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Is STEM Education Portable? Country of Education and the Economic Integration of STEM Immigrants

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Abstract The core question in this research asks what are the occupational and earnings consequences of place of education for immigrants with bachelor's degrees or higher and whose highest degrees are in STEM fields compared to the native born. The focus is on immigrants with degrees in 15 countries which represent 88% of the immigration population of interest. In the analysis of the Canadian 2011 National Household Survey, STEM education is matched to three occupational outcomes: employment in STEM occupations, employment in other occupations usually requiring university bachelors' degrees or higher, and employment in all other occupations which usually require less than university education. The Canadian-born and permanent legal residents whose highest degrees in STEM fields are from institutions in Canada, the USA, the UK, and in the case of the foreign born, France, are more likely to be employed in either STEM occupations or high-skilled occupations requiring bachelors' degrees than are immigrants educated elsewhere; the latter are more likely to be employed in occupations that are not STEM related and usually do not require bachelor's degrees. Immigrant disadvantages are stronger for earnings; regardless of the location of their STEM education, immigrants earn less than the Canadian born who received university degrees in Canada. However, the size of the gap varies by the country of the highest degree with the largest gaps, relative to the Canadian born and Canadian educated, observed for immigrants who are educated in countries other than Canada, the USA, the UK, and France.

Keywords STEM · Science technology engineering mathematics · Immigrants · Foreign born · Fields of study · Occupational location · Earnings · Canada · Earning inequalities

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Introduction

In post-industrial countries, globalization and the knowledge economy go hand-in-hand with innovation and product development, thus increasing the importance of workers in science, technology, engineering, and mathematics (STEM). Related concerns about the size of the STEM labor supply are fueling immigration policy changes to increase the in-take of the highly trained in North America and elsewhere (Boyd 2014). Nations rely on the recruitment of foreign-born workers to such an extent that they are now over-represented in STEM occupations in Canada and the USA (Beckstead and Gellatly 2006; Council of Canadian Academies 2015a; b; Hango 2013; National Science Foundation 2014).

Researchers generally find strong positive associations between higher levels of education and labor market outcomes such as professional or high-status occupations and higher earnings. Because many STEM-educated migrants hold university degrees, it is reasonable to think they will be successful in the destination country's labor market. But, investigations into *where* education was obtained mostly conclude that immigrants are penalized for having foreign degrees (Arbeit and Warren 2013; Buzdugan and Halli 2009; Alboim et al. 2005; Kanas and van Tubergen 2009; Li and Sweetman 2014; Mata 2008; Xue and Xu 2010; Zeng and Xie 2004). Since many STEM-educated migrants have received their degrees outside the destination country, it is possible that these STEM migrants also will be disadvantaged in terms of their work and earnings.

By focusing on the top countries in which STEM immigrants obtain educational credentials, this paper extends existing North American research in two domains: the economic integration of a highly sought after workforce, notably STEM workers, and more generally, the value of international education for the economic integration of highly skilled immigrants. The analysis moves beyond crude categorizations of education received in—or outside—the destination country to consider specific countries where immigrants and the native-born alike have been educated. It focuses on the population most likely to be unaffected by location of education, the highly educated and in-demand STEM trained, making it a conservative test of the impact of educational location.

The core question is what are the economic consequences of place of education for immigrants whose highest degrees are in the STEM fields? Our approach distinguishes between those whose highest degrees were received in the destination country and those whose degrees were received elsewhere and compares their outcomes. A secondary question asks about consequences for the native born who are internationally educated in STEM fields. These questions are answered with the Canadian 2011 National Household Survey data on immigrant characteristics, educational attainments (level of education, fields of study, country/region of highest degree), and occupational and earning outcomes.

Our findings contribute to the fields of migrant integration and education in several ways. First, our study goes beyond the typical STEM/non-STEM occupational divide found in research by matching STEM education to three occupational outcomes: employment in STEM occupations, employment in other occupations usually requiring university bachelors' degrees or higher, and employment in all other occupations which usually require less than university education. Second, our treatment of location of education goes beyond the tendency of research to treat location as a binary outcome (educated in the host country/educated outside) or as regional aggregations. Instead, our analysis includes 15 specific countries of study that capture 88% of the immigrants in our study. Third, because immigrants from different countries differ in their STEM fields of study, our research design adjusts results for this mediating influence.

Results indicate that the occupational outcomes and earnings of those with bachelors' degrees and higher vary by place of highest education but also depend on the measure (occupation versus earnings) and nativity. The native born and permanent legal residents whose highest degrees in STEM fields are from institutions in Canada, the USA, the UK, and, in the case of the foreign born, France are the least likely to be employed in occupations that usually require less than a bachelor's degree and high percentages are employed in either STEM occupations or high-skilled occupations requiring bachelors' degrees. Immigrants educated elsewhere are more likely to be employed in occupations that are not STEM related. Immigrant disadvantages are stronger for earnings: regardless of whether they hold STEM, high skill or other occupations. Within these occupational clusters, earning outcomes vary by the country of STEM education and immigrants earn less than the Canadian born who received university degrees in Canada. However, the pattern found for occupational outcomes persists for earnings, with differentials the largest for those educated in countries other than the USA, the UK, and France. In particular, immigrants educated in selected countries in Eastern Europe, the Middle East, South Asia, and East Asia show large earning gaps relative to the Canadian born with Canadian degrees. These findings indicate that the portability of educational training remains an issue, even for a highly trained and highly sought after group of skilled workers.

Why Study Place of Education and STEM-Trained Immigrants?

Three background motivators exist for our study. First, North American investigations into immigrant economic integration show that the international education often is devalued. Compared to credentials received in the host country, foreign credentials are associated with lower employment rates (Gilmore and Le Petit 2008; Mata 2008; Plante 2010; Xue and Xu 2010), lower likelihood of working in occupations matching fields of study or requiring similar or higher levels of education (Adamuti-Trache 2016; Lo et al. 2010; Plante 2010), and lower earnings/earning growth (Adamuti-Trache and Sweet 2005; Arbeit and Warren 2013; Banerjee and Verma 2012; Banerjee and Lee 2015; Buzdugan and Halli 2009; Kaushal 2011; Lo et al. 2010; Plante 2010; Rollin 2011; Zeng and Xie 2004). Findings about the lower labor market returns to foreign education are robust, both in bivariate associations and after adjusting for compositional differences in socio-demographic factors, educational levels, educational fields, and language skills (Adamuti-Trache and Sweet 2005; Adamuti-Trache 2016; Arbeit and Warren 2013; Buzdugan and Halli 2009). A least five explanations exist for these findings, although most studies lack the appropriate measures to test for them. First, the quality of education may be lower for many countries, making internationally educated workers less productive (Li and Sweetman 2014). Second, skills acquired from foreign education may be less relevant to the successful performance of a job in the destination labor market (Chiswick and Miller 2009; Damelang and Abraham 2016). This lack of transferability applies most directly to immigrants who wish to work in a regulated occupation, such as engineering, accounting, law, or medicine (Adamuti-Trache et al. 2011; Boyd and Thomas 2001; Girard and Smith 2013). Third, in the absence of information on the quality and transferability of foreign education, employers may prefer host country credentials when hiring migrants because they signal the quality and relevancy of an immigrant's education (Banerjee and Lee 2015; Buzdugan and Halli 2009; Damelang and Abraham 2016; Sweetman et al. 2015; Zeng and Xie 2004). Conversely, and fourth, schooling outside the destination country along with ethnic-sounding names may cause employers to discriminate in their job hires (Dechief and Oreopoulos 2012; Oreopoulos 2011). Finally, location of study effects may reflect the immigrant's knowledge of the destination country culture and work practice and the development of networks that can be used in jobs searches by immigrants (Li 2008; Kanas and van Tubergen 2009).

Many studies operationalize location of study as a binary (destination country/ outside destination country). A second motivator for our study is that research also confirms that the devaluation of foreign credentials vary by regions and countries where degrees were received. Although the rank order of economic returns to specific country of education differs from study to study, there is a general pattern: returns to foreign education are higher if the education was received in countries with higher levels of economic development, with more highly ranked educational institutions and with the beliefs and practices of many post-industrial societies. In general, studies find that compared to those with host country credentials, immigrants with credentials from North America, Western and Northern Europe, and Australia have similar or higher labor market performances, while those with education from Asia, Africa, and Central and South America have significantly lower labor ones (Adamuti-Trache and Sweet 2005; Arbeit and Warren 2013; Buzdugan and Halli 2009; Gilmore and Le Petit 2008; Munro 2015; Lo et al. 2010; Plante 2010; Xue and Xu 2010). This pattern is considered to be consistent with human capital explanations on the quality and relevance of education and signaling theory. However, regional variations cannot be easily disassociated from ethnic and racial markers, and alternative explanations also may hold.

With rare exceptions, studies documenting the impact of place of education on labor market outcomes focus on workers regardless of their levels of education or on those with bachelor's degrees or higher. A third motivator for our study is that the STEM educated is a significant subset of the highly educated population from a policy perspective and from a labor supply perspective. The Council of Canadian Academies recent report on the relation between STEM skills and Canada's economic productivity confirms that in 2011, immigrants (permanent residents) age 25–54 represented 29% of the non-STEM educated compared to over half (51%) of the STEM educated with bachelor's degrees and higher (Council of Canadian Academies 2015b, Table B.5).

In Canada, over-representation of migrants in the STEM workforce relative to their total share of the labor force reflects policies on stimulating innovation and increasing the labor supply of STEM workers through early education interventions and though immigration policy changes. Beginning in the 1970s but rapidly growing in the 1980s and 1990s, new information technology-based products were developed in Canada by firms such as Mitel and Research In Motion Limited, now called BlackBerry Limited. Using broad definitions of information and communication technology, the Brookfield Institute for Innovation and Entrepreneurship (2016) estimates that in 2015, the technology sector accounted for 7.1% of the Canada 2015 economic output and consisted of over 864,000 employees. From the late 1980s on, the maintenance and expansion of this and other STEM-related sectors quickly became part of the innovation policy initiatives of the Canadian federal government, most recently showcased in the 2017 budget (see www.budget.gc.ca/2017/docs/plan/chap-01-en.html#Toc477707331). This budget included plans for growing the STEM pipeline by encouraging STEM learning by Canadian youth. Yet, the effectiveness of such efforts can be questioned; in the recent past, the Conference Board of Canada awarded a grade of C to previous learning attempts; the report cites a steady decline from previous years in the proportion of overall graduates in Canada who were in science, math, computer Science, and engineering fields (http://www.conferenceboard.ca/hcp/details/education/graduates-science-math-computer-science-engineerin.aspx).

