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Matching Workers to Work: The Case of Asian Immigrant Engineers in Canada

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Introduction

The start and end of the 20th century embodies three polarities for students of North American immigration. In the early 1900s, immigration to Canada and to the United States was not extensively state regulated, the primary exceptions being the exclusion of paupers, imbeciles, and non-Europeans, particularly Asians. Sources countries were the United Kingdom, and those in North and Western European and Eastern European regions. Immigrant labor was employed in economies dominated by agricultural and industrial-manufacturing activities. By the late 1990s, this portrait was outdated, and even reversed. American and Canadian governments had comprehensive immigration policies regulating numbers and types of migrants to be admitted. Major policy changes in the 1960s and thereafter removed national origins as a criterion of admissibility, allowing immigration from non-European countries when family reunification, economic contribution, and humanitarian based criteria were met (Boyd, 1976; Keely, 1971). North American immigrants disproportionately came from Asian countries and in the case of the United States, also from Mexico, Central and South America. The transformation from an industrial to a post-industrial economy was complete, characterized by high employment in service industries and growing knowledge based sectors.1

A fourth polarity was in the making in the closing decade of the 1900s. Whereas immigrant labor at the start of the 20th century was primarily unskilled, immigration policy developments and debates during the 1990s increasingly emphasized the high skilled and professional component of immigrant flows. Such emphasis reflected the broader context of economic globalization, which had emerged from worldwide networks of communication, transportation, economic transactions and the market and production strategies of companies (Reich, 1991; Thurow, 1992). Both Canada and the United States actively sought agreements

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1 For a discussion of the growth of the post-industrial economy in both Canada and the United States, see: Boyd, Myles, and Haywood, 1991; Singelmann, 1978; Tienda, Jensen, and Bach, 1984.

such as the GATS and NAFTA in order to regulate and institutionalize their participation in this new international system. Economic competitiveness in a knowledge based society became the mantra of the late 1990s, highlighting the importance of high-skilled labor in post-industrial economies. 2

Engineering is a professional occupation which not only plays an important role in the attempts of firms and nations to position themselves in the new world order but also relies on a global labor supply. In North America, high technology sectors with extensive global linkages employ engineers, and exporting engineering services is a core activity for many firms. A significant percentage of workers in these engineering occupations are foreign born. 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, Waldinger and Borogmehr, 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 have engineering as a post-secondary major field of study. Most (97 percent) are permanent residents (unpublished tabulations from the 1996 2B census database).

Asian-born engineers appear to be important components of this foreign born labor. This is suggested by research in the United States which focuses on the experience of Asian engineers, particularly those in California's "silicon valley" (Alarcon, 1999; Fernandez, 1998; Lim, Waldinger and Borogmehr, 1998; Tang, 1993a, 1993b, 1995). However, research also indicates that the skills of these workers are not always well matched to their jobs, finding evidence for under-employment or blocked mobility. 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.

Are such findings observed in other post-industrial economies? This paper addresses this question for immigrant Asians with engineering training who are living and working in Canada. After a review of the reasons why Asian engineers may be mismatched in the Canadian labor market, immigrant engineer flows are briefly profiled before raising the three research questions of this paper: 1) do Asian immigrants with foreign training in engineering have the same labor market insertion profiles as do those who are native born; 2) do Asian immigrants with foreign engineering training have the same occupational patterns of employment that are observed for the native born with similar credentials; and 3) does increasing duration in Canada attenuata any observed differences in employment and occupational profiles that exist between the Asian born and other immigrant groups or between the Asian born and the Canadian born? The analysis associated with these questions extends U.S. research in two ways. First, in reviewing the reasons for mis-matches in training and labor market performance, attention is given to a factor not extensively studied by U.S. researchers, namely certification requirements that may exist in highly regulated occupations. Second, by focusing on Canada, the analysis offers a comparative perspective on the utilization of high skilled immigrant labor.

Why the Difference between Asian Born Engineers and Others?

