and Trade Affect Labor Market Outcomes?" Brookings Papers on Economic Activity, 1997(1).

Borjas, G., Grogger, J. and Hanson, H.G. 2008. "Imperfect Substitution between Immigrants and Natives: A Reappraisal" National Economic Bureau Research NBER Working paper 13887.

Card, D. 1997. "Immigrant Inflows, Native Outflows, and the Local Market Impacts of Higher Immigration." National Economic Bureau Research NBER Working paper 5927.

Card, D. and DiNardo, J. 2000. "Do Immigrant Inflows Lead to Native Outflows?" New Issues in Immigration Volume. 90(2).

Card, D. 2001. "Immigrant Inflows, Native Outflows, and the Local Labour Market Impacts of Higher Immigration." Journal of Labour Economics Vol. 19, p. 22-64.

Chiswick, B.R., C.U. Chiswick and P.W. Miller. 1986. "Are Immigrants and Natives Perfect Substitutes in Production?" International Migration Review Vol xix, No.4.

Friedberg, R. and Hunt, J. 1995. "The Impacts of Immigrants on Host Country Wages, Employment and Growth." Journal of Economic Perspectives, 9(2).

Ottaviano, G.I.P., and Giovanni, P. 2006. "Rethinking the Effects of Immigration on Wages." National Economic Bureau Research NBER Working paper 12497.

Saiz, A. 2007. "Immigration and Housing Rents in American Cities." Journal of Urban Economics, 61:345-71.