Canada has a long history of using immigrants to meet labor demands; amid the concern over the training of Canadian youth for the STEM pipeline, immigration policy shifted admissions toward high skill workers, including STEM trained. In 1996, over half of all permanent resident admissions to Canada were in the economic class, with fewer entries in the family reunification and humanitarian classes. The skilled worker category is an important source of migrants in the economic class; principle applicants in this group must satisfy a point system that gives weight to higher education and English/French language skills. Additional newer categories for admission, such as the Canadian Experience Class, are designed to tap the pool of highly qualified international students, many of them with STEM backgrounds; other programs including the provincial nominee program offer the potential to recruit those with STEM expertise (Skuterud 2013). Research confirms the role of immigration in providing STEM labor; a comparison of trends between 1990 and 2000 finds that by 2000, greater numbers of engineering and computer science graduates were entering Canada as immigrants than were graduating from the Canadian university system (Picot and Hou 2009, Table 2).

Research Studies, Research Expectations

Despite the importance of the immigrant population as a source of labor for Canadian STEM jobs, detailed attention to their actual labor market integration is quite recent. One study documents that immigrants with university degrees who studied engineering, mathematics, applied sciences and technology, or computer science are more likely to be in occupations with low educational requirements in 2006 than in 1991 (Galarneau and Morissette 2008). A second analysis of the 2011 National Household Survey for workers age 25–34 with a university degree finds that immigrants who studied physical and life sciences and technology, mathematics, computer and information sciences and architecture, engineering, and related technologies are more likely to hold occupations with lower educational requirements (Uppal and LaRochelle-Côté 2014). In both studies, similar differentials exist for other fields of study, suggesting that many of the difficulties facing immigrants in the 2000s also hold for the STEM university-educated population.

These studies do not distinguish between immigrants receiving their STEM-related university degrees inside or outside Canada. Two US investigations show that international degrees depress the earnings of the STEM trained (Kaushal 2011; Tong 2010), with exceptions existing for those with Canadian or European degrees. For Canada, multivariate analysis of the 2011 National Household Survey shows that the STEM-educated immigrants who arrive as adults are less likely than the Canadian born to hold STEM occupations and they earn less than their Canadian born counterparts (Boyd and Tian 2017). These findings partially reflect nativity differences in socio-cultural characteristics, including language use. But a major factor underlying the occupational and earning differentials is the greater propensity of immigrants to have non-Canadian degrees.

The Boyd and Tian (2017) study treat location of final degree as a dichotomy, educated in Canada/not educated in Canada. Yet, studies of the highly educated find that the portability of international training varies, depending on the region or country in which the degrees are received (see Arbeit and Warren (2013); Kaushal (2011); Tong (2010)). Starting with the 1975 Immigration Act (effective 1978), and reaffirmed in the Immigration and Refugee Protection Act 2002, immigrants primarily come from countries other than the USA and Europe. Census data show that in 2016, nearly seven out of ten immigrants were not born in the USA and Europe with almost half from Asia, including the Middle East (www.statcan.gc.ca/eng/dai/btd/othervisuals/other009). Birthplace and location of studies are highly correlated (Hango et al. 2015, Table 2), implying that higher devaluation penalties may exist for these STEM immigrants who are not trained in countries such as the USA, Canada, or West/North Europe but who are increasingly coming to Canada.

This paper extends previous research on STEM immigrant workers by incorporating detailed countries of education into the analysis. We emphasize country rather than larger geographic regions, because educational systems and their characteristics are usually functions of national governments. Our goal is to demonstrate the country of education variability in labor market outcomes that exist within the immigrant and Canadian university educated STEM population; this not only provides a foundation for future research but also adds to, and refines, our knowledge of the labor market integration of the STEM educated. We expect to find the following:

1. Compared to the Canadian born trained in Canada, STEM immigrants educated outside Canada are disadvantaged in the labor force with respect to occupations and earnings.
2. Earning differentials between the Canadian born, the Canadian educated, and the immigrants educated in countries outside Canada are smaller for those employed in STEM occupations and the largest for those working in non-STEM, non-high skill occupations
3. The disadvantages associated with the STEM place of education indicate a hierarchy in which STEM-educated immigrants who are educated in advanced post-industrial democracies (Canada, USA, West or Northern Europe, etc.) are less penalized than those educated elsewhere.
4. Occupational profiles and earning differentials by nativity and location of study are robust; most cannot be explained by location of study groups having different demographic characteristics, language capabilities, educational level, and type of STEM majors.

Data Source, Sample, and Location of Education

Small surveys often lack the sample size necessary for examining detailed countries of education; consequently, our study analyzes data from the 2011 National Household Survey (NHS) which is a voluntary survey mandated by a 2010 Federal Cabinet decision to replace the mandatory census of population. It was administered to one in three households (4.5 million), with a weighted response rate of 78%. The data are considered internally robust by Statistics Canada, as relationships between variables observed in earlier censuses continue to hold. A university-based Research Data Centre (RDC) permits research access to the Masterfile of the Survey once a topic-specific proposal has been vetted and approved by the Social Sciences and Humanities Research Council (SSHRC) and Statistics Canada.

We compare non-Aboriginal Canadian-born workers and immigrant workers who are permanent legal residents and majored in STEM fields of study. We exclude the foreign born who are in Canada temporarily; Canada lacks a program equivalent to the US H1B program, and most workers in its Temporary Worker Program are considered “unskilled” as defined by the educational levels required for their jobs. Instead, the policy emphasis for the past 20 years has been the recruitment of highly skilled permanent residents (Boyd 2014).

The population of interest is restricted to those aged 25–64 and in the experienced labor force, defined as those who held an occupation for part or all of January 2010–May 2011. This age range represents the core labor force population. Only immigrant workers who arrived at or after age 25 are included given our interest in the relationship between place of education and labor market outcomes for adult migrants targeted by Canada’s immigration policies. We omit immigrant adults arriving during or after 2010 and all respondents still in school (September 2010 to May 2011); both group have partial or no 2010 earnings in Canada, and their labor market behavior will differ from those who have finished their education. We also exclude persons with trade diplomas, apprenticeships, and college degrees, because the correspondence of their STEM skills to STEM occupations is less certain (see Council of Canadian Academies (2015a)) and because immigration policy emphasis is on the highly skilled, usually defined as those with university degrees and higher.

The STEM-educated population consists of those with bachelor’s degrees or higher and with STEM fields of study. The latter are from the Classification of Instructional Programs (CIP) Canada 2011, using a classification developed at Statistics Canada (2013). In the multivariate analysis, we collapse these STEM fields of study into seven broader categories; health-related fields such as medicine are excluded in keeping with definitions of core STEM occupations (Council of Canadian Academies 2015a; Lowell 2010).

As place of education is a focal variable of interest affecting occupational outcomes and earnings, the Canadian-born and foreign-born populations are classified by the country where the highest degree was received. The NHS lists 185 countries of education outside Canada. To reflect the distribution of where the Canadian-born population was educated, we distinguish between the Canadian-born educated in Canada and those educated in the USA, the UK, and all other countries. For the immigrant population, we identify the 15 largest countries of education, including Canada and a final category for all other countries. These larger countries are the USA, the UK, France, Poland, Romania, Russian

Federation, Ukraine, Algeria, Iran, China, South Korea, Philippines, India, and Pakistan. Sample sizes for "all other countries" are smaller, with 22% of the immigrants in the study distributed across the remaining 161 countries.

Measuring Economic Outcomes

Our basic question asks how the native-born and foreign-born STEM educated do in the labor force, focusing on two commonly used economic outcomes: occupations and earnings. With occupations, the research task is to assess the nativity differences in the match and mismatch of the field of expertise with the work performed while employed. For the STEM trained, employment in STEM occupations (or non-STEM occupations) indicates if their STEM educational training is relevant for their jobs (Boudarbat and Chernoff 2012; Lowell et al. 2009; Mishagina 2009). We develop a classification of core STEM occupations from the 500 occupational groups in the National Occupational Classification 2011 (Statistics Canada 2012), displayed in Appendix 1. This classification includes three senior management positions in architecture, engineering, and computers and information sciences.

The Council of Canadian Academies (2015a) notes that not working in a STEM occupation imperfectly indicates training waste; those with STEM training can be found and indeed may seek out employment in other occupations where they produce value-added innovation. A theoretical mathematician who programs complex algorithms for derivatives for a financial institution is an example. To better depict the employment sites of the STEM educated, we refine the classification of non-STEM occupations by creating a category for the "high skilled." Canada's official National Classification of Occupations (NOC) indicates the level of education most commonly found in each occupational title. Skill level A, also referred to as high skilled in immigration statistics, includes all occupations that normally require university education or higher. We also include select managerial occupations, defined as NOC classification 0, in the non-STEM skilled category when 50% or more of the entire workforce with specific managerial titles has bachelors' degrees or higher[1] (Appendix 1). Taken together, the occupational reclassifications produce three occupational sites for the STEM-educated population with university bachelors' degrees or higher: employed in STEM occupations; employed in non-STEM occupations normally requiring university education; employed in all other occupations, normally requiring less than a bachelor's degree. Since the population under investigation has bachelors' degrees or higher, employment in the last category indicates mismatches both by educational attainment and by expected jobs, given the STEM fields of studies.

