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# Match or mismatch? The employment of immigrant engineers in Canada's labor force

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**Abstract.** Using major field of study and labor force data from the 1996 Canadian census, this paper assesses variations in the correspondence between training in engineering fields and employment patterns. Following a review of the issues associated with under-valuation of credentials, comparisons are made between Canadian born men age 30–54 and permanent residents who immigrated at children and those who immigrated at age 28 or later with respect to labor force participation, employment, and occupational location. Permanent residents who immigrated as adults are assumed to be foreign trained. Compared to the Canadian born and to those immigrating as children, this group is the least likely to be in the labor force or employed. When employed, they are less likely to have either manager, engineering or technical occupations, and most likely to be employed in other occupations. This slippage between training and occupational location is the greatest for those permanent residents with only Bachelors degrees. In part, these aggregate findings reflect recency of arrival of those immigrating as adults. For this group, mis-match is strongest within the first few years of arriving in Canada. Men with engineering training who have been in Canada 15 years or more and/or who have Masters and Ph.D. degrees have employment patterns and occupational profiles that more closely correspond to those of their Canadian-born counterparts or those arriving as children.

**Keywords:** Engineers, Foreign born, Labor force, Canada

## Introduction

In the context of global competition, we are often told that the wealth of nations and the economic well being of their residents will rest on the skills of their workforces. National wealth and individual well-being not only depend on the level of skills but also how efficiently those skills are employed to add value (Reich 1991). These themes of levels and utilization of human resources are core in many discussions over international migration to post-industrial countries. How to increase the skill levels of immigrant inflows is a question often raised Do skilled immigrants find employment commensurate with their education and experience is a second.

Increasing the skill component of immigration flows fosters not only the entry of more highly educated migrants in general but also the migration of professionals. The latter is particularly likely in an era where economic activ-

ities cross political boundaries and where regional trading agreements such as the North American Free Trade Agreement (NAFTA) facilitate the flow of goods and services. However, many professions are subject to some form of regulation, implying that immigrants with specific forms of occupational training must satisfy host country regulations in order to work in their areas of expertise. If these certification requirements are not met, immigrant professionals may experience difficulty in finding employment commensurate with their training.

With these concerns in mind, this paper studies the experiences of the foreign-born professionals in one select occupation, engineering. Three reasons exist for this focus on workers in this profession. First, engineering is a professional occupation that increasingly is part of the global economy. Not only are engineering based services exported but also high technology sectors with extensive global linkages employ engineers. The United States and Canada are among the leading countries of the world in exporting engineering services. As a result there is current and sustained interest in engineering based services and in the employment of engineers.

Second, the foreign born are a significant share of the stock of engineers in North America, a fact that is not surprising given the demand for engineers and the migration networks which develop from international economic linkages. In the United States, the foreign born accounted for almost 10 percent of all engineers enumerated in the 1980 census, rising to 12 percent in the 1990 census (Lim et al. 1998). This is a minimum estimate of those with engineering training, since the data refer only to persons actually employed in engineering occupations. In Canada, the foreign born are close to half (44.5 percent) of those in the 1995–1996 experienced labor force who are age 15 and older and who declare engineering as a post-secondary major field of study. Most (97 percent) are permanent residents (unpublished tabulations from the 1996 2B census database).

Third, a growing number of United States studies support the argument that foreign-born high skilled workers in general, and engineers in particular, differ from the native-born in their labor force experiences. Studies note the substantial participation of foreign students in university engineering and science graduate programs, the reliance by academe on post-doctoral fellowships, and the eventual transformation of student visas into green cards (DiTomaso et al. 1994; North 1995). Despite these indicators of labor market demand, foreign born scientists and engineers have relatively unfavorable labor market profiles. Analyses of case studies and of data from surveys of graduates, various National Science Foundation surveys, and the decennial censuses reveal that foreign born engineers are more likely than their American born counterparts to state they have experience discrimination

at work. Compared to white American-born engineers, Asian and Mexican foreign born engineers are less likely to leave the labor force or to be self-employed. Research also suggests under-employment or blocked mobility for these groups. Asian and Mexican foreign born engineers in the United States are more likely than their white American born counterparts to be employed in technical work and less likely to move from engineering positions into the management rungs (Alarcon 1999; Fernandez 1998; Lim et al. 1998; Tang 1993a, 1993b, 1995).

Our research focuses on the under-employment issue found in much of the American research. We ask three questions: (1) Do immigrants with foreign training in engineering have the same labor market insertion profiles as do those who are Canadian born or immigrated as children?; (2) Are immigrants with foreign engineering training likely to exhibit the occupational patterns observed for the native born or for those who immigrated as children?; and (3) With increasing duration in Canada, do the employment and occupational characteristics of immigrants with foreign training approximate those observed for those who are Canadian born or who immigrated as children?

## Data sources and methods

In general, research on engineers in the United States indicates that immigrant engineers experience difficulty in finding employment and/or wages commensurate with their training. These findings primarily derive from two data sources: the United States census and the Survey of Natural and Social Scientists and Engineers (SSE), collected by the Bureau of the Census for the National Science Foundation. United States census data provide information only on those who are employed as engineers, thus preventing analysis of those who trained as engineers but who are not currently in engineering occupations. The longitudinal samples in the SSE rest on a 1982 study, which in turn included only those individuals who responded to the 1980 census. As a result, data on foreign-born engineers arriving after 1980 are not available from the 1984,1986 and 1989 follow-ups. Concern also exists over the definition of scientists and engineers used in the SSE and selective sample attrition over time (Tang 1995, 1997).

Our research relies on a data set that not only provides a more up-dated look at the labor force experiences of engineers but also lacks the difficulties associated with earlier data sources. Fielded on 14 May 1996, the most recent census of Canada includes a one-in-five sample of the Canadian population that answered the 2B questionnaire. Information is available for a large population on immigration (birthplace, permanent or non-permanent immigrant status; year of arrival; age at immigration), education (level, years, degrees,

fields of major and minor study) and labor force characteristics. Compared with previous research conducted in the United States, the novel contribution of the Canadian census is that it provides information on major field of study for those who have post-secondary education or higher. A census question asks: "What was the major field of study or training of this person's *highest* degree, certificate or diploma (*excluding* secondary or high school graduation certificates?)". The bold print words appear on the questionnaire. The resulting data on major field of study permits identifying those who underwent training in engineering fields, a identification which is not possible with US census data.

The ability to identify those who have engineering majors broadens the scope of our investigation from a more narrow examination of only those employed in engineering and related occupations. When applied to those with engineering training, the general analytical question "Do immigrants find employment commensurate with their education and experience?" generates two specific questions: (1) Are immigrants with engineering training more likely than the Canadian born to experience lower labor force participation rates and higher unemployment?; and (2) If they are employed, do they experience 'mis-matches'? Specifically are their occupations more likely to be ones that are technical in nature or are not related to engineering training? Drawing upon a large assimilation literature that stresses labor market improvements for immigrants with increasing duration in the host country, we also ask a third question: do employment and occupational differences observed between the Canadian-born and foreign-born diminish with increasing residency in Canada? These questions are answered for the population of men, between ages 30 and 54 who met three criteria: they had at least 16 years of schooling; they received Bachelor degrees or higher; and they declared engineering fields as their areas of major study in the 1996 census.