American research offers four explanations for the observed disparities between engineers, demarcated by birthplace and race. One explanation for disparities between groups of engineers is that specific birthplace or racially defined groups lack the requisite human capital skills, represented by training, work experience, and high levels of language proficiency. Another is that these workers have fewer social capital based resources than their white American-born colleagues. Asian, and other migrants, may have fewer professional networks to draw upon in their job searches, and they may be less likely to have English

2 GATS refers to General Agreement on Trades and Services; NAFTA refers to the North American Free Trade Agreement

language based networks. Social skills, including leadership styles may differ as well. Researchers, however, argue that these gaps should disappear over time to the extent that "assimilation" occurs and improves networks, job searches, and language skills. This supposition implies that differences between Asian born immigrants and other groups should diminish as duration in the host society increases. Similarly, any labor market differences among Asian origin groups which reflect diverse human capital characteristics and social networks are expected to diminish over time. A third explanation is that discrimination exists. (Alarcon, 1999; Fernandez, 1998; Lim, Waldinger and Borogmehr, 1998; Tang, 1993b, 1995; 1997). In United States studies, discrimination frequently is described in terms of employer decisions over hiring and promotions, negative stereotyping and homosocial behaviors in which colleagues are selected on the basis of presumed similarities in outlooks, managerial styles and "understandings" (Fernandez, 1998; Tang, 1997). In this context, "race," country of origin or other phenotypical characteristics act as markers of presumed dissimilarities, thus leading to racial and country of origin based discrimination. In such circumstances, differences should be observed in the labor market outcomes of Asian (and other non-white groups) compared to whites, or compared to immigrant groups originating from areas viewed as desirable.

Discrimination also can refer to structural barriers. In Canada, the term "systemic discrimination" has become part of the common and policy lexicon, referring to rules and procedures that are not explicitly designed to produce differential outcomes but do so through their applications. 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 a trade or profession among the foreign born (Boleria, 1992; McDade, 1988). 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 and 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.

The accreditation of immigrant professionals is of growing concern in Canada, with special attention focussed on medical, health and engineering professions.3 The Canadian 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)

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3 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 under-recognition of foreign credentials (McDade, 1988; Mata, 1992, 1994, 1999; Wright and 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 and Iredale, 1993; Mata, 1999).

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).

Within North America, gradual movement has occurred in the direction of removing accreditation barriers that appear when individuals change places of residence. As the umbrella association representing the federation of the provincial/territorial associations, the Canadian Council of Professional Engineers (CCPE) 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 that 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 as a result of lengthy searches for jobs considered suitable for their degrees.

The second scenario is that when employed, immigrants with foreign training may also less likely to be working in engineering or engineering related occupations than are the Canadian born or the foreign born who received Canadian engineering degrees. Since employment in engineering occupations often is the first rung on a ladder to management (Fernandez; 1998; Tang, 1993b, 1997), this scenario implies that engineers with foreign training will be less likely to be in management. Finally, because knowledge of engineering programs and the CCPE list of acceptable engineering institutions are likely to favour engineering programs in the United States, the U.K. and Europe, such occupational patterns should be especially pronounced for the Asian born.4 It should be noted that these two outcomes of greater "slippage" for the foreign born with foreign training can also result from other factors, notably the lesser worth of some programs of study, language difficulties, the absence of professional networks, 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 outcomes, but emphasizes the fluctuation of these end states, particularly over time. This view of diminished slippage and improved occupational fit with

4 Agreements exist between accreditation bodies in Canada, the United Kingdom, Ireland, Australia, New Zealand, South Africa and Hong Kong for recognizing accredited university Bachelor degree programs in engineering (Canadian Council of Professional Engineers, www.ccpe.ca ,1/25/2000).

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.

Data Sources and Methods

Insightful as it is, American research rests either on small case studies or on two data sets, notably 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 any analysis of those trained as engineers but 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).

In Canada, information on the immigrant engineers is available from two sources: the Landed Immigrant Data System and censuses. LIDS is the administrative system of Citizenship and Immigration Canada that records the entries for permanent residence in Canada. Unlike INS flow data, this information is not routinely released in the form of public use micro-data files. In this paper, information on the flows of foreign born engineers are obtained from special tabulations. Census data is the second source of data on engineers. Fielded on May 14, 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. A list of over 500 occupational titles is on the master data base, which can be accessed only on site at Statistics Canada as they are collapsed to 25 major categories on the public micro data files. This detailed array of occupational titles permits the identification and sorting of occupations into those that are engineering or related and those which are not (the classification of detailed occupational titles is available from the authors). While similar occupational classifications also are possible with United States census data, 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. The 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.