Earnings are generally considered to represent remuneration for skills and productivity. From a more practical perspective, earnings also allow workers to buy goods and

[1] In NOC, managerial occupations form level O. However, the occupational titles for manager are heterogeneous, ranging from senior executives to middle managers, such as retail managers (e.g., variety store managers), food and beverage managers, and agricultural managers; the latter category includes a wide range, such as dairy farmers, chicken farmers, maple syrup producers, and market gardeners (see http://noc.esdc.gc.ca/English/noc/OccupationIndex.aspx?ver=11). As a result of this heterogeneity, occupational titles in level O are not assigned an educationally based "skill" level by the Economic and Social Development Canada which manages the NOC classification scheme.

services, including housing, health, food, and other items. We use the natural logarithm of weekly earnings to take into account the fluctuations in weeks worked and to adjust for any skewed earnings distributions. The earning analysis is restricted to those who have a bachelor's degree or above in a STEM field of study, arrived before 2010, worked for a week or more in 2010, and reported 2010 earnings. Unlike the USA where the American Community Survey asks respondents to indicate hours worked in the previous year, the National Household Survey asks for hours worked in the week preceding the May 10, 2011 survey. Consequently, the metric for the 2010 earnings data is weekly wages, not hourly rates. Consistent with the initial focus on occupational sites of employment, comparisons of earnings by country of education are done for each site (STEM, high skill, and other occupations). Earnings on average vary between these three clusters of occupations, and occupational site-specific analysis allows wage determination models to vary across these sites.

Methods and Methodologies

Multinomial regression analysis assesses nativity differentials in the occupational locations of those with STEM degrees, and ordinary least square regression assesses the earnings. These methods employ a main effects methodology, reflecting substantial attenuation in numbers when interactions are employed for many of the countries of education. However, the main effects methodology proceeds in three steps, to better illuminate the impact of factors also known to influence occupational location and earnings. The basic "unadjusted" results are first presented, followed by findings that indicate the patterns that would exist if all country of location groups had the same distributions for age, sex, marital status, current place of residence in Canada, language use, and the highest level of educational attainment (years of schooling data were not collected starting with the 2006 census). The final "adjusted" model indicates the occupational and earning outcomes if all groups had the same distributions across STEM fields of study. Comparisons of models 2 and 3 thus indicate the impacts of country specific patterns of STEM fields of study.

All these variables are related to labor market outcomes. Individuals gain work experience as they grow older, which influences occupational careers and earnings but the gains over the life course can flatten; studies of wage determination typically include both a continuous and a quadratic measure of age are included in the analysis. Numerous studies document gender inequality in wages and in other labor market outcomes exists among the Canadian born and immigrants. Married men and women tend to have earnings premiums (Killewald and Gough 2013). Place of residence is used to capture local labor market variations in industrial mix and labor force compositions which in turn affects the individuals' labor market; such variations potentially confound nativity earning gaps, because the vast majority of immigrants concentrate in large census metropolitan areas (CMAs), especially in Toronto, Montreal, and Vancouver (Haan 2008). Destination country language skill is another possible predictor of the labor market outcomes of immigrant versus native-born STEM degree holders. In the US and Australian censuses/ACS, language proficiency is measured in terms of how well a person speaks English; studies frequently treat it as a measure of human capital where higher levels of proficiency are associated with greater productivity in the market. However, the NHS does not have direct measures of language proficiency, emphasizing knowledge or use of official languages instead. We construct a four-category language-use typology based on NHS questions on mother tongue, language most often spoken at home, and language regularly spoken at home. Educational attainment often is used as a proxy for experience or skill and it is central in human capital perspectives that view investments in formal education as enhancing job productivity and earnings (Becker 1962). The analysis includes the highest degrees obtained, ranging from bachelors' degrees only to those with medical, dentistry, and PhD degrees. Finally, STEM fields of study vary in the likelihood of employment in STEM jobs and in the level of earnings (Lavoie and Finnie 1999); the NHS includes nearly 1500 titles for fields of study; these are collapsed into six areas representing major STEM areas of study.

Characteristics of the STEM Educated

Table 1 highlights the geographical concentration of the Canadian born and immigrants with bachelors' degrees or higher, as well as correlates of the major countries in which they were educated. Virtually, all the Canadian born were educated in Canada and to a much lesser extent in the USA and the UK; these countries, as well as France, have high gross national income per capita (GNI) and their official languages are English and/or French. Collectively, over one in four immigrants (28%) received his/her highest education in these four countries. The remaining immigrants received their highest degrees in countries characterized by lower GNI per capita and by official languages other than English and/or French (excluding Philippines, India, and Pakistan). Studies have used per capita income as a proxy for educational quality, and official language can be considered a measure of exposure to Canada's official languages. However, given the small number of countries considered in this study (which nonetheless covers nearly all the Canadian-born and nearly 80% of the selected foreign-born population), our analysis does not test directly for contextual effects. That said, many immigrants are educated in lower GNI countries where quality of education may be an issue for the national population, and where exposure to English and/or French may be limited.

RDC releases rules governing the minimum size of unweighted *n*s in cells prevent us from showing detailed characteristics of immigrants by specific countries of educational location. However, Table 2 demonstrates differences between four groups defined by nativity and whether the highest degree was received in the destination country (Canada) or elsewhere. Men are approximately 70% of the STEM educated, confirming the well-documented absence of women in STEM curricula (Council of Canadian Academies 2015b; Hango 2013). Compared to the Canadian born and Canadian educated, the foreign born, whose highest degrees were received outside of Canada are older on average, have higher percentages currently married and are far more likely to live in Toronto (44 versus 15%). The foreign-born STEM educated, in general, have higher percentages living in Canada's 10 largest CMAs, and this is especially true for those educated outside Canada; only 1% reside in non-CMA areas. Consistent with country of origin shifts in immigration (Boyd and Alboim 2012; Boyd and Vickers 2017), very high percentages of STEM immigrants claim non-English, non-French language usage (defined as having both a mother tongue language and a mostly or

Table 1 Population size, percentages, GNI per capital, and official language by 15 largest countries of the highest degree Canadian born and immigrants, arriving at age 25 or later, age 25–64, Canada 2011

Place of education of the highest degree	Population counts, rounded	Percent total	Percent by nativity	2010 gross national income per capita	Official language(s)
Total	706,340	100.0			
Canadian born, Educated in			100.0		
Canada	402,370	57.0	96.9	46,543	Eng/Fr[a]
USA	8940	1.3	2.2	48,881	English
UK	2085	0.3	0.5	39,206	English
All other countries	1970	0.3	0.5	(NA)	(NA)
Immigrants, educated in			100.0		
Canada	47,055	6.7	16.2	46,543	Eng/Fr[a]
USA	14,895	2.1	5.1	48,881	English
UK	12,575	1.8	4.3	39,206	English
France	6305	0.9	2.2	41,537	Fr
Poland	5240	0.7	1.8	12,150	Other
Romania	12,445	1.8	4.3	8172	Other
Russian Federation	10,890	1.5	3.7	10,345	Other
Ukraine	7530	1.1	2.6	2921	Other
Algeria	3895	0.6	1.3	4053	Other
Iran	6680	0.9	2.3	6301	Other
China	40,875	5.8	14.0	4541	Other
South Korea	5160	0.7	1.8	22,173	Other
Philippines	21,220	3.0	7.3	2858	Other and English
India	25,060	3.5	8.6	1331	Other, English[b]
Pakistan	8080	1.1	2.8	1083	Other and English
All other countries	63,070	8.9	21.7	(NA)	(NA)

Sources: population counts and percentages are from the Research Data Centre 2011 National Household. Survey file; 2010 Gross National Income Per Capita is from the World Bank, World Bank Data, databank.worldbank.org/data/reports.aspx?source=2&series=NY.GNP.PCAP.KD&country=#, accessed February 17, 2017; English/French data are from The CIA Factbook, www.cia.gov/library/publications/resources/the-world-factbook/index.html, accessed February 17, 2017

[a] English and French are the two official languages

[b] English is not an official language, but it has the status of a subsidiary language and is widely used in national, political, and business-related communications

regular use of a language at home that is neither English nor French); this is highest for the foreign born who received their highest degrees outside Canada.

Groups defined by nativity and location of study also differ with respect to the highest level of education attained, in the STEM fields of study, in type of occupation, and in earnings. Three quarters of the Canadian born with Canadian education have

Table 2 Demographic, educational, and economic characteristics for Canadian born and immigrants (arrived 25 and older, arrived before year 2010). [a]STEM degree holders in the experienced labor force, age 25–64, by location of the highest degree, Canada, 2011

	Total population	Canadian born, highest degree in		Foreign born, highest degree in	
		Canada	All other countries	Canada	All other countries
Population counts, rounded	706,340	402,370	12,995	47,055	243,920
Percent, row	100	57.0	1.8	6.7	34.5
Sex (%)	100.0	100.0	100.0	100.0	100.0
Women	28.4	29.1	27.3	25.9	27.9
Men	71.6	70.9	72.7	74.1	72.1
Age (mean)	43.5	42.0	44.0	44.5	45.9
Marital status (%)	100.0	100.0	100.0	100.0	100.0
Married/CL	79.4	73.6	70.6	84.6	88.6
Single	14.2	20.2	19.8	8.8	5.0
Other	6.4	6.2	9.7	6.6	6.4
CMA (%)	100.0	100.0	100.0	100.0	100.0
Toronto	26.3	15.2	16.3	29.9	44.4
Quebec	2.4	3.8	1.2	1.3	0.5
Montreal	13.4	14.3	8.5	17.2	11.5
Ottawa	6.4	7.3	7.1	10.0	4.1
Hamilton	1.9	2.2	2.2	1.9	1.5
Kitchener	2.0	2.0	1.8	2.3	2.0
Winnipeg	2.0	2.2	2.0	2.1	1.6
Edmonton	3.8	3.9	3.8	4.7	3.5
Calgary	7.2	7.3	9.8	7.1	7.0
Vancouver	9.1	6.1	10.4	9.8	13.9
All other CMAs	19.1	26.0	27.7	12.5	8.7
All other areas	6.3	9.7	9.1	1.3	1.4
Language use (%)	100.0	100.0	100.0	100.0	100.0
MT, most, reg=EngFr	58.9	92.1	90.2	13.6	11.2
MT=EngFr, most, and/or reg=Oth	2.2	1.6	2.3	3.2	3.0
MT=Oth, most=EngFr, reg=EngFr	7.9	3.7	3.7	17.0	13.3
MT=Oth, most, and/or reg=Oth	31.0	2.6	3.8	66.2	72.6
Educational level (%)	100.0	100.0	100.0	100.0	100.0
Bachelor's degree	65.1	75.6	43.4	34.9	54.6
University above bachelor	8.3	5.6	5.0	7.7	13.1
Master's degree	19.6	14.1	29.3	38.5	24.6
MD, Dentistry and Ph.D.	7.0	4.6	22.3	18.9	7.8
STEM field of study (%)	100.0	100.0	100.0	100.0	100.0