We focus only on the experiences of men in this paper. Most engineering majors are men and the comparatively small numbers of women constrain the analysis, particularly when examining variations by level of degree. The age parameters are chosen because the period between age 30 and 54 is the core of the productive life for most people. It is also the period when they are typically well launched in their careers. By focusing on this age group, we also remove variation associated with school completion and selective early retirement. In our analysis of the male population age 30–54, we compare three groups who declare engineering as a major field of study at the Bachelor degree level or higher: (1) the Canadian born; (2) permanent residents who immigrated to Canada by age 18; and (3) permanent residents who immigrated to Canada (it age 28 or later and arrived by 1994. 'Permanent resident' is a term used by immigration authorities to denote a person who

is in Canada legally and has permanent residence status. It has replaced the 'landed immigrant' terminology of the 1970s and 1980s. In this paper we used the terms 'permanent residents' and 'immigrants' interchangeably.

The Canadian census currently does not ask for the geographical location of the last degree, thereby preventing a precise grouping of those who received engineering degrees from Canadian institutions or from institutions in other countries. We assume that most, if not all, of the Canadian born and those permanent residents immigrating by age 18 have received degrees from Canadian institutions. The inclusion of permanent residents immigrating by age 18 also permits assessing if labor market disadvantages reflect immigrant status and/or place of degree. Since education generally is completed by the mid-twenties, we assume that most, if not all, of those immigrating at age 28 or later have received their degrees outside Canada. We require this latter group to have legally entered Canada by 1994 for two reasons. First, this restriction means they are at least age 30 by the date of the 1996 census. Second, the initial impact of arrival, which for the general immigrant population is associated with high unemployment is minimized (Badets & Howatson-Leo 1999).

In this paper, employment states are defined as: out of the labor force; unemployed; or currently employed. Occupational location consists of working in one of four main types of occupations: managers; engineering occupations, technical occupations that are related to engineering activities; and all other occupations. This categorization captures the four types of outcomes for engineers observed in other studies (Fernandez 1998; Lim et al. 1998; Tang 1993a, b, 1995, 1997). For some, engineering occupations are steps on the ladder to managerial occupations where they eventually will move. Alternatively some find a glass ceiling between engineering and managerial jobs that restrict such mobility. In addition to employment in manager and engineering occupations, some individuals trained in engineering will find employment in occupations that are further removed from engineering per se but which are of a technical nature that may require or utilize engineering knowledge and applications. Others will find no employment at all in occupations related to engineering. Based on these outcomes, we devise a four category classification of over 500 occupational titles into manager, engineer, technical and all other occupations (see Appendix A for further discussion).

Because our dependent variables are categorical variables, multinomial logistic regression (Liao 1994) is used. The technique relies on the computation of logits reflecting the natural log of the odds (log odds) of being in each occupational category as opposed to some reference category (Equation 1).

$$\text{Log}(P(\text{category}_I)/P(\text{category}_j)) = B_{i0} + B_{i1}X_I + B_{i2}X_2 + \cdots + B_{ip}X_p. \quad (1)$$

The $P(\text{category}_i)$ is the probability of falling into a given category $i$ of the dependent variable (e.g. technical occupations) and $P(\text{category}_j)$ is the probability of being in a designated reference category $j$ of the dependent variable (e.g., engineering occupations). $B_{i0}$ is the intercept associated with the logit for occupational category $i$ and $B_{i1}$ to $B_{ip}$ are the coefficients associated with a set of $p$ independent variables (e.g., sex, age, education level, years in Canada etc.). $X_{i1}$ to $X_{ip}$ contain the values of interest for the $p$ independent variables. Key independent variables of interest are education, defined as level of degree (bachelors, masters, and Ph.D.) and duration in Canada for those arriving in Canada as adults. Control variables include age, residence in large CMAs, (specifically Montreal, Toronto, and Vancouver versus other areas), and specialized fields of study within engineering.

## Assessing the worth of education

Past research suggest affirmative answers for two of the core questions in this study: are immigrants with engineering training more likely than the Canadian born to experience employment 'slippage' and occupational 'mismatch'? We anticipate finding greater slippage and occupational mismatch for permanent residents arriving at age 28 or later than for the Canadian born or those permanent residents who immigrated before age 19. We interpret such patterns as consistent with those produced when training received abroad is devalued although we acknowledge that census data does not allow for a direct test of this supposition. A direct test would require a case study in which the micro-processes producing differential outcomes would be studied. Such a study would involve interviews with engineers, obtaining more in-depth knowledge of their training and education, and interviews with employers on their assessment of educational credentials and their hiring and job allocation decisions regarding such credentials.

Devaluation of educational training can reflect the operation of several different processes. The likely sources are twofold: those associated with the evaluation of the 'worth' of a given degree or programme of study and those which arise from the requirements of regulated occupations. Most discussions of why foreign credentials may be 'under-valued' either explicitly or implicitly define education as a form of human capital that enhances productivity. Under this model, a given level of education is associated with a given level of productivity and thus comes to be evaluated at a given level of 'worth' and 'desirability' in the larger society as well as by specific employers. However, it is not the educational level *per se* that determines productivity. Rather it is the productivity related substantive and analytical content of education that is important, or what sociologists and economists refer to as 'skill'.

Under this reasoning, the educational credentials of the foreign born who received their education outside the host country may be under-valued for two quite different reasons. First, foreign credentials in fact may differ (i.e., be lower) in productivity enhancing content compared with host country degrees. In this circumstance, while the title of a degree or a program of study would be the same, the worth might be different and less for foreign earned credentials. This argument assumes perfect knowledge by the employer of cross-national variations in the content of credentials, near-perfect indicators of the fit between education and productivity, and obvious indicators of the irrelevancy of foreign credential content for receiving country's labor market. McDade (1988: 3) notes that difficulty in transferring educational credentials across borders may occur because the content of an immigrant's education may genuinely be less relevant to the needs of the Canadian labor market.

The second perspective underlying discussions of foreign credentials reverses the parameters. The content of foreign credentials is assumed to be the same for similarly titled post-secondary educational levels, regardless of the country or university where credentials were earned. However, because imperfect knowledge exists on the part of employers and others in Canadian society, full recognition is not given to foreign credentials, and the 'worth' is under-valued relative to comparable host country levels of education.

Researchers also note a third interpretation for the devaluation of education as human capital, namely the deliberate devaluation by employers of foreign credentials as a device to lower labor costs and enhance profits (Boleria 1992; Wright & McDade, 1992). Although this is not easy to determine without case studies, such tendencies might be more likely to occur when knowledge about the source of foreign degrees is low and where racial or birthplace discrimination is already practiced. United States research finds evidence for race-based discrimination affecting the mobility of Asian engineers (Fernandez 1998; Tang 1993). In Canada, Basran & Zong (1999) report that foreign-trained Indo and Chinese professionals perceive institutionalized barriers such as nonrecognition or devaluation of credentials as major factors contributing to their occupational disadvantages.