This data on major field of study permits identifying those who underwent training in engineering fields, a identification which is not possible with U.S. 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, and allows the matching of those with engineering training to employment patterns.

The focus in this paper is on the labor market experiences of men age 30-54 who have bachelor degrees or higher and at least 16 years of schooling . Most engineering majors are men and the comparatively small numbers of women constrain the analysis, particularly when examining variations by place of birth. 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. The restriction of the population under study to those with bachelors degrees or higher and a minimum of 16 years of schooling is done to conform to the group eligible for CCPE accreditation.

Most discussions of the immigration of highly skilled labor assumes that training has been received abroad. As previously discussed, it is this group that is most likely to face re-certification requirements in professions such as engineering or medicine, and it is this group that may have greater language problems, face employers who are not familiar with their credentials or may be trained in programs that differ from that those in North America . In order to better capture the group that most likely trained outside Canada, permanent residents 5 are restricted to those who immigrated at age 28 or later and arrived by 1994.6 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. Since education generally is completed by the mid-twenties, it is assumed that most, if not all, of those immigrating at age 28 or later have received their degrees outside Canada. Two reasons exist for the requirement that this group legally entered Canada by 1994. 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 (Badets and Howatson-Leo, 1999) is minimized. It is assumed that most if not all of the Canadian born have received degrees from Canadian (or American) institutions.

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 rests on United States research on engineers (Fernadez, 1998; Lim, Waldinger and Bozorgmehr, 1998; Tang, 1993a, 1993b, 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

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5 “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. Non-permanent residents refers to foreign born who are in Canada on a temporary basis and are not considered permanent residents. They are a diverse group which includes students, persons on short term work authorization permits, and refugee claimants. Non-permanent residents represented about 1% of the population enumerated in the 1996 census. Although over-all flows may be large, the numbers in Canada at any one point in time are much smaller. Numbers of non-permanent residents who were engineers in the 1996 census were too few for analysis.

6 Another analysis of those with engineering as a major field of study (Boyd and Thomas, 2000) compared the employment and occupational profiles of the Canadian born, permanent residents immigrating as children (0-18) and permanent residents immigrating at age 28 or later. The profiles for permanent residents who immigrated to Canada before age 18 were remarkably similar to the Canadian-born, suggesting that a major distinction is between degrees received from Canadian institutions and those received outside of Canada, rather than between Canadian birth and immigrant status per se.

being in each occupational category as opposed to some reference category

(Equation 1).

$$\text{Log}\ (\ P(category_i)/\ P(category_j)) = B_{i0}+B_{i1}X_i+B_{i2}X_2+\ \ +B_{ip}X_p \qquad \text{(EQ. 1)}$$

The $P(category_i)$ is the probability of falling into a given category i of the dependent variable (e.g. technical occupations) and $P(category_j)$ 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.). Xi_1 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, specialized fields of study within engineering, and for those arriving age 28 or later, home language. This latter variable is selected as a crude measure of the extensiveness of English and/or French language use.[7]

Engineers on the Move

During the past 15 years (1980-1995), migration flows from Asia have represented about one-third of all foreign-born men age 25-64 who enter Canada with engineering as an intended occupation and who have at least a Bachelor's degree (Table 1). This percentage is slightly lower than the overall percentage that are Asian born (including those who intend no or non-engineering occupations). Close to 90 percent (88.9%) of Asian born men intending to enter engineering and related occupations (managerial and technical occupations) enter Canada in the economic class rather than in the family or humanitarian classes (Table 2, panel 1, column 2). Comparable data for non-Asian born indicates that under three-quarters (72.7%) entered in the economic classes. Nearly one in five of the non-Asian born men intending an engineering related occupation were admitted under humanitarian criteria compared to less than one in fifty of those who were Asian born. These differences between the non-Asian born and the Asian born partly reflect the movement out of Eastern European countries in the late 1980s and the early 1990s, fueled by the dissolution of the former U.S.S.R and the ensuing political upheavals and military confrontations in former satellite areas.

Table 1: Numbers of Male Permanent Residents, Age 25-64 with B.A.

7 The language variable is constructed as English and/or French spoken in the home, either solely or with another language versus no English and/or French spoken in the home. It is an imperfect measure of language familiarity. However, unlike the Australian and United States census questions, Canadian census questions in general do not provide good measures of linguistic skill (see Boyd, 1999 and Boyd, DeVries, and Simkin, 1994 for further discussion). The question on knowledge of Canada's two official languages provides even less information than the question on home language. When asked the question on knowledge of Canada's two official languages, virtually all engineers in our sample indicate they speak English and/or French well enough to carry on a conversation.