Table 2 (continued)

	Total population	Canadian born, highest degree in		Foreign born, highest degree in	
		Canada	All other countries	Canada	All other countries
Life sciences	20.0	26.5	32.4	12.4	10.2
Physical sciences	9.4	9.3	10.8	8.1	9.8
Engineering	46.9	40.0	35.0	47.8	58.8
Science technicians	1.0	1.0	2.1	1.0	0.7
Mathematicians, Computer Sci., and IT	19.8	19.5	16.9	28.8	18.8
Agricultural sciences	2.9	3.7	2.9	1.9	1.7
Occupational groups (%)	100.0	100.0	100.0	100.0	100.0
STEM occupations	46.9	49.0	35.6	55.8	42.3
High-skilled occupations	17.9	20.8	32.9	19.2	12.1
All other occupations	35.2	30.2	31.5	25.0	45.6
Actual weekly earning (mean)[(b)]	1757	1955	2274	1714	1405
Log weekly earning (mean)[(b)]	7.1	7.2	7.3	7.1	6.9

Source: Research Data Centre 2011 National Household Survey Master Data File

[(a)] Age 25–64, bachelor's degrees and above, has an occupation code, not attending school, and non-indigenous (previously labeled non-Aboriginal in Statistics Canada documents)

[(b)] For those who worked at least 1 week and had positive earnings in 2010

only bachelors' degrees; all other groups have higher percentages with post-bachelor degrees. Those born in Canada but holding their highest degrees from elsewhere have the highest percentages with medical, dentistry, and PhD degrees, followed by immigrants who received their last degrees in Canada. Among the STEM educated, the three top fields of study are life sciences, engineering, and the combined area of mathematics, computer science, and information technology. However, the concentration in these areas varies by nativity and location of study. Compared to the Canadian born, immigrants—especially those educated outside Canada—are most likely to have studied engineering, followed by mathematics, computer science, and information technology. Our multivariate analysis takes into account these fields of study differences.

Not all who are STEM educated are employed in STEM occupations, as defined in Appendix 1; many hold non-STEM high-skilled occupations, defined as requiring at least a university degree. Approximately seven out of ten of the Canadian born, educated in or outside Canada, hold either STEM or high-skilled occupations. Consistent with the higher percentages with post-university degrees and with training in math, computer science, and information technology, three quarters of immigrants with Canadian degrees are also found in these occupations. For the foreign born with degrees outside Canada, fewer than half work in STEM occupations; almost half (46%) are in non-STEM, lower-skilled occupations. Their average earnings also are the lowest; the Canadian-born STEM trained has the highest average earnings, especially those receiving their highest degrees outside Canada.

Countries of Education and STEM Occupations

Multinomial logistic regression highlights the general stability of the results even after adjusting for differences among groups in demographic characteristics, language use, levels of education, and STEM fields of study (Appendix 2, Table 1). For ease of presentation, predicted probabilities (expressed as chances out of 100) are calculated using the margins command in STATA13. They are presented in Table 3, first as unadjusted results, then adjusting for distributional differences among groups in demographic characteristics, language use, and levels of educational attainment, and then, adjusting for the impacts of country of education differences in STEM fields of study.

The baseline unadjusted probabilities (Table 3, columns 2–4) are identical to observed percentages for nativity and country of education groups. These show the advantages of education in Canada, the USA, and the UK for the Canadian born and of education in France for immigrants. Not all are employed in STEM occupations, but many are in high-skilled ones; persons with the highest degrees from Canada, the USA, the UK, and France are the least likely to be employed in all other occupations. Immigrants educated in Eastern Europe countries, notably Poland, Romania, Russian Federation, and Ukraine, and those educated in Iran and China, have comparatively high percentages in STEM occupations (40% or more), but high percentages, relative to the Canadian born, are also employed in non-STEM, non-skilled (or "other") occupations. Mismatches, defined as employed in "other occupations," are the highest for those educated in the remaining countries, including Algeria (51%), South Korea (72%), Philippine (67%), India (52%), and Pakistan (58%).

These occupational patterns are reasonably stable, even after taking into account the roles of group variations in demographic characteristics, language use, and educational attainments, and field of study. Multinomial analysis (Appendix 2, Table 1) and probabilities (expressed as hypothetical chances out of 100) indicate shifts for the Canadian born educated in the USA and the UK toward higher proportions in non-STEM, non-high-skilled occupations; these shifts reflect what would be their occupational profiles if they had the identical distributions of the entire population. In other words, if the Canadian born had the same demographic, language, and educational attainments of the overall population, they would be less likely to work in high-skilled occupations and more likely to work in non-STEM, non-high-skilled (or other) occupations (Table 3, columns 6–8). This is particularly true for the Canadian born educated in the UK and in other countries. Comparisons of the actual and hypothetical estimates in other occupations (non-STEM, not high-skill) show increases by 12 and 11% for the Canadian born in the UK and elsewhere (Table 3, column 8 versus column 4). A major factor underlying the shifts is that these two groups have high levels of education, as do those educated in the USA (see Table 1, columns 2–3 for educational levels). Taking field of study into account only very marginally changes the chances of working or not working in STEM or high-skilled occupations for the Canadian born (Table 3, columns 10–12 versus 6–8).

The multivariate analyses indicate modest changes in country-of-education outcomes for immigrants were they to have exactly the demographic and educational attainment distributions as the overall population (Table 3, columns 6–8 versus 2–4). The exception is immigrants receiving their highest degrees in France; here, the pattern parallels the findings for the Canadian born; the chances of holding other occupations

Table 3 Chances out of 100[a] of working in a STEM occupation, a high-skilled occupation, or other occupation, by CB/FB and the 14 largest location of the study, Canada, 2011

	Model A: unadjusted				Model B: net of demographic, language use, and educational level				Model C: further net of STEM fields of study			
	Total	(1) STEM occupations	(2) High-skilled occupations	(3) All other occupations	Total	(1) STEM Occupations	(2) High-Skilled Occupations	(3) All Other Occupations	Total	(1) STEM Occupations	(2) High-Skilled Occupations	(3) All Other Occupations
Nativity and location of study groups												
Canadian born, educated in												
Canada	100.0	49.0	20.8	30.2	100.0	49.8	20.0	30.2	100.0	51.4	19.2	29.4
USA	100.0	34.8	30.2	35.0	100.0	37.0	22.9	40.1	100.0	38.5	22.2	39.3
UK	100.0	37.4	43.4	19.2	100.0	42.7	25.9	31.4	100.0	43.5	25.8	30.6
All other countries	100.0	37.1	34.3	28.7	100.0	38.7	21.3	40.0	100.0	39.3	21.2	39.5
Foreign born, educated in												
Canada	100.0	55.8	19.2	25.0	100.0	56.1	14.8	29.1	100.0	52.9	15.5	31.6
USA	100.0	45.5	24.4	30.1	100.0	47.3	17.2	35.5	100.0	44.4	17.7	37.9
UK	100.0	49.9	20.0	30.1	100.0	53.1	13.5	33.3	100.0	50.6	14.1	35.2
France	100.0	49.9	24.6	25.5	100.0	47.6	15.6	36.8	100.0	45.3	15.5	39.1
Poland	100.0	40.8	9.6	49.4	100.0	45.0	6.5	48.5	100.0	41.8	7.2	51.0
Romania	100.0	50.7	9.3	40.1	100.0	54.6	9.1	36.3	100.0	49.7	10.9	39.3
Russian Federation	100.0	45.9	13.1	41.0	100.0	49.2	9.8	41.0	100.0	44.8	10.8	44.5
Ukraine	100.0	40.7	8.9	50.4	100.0	44.5	7.3	48.2	100.0	39.5	8.3	52.2
Algeria	100.0	34.3	14.9	50.8	100.0	32.1	18.9	49.0	100.0	30.7	18.8	50.5
Iran	100.0	45.8	10.0	44.2	100.0	49.5	11.7	38.8	100.0	46.7	13.0	40.3
China	100.0	48.3	9.3	42.4	100.0	50.8	9.9	39.3	100.0	46.2	11.0	42.8

Table 3 (continued)

	Model A: unadjusted				Model B: net of demographic, language use, and educational level				Model C: further net of STEM fields of study			
	Total	(1) STEM occupations	(2) High-skilled occupations	(3) All other occupations	Total	(1) STEM Occupations	(2) High-Skilled Occupations	(3) All Other Occupations	Total	(1) STEM Occupations	(2) High-Skilled Occupations	(3) All Other Occupations
South Korea	100.0	21.2	6.7	72.1	100.0	23.8	8.1	68.1	100.0	20.9	8.3	70.8
Philippines	100.0	27.3	6.0	66.7	100.0	31.5	7.7	60.8	100.0	28.0	8.5	63.5
India	100.0	37.5	10.6	52.0	100.0	37.8	10.3	52.0	100.0	37.9	10.0	52.1
Pakistan	100.0	34.3	8.2	57.5	100.0	33.3	9.1	57.6	100.0	33.1	8.7	58.1
All other countries	100.0	43.4	12.6	44.0	100.0	45.4	11.8	42.8	100.0	42.9	12.5	44.6

Source: multinomial regressions in Appendix 2, Table 6

[a] If divided by 100, figures are converted into probabilities. Predicted probabilities are calculated by the margins procedure in STATA 13

would be higher than observed for those educated in France if everyone had identical distributions for demographic and educational attainment characteristics (Table 3 columns 6–8 versus 2–4). Taking into account the country of education-specific differences in fields of study also diminishes the chances of holding STEM occupations and increases chances of holding non-STEM, non-high-skilled occupations (Table 3 columns 6–8 versus 10–12). For most countries of study, the magnitude of the shifts into other occupations is greater than observed for the Canadian born after taking fields of study into account. This likely reflects the fact that immigrants trained both in and outside Canada are more likely than the Canadian born to study engineering, mathematics, computer science, or information technology (Table 2). Adjusting for group differences in fields of study effectively gives the same overall distribution to all groups. The result is that the impact of majoring in engineering and ICT-related fields on STEM or high skill occupations is diminished for many immigrant groups, and the chances of working in other occupations increase.