## Regulating the engineering profession

A final source of under-recognition of foreign credentials occurs when the performance of occupationally related tasks are regulated by associations and/or governments. Regulated occupations such as in certain trades, law, engineering and health areas require certification and/or licensing, primarily through professional associations, often based on government statutes. While the purpose of licensing and certification is to assure public health and safety

(Mata 1992, 1999; McDade 1988; Wright & McDade 1992), these practices also are the defining characteristics of occupational internal labor markets which create monopolies on products and/or services by controlling labor supply. In Canada, certification requirements are often described as a form of systemic discrimination, in that criteria are created which are universally applied to the Canadian born and foreign born alike, but have disproportionate effects in restricting access to trades or professions among the foreign born (Boleria 1992; McDade 1988).

Certainly, the accreditation of immigrant professionals is of growing concern in Canada. Developments during the past decade include: (1) the creation of several provincial task forces on the recognition of credentials obtained outside of Canada (see: Ontario, government of 1989); (2) the generation of reports by policy institutes and federal government departments on the underrecognition of foreign credentials (McDade 1988; Mata 1992, 1994, 1999; Wright & McDade 1992); (3) the establishment in 1992 of a federal interdepartmental group on the topic; and most recently (4) a major conference in October 1999 in Toronto. This conference featured keynote addresses by prominent provincial and federal politicians, including the two ministers of Citizenship and Immigration Canada and of Human Resources Canada, and the conference drew participants from federal and provincial governments, immigrant associations, and professional associations. Such developments are motivated by the concern that barriers to credentials hamper an adequate delivery of professional services, the rational utilization of human resources and the equitable participation of all individuals, including the foreign born, in Canadian society (Mata 1992: 2; also see Chapman & Iredale 1993; Mata 1999).

In Canada, the engineering profession is a publicly regulated occupation with its own 'reserve' title. This means that by law, no one may offer engineering services to the public unless they first obtain a license from one of the 12 provincial and territorial engineering associations ('ordre': in Quebec) that have been mandated by provincial/territorial law. In Canada, regulating the conditions of work is under the legal jurisdiction of each province. Although requirements vary by province, to be licensed as a professional engineer, individuals must satisfy the following requirements: (1) be a Canadian citizen or a permanent resident; (2) possess an undergraduate degree at the Bachelor level from an accredited Canadian university program in engineering or possess an otherwise recognized engineering degree and complete an assigned exam program. Normally associations will assign an program if an applicant does not have a Bachelor degree in engineering from an accredited Canadian university engineering program; (3) complete two to four years of engineering work experience. A minimum of 12 months of experience must

be in North America; (4) write and pass a professional practice examination on professional practice, ethics, engineering law and liability; (5) be of good character and reputation; and (6) be proficient in English or French, in Quebec (English or French in New Brunswick). Once licensed, as a full member of a provincial or territorial association, engineers may legally use the designation 'P.Eng.' ('ing.' in Quebec) after their name. It is illegal to use the 'P.Eng/ing' title without having a license and being a member of the provincial/territorial association (Canadian Council of Professional Engineers, website: www.ccpe.ca 1/25/ 2000). As of the year 2000, approximately 157,000 engineers were licensed (www.ccpe.ca), representing 60 percent of the 262,000 persons age twenty-one and older who had at least a Bachelor degree and gave engineering as their major field of study in the 1996 census.

Within North America, gradual movement has occurred in the direction of removing accreditation barriers that appear when individuals change places of residence. In the past, all persons who were licensed by one provincial/territorial association had to undergo re-certification by another association if they moved or wished to practice as an engineer in another province. On 14 June 1999 the Inter-Association Agreement on Mobility of Professional Engineers was signed by the 12 provincial and territorial regulatory engineering associations. This agreement ended the requirement for engineers to be licensed for five consecutive years in one jurisdiction before they could relocate to another jurisdiction and be fully licensed. As the umbrella association representing the federation of the provincial/territorial associations, the Canadian Council of Professional Engineers (CCPE) also has signed four international agreements that make it easier for Canadian engineers to work and be licensed through foreign engineering jurisdiction and vice versa. The Washington Accord and the NAFTA mutual recognition agreement are intended to facilitate the movement of engineers across the American-Canadian border as part of the free movement of services initiatives. The CCPE also has developed, and continues to enlarge, a list of acceptable foreign engineering educational institutions that may be used by provincial/territorial associations. But for many immigrants who study engineering outside of Canada, particularly in institutions that are not in the USA, the United Kingdom, or in France, working as a professional engineer may require a program of study associated with accreditation by a Canadian association. Persons may do engineering work without accreditation, but it must be under the direct supervision of a professional engineer (Canadian Council of Professional Engineers, website: www.ccpe.ca ,1/25/ 2000).

For the foreign born who studied engineering outside Canada, the requirement for within-Canada accreditation has two implications. First, if the program of study involved engineering but the degree granted was not a

Bachelor degree in engineering, they are not likely to qualify for the accreditation process. Second, even if the degree was from a program in engineering, within-Canada accreditation requirements mean that the foreign trained will be unable upon arrival to practice their profession, and that substantial time and effort may be required to meet the accreditation requirements (including acquiring proficiency in English or French). This suggests that permanent residents who immigrate to Canada after receiving their degrees abroad are faced with three outcome scenarios. First, they may be less likely to be in the labor force, in part because they are re-accrediting or retraining in another field altogether. They also may be more likely to be unemployed if their job searches take longer because of the uncertainly over the worth of their degrees without accreditation.

The second scenario is that when employed, immigrants with foreign training may also less likely to be working in engineering occupations than are the Canadian born or the foreign born who received Canadian engineering degrees. Instead, we expect to find that such permanent residents are more likely to be found in other occupations. Since employment in engineering occupations often is the first rung on a ladder to management (Fernandez 1998; Tang 1993b, 1997) we also expect that the foreign-born men in our study who immigrated at age 28 or later will be less likely to be in management. We note that these two outcomes of greater 'mis-match' for the foreign born arriving at age 28 or later do not negate the possibility of other factors also at work, notably the lesser worth of some programs of study, inabilities by employers to assess degrees, and employer discrimination. Indeed, accreditation requirements may produce situations that facilitate or activate these other factors.

The third scenario does not refute the previous two, but emphasizes the fluctuation of these end states, particularly over time. This view of diminished slippage and improved occupational fit with length of residency derives from two inputs. The first is more specific and emphasizes that re-accreditation takes time, particularly when language skills must be improved, courses must be taken and Canadian experience obtained. The second rests on the general literature on immigrant adaptions, observing that downward mobility and unemployment are not uncommon in the early periods. Researchers, however, argue that these gaps should disappear over time to the extent that job, related networks improve, and knowledge about the new society increases.

## Degrees, and labor force participation

Population estimates from the 1996 Canadian census indicate that around 140,000 men between 30 and 54 with 16 or more years of schooling have

university degrees with engineering as their major field of study. Nearly 79,000 are Canadian born with approximately 12,000 and 32,000 permanent residents respectively immigrating at ages 0–18 or at ages 28 or higher (Table 1). However, human capital characteristics differ by immigrant status for men with engineering as their major field of study. Although the majority of those with engineering as a major field of study have only a Bachelor degree, percentages with Masters or Ph.D. degrees are highest for permanent residents immigrating as adults and lowest for the Canadian-born (Table 1). One explanation for these patterns of more advanced degrees is the use of educational credentials in the immigration selection process. Although family class immigrants have predominated in the recent past, Canada does have a point system that targets the immigration of high skill labor. Regulatory changes on 17 November 1995 strengthened this part of the immigration program.