Degrees or Higher, Entering Canada, 1980-1995 by Asian and Other Birthplace and by Intended Occupation[a]

Percent of	Asian Born	Other Areas	Total that are Asian Born
Total	81526	109971	43.6
Engineer & Rel. Manager	10921	26190	33.8
Other Intended Occup.	64945	79355	45.9
No Intended Occup	5660	4426	59.4
Percent of Those Giving Intended Occupations that are			
Engineer & Related Occupations[b]	14.4	24.8	

(a) Based on the Canadian Classification and Dictionary of Occupations (CCDO) list of occupational titles.
(b) Includes management occupations in engineering, all engineering occupations, and related technical occupations.
Source: Citizenship and Immigration Canada, Landed Immigrant Data System, April, 2000.

Table 2: Class of Admission for Male Permanent Residents, Age 25-64 with B.A.Degrees or Higher, Entering Canada, 1980-1995 by Asian and Other Birthplace and by Intended Occupation[a]

Birthplace	Total (1)	Engineer & Related Occupations[b] (2)	Other Intended Occupation (3)	No Intended Occup. (4)
Asian born				
Total	100.0	100.0	100.0	100.0
Family	28.7	9.6	29.9	52.0
Humanitarian	3.8	1.5	4.5	0.9
Economic	67.4	88.9	65.6	47.1
All Other Birthplaces				
Total	100.0	100.0	100.0	100.0
Family	16.5	7.1	17.6	52.7
Humanitarian	18.9	20.2	19.2	6.2
Economic	64.6	72.7	63.2	41.1

(a) Based on the Canadian Classification and Dictionary of Occupations (CCDO)list of occupational titles.
(b) Includes management occupations in engineering, all engineering occupations, and related technical occupations.
Source: Citizenship and Immigration Canada, Landed Immigrant Data System, April, 2000.

Stock data from the 1996 Census 2b form (representing one in five Canadian households) confirms that most permanent residents with engineering as a major field of study are recent arrivals to Canada (Table 3). Over two-thirds of those born in Asia and elsewhere who have B.A. degrees or higher have lived in Canada for less than 10 years (Table 3). Compared to the Canadian born, both Asian and non-Asian born men are on average about three years older, have much higher percentages living in the three major metropolises of Montreal, Toronto and Vancouver, and are much more likely

not to be speaking English and/or French (Canada's two official languages) in their homes.

Table 3: Selected Characteristics of Men, Age 30-54 with Bachelor Degrees or Higher, with Engineering as T heir Major Field of Study, Canadian Born and Permanent Residents, Arriving at Age 28+, Canada, 1996

	Permanent Residents Immigrating Age 28		
Characteristics	Canadian Born (1)	Asian Born (2)	All Other Birthplaces (3)
Highest Degree	100.0	100.0	100.0
Bachelor Degree	82.2	68.1	58.3
Masters Degree	15.4	20.7	33.8
Ph.D. Degree	2.4	11.2	8.0
Specialization	100.0	100.0	100.0
Electrical	20.1	25.6	24.7
Mechanical	18.3	18.0	22.9
Civil	18.2	20.3	18.0
Chemical	7.2	6.3	5.1
All Other	36.2	29.8	29.3
Labour Force Activity	100.0	100.0	100.0
Not in Labour Force	2.5	11.4	7.6
Unemployed	2.0	6.1	8.5
Employed	95.5	82.4	83.9
Occupational Group	100.0	100.0	100.0
Manager	28.6	17.2	18.3
Engineer	41.3	29.2	33.4
Technician	11.6	16.4	16.5
Other	18.6	37.2	31.9
Place of Residence	100.0	100.0	100.0
Montreal, Toronto, Vancouver	34.6	73.4	67.5
All Other Areas	65.4	26.6	32.5
Official Language(s)			
Spoken at Home	100.0	100.0	100.0
Yes	99.4	35.3	44.5
No	0.6	64.7	55.5
Years in Canada			
Non-Immigrant	(na)	100.0	100.0
2-4		34.2	35.9
5-9		37.6	32.7
10-14		9.1	14.7
15-19		8.7	10.5
20 or over		10.4	6.2
Mean Age	39.7	42.7	42.5

(na) Not applicable.Source: Statistics Canada. 1996 Census 2B database.