Despite the changes that occur in the employment sites after successively taking into account specific country of education demographic and educational characteristics, the basic patterns remain: STEM-educated immigrants, particularly those educated outside of Canada (those than the USA, the UK, or France), are more likely than the Canadian born, Canadian educated to be employed in occupations that are not STEM or high-skilled occupations. This is portrayed graphically in Chart 1 which shows the countries of study arranged from the lowest to the highest employed in STEM occupations. Additional rankings of country of education using actual percentages versus rankings which adjust for compositional differences (Table 3, columns 2–4 versus) produce Spearman's Rho correlations of 0.97, 0.78, and 0.96 for employment in STEM, high-skill, and other occupations, respectively. These scores indicate that substantial changes do not occur after socio-demographic controls. Stated differently, the actual findings on employment sites are fairly

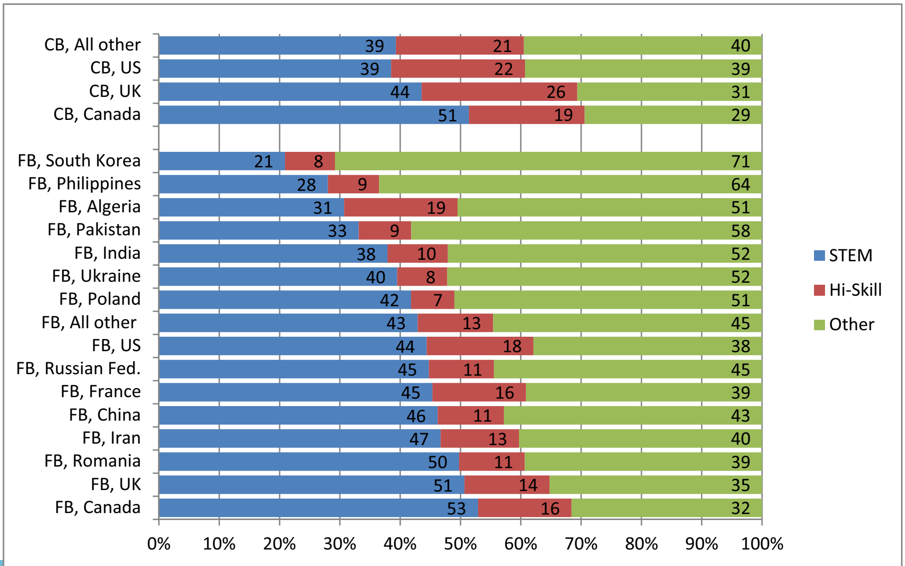

Chart 1. Chances out of 100 of working in STEM, high skill, or other occupations, by country of study, from multivariate Model C, Table 3

stable even when statistical adjustments are made for group differences in demographic and educational characteristics.

Place of Education and Earnings

Table 4 shows earning differentials by country of education specific to each occupational site (STEM, high-skill, and other occupations). In OLS regression, logged (ln) weekly earnings are expressed relative to the weekly earnings of the Canadian-born Canadian educated (Appendix 2, Table 7) and transformed into percentage deviations (Halvorsen and Palmquist 1980). Model A indicates deviations with no adjustments for compositional differences in demographic characteristics, language use, highest education, and field of study; model B shows the deviations that would exist if all groups defined by the location of the highest degree had the same distributions with respect to their demographic characteristics and educational attainments. Model C shows the deviations that exist taking into account all these compositional characteristics, including field of study.

Among the Canadian born educated in the USA or in the UK, actual average wages either are higher are than those of the Canadian born or are not significantly different (Table 4, columns 1 and 4); this holds across occupations defined as STEM, high skilled, and other occupations. However, education in all other countries does confer a 22% penalty for the STEM-educated Canadian born who work in other occupations (Table 4, column 7). The pattern is different for immigrants who arrive at age 25 or later. Table 4 (columns 1, 4, and 7) shows that STEM-educated immigrants, regardless of where their highest education was received and regardless of where they are employed, receive lower weekly earnings than the Canadian-born Canadian educated who also work in the same set of occupations (STEM, high skill, or other occupations).

At the same time, the negative consequences are not uniform, varying by employment site and country of education. Within all three occupational locations (STEM, high-skilled, other occupations), the actual earning gaps between the Canadian born with Canadian highest degrees and the immigrants educated in Canada, the USA, the UK, and France are among the smallest, with larger earning gaps observed for those educated in other countries (we note that immigrants educated in the UK in fact have higher actual earnings). The actual earning gaps between the Canadian-born Canadian educated and the immigrants educated in China (PRC), South Korea, and Pakistan are among the largest (Table 4, columns 1, 4, and 7). Those educated in Ukraine or Algeria also experience substantially lower 2010 weekly earnings on average relative to the Canadian-born Canadian educated, although the magnitude varies according to earlier observed patterns of whether employment is in STEM, high-skilled, or other occupations.

The patterns discussed previously by nativity and countries of STEM education are for the actual observed earnings. In fact, earning differentials become slightly greater when differences in composition are considered in model B (Table 4, columns 2 versus 1, columns 5 versus 4, and columns 8 versus 7), partly because such adjustments mitigate the earnings impact of higher educational attainments, such as medicine, dentistry and PhD degrees, and the concentration of these immigrants in Canada's largest (and generally higher paying) cities. Earnings between the STEM Canadian born and Canadian education and the immigrants differentials also increase slightly again, when country differences in fields of study are taken into account (Table 4, columns 3, 6, and 9).

Table 4 Percent deviations of 2010 weekly earnings and significance[(a)] for STEM degree holders, by CB/FB (arrived age 25 and older, arrived before year 2010)[(a)], 15 countries of study, and in STEM, high-skilled, or all other occupations, Canada, 2011 NHS

	In STEM occupations			In high-skilled occupations			In all other occupations		
	Unadjusted model A	Adjusted model B[(b)]	Adjusted model C[(c)]	Unadjusted model A	Adjusted model B[(b)]	Adjusted model C[(c)]	Unadjusted model A	Adjusted model B[(b)]	Adjusted model C[(c)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Nativity and location of study groups									
Canadian born, educated in									
Canada	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)
USA	11.1**	0.2 (ns)	− 0.2 (ns)	13.6**	0.8 (ns)	0.5 (ns)	9.3 (ns)	2.4 (ns)	2.6 (ns)
UK	8.1 (ns)	− 1.6 (ns)	− 0.2 (ns)	21.8***	10.7 (ns)	9.3 (ns)	18.9 (ns)	17.7 (ns)	17.9 (ns)
All other countries	0.9 (ns)	− 1.6 (ns)	− 1.3 (ns)	−8.2 (ns)	− 14.7 (ns)	− 15.0 (ns)	− 22.4*	− 19.4 (ns)	− 21.5*
Foreign born, educated in									
Canada	− 8.1***	− 13.8***	− 14.8***	− 8.2**	− 13.2***	− 15.0***	− 24.7***	− 27.8***	− 29.2***
USA	− 6.8*	− 16.7***	− 17.4***	6.4 (ns)	− 4.6 (ns)	− 6.4 (ns)	− 29.0***	− 34.1***	− 35.4***
UK	8.4**	− 6.0*	− 7.2*	17.8**	0.2 (ns)	− 1.0 (ns)	− 9.5 (ns)	− 18.9***	− 21.2***
France	− 11.8***	− 13.6***	− 14.1***	− 11.6*	− 19.9***	− 20.6***	− 22.1***	− 26.6***	− 27.6***
Poland	− 9.2 (ns)	− 18.8***	− 20.4***	− 17.9 (ns)	− 16.1 (ns)	− 17.4 (ns)	− 31.2***	− 29.0***	− 33.5***
Romania	− 15.5***	− 19.0***	− 21.6***	− 14.6**	− 8.3 (ns)	− 11.8*	− 26.7***	− 27.5***	− 33.5***
Russian Federation	− 18.0***	− 24.9***	− 26.6***	− 34.8***	− 38.3***	− 39.7***	− 46.0***	− 47.0***	− 50.6***
Ukraine	− 19.9***	− 25.7***	− 27.8***	− 47.1**	− 44.2**	− 45.9**	− 41.3***	− 42.6***	− 47.1***

Table 4 (continued)

	In STEM occupations			In high-skilled occupations			In all other occupations		
	Unadjusted model A	Adjusted model B[(b)]	Adjusted model C[(c)]	Unadjusted model A	Adjusted model B[(b)]	Adjusted model C[(c)]	Unadjusted model A	Adjusted model B[(b)]	Adjusted model C[(c)]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Algeria	− 34.8***	− 33.3***	− 33.1***	− 22.7**	− 18.9*	− 20.4*	− 49.5***	− 50.9***	− 52.1***
Iran	− 14.8***	− 19.1***	− 21.6***	− 21.4**	− 17.0*	− 18.4*	− 49.3***	− 50.3***	− 52.7***
China	− 23.4***	− 29.4***	− 30.9***	− 40.8***	− 40.1***	− 41.5***	− 44.2***	− 47.1***	− 50.2***
South Korea	− 23.7***	− 33.2***	− 33.9***	− 47.4***	− 46.7***	− 47.6***	− 54.9***	− 57.3***	− 59.3***
Philippines	− 17.8***	− 23.1***	− 25.3***	− 20.1***	− 14.2*	− 15.9**	− 31.0***	− 32.8***	− 37.1***
India	− 16.3***	− 20.9***	− 21.8***	− 34.1***	− 33.7***	− 34.1***	− 39.6***	− 44.1***	− 44.6***
Pakistan	− 31.6***	− 37.6***	− 37.6***	− 43.7***	− 43.8***	− 44.4***	− 44.6***	− 51.5***	− 52.0***
All other countries	− 15.2***	− 20.7***	− 22.0***	− 20.9***	− 22.9***	− 24.0***	− 38.6***	− 40.1***	− 42.6***