Although permanent residents arriving after age 28 are more likely to have Master and Ph.D. degrees, they are less likely to be in the labor force. Unemployment rates also are higher than observed for the Canadian born and for permanent residents immigrating as youngsters. Multinomial logistic regression shows the effects of level of degree on the likelihood (log odds) of being out of the labor force, unemployed or employed, controlling for age, place of residence and area of specialization. The latter controls are introduced because of differences between the three groups with respect to these variables (Table 1) and because labor market demand may vary according to age, place of residence and specialization. The Canadian born and early arrivers are on average two to three years younger than permanent residents arriving at age 28 or later. The Canadian born also are more likely to be residing outside of the 'big-three' dominant census metropolitan areas (CMAs), comprised of Montreal, Toronto and Vancouver whereas the majority of permanent residents, especially those arriving at age 28 or later live in these three cities. Permanent residents entering Canada after age 28 are slightly more likely than the Canadian born and those arriving as youngsters to have specialized in electrical and mechanical engineering. Along with civil engineering, these areas of specialization are core fields in the Canadian engineering industry. Electrical engineering includes electronic and computer relevant knowledge.

Multinomial logits in Table 2 for Masters and Ph.D. degrees indicate that net of other variables, level of degree does not substantially influence the likelihood of not being in the labor force or unemployed over being employed for the Canadian born and those immigrating early in life (also see Appendix B, Table B). However, for permanent residents arriving at age 28 or later, having degrees beyond the Bachelor degree does reduce the log odds of either being out of the labor force or unemployed (Table 2, columns 3 and 4). At the

*Table 1.* Selected characteristics of men, age 30–54 with Bachelor degree or higher, with engineering as their major field of study, Canadian born and permanent residents, Canada, 1996

| | Canadian born (1) | Immigrated age 0–18 (2) | Foreign born immigrated age 28+ (3) |
|---|---|---|---|
| Actual N[a] | 15940 | 2380 | 6350 |
| Population estimates[a] | 78780 | 11750 | 32070 |
| *Degree level* | 100.0 | 100.0 | 100.0 |
| Bachelors | 82.2 | 79.8 | 61.8 |
| Masters | 15.4 | 16.9 | 29.0 |
| Ph.D. | 2.4 | 3.4 | 9.1 |
| *Field of study* | 100.0 | 100.0 | 100.0 |
| Electrical | 20.1 | 24.2 | 25.0 |
| Mechanical | 18.3 | 16.2 | 21.1 |
| Civil | 18.2 | 13.5 | 18.8 |
| Chemical | 7.2 | 7.9 | 5.6 |
| All other fields | 36.2 | 38.3 | 29.5 |
| *Labor force status* | 100.0 | 100.0 | 100.0 |
| Not in LF | 2.5 | 3.7 | 9.0 |
| Unemployed | 2.0 | 2.9 | 7.6 |
| Employed | 95.5 | 93.4 | 83.4 |
| *Occupation, employed only* | 100.0 | 100.0 | 100.0 |
| Managerial occ. | 28.6 | 26.5 | 17.9 |
| Engineering | 41.3 | 40.5 | 31.9 |
| Technical | 11.6 | 12.9 | 16.4 |
| All others | 18.6 | 20.1 | 33.8 |
| *Mean age* | 39.7 | 39.9 | 42.6 |
| *Place of residence* | 100.0 | 100.0 | 100.0 |
| 3 major CMAs | 34.6 | 57.0 | 69.6 |
| All others | 65.4 | 43.0 | 30.4 |
| *Duration in Canada, foreign born* | | 100.0 | 100.0 |
| 2–4 years | | ... | 35.3 |
| 5–9 | | ... | 34.5 |
| 10–14 | | 2.4 | 12.7 |
| 15–19 | | 10.2 | 9.8 |
| 20+ years | | 87.3 | 7.7 |
| *Mean years in Canada* | | 30.5 | 8.2 |

[a]Rounded to nearest 10.

same time, the basic pattern displayed by the marginals in Table 1 remains: men with engineering training who arrived in Canada after age 28 are more likely than those arriving in childhood and those born in Canada to be out of the labor force or unemployed.

The fourth column in Table 2 adds duration as a predictor of employment outcomes for male engineers arriving at age 28 or later.[1] Compared to those who have been in Canada twenty years or more, men with less than ten years of duration in Canada are more at risk of being out of the labor force or being unemployed than employed.

Calculating probabilities from logits tells the same story, but in a more 'common sense' language. Table 3 displays the calculated probabilities (expressed as chances out of 100) for men who are age 45, who are living in Montreal, Toronto, and Vancouver, and whose major field of study (specialization) was civil engineering. As a field, civil engineering involves activities (bridge building, construction) that have the potential to affect public health and safety. For this reason, certification requirements are most likely to affect the work experiences of persons who trained as civil engineers.

Compared to the Canadian born or those immigrants arriving in their youth, permanent residents arriving at age 28 or later are less likely to be employed. They are more likely to be unemployed or out of the labor force. This pattern persists at all degree levels. However, the contrasts in probabilities are sharpest for those with Bachelor degrees, indicating again that advanced degrees diminish the likelihood of underemployment for permanent residents who arrived after age 28. Although data are presented for permanent residents who immigrated between the ages of 0–18 and who have Ph.D. degrees, very few respondents are in this category (actual counts of less than 100). Given the small numbers, it is risky to attach much substantive importance to the slightly higher chances of this group being out of the labor force compared to the Canadian born or to permanent residents immigrating after age 28 (Table 3, third panel).

Duration-specific probabilities (Table 4) indicate that recency of arrival is highly associated with these lower probabilities of labor force participation and greater unemployment for male immigrants arriving as adults. For the group under scrutiny (age 45, living in Montreal, Toronto and Vancouver, with civil engineering as the major field of study), only very small differences exist in the employment profiles of the Canadian born and those who immigrated after age 27 and have lived in Canada at least 15 years.

*Table 2.* Multinomial logit estimates of labor force status for men aged 30–54 with engineering as major field of study, bachelor degrees or higher, Canadian born and permanent residents arriving at age 0–18 and at age 28+, Canada,1996