The Asian and non-Asian immigrant populations, of course, consist of many birthplace groups. Historically, the U.S., the U.K. and Europe were the major sources of immigrants to Canada prior to the legislative changes of the 1960s and 1970s. Thereafter, immigration from other areas grew, with the result that the Asian-born population is quite diverse with respect to origins. For men in our reference population (age 25-54, bachelors degrees or higher, immigrated at age 28 or later), the largest groups of Asian born are those born in China, Hong Kong, Philippines, and India. Table 4 shows the demographic diversity by birthplace that exists within the Asian and non-Asian born immigrant populations. Of those born in China and Hong Kong, more than 4 out of 5 have been in Canada for less than 10 years. Immigrants born in the Philippines and in India also have substantial proportions in Canada for less than 10 years. However, about one in four of those born in the Phillippines have been resident in Canada for 10 years or more as have nearly half of those born in India. Reflecting the influence of the pre-1970 migration streams, nearly 60 percent of those born in the U.S., U.K./ or in European countries have lived in Canada for ten years or more. This group also is on average the oldest and evenly split in residence between Canada's largest three CMAs and other areas. In contrast, over three quarters of those born in Hong Kong and in the Philippines reside in Montreal, Toronto or Vancouver. As might be expected given their origins and recent immigration history, those born in China and Hong Kong have very large percentages (over 80 %) not speaking any English and/or French in their homes. In contrast over half of those born in India and in the Philippines speak English or French in their homes and well over 90 percent of those born in the U.S., U.K. and Europe.

Table 4: Selected Characteristics of Men, Age 30-54 with Bachelor Degrees or Higher, with Engineering as Their Major Field of Study, Permanent Residents Arriving at Age 28+, by Region and Country of Birth, Canada,1996

	Not Born in Asia		Born in Asia				
	Europe (1)	U.S., U.K. Countries (2)	All Other China (3)	Hong Kong (4)	Phillipines (5)	India (6)	All Other Asian Countries (7)
Highest Degree	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Bachelor Degree	62.4	57.6	43.4	73.6	96.6	57.1	72.0
Masters Degree	25.3	35.2	29.7	21.3	3.2	25.7	21.1
Ph.D. Degree	12.3	7.3	26.9	5.1	0.2	17.2	6.9
Specialization	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Electrical	23.2	24.9	27.7	26.6	25.1	28.6	22.3
Mechanical	16.2	24.0	16.1	15.9	23.9	18.2	17.4
Civil	14.4	18.5	16.2	26.7	19.7	12.5	23.6
Chemical	6.8	4.9	7.7	3.9	6.5	6.1	6.6
All Other	39.4	27.6	32.4	26.9	24.8	34.6	30.1
Labour Force Activity	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Not in Labour Force	3.6	8.3	10.6	14.5	9.7	5.2	14.3
Unemployed	2.5	9.5	6.8	5.3	5.1	6.3	6.6
Employed	93.9	82.3	82.5	80.2	85.3	88.6	79.1
Occupational Group	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Manager	33.4	15.4	13.5	17.3	5.7	17.9	26.1
Engineer	36.6	32.8	38.7	31.7	9.5	37.6	27.6
Technician	11.5	17.4	21.5	25.0	11.9	13.6	11.8
Other	18.5	34.4	26.3	25.9	72.9	30.9	34.6
Place of Residence	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Montreal, Toronto, Vancouver	50.9	70.2	66.4	84.8	76.3	64.1	74.6
All Other Areas	49.1	29.8	33.6	15.2	23.7	35.9	25.4
Official Language(s)Spoken	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Yes	90.3	37.0	18.6	16.1	54.9	61.9	34.3
No	9.7	63.0	81.4	83.9	45.1	38.1	65.7
Years in Canada	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2-4	16.9	39.0	37.1	31.4	39.0	24.6	36.2
5-9	21.0	34.6	48.5	49.1	33.5	28.2	30.2
10-14	19.7	13.9	5.1	10.7	4.3	15.1	10.6
15-19	25.3	8.1	4.0	6.7	8.9	11.4	11.5
20+	17.1	4.4	5.3	2.1	14.2	20.7	11.5
Mean Age	45.1	42.1	41.2	40.3	42.2	44.8	44.2

Source: Statistics Canada. 1996 Census 2B database.