Source: Appendix 2, Table 7

RG reference group

[(a)] Significance levels are shown for the underlying OLS regression coefficients for logged (ln) weekly earnings

[(b)] Net of demographic information, language use, and educational level

[(c)] Net of variables listed in (b) and STEM fields of study

In order to simplify the amount of information contained in the analysis of 15 separate locations of study and three occupational sites of employment, Chart 2 highlights the final results for several immigrant countries of education, based on the largest STEM countries of education for immigrants (Table 1). These results graphically show what the earning gap, relative to the Canadian born and Canadian educated, would be if all groups had the same distributions for select demographic variables and for educational attainment and fields of study (Table 4, model C). Immigrants whose final education was received in Canada still earn less if they are employed in STEM or high-skilled occupations. Others such as those educated in the USA or the UK would have lower earnings (relative to the Canadian born) if they were employed in STEM occupations but their weekly earnings in high-skilled occupations are not statistically different from the Canadian born and educated who are employed in high-skilled occupations. The size of the earning gaps in STEM and high skill occupations are larger for immigrants educated in Romania, India, the Russian Federation, China, and South Korea. For those in non-STEM, non-high-skilled occupations, earning differences are even greater. Compared to the Canadian born who received STEM training in Canada and who work in other occupations, immigrants educated in Canada on average would earn nearly 30% less with differentials rising to over 50% less for those educated in the Russian Federation and nearly 60% less for immigrants educated in South Korea.

In short, earning stratification exists for STEM-trained immigrants regardless of where their degrees were obtained. Additionally, the magnitude of earning differences by occupational site of employment also interacts with the country of education. Compared to the earnings of the Canadian-born and the Canadian-educated counterparts, penalties are less severe for immigrants employed in STEM occupations. In high skill occupations, the size of the earning gaps varies by country of education for immigrants but the gaps are higher for those not educated in Canada, the USA, the

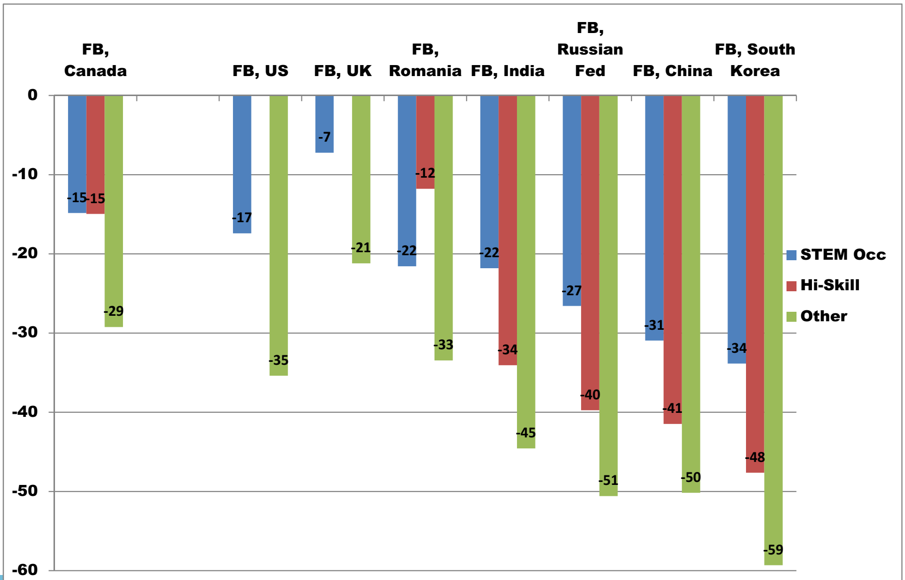

Chart 2. Percent deviation of 2010 weekly earnings for immigrants by sector of employment, relative to Canadian Born, Canadian Educated (Model C, Table 4)

UK, or France (see Table 4, model C). And the wage gaps are higher still for those in all other occupations.

Conclusions

Our analysis adds to the body of research on immigrant STEM workers in three ways. First, we pay special attention to the location of the highest degree obtained, for both the Canadian born and the immigrants from 15 countries. Second, with country of study in mind, we examine where the STEM educated are occupationally situated, distinguishing between those in STEM occupations, those in high-skill occupations, and those in other occupations usually requiring less than a university education (Tables 2, 3, 5 and 6). Third, we demonstrate how country of final degree in STEM fields and occupational sites operate to stratify the earnings of STEM immigrants, particularly in relation to the earnings of the Canadian born whose highest degrees were obtained in Canada (Tables 4 and 7).

The analysis confirms differences by nativity and country of the highest degree in the likelihood of employment in STEM, high-skill, and other occupations, and in earnings deviations in relation to the Canadian born with Canadian degrees. Although each country of education has its own variations, we see three patterns: first, differences are either insignificant or small between the Canadian-born who were educated in Canada, the USA, the UK, or elsewhere and immigrants educated in the same places. Second, immigrants educated in Canada, the USA, the UK, and France are similar to the Canadian-born Canadian educated in their occupational location; they do earn less, but the earning gaps are lower than for immigrants educated elsewhere. Third, higher percentages of immigrants educated in other countries are employed in other occupations and have even lower earnings. Simply put, degrees from countries in Eastern Europe and Asia are not as portable for STEM-educated immigrants as those from Canada, the USA, the UK, and France. These findings hold after statistically taking into account compositional differences among groups in demographic characteristics and in levels of education and fields of study. Generally speaking, the results are similar to research on the consequences of international education for the labor market integration of all immigrants, suggesting that STEM-trained migrants also are not exempt from such integration difficulties.

These empirical findings invite additional analysis. For starters, refinement in explanatory variables such as language and educational training could add additional insights into the country of education results. The Canadian census currently collects the highest level of attainment using a limited number of categories; years of education has not been part of the census since 2001. Other than fields of study, no additional detail on educational programs is collected. In combination, the lack of such information prevents precise comparisons of educational equivalencies. For example, do persons trained in engineering or in IT fields in China take programs of study that are similar to those offered in Canada? If not, does that help explain the occupations and earnings of these individuals relative to the Canadian born and educated? Also, the census focuses on language use is consistent with the constitutionally mandated bilingualism of Canada, but it does not necessarily capture the skill or proficiency of people in the destination languages.

Additional factors not captured in the Canadian census also may help to explain disparities by country of education. Unlike the Canadian National Survey of Graduates which surveys only those with Canadian degrees, the comprehensive US National Survey of Graduates inventories all college graduates living in the USA and provides information on a number of factors that influence the labor market outcomes of immigrants, including work-related history, employer characteristics, job training, and work outside the USA. Immigrants are asked about their reasons for coming to the USA and about their first entry visa type. Class of entry (or visa type) may explain some of the findings for STEM immigrants in countries characterized by past humanitarian flows to Canada, such as Poland, Romania, Ukraine, and Iran. There are plans to append entry status information from immigration records to 2016 census records, so this type of analysis may soon be feasible.

Left unattended and in need of future research is why a hierarchy of differences by country of education exists for STEM workers. Our research conclusively shows that differences in the chances of employment in STEM, high skill, and the remaining occupations as well as earnings within those sites of employments exist; university-educated (or higher) immigrants who migrate as adults (age 25–64) and who received STEM education in countries other than Canada, the USA, the UK, and France often are less likely to be employed in STEM or high-skilled occupations, and they earn less on average in these occupational clusters. Compared to smaller surveys, census data can indicate the differences that exist by many countries of study. But in-depth targeted surveys or qualitative studies will be required to further explore why these patterns exist.

Appendix 1

Table 5 Classification of STEM occupations and high-skill occupations

2011 NHS NOC code[a]	
	STEM occupational classification[b]
131	Telecommunication carriers managers
211	Engineering managers
212	Architecture and science managers
213	Computer and information systems managers
2111	Physicists and astronomers
2112	Chemists
2113	Geoscientists and oceanographers
2114	Meteorologists and climatologists
2115	Other professional occupations in physical sciences
2121	Biologists and related scientists
2122	Forestry professionals
2123	Agricultural representatives
2131	Civil engineers
2132	Mechanical engineers
2133	Electrical and electronics engineers
2134	Chemical engineers

Table 5 (continued)

2011 NHS NOC code[a]	
2141	Industrial and manufacturing engineers
2142	Metallurgical and materials engineers
2143	Mining engineers
2144	Geological engineers
2145	Petroleum engineers
2146	Aerospace engineers
2147	Computer engineers (except software engineers and designers)
2148	Other professional engineers, n.e.c.
2154	Land surveyors
2161	Mathematicians, statisticians and actuaries
2171	Information systems analysts and consultants
2172	Database analysts and data administrators
2173	Software engineers and designers
2174	Computer programmers and interactive media developers
2175	Web designers and developers
2211	Chemical technologists and technicians
2212	Geological and mineral technologists and technicians
2221	Biological technologists and technicians
2222	Agricultural and fish products inspectors
2223	Forestry technologists and technicians
2224	Conservation and fishery officers
2225	Landscape and horticulture technicians and specialists
2231	Civil engineering technologists and technicians
2232	Mechanical engineering technologists and technicians
2233	Industrial engineering and manufacturing technologists and technicians
2241	Electrical and electronics engineering technologists and technicians
2242	Electronic service technicians (household and business equipment)
2243	Industrial instrument technicians and mechanics
2244	Aircraft instrument, electrical and avionics mechanics, technicians and inspectors
2253	Drafting technologists and technicians
2254	Land survey technologists and technicians
2255	Technical occupations in geomatics and meteorology
2261	Non-destructive testers and inspection technicians
2262	Engineering inspectors and regulatory officers
2271	Air pilots, flight engineers and flying instructors
2274	Engineer officers, water transport
2281	Computer network technicians
2282	User support technicians
2283	Information systems testing technicians
5224	Broadcast technicians
5241	Graphic designers and illustrators