| | | Permanent residents, immigrated at | | |
|---|---|---|---|---|
| | (1) Canadian born | (2) Age 0–18 | (3) Model I Age 28+ | (4) Model II Age 28+ |
| *Not in LF vs employed* | | | | |
| Intercept | −4.743 | −2.812 *** | −1.116 *** | −3.521*** |
| Degree level | | | | |
| Bachelors | (rg) | (rg) | (rg) | (rg) |
| Masters | −0.266 ns | 0.072 ns | −0.498 *** | −0.443 *** |
| Ph.D. | 0.012 ns | 0.853 * | −1.033 *** | −1.010 *** |
| Field of study | | | | |
| Electrical | −0.044 ns | −0.326 ns | −0.197 ns | −0.216 ns |
| Mechanical | −0.322 * | −0.411 ns | −0.018 ns | 0.046 ns |
| Civil | −0.056 ns | −0.574 ns | 0.269 ** | 0.245 ns |
| Chemical | −0.281 ns | −0.131 ns | 0.208 ns | 0.214 ns |
| All other fields | (rg) | (rg) | (rg) | (rg) |
| Place of residence | | | | |
| 3 major CMAs | (rg) | (rg) | (rg) | (rg) |
| All others | −0.064 ns | −0.054 ns | −0.185 ns | −0.083 ns |
| Age | 0.031 *** | −0.006 ns | −0.021 ** | 0.019 * |
| Duration in Canada | | | | |
| 2–4 years | | | | 1.126 *** |
| 5–9 years | | | | 0.717 *** |
| 10–14 years | | | | 0.001 ns |
| 15–19 years | | | | −0.387 ns |
| 20+ years | | | | (rg) |
| *Unemployed versus employed* | | | | |
| Intercept | −3.558 *** | −2.494 *** | −1.057 *** | −4.058 *** |
| Degree level | | | | |
| Bachelors | (rg) | (rg) | (rg) | (rg) |
| Masters | −0.374 * | 0.077 ns | −0.174 ns | −0.106 ns |
| Ph.D. | −0.664 ns | −1.541 ns | −0.599 | −0.576 ** |
| Field of study | | | | |
| Electrical | −0.032 ns | 0.679 * | −0.273 * | −0.302 * |
| Mechanical | 0.077 ns | 1.008 ** | −0.041 | −0.076 ns |
| Civil | 0.386 * | 0.999 ** | 0.187 | 0.161 ns |
| Chemical | −0.089 ns | −0.872 ns | −0.267 | −0.265 ns |
| All other fields | (rg) | (rg) | (rg) | (rg) |
| Place of residence | | | | |
| 3 major CMAs | (rg) | (rg) | (rg) | (rg) |
| All others | −0.118 ns | 0.305 ns | −0.325 ** | −0.214 ns |
| Age | −0.006 ns | −0.042 * | −0.026 *** | 0.021 * |
| Duration in Canada | | | | |
| 2-4 years | | | | 1.513 |
| 5–9 years | | | | 0.954 ** |
| 10–14 years | | | | 0.352 ns |
| 15–19 years | | | | −0.298 ns |
| 20+ years | | | | (rg) |
| Model −2 Log Likelihood | 1925.22 | 764.92 | 2479.11 | 3779.38 |
| Chi-square | 43.9 | 31.67 | 111.96 | 270.82 |
| df | 16 | 16 | 16 | 24 |

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

*Table 3.* Chances out of 100[a] of not being in the labor force, unemployed or employed for men age 45, with specialization in civil engineering, residing in Montreal, Toronto, and Vancouver, by level of degree, for Canadian born and permanent residents immigrating between age 0–18 and at age 28+, Canada, 1996

| | Canadian born | Permanent residents immigrated at age | | Difference between Canada born and permanent residents immigrated at age | |
|---|---|---|---|---|---|
| | | 0–18 | 28+ | 0–18 | 28+ |
| | (1) | (2) | (3) | (4) | (5) |
| *Bachelors degree* | 100.0 | 100.0 | 100.0 | | |
| Not in LF | 3.2 | 2.5 | 13.0 | −0.7 | 9.9 |
| Unemployed | 3.0 | 3.2 | 10.0 | 0.2 | 7.0 |
| Employed | 93.9 | 94.4 | 77.0 | 0.5 | −16.9 |
| *Masters degree* | 100.0 | 100.0 | 100.0 | | |
| Not in LF | 2.5 | 2.6 | 8.5 | 0.1 | 6.0 |
| Unemployed | 2.1 | 3.4 | 9.0 | 1.3 | 6.9 |
| Employed | 95.4 | 94.0 | 82.5 | −1.5 | −12.9 |
| *Ph.D. degree* | 100.0 | 100.0 | 100.0 | | |
| Not in LF | 3.3 | 5.7 | 5.3 | (b) | 2.1 |
| Unemployed | 1.5 | 0.7 | 6.3 | (b) | 4.7 |
| Employed | 95.2 | 93.6 | 88.4 | −1.6 | −6.8 |

[a]If divided by 100, figures are converted into probabilities.
[b]Not provided because of small cell n's (less than 100).
Source: Table 2.

## Degrees, duration and occupational location

Once employed, how likely are foreign educated engineers to find employment that is consistent with their training? Not everyone who studies engineering fields find employment in engineering or related occupations. Among the Canadian born and those permanent residents who immigrated in their youth, close to one in five are working in occupations whose job titles indicate no engineering component (Table 1). Approximately one in ten are in technical occupations. It should be noted that the CCPE in its overview documents on accreditation makes a strong distinction between professional engineering work and technical work. In our occupational groupings, computer programmers are placed in the technical occupational category. Although persons with engineering backgrounds may be employed as computer programmers and analysts, the CCPE indicates that computer programmers who lack a Bachelor degree in engineering are not eligible for accreditation

*Table 4.* Chances out of 100[a] of being employed for men age 45, with specialization in civil engineering, residing in Montreal, Toronto, and Vancouver, by Bachelor, Masters and Ph.D. degrees, Canadian born and permanent residents immigrating at age 28+, by duration in Canada, 1996

| | Canadian born | Permanent residents, immigrated age 28+ duration in Canada | | | |
|---|---|---|---|---|---|
| | | 2–4 | 5–9 | 10–14 | 15–19 |
| | (1) | (2) | (3) | (4) | (5) |
| *Bachelors degree* | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Not in LF | 3.2 | 18.4 | 14.0 | 7.8 | 5.6 |
| Unemployed | 3.0 | 15.6 | 10.2 | 6.3 | 3.5 |
| Employed | 93.9 | 66.0 | 75.8 | 85.9 | 90.9 |
| *Masters degree* | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Not in LF | 2.5 | 12.9 | 9.6 | 5.2 | 3.7 |
| Unemployed | 2.1 | 15.2 | 9.8 | 5.9 | 3.2 |
| Employed | 95.4 | 71.9 | 80.6 | 88.9 | 93.1 |
| *Ph.D. degree* | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Not in LF | 3.3 | 8.2 | 5.9 | 3.1 | 2.1 |
| Unemployed | 1.5 | 10.7 | 6.6 | 3.9 | 2.1 |
| Employed | 95.2 | 81.0 | 87.5 | 93.1 | 95.8 |
| *Difference, percent employed Canadian born – permanent residents*[b] | | | | | |
| Bachelors degree | | 27.9 | 18.1 | 8.0 | 3.0 |
| Masters degree | | 23.5 | 14.8 | 6.5 | 2.3 |
| Ph.D. degree | | 14.2 | 7.7 | 2.1 | −0.6 |

[a]If divided by 100, figures are converted into probabilities.
[b]Column 1 minus columns 2–4, for the percentage employed.
Source: Table 2.

as a professional engineers. Because of this distinction, and the fact that not all computer programmers have engineering degrees, our classification puts these occupations in the technical category. In fact very few men who have Bachelor degrees or higher and whose major field of study was engineering are employed as computer systems analysts or computer programmers (4.1, 6.2 and 6.3 per cent respectively for the Canadian born, permanent residents immigrating between age 0-18 and permanent residents immigrating at age 28 or older).