Table 5 (continued)

2011 NHS NOC code[a]	
	Non-STEM, high-skill occupations[c]
12	Senior government managers and officials
13	Senior managers—financial, communications, and other business services
14	Senior managers—health, education, social and community services, and membership organizations
111	Financial managers
124	Advertising, marketing and public relations managers
311	Managers in health care
411	Government managers—health and social policy development and program administration
412	Government managers—economic analysis, policy development, and program administration
413	Government managers—education policy development and program administration
414	Other managers in public administration
421	Administrators—post-secondary education and vocational training
422	School principals and administrators of elementary and secondary education
433	Commissioned officers of the Canadian Forces
511	Library, archive, museum, and art gallery managers
1111	Financial auditors and accountants
1112	Financial and investment analysts
1113	Securities agents, investment dealers, and brokers
1114	Other financial officers
1121	Human resources professionals
1122	Professional occupations in business management consulting
1123	Professional occupations in advertising, marketing and public relations
2151	Architects
2152	Landscape architects
2153	Urban and land use planners
3011	Nursing coordinators and supervisors
3012	Registered nurses and registered psychiatric nurses
3111	Specialist physicians
3112	General practitioners and family physicians
3113	Dentists
3114	Veterinarians
3121	Optometrists
3122	Chiropractors
3124	Allied primary health practitioners
3125	Other professional occupations in health diagnosing and treating
3131	Pharmacists
3132	Dietitians and nutritionists
3141	Audiologists and speech-language pathologists
3142	Physiotherapists
3143	Occupational therapists
3144	Other professional occupations in therapy and assessment

Table 5 (continued)

2011 NHS NOC code[(a)]	
4011	University professors and lecturers
4012	Post-secondary teaching and research assistants
4021	College and other vocational instructors
4031	Secondary school teachers
4032	Elementary school and kindergarten teachers
4033	Educational counselors
4111	Judges
4112	Lawyers and Quebec notaries
4151	Psychologists
4152	Social workers
4153	Family, marriage and other related counselors
4154	Professional occupations in religion
4155	Probation and parole officers and related occupations
4156	Employment counselors
4161	Natural and applied science policy researchers, consultants, and program officers
4162	Economists and economic policy researchers and analysts
4163	Business development officers and marketing researchers and consultants
4164	Social policy researchers, consultants, and program officers
4165	Health policy researchers, consultants, and program officers
4166	Education policy researchers, consultants, and program officers
4167	Recreation, sports and fitness policy researchers, consultants, and program officers
4168	Program officers unique to government
4169	Other professional occupations in social science, n.e.c.
5111	Librarians
5112	Conservators and curators
5113	Archivists
5121	Authors and writers
5122	Editors
5123	Journalists
5125	Translators, terminologists
5131	Producers, directors, choreographers, and related occupations
5132	Conductors, composers, and arrangers
5133	Musicians and singers
5134	Dancers
5135	Actors and comedians
5136	Painters, sculptors and other visual artists

(a) Refers to the code used in the RDC master data file for the 2011 National Household Survey

(b) Classification devised by authors based on STEM fields of study and detailed occupational descriptions from the National Occupational Classification matrix posted by Employment and Social Development Canada http://noc.esdc.gc.ca/English/noc/welcome.aspx?ver=11

(c) Defined by NOCs as requiring a university education or higher. Managerial occupations which have no designated educational requirement are included if 50% (or more) of all incumbents of these occupations had bachelor's degrees and above

Appendix 2

Table 6 Multinomial regressions predicting likelihoods of working in STEM occupations, high-skilled occupations versus in all other occupations for STEM degree holders, by CB/FB

	Model A: unadjusted				Model B: net of demographic, language				Model C: further net of STEM fields of Study			
	(1) Working in STEM		(2) Working in high-skill occ		(3) Working in STEM		(4) Working in high-skill occ		(5) Working in STEM		(6) Working in high-skill occ	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Nativity and location of study groups												
Canadian born, educated in												
Canada												
USA	−0.492	***	0.223	**	−0.581	***	−0.148	(ns)	−0.578	***	−0.142	(ns)
UK	0.182	(ns)	1.185	***	−0.194	(ns)	0.219	(ns)	−0.206	(ns)	0.257	(ns)
All other countries	−0.233	(ns)	0.543	***	−0.534	***	−0.219	(ns)	−0.563	***	−0.196	(ns)
Foreign born, educated in												
Canada	0.317	***	0.108	**	0.156	***	−0.265	***	−0.044	(ns)	−0.288	***
USA	−0.074	(ns)	0.161	**	−0.214	***	−0.309	***	−0.399	***	−0.337	***
UK	0.021	(ns)	−0.038	(ns)	−0.033	(ns)	−0.485	***	−0.195	***	−0.489	***
France	0.183	*	0.330	***	−0.242	**	−0.444	***	−0.410	***	−0.496	***
Poland	−0.677	***	−1.263	***	−0.577	***	−1.595	***	−0.758	***	−1.532	***
Romania	−0.251	***	−1.093	***	−0.093	(ns)	−0.973	***	−0.323	***	−0.854	***
Russian Federation	−0.375	***	−0.768	***	−0.320	***	−1.020	***	−0.551	***	−0.990	***

Table 6 (continued)

	Model A: unadjusted				Model B: net of demographic, language				Model C: further net of STEM fields of Study			
	(1) Working in STEM		(2) Working in high-skill occ		(3) Working in STEM		(4) Working in high-skill occ		(5) Working in STEM		(6) Working in high-skill occ	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Ukraine	−0.700	***	−1.360	***	−0.580	***	−1.476	***	−0.837	***	−1.416	***
Algeria	−0.881	***	−0.854	***	−0.924	***	−0.538	***	−1.057	***	−0.559	***
Iran	−0.449	***	−1.113	***	−0.258	**	−0.784	***	−0.410	***	−0.706	***
China	−0.356	***	−1.142	***	−0.245	***	−0.964	***	−0.482	***	−0.936	***
South Korea	−1.708	***	−2.006	***	−1.551	***	−1.709	***	−1.777	***	−1.711	***
Philippines	−1.379	***	−2.046	***	−1.157	***	−1.652	***	−1.377	***	−1.587	***
India	−0.814	***	−1.223	***	−0.819	***	−1.209	***	−0.875	***	−1.222	***
Pakistan	−1.003	***	−1.583	***	−1.047	***	−1.431	***	−1.120	***	−1.468	***
All other countries	−0.499	***	−0.878	***	−0.440	***	−0.871	***	−0.595	***	−0.847	***
Age					−0.026	***	0.003	*	−0.024	***	0.003	**
Sex												
Female					−0.763	***	0.427	***	−0.475	***	0.361	***
Male					(rg)							
Marital status												
Married/CL					(rg)							
Single					−0.097	***	−0.031	(ns)	−0.079	**	−0.048	(ns)
Other					−0.189	***	−0.051	(ns)	−0.202	***	−0.066	(ns)
Region of residence (CMA)												
Toronto					(rg)							

Table 6 (continued)

	Model A: unadjusted				Model B: net of demographic, language				Model C: further net of STEM fields of Study			
	(1) Working in STEM		(2) Working in high-skill occ		(3) Working in STEM		(4) Working in high-skill occ		(5) Working in STEM		(6) Working in high-skill occ	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Quebec					0.606	***	0.222	***	0.558	***	0.226	***
Montreal					0.143	***	−0.106	**	0.099	***	−0.074	*
Ottawa					0.648	***	0.463	***	0.620	***	0.463	***
Hamilton					−0.293	***	−0.110	(ns)	−0.244	***	−0.077	(ns)
Kitchener					0.274	***	0.091	(ns)	0.254	***	0.113	(ns)
Winnipeg					−0.068	(ns)	−0.320	***	0.045	(ns)	−0.324	***
Edmonton					0.007	(ns)	−0.111	*	0.085	*	−0.056	(ns)
Calgary					0.483	***	−0.207	***	0.490	***	−0.150	**
Vancouver					−0.088	**	−0.165	***	−0.036	(ns)	−0.152	***
All other CMAs					−0.051	*	−0.026	(ns)	0.042	(ns)	0.011	(ns)
All other areas					−0.411	***	−0.332	***	−0.257	***	−0.274	***
Language use												
MT, most, reg=EngFr					(rg)							
MT=EngFr, most, and/or reg=Oth					−0.124	*	−0.043	(ns)	−0.158	**	−0.038	(ns)
MT=Oth, most=EngFr, reg=EngFr					−0.003	(ns)	−0.098	*	−0.046	(ns)	−0.084	(ns)
MT=Oth, most, and/or reg=Oth					−0.110	***	−0.390	***	−0.173	***	−0.361	***
Bachelor’s degree					(rg)							
University above bachelor					0.061	*	0.399	***	0.057	*	0.413	***
Master’s degree					0.557	***	0.898	***	0.620	***	0.903	***

Table 6 (continued)

	Model A: unadjusted				Model B: net of demographic, language				Model C: further net of STEM fields of Study			
	(1) Working in STEM		(2) Working in high-skill occ		(3) Working in STEM		(4) Working in high-skill occ		(5) Working in STEM		(6) Working in high-skill occ	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
MD and Ph.D.					0.936	***	2.454	***	1.241	***	2.463	***
STEM fields of study												
Engineering (incl. technicians)												
Life sciences									− 1.294	***	0.242	***
Physical sciences									− 0.425	***	0.228	***
Science technicians									− 0.615	***	0.186	(ns)
Mathematics and computer sciences									0.308	***	0.690	***
Agricultural sciences									− 1.098	***	0.035	(ns)
Constant	0.486	***	− 0.370	***	1.652	***	− 0.851	***	1.799	***	− 1.119	***
Log pseudolikelihood	− 709,988				− 667,158				− 645,443			
Pseudo R-square	0.025				0.084				0.113			