Among those who studied engineering, foreign born men who arrived in Canada before age 19 have occupational distributions that are quite similar to those characterizing Canadian born men. However, compared to these

two groups, permanent residents who entered Canada at age 28 or later have much higher percentages in both the technical category and in the 'other occupations' category. Conversely these men are much less likely than their Canadian born counterparts or those who arrived before age 19 to be employed in managerial occupations or in engineering occupations (Table 1).

As noted earlier, although the majority of those with engineering as a major field of study have only a Bachelor degree, percentages with Masters or Ph.D. degrees are highest for permanent residents immigrating as adults and lowest for the Canadian-born. These differences should work to increase the likelihood of being in engineering or engineering related occupation for those foreign born arriving later in life. Higher degrees should be associated with greater training-occupational matches for those immigrating as adults for at least two reasons. First, recipients with higher degrees may be more likely to be in engineering or related occupations simply because advanced degrees may offer assurance to employers that engineering training is adequate. This indicates the operation of over-credentialism in the market. Second, those with advanced degrees may be more likely to be in engineering occupations particularly if the advanced degree might have been obtained in those countries or schools where knowledge exists, or is assumed, regarding the program of study. In such instances the assessment of bachelors degrees received in home countries would be replaced by assessments of Masters or Ph.D. degrees received elsewhere.

Group specific multinomial logistic regressions show the effects of specific levels of educational degrees on the likelihood of working in managerial, technical or other occupations compared to engineering occupations, again controlling for the effects of age, place of residence and field of specialization. Multinomial logits in Table 5 for Masters and Ph.D. degrees confirm that men who have Ph.D. degrees and whose major field of study was engineering are more likely than those with Bachelor degrees to be employed in engineering occupations. Having a Masters degree rather than a Bachelor degree does not increase the likelihood of holding an engineering occupation for Canadian born or permanent residents arriving before age 19. But it significantly increases the log-odds for those permanent residents who arrived in Canada at age 28 or later.[2] For those immigrating as adults, duration in Canada also affects the (log) likelihoods of occupational location. Increasing years spent in Canada increases the (log) likelihoods of being employed in engineering occupations instead of in technical occupations or other occupations.

Again, calculated probabilities flesh out the story for the reference population defined as age 45 and living in Montreal, Toronto or Vancouver with specialization in civil engineering (Table 6). Overall, the pattern of probabilities produce three main conclusions. First, regardless of level of degree,

*Table 5.* Multinomial logit estimates of employment in managerial, engineering technical, and all other occupations for men aged 30–54 with engineering as major field of study, Bachelor degrees or higher, Canadian born and permanent residents arriving at age 0–18 and at age 28+,Canada, 1996

| Occupational groups | Canadian born (1) | Permanent residents, immigrated at Age 0–18 (2) | Age 28+ Model I (3) | Age 28+ Model II (4) |
|---|---|---|---|---|
| *Manager vs engineering occupations* | | | | |
| Intercept | −2.453 *** | −2.964 *** | −2.195 *** | −3.761 *** |
| Degree level | | | | |
| Bachelors | (rg) | (rg) | (rg) | (rg) |
| Masters | 0.063 ns | −0.088 ns | −0.519 *** | −0.523 *** |
| Ph.D. | −0.931 *** | −1.553 *** | −1.309 *** | −1.341 *** |
| Field of study | | | | |
| Electrical | −0.429 *** | −0.502 *** | −0.634 *** | −0.629 *** |
| Mechanical | −0.151 ** | − 0.203 ns | −0.496 *** | −0.513 *** |
| Civil | −0.124 * | −0.042 ns | −0.005 *** | −0.005 ns |
| Chemical | −0.085 ns | −0.138 ns | −0.008*** | 0.000 ns |
| All other fields | (rg) | (rg) | (rg) | (rg) |
| Place of residence | | | | |
| All others | −0.076 ns | −0.301 ** | −0.345 *** | −0.326 *** |
| 3 major CMAs | (rg) | (rg) | (rg) | (rg) |
| Age | 0.057 *** | 0.072 *** | 0.053 *** | 0.075 *** |
| Duration in Canada | | | | |
| 2–4 years | | | | 0.720 *** |
| 5–9 years | | | | 0.782 *** |
| 10–14 years | | | | 0.510 ** |
| 15–19 years | | | | 0.441 ** |
| 20+ years | | | | (rg) |
| *Technical versus engineering occupations* | | | | |
| Intercept | −0.992 *** | 0.366 ns | 1.454 *** | 0.099 ns |
| Degree level | | | | |
| Bachelors | (rg) | (rg) | (rg) | (rg) |
| Masters | −0.133 ns | −0.156 ns | −0.367 *** | −0.351 *** |
| Ph.D. | −0.469 ** | −0.639 ns | −0.984 *** | −0.990 *** |

*Table 5* (continued)

| Occupational groups | Canadian born (1) | Permanent residents, immigrated at Age 0–18 (2) | Age 28+ Model I (3) | Age 28+ Model II (4) |
|---|---|---|---|---|
| Field of study | | | | |
| Electrical | 0.089 ns | 0.050 ns | 0.158 ns | 0.148 ns |
| Mechanical | −0.490 *** | −0.355 ns | −0.336 ** | −0.353 ** |
| Civil | −0.349 *** | −0.266 ns | −0.175 ns | −0.178 ns |
| Chemical | −0.411 ** | −0.399 ns | −0.398 ns | −0.390 ns |
| All other fields | (rg) | (rg) | (rg) | (rg) |
| Place of residence | | | | |
| All others | −0.152 ** | −0.342 * | −0.205 * | −0.168 ns |
| 3 major CMAs | (rg) | (rg) | (rg) | (rg) |
| Age | −0.000 ns | −0.013 ns | −0.041 *** | −0.018 * |
| Duration in Canada | | | | |
| 2–4 years | | | | 0.599 ** |
| 5–9 years | | | | 0.391 * |
| 10–14 years | | | | 0.203 ns |
| 15–19 years | | | | 0.015 ns |
| 20+ years | | | | (rg) |
| *Other occupations versus engineering occupations* | | | | |
| Intercept | −1.360 *** | −1.885 *** | 1.179 *** | −1.160 ** |
| Degree level | | | | |
| Bachelors | (rg) | (rg) | (rg) | (rg) |
| Masters | −0.244 *** | −0.322 * | −0.900 *** | −0.887 *** |
| Ph.D. | −0.642 *** | −0.724 * | −1.887 *** | −1.929 *** |
| Field of study | | | | |
| Electrical | −0.847 *** | −0.530 *** | −0.431 *** | −0.434 *** |
| Mechanical | −0.455 *** | −0.630 *** | −0.106 ns | −0.132 ns |
| Civil | −0.530 *** | −0.380 * | 0.032 ns | 0.012 ns |
| Chemical | −0.274 ** | 0.094 ns | 0.213 ns | 0.239 ns |
| All other fields | (rg) | (rg) | (rg) | (rg) |
| Place of residence | | | | |
| All others | −0.157 *** | −0.390 *** | −0.467 *** | −0.406 *** |
| 3 major CMAs | (rg) | (rg) | (rg) | (rg) |
| Age | 0.027 *** | 0.043 *** | −0.009 ns | 0.027 *** |
| Duration in Canada | | | | |
| 2–4 years | | | | 1.033 *** |
| 5–9 years | | | | 0.998 *** |
| 10–14 years | | | | 0.516 *** |
| 15–19 years | | | | 0.085 ns |
| 20+ years | | | | (rg) |

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

permanent residents who immigrated at age 28 or later have lower chances of working in managerial occupations than do the Canadian born. Second, advanced educational degrees narrows the differentials in the (hypothetical) distribution of employment for the three groups under scrutiny. The differentials are largest for men with Bachelor degrees. Compared to the Canadian born or those immigrating as youth, men who arrived at age 28 or later have lower probabilities of being employed in engineering occupations or in technical occupations and higher probabilities of employment in non-engineering related (all others) occupations. This finding has important implications for the labor market integration of permanent residents, particularly if they immigrate as adults. Most men who indicate engineering as a field of study have only Bachelor degrees, with proportions ranging from slightly over three-fifths (62 percent) of permanent residents immigrating as adults to four-fifths of the Canadian born (Table 1).

The third and final conclusion is that these differences are attenuated when duration is taken into account along with educational degree. As Table 7 shows, the probability of employment in engineering occupations increases the longer immigrants live in Canada. For those who arrived as adults and have Masters degrees or higher, the occupational distributions are quite similar to those observed for the Canadian born. However, the one exception is the lower probability that these foreign born men will be managers compared to their Canadian born counterparts. These findings are consistent with those found in U.S. studies, where the under-representation in management is interpreted as revealing a 'glass ceiling' (Lim et al. 1998; Tang 1997).

For those with only Bachelor's degrees, divergent occupational profiles between the Canadian born and immigrants arriving as adults narrow but do not disappear, even for those who have resided in Canada for a considerable time. After ten or more years, those who have arrived after age 28 are still less likely than their Canadian born counterparts to be employed in engineering occupations. They are more likely to be employed in occupations that are not directly related to managerial or engineering occupations.

## Conclusion

Overall, variations in the occupational locations of persons with engineering as a major field of study suggests that immigrants who arrive as adults and who most probably received their education outside Canada are less likely to be in the labor force and to be employed than are their Canadian born counterparts or immigrants arriving early in life When they are employed, immigrants arriving as adults are less likely to hold managerial and engineering occupations. These findings are particularly true for persons who have

*Table 6.* Chances out of 100[a] of employment in managerial, engineering, technical and other occupations for men age 45, with specialization in civil engineering, residing in Montreal, Toronto, and Vancouver, by level of degree, for Canadian born and permanent residents immigrating between age 0–18 and at age 28+, Canada, 1996

| | Canadian born | Permanent residents immigrated at | | Difference[b] between Canadian born and Permanent residents immigrated | |
|---|---|---|---|---|---|
| | | Age 0–18 | Age 28+ | Age 0–18 | Age 28+ |
| | (1) | (2) | (3) | (4) | (5) |
| *Bachelors degree* | 100.0 | 100.0 | 100.0 | | |
| Manager | 36.1 | 38.2 | 24.1 | 2.1 | −12.0 |
| Engineer | 36.0 | 30.8 | 20.2 | −5.2 | −15.8 |
| Technical | 9.4 | 9.2 | 11.3 | −0.1 | 1.9 |
| Other occ. | 18.5 | 21.8 | 44.4 | 3.2 | 25.9 |
| *Masters degree* | 100.0 | 100.0 | 100.0 | | |
| Manager | 39.5 | 39.1 | 23.8 | −0.4 | −15.8 |
| Engineer | 37.1 | 34.4 | 33.4 | −2.6 | −3.7 |
| Technical | 8.5 | 8.8 | 13.0 | 0.4 | 4.5 |
| Other occ. | 14.9 | 17.6 | 29.9 | 2.7 | 14.9 |
| *Ph.D. degree* | 100.0 | 100.0 | 100.0 | | |
| Manager | 21.6 | 14.9 | 17.3 | −6.7 | −4.3 |
| Engineer | 54.7 | 56.7 | 53.6 | 2.0 | −1.1 |
| Technical | 8.9 | 9.0 | 11.2 | 0.1 | 2.3 |
| Other occ. | 14.8 | 19.4 | 17.9 | 4.6 | 3.1 |

[a]If divided by 100, figures are converted into probabilities.
[b]Calculated as columns 2 minus column 1, and column 3 minus column 1.
Source: Table 5.

only Bachelor degrees and for those who have resided in Canada for less than 10 years. Conversely, those permanent immigrants who arrived as children are more similar to the Canadian population in their labor force participation patterns and in their occupational destinations.

In Canada and in the United States, the topic of high skilled labor flows is currently receiving renewed attention from policy makers, politicians and the media. Proponents for increasing the levels of high skill immigration usually conceptualize such flows in positive terms, stressing both the economic savings derived from importing already trained labor and the economic contribution made by highly trained immigrants to national economies. However, lost in these positive depictions is the potential for an

*Table 7.* Chances out of 100[a] of employment in managerial, engineering, technical and other occupations for men age 45, with specialization in civil engineering, residing in Montreal, Toronto, and Vancouver, by level of degree, for Canadian born and permanent residents immigrating at age 28+, by duration, Canada, 1996

| | | Permanent residents immigrating age 28+ Duration in Canada | | | | Difference[b] between Canadian born and permanent residents immigrating age 28+ Duration in Canada | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Canadian born | 2–4 | 5–9 | 10–14 | 15–19 | 2–4 | 5–9 | 10–14 | 15–19 |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Bachelors degree* | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | | | |
| Manager | 36.1 | 22.5 | 24.6 | 25.4 | 28.9 | −13.6 | −11.5 | −10.7 | −7.2 |
| Engineer | 36.0 | 16.1 | 16.5 | 22.4 | 27.3 | −19.9 | −19.5 | −13.6 | −8.7 |
| Technical | 9.4 | 12.1 | 10.1 | 11 4 | 11.5 | 2.8 | 0.7 | 2.0 | 2.1 |
| Other occ. | 18.5 | 49.2 | 48.7 | 40 8 | 32.3 | 30.7 | 30.2 | 22.3 | 13.8 |
| *Masters degree* | 100.0 | 1 00.0 | 100.0 | 100.0 | 100.0 | | | | |
| Manager | 39.5 | 22.9 | 25.0 | 24.2 | 26.0 | −16.6 | −14.5 | −15.4 | −13.5 |
| Engineer | 37.1 | 27.7 | 20.4 | 36.0 | 41.5 | −9.4 | −8.7 | −1.1 | 4.4 |
| Technical | 8.5 | 14.7 | 12.2 | 12 8 | 12.3 | 6.2 | 3.8 | 4.4 | 3.8 |
| Other occ. | 14.9 | 34.8 | 34.4 | 27.0 | 20.2 | 19.8 | 19.5 | 12.1 | 5.3 |
| *Ph.D. degree* | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | | | | |
| Manager | 21.6 | 17.5 | 19.0 | 16.9 | 17.2 | −4.1 | −2.6 | −4.7 | −4.4 |
| Engineer | 54.7 | 47.9 | 48.9 | 57.2 | 62.3 | −6.8 | −5.8 | 2.5 | 7.6 |
| Technical | 8.9 | 13.4 | 11.1 | 10.8 | 9.7 | 4.5 | 2.2 | 1.8 | 0.8 |
| Other occ. | 14.8 | 21.2 | 20.9 | 15.1 | 10.7 | 6.4 | 6.1 | 0.3 | −4.1 |

[a]If divided by 100, figures are converted into probabilities.
[b]Calculated by subtracting values for the Canadian born (column 1) from those for permanent residents, specific for years in Canada.
Source: Table 5.

under-utilization of human capital skills. This can occur when educational credentials are under-valued and/or when accreditation requirements exist in the host country.