Source: RDC Master Data File of the 2011 National Household Survey

(ns) not significant

*$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$

Table 7 OLS models of log weekly earnings for STEM degree holders, by CB/FB (arrived age 25 and older, arrived before year 2010)[a], 15 countries of study, and in STEM, high-skilled, or all other occupations, Canada, 2011 NHS

	In STEM occupations						In high-skilled occupations						In all other occupations					
	Model A		Model B		Model C		Model A		Model B		Model C		Model A		Model B		Model C	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Nativity and location of study groups																		
Canadian born, educated in																		
Canada	(rg)		(rg)		(rg)		(rg)		(rg)		(rg)		(rg)		(rg)			
USA	0.105	**	0.002	(ns)	−0.002	(ns)	0.128	**	0.008	(ns)	0.005	(ns)	0.089	(ns)	0.024	(ns)	0.026	(ns)
UK	0.078	(ns)	−0.016	(ns)	−0.002	(ns)	0.198	***	0.101	(ns)	0.089	(ns)	0.173	(ns)	0.163	(ns)	0.165	(ns)
All other countries	0.009	(ns)	−0.016	(ns)	−0.013	(ns)	−0.085	(ns)	−0.159	(ns)	−0.163	(ns)	−0.253	*	−0.216	(ns)	−0.243	*
Foreign born, educated in																		
Canada	−0.085	***	−0.148	***	−0.161	***	−0.085	**	−0.142	***	−0.162	***	−0.284	***	−0.326	***	−0.346	***
USA	−0.070	*	−0.183	***	−0.191	***	0.062	(ns)	−0.047	(ns)	−0.066	(ns)	−0.342	***	−0.417	***	−0.437	***
UK	0.081	**	−0.062	*	−0.075	*	0.164	**	0.002	(ns)	−0.010	(ns)	−0.100	(ns)	−0.210	***	−0.238	***
France	−0.125	***	−0.147	***	−0.152	***	−0.124	*	−0.222	***	−0.231	***	−0.249	***	−0.310	***	−0.322	***

Table 7 (continued)

	In STEM occupations						In high-skilled occupations						In all other occupations					
	Model A (1) Unadjusted		Model B (2) Adjusted 1: demographic information + language use + educational level		Model C (3) Adjusted 2: broad STEM fields of study		Model A (4) Unadjusted		Model B (5) Adjusted 1: demographic information + language use + educational level		Model C (6) Adjusted 2: broad STEM fields of study		Model A (7) Unadjusted		Model B (8) Adjusted 1: demographic information + language use + educational level		Model C (9) Adjusted 2: broad STEM fields of study	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Poland	−0.097	(ns)	−0.208	***	−0.229	***	−0.197	(ns)	−0.175	(ns)	−0.191	(ns)	−0.375	***	−0.342	***	−0.408	***
Romania	−0.169	***	−0.211	***	−0.243	***	−0.158	**	−0.087	(ns)	−0.125	*	−0.311	***	−0.322	***	−0.407	***
Russian Federation	−0.198	***	−0.287	***	−0.309	***	−0.428	***	−0.483	***	−0.507	***	−0.617	***	−0.635	***	−0.705	***
Ukraine	−0.222	***	−0.296	***	−0.325	***	−0.638	**	−0.584	**	−0.614	**	−0.533	***	−0.555	***	−0.636	***
Algeria	−0.427	***	−0.404	***	−0.401	***	−0.258	**	−0.210	*	−0.228	*	−0.682	***	−0.711	***	−0.735	***
Iran	−0.160	***	−0.212	***	−0.243	***	−0.240	**	−0.186	*	−0.204	*	−0.680	***	−0.699	***	−0.748	***
China	−0.267	***	−0.348	***	−0.370	***	−0.523	***	−0.512	***	−0.536	***	−0.583	***	−0.637	***	−0.696	***
South Korea	−0.271	***	−0.403	***	−0.413	***	−0.643	***	−0.630	***	−0.647	***	−0.796	***	−0.850	***	−0.899	***
Philippines	−0.196	***	−0.263	***	−0.292	***	−0.224	***	−0.154	*	−0.173	**	−0.371	***	−0.398	***	−0.464	***
India	−0.178	***	−0.235	***	−0.246	***	−0.417	***	−0.412	***	−0.416	***	−0.504	***	−0.582	***	−0.590	***
Pakistan	−0.380	***	−0.472	***	−0.471	***	−0.574	***	−0.577	***	−0.587	***	−0.591	***	−0.724	***	−0.735	***
All other countries	−0.165	***	−0.231	***	−0.249	***	−0.235	***	−0.260	***	−0.274	***	−0.488	***	−0.513	***	−0.555	***
Age			0.080	***	0.082	***			0.106	***	0.106	***			0.110	***	0.106	***
Age squared/100			−0.079	***	−0.081	***			−0.108	***	−0.107	***			−0.121	***	−0.117	***

Table 7 (continued)

	In STEM occupations						In high-skilled occupations						In all other occupations					
	Model A		Model B		Model C		Model A		Model B		Model C		Model A		Model B		Model C	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Sex																		
Female			−0.136	***	−0.092	***			−0.230	***	−0.201	***			−0.364	***	−0.298	***
Male			(rg)		(rg)				(rg)		(rg)				(rg)		(rg)	
Marital status																		
Married/CL			(rg)		(rg)				(rg)		(rg)				(rg)		(rg)	
Single			−0.141	***	−0.136	***			−0.128	***	−0.128	***			−0.215	***	−0.203	***
Other			−0.062	***	−0.060	***			−0.046	(ns)	−0.047	(ns)			−0.089	***	−0.084	***
Region of residence (CMA)																		
Toronto			(rg)		(rg)				(rg)		(rg)				(rg)		(rg)	
Quebec			−0.246	***	−0.240	***			−0.218	***	−0.216	***			−0.076 (ns)		−0.093	*
Montreal			−0.082	***	−0.092	***			−0.122	***	−0.124	***			−0.114 ***		−0.125	***
Ottawa			0.048	***	0.041	**			0.060	*	0.064	**			−0.052 (ns)		−0.053	(ns)
Hamilton			−0.016	(ns)	−0.020	(ns)			−0.083	(ns)	−0.078	(ns)			−0.040 (ns)		−0.035	(ns)
Kitchener			0.051	**	0.047	*			−0.009	(ns)	−0.018	(ns)			−0.058 (ns)		−0.060	(ns)

Table 7 (continued)

	In STEM occupations						In high-skilled occupations						In all other occupations					
	Model A		Model B		Model C		Model A		Model B		Model C		Model A		Model B		Model C	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Winnipeg			−0.126	***	−0.115	***			−0.144	***	−0.123	**			−0.173 ***		−0.155	***
Edmonton			0.091	***	0.083	***			0.055	(ns)	0.069	(ns)			0.042 (ns)		0.043	(ns)
Calgary			0.256	***	0.242	***			0.072	(ns)	0.079	*			0.195 ***		0.186	***
Vancouver			−0.016	(ns)	−0.015	(ns)			−0.130	***	−0.120	***			−0.101 ***		−0.090	***
All other CMAs			−0.074	***	−0.070	***			−0.100	***	−0.087	***			−0.105 ***		−0.099	***
All other areas			−0.159	***	−0.141	***			−0.206	***	−0.185	***			−0.333 ***		−0.322	***
Language use																		
MT, most, reg=EngFr			(rg)		(rg)				(rg)		(rg)				(rg)		(rg)	
MT=EngFr, most, and/or reg=Oth			−0.085	***	−0.086	***			−0.143	**	−0.152	**			−0.103	**	−0.110	**
MT=Oth, most=EngFr, reg=EngFr			−0.064	***	−0.071	***			−0.084	**	−0.091	**			−0.061	**	−0.068	**
			−0.100	***	−0.111	***			−0.172	***	−0.182	***			−0.171	***	−0.183	***

Table 7 (continued)

	In STEM occupations						In high-skilled occupations						In all other occupations					
	Model A		Model B		Model C		Model A		Model B		Model C		Model A		Model B		Model C	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)		(9)	
	Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study		Unadjusted		Adjusted 1: demographic information + language use + educational level		Adjusted 2: broad STEM fields of study	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
MT=Oth, most, and/or reg=Oth																		
Educational level																		
Bachelor's degree			(rg)		(rg)				(rg)		(rg)				(rg)		(rg)	
University above bachelor			0.002	(ns)	0.003	(ns)			−0.007	(ns)	−0.008	(ns)			−0.002	(ns)	−0.015	(ns)
Master's degree			0.052	***	0.062	***			0.021	(ns)	0.031	(ns)			0.043	*	0.049	*
MD and Ph.D.			0.098	***	0.145	***			0.198	***	0.227	***			0.110	**	0.152	***
STEM fields of study																		
Engineering (incl. technicans)					(rg)						(rg)						(rg)	
Life sciences					−0.230	***					−0.116	***					−0.221	***
Physical sciences					−0.078	***					−0.099	***					−0.173	***
Science technicians					−0.259	***					−0.106	*					−0.180	***

Table 7 (continued)

	In STEM occupations						In high-skilled occupations						In all other occupations					
	Model A (1) Unadjusted		Model B (2) Adjusted 1: demographic information + language use + educational level		Model C (3) Adjusted 2: broad STEM fields of study		Model A (4) Unadjusted		Model B (5) Adjusted 1: demographic information + language use + educational level		Model C (6) Adjusted 2: broad STEM fields of study		Model A (7) Unadjusted		Model B (8) Adjusted 1: demographic information + language use + educational level		Model C (9) Adjusted 2: broad STEM fields of study	
	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.	Coef.	Sig.
Mathematics and computer sciences					−0.078	***					0.015	(ns)					−0.191	***
Agricultural sciences					−0.285	***					−0.141	**					−0.247	***
Constant	7.348	***	5.576	***	5.583	***	7.235	***	4.946	***	5.006	***	7.028	***	4.948	***	5.140	***
R-square	0.016		0.082		0.091		0.025		0.094		0.097		0.060		0.122		0.130	

Source: RDC Master Data File of the 2011 National Household Survey

(ns) not significant

*$p \leq 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$

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