Our analysis of permanent residents in Canada who have engineering as a major field of study points to such under-utilization, at least in the early years after arrival. Data from the 1996 census of Canada show that the likelihood of being employed, and having employment in manager and engineering occupations is less for permanent resident men who immigrated at age 28 or later than for men immigrating by age 18 and for Canadian born men. Men who immigrate to Canada as adults are assumed to have received foreign degrees,

and the findings thus imply that they faced difficulty in getting recognition for their credentials. Such men are more likely than the Canadian born or those arriving before age 19 to find employment in occupations other than managerial, engineering and technical occupations. For those with masters and Ph.D. degrees, these disparities do dissipate with increasing years of residency, suggesting that this group overcomes initial adjustment difficulties.

These findings have at least two implications. Conceptually, the lack of fit between training and occupational location highlight the need to better understand the factors that produce such outcomes. Are accreditation barriers the major cause of these slippages between training, labor force participation, and occupational locations, or do other factors such as the quality of educational training and/or statistical discrimination also play roles? Addressing these questions will require in-depth occupation-specific studies, much like those done by the US National Academy of Sciences panel in the 1980s on women in the workplace.

Second, our findings also call attention to the potential tensions between immigration policy and immigrant policy, the latter dealing with immigrant integration. North American policies targeted at importing credentialed labor focus on the mechanisms fostering the entry of high skill labor. They seldom address issues of its utilization, relying instead on implicit assumptions that strong demand for skilled labor is synonymous with a win-win situation for employers and immigrants alike. Recent evidence of this perspective can be seen in the debate over the H-1B bill, prior to its passage by the United States Congress on 4 October 2000. Much of the public discourse prior to the passage of the bill emphasized the expansion of high-tech industries, the inability of indigenous labor supplies to fill the rapidly growing vacancies; and the importance of firms being globally competitive. Less prominent in the media coverage was the implications for these foreign born workers, including the charges that companies were importing more workers than needed, effectively laying them off (Kirby 2000) and/or paying lower wages than given to American workers (Khirallah 2000; Kruger 2000; Leopold & Costlow 2000).

In Canada, a new Immigration and Refugee Protection Act (Bill C-3 1) recently was tabled on 6 April 2000 in Parliament. Intended to replace existing legislation, the bill is "designed to curb criminal abuse of the immigration and refugee systems while expanding policies to attract the world's best and brightest to Canada" (Citizenship & Immigration Canada 2000a). Part of the explicitly stated rationale for the bill is to "to enhance Canada's advantage in the global competition for highly skilled workers" (Citizenship & Immigration Canada 2000b). In keeping with this economic agenda, the new legislation, when passed, will shift the selection system for skilled workers away from occupational criteria. It also will allow recently graduated for-

eign students working in Canada and temporary workers to apply for landed immigrant status from within Canada (Citizenship & Immigration Canada 2000c).

Increased numbers of skilled workers entering Canada as permanent residents is one likely outcome of this new legislation. Yet, from a immigrant integration perspective, the outcomes are less clear. Our research on engineers demonstrates that professional migration, carries the potential to create a paradox in which increased flows of high skilled labor trained abroad will not necessarily be accompanied by the same labor market and occupational fit that characterize nationals or immigrant arriving as youths. Although our research on foreign born engineers shows that the level of "mismatch" declines for those immigrants with longer residency in Canada, the training and labor force participation/occupation gaps remain large for recent arrivals and for those with Bachelor's degrees. These findings underscore the need to better understand the underlying causes, including certification requirements, and to determine if such 'matches and mismatches' also characterize immigrants in other high skill professions.

## Appendix A: Classifying manager, engineering, technical and other occupations

Even though some 500 occupational categories are used in the Canadian census, they are broad groups and heterogeneity exists within them. 'Engineering' consists of twelve smaller occupational groupings. For the most part, the category is composed of persons in the major sub-occupations of 'Electrical/Electronic Engineering' (25%), 'Civil Engineering' (24%), 'Mechanical Engineering' (16%). 'Chemical Engineers', 'Computer Engineers' and 'Industrial & Manufacturing Engineers' each make up about 6% of the group. 'Petroleum Engineers' and 'Aerospace Engineers' make up 2–3% each. 'Mining', 'Geological' and 'Materials' Engineers make up about 4% all together. Just over 2% are in a residual 'Not Elsewhere Classified' sub-category.

The 'Management' category consists of over 40 different occupational groups. Almost one in five are classified as 'Engineering and Science Managers'. Some are senior or more general managers in fields clearly related to engineering such as manufacturing, construction, utilities and transportation. A smaller but still significant proportion (over 12%) are sales or purchasing managers. Others are managers involved in regulation and inspection for government and the financial services industries or are officers in the military.

The Technician occupational group contains computer programmers and analysts, draftsmen, inspectors and technicians of various types. The residual

'Other' category is the most diverse. It contains architects, urban planners, mathematicians and scientists of various types along with everyone else in the labor force. It should be noted that the groups such as architects, scientists are not part of the accreditation mandate of the CCPE.

## Appendix B

*Table B.* Significance of increments to chi-square tests for models in Tables 2 and Table 5

| | Canadian born (1) | Permanent residents Immigrating at Age 0–18 (2) | Age 28+ (3) | Age 28+ (4) |
|---|---|---|---|---|
| *Labor force participation* | | | | |
| Level of degree | 0.050 | ns | 0.001 | 0.001 |
| Field of study | ns | 0.050 | 0.001 | 0.001 |
| Place of residence | ns | ns | 0.010 | ns |
| Age | 0.001 | ns | 0.001 | 0.010 |
| Duration in Canada | | | | 0.001 |
| *Occupation* | | | | |
| Level of degree | 0.05 | 0.001 | 0.001 | 0.001 |
| Field of study | ns | 0.001 | 0.001 | 0.001 |
| Place of residence | ns | 0.001 | 0.01 | 0.001 |
| Age | 0.001 | 0.001 | 0.001 | 0.001 |
| Duration in Canada | | | | 0.001 |

Source: Tables 2 and 5.

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## Notes

1. Models also were run that incorporated home language (English and/or French). However, this variable was not significantly related to labor force status for either group of immigrants. Increment to chi-square tests also indicated that duration was not significantly related to the labor force status of persons immigrating as children. For those immigrating to Canada as children, all have had at least ten years of residency in Canada. The upper limit for those who are age 54 and arrived in their first year of life is 54 years.
2. This may seem counter-intuitive given that the logits in Table 5 refer to the log-likelihoods of being in an occupation other than those with engineering titles. However, multinomial logistic regressions which are run for engineering occupations vis-a-vis other reference groups will produce the same coefficients but with opposite signs. The vocabulary reflects this.

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