Human Capital Stock and Immigrant Engineers

Compared to the Canadian born population that studied engineering, the Asian born are more likely to have received masters and Ph.D degrees rather than only bachelors degrees. The receipt of higher degrees is

especially true for those born in China and India, followed by men born in Hong Kong in other Asian countries. In contrast, nearly all men born in the Philippines have only a bachelors degree. Compared to the Canadian born, permanent residents born in the United States, the U.K. and Europe also have higher percentages receiving masters and Ph.D. degrees although the percentages are below those observed for men born in China and in India (Tables 3 and 4).

Electrical, mechanical and civil engineering are the three "core" fields in engineering. Electrical engineering includes expertise in electronics, which like the United States, has become an important sector in Canada's knowledge based economy. Civil engineering is the area most likely to be affected by the CCPE regulations for it includes construction activities that affect public safety. Most men age 30-54 have studied in these areas although variations exist in the degree of concentration in each area. Asian born are slightly more likely than the Canadian born and non-Asian permanent residents to have studied either electrical engineering or civil engineering although this concentration partly reflects the specialization patterns of those born in Hong Kong, where over one-quarter have studied civil engineering (Tables 3 and 4).

Employment Patterns: Variations by Region of Birth, Degree and Duration

In addition to the social and demographic differences discussed above, the Asian born population differ from the Canadian born with respect to their employment and occupational profiles. Table 3 shows that men born in Asian countries have lower percentages employed at the time of the census and they are more likely than non-Asian immigrant groups to not be in the labor force. This lower propensity to be employed characterizes all the specific Asian born birthplace groups and those not born in the U.S., U.K. and Europe. Only those men who were born in the U.S., the U.K. or in Europe have employment profiles that are similar to those observed for the Canadian born.

This relative under-employment of permanent residents who are either Asian born or born elsewhere is consistent with the recency of arrival patterns observed for these groups and with the higher percentages speaking only a non-English/French language n the home. . However, the permanent resident population has other characteristics which should enhance employment, such as higher percentages with masters and Ph.D. degrees, and residency in large urban areas.

Multinomial analysis reveals the diverse influence of these variables on being out of the labor force, unemployed or employed. Earlier analysis found that residential location (major CMA versus other areas) and language spoken in the home had no significant effects on the likelihood of being employed, unemployed or out of the labor force and these two variable were excluded from the results presented in Table 5. Other variables significantly influenced the (log) likelihood of not being in the labor force or of being unemployed versus being employed for the permanent resident population. The coefficients for place of birth indicate that compared to non-Asian immigrants, those born in Asia had greater (log) likelihood of not being in the labor force versus being employed but that they were less likely to be unemployed than employed (Table 5).

Table 5:Multinomial Logit Estimates of Labor Force Status for Men Aged 30-54 With Engineering as a Major Field of Study, Bachelor Degrees or Higher, Canadian born and Permanent Residents Arriving at Age 28+, Canada, 1996

	Canadian Born		Foreign born	
	Not in LF Vs Employed	Unemployed Vs Employed	Not in LF Vs Employed	Unemployed Vs Employed
	(1)	(2)	(3)	(4)
Intercept	-4.760 ***	-4.274 ***	-5.021 ***	-4.843 ***
Age	0.031 ***	-0.007	0.020 *	0.022 *
Highest Degree				
Bachelors Degree	-0.150	0.659	1.054 ***	0.609 **
Masters Degree	-0.277	0.293	0.659 **	0.447 *
Ph.D. Degree	(rg)	(rg)	(rg)	(rg)
Specialization				
Electrical	-0.042	-0.028	-0.216	-0.302 *
Mechanical	-0.324	0.074	-0.022	-0.105
Civil	-0.058	0.382 *	0.238	0.169
Chemical	-0.285	-0.096	0.191	-0.266
Other	(rg)	(rg)	(rg)	(rg)
Years in Canada				
2-4			1.360 ***	1.697 ***
5-9			0.927 ***	1.137 ***
10-14			0.255	0.479
15+			(rg)	(rg)
Place of Birth				
Asian			0.391 ***	-0.314 **
All Others			(rg)	(rg)
Parameters				
Log Likelihood	1348.65		3790.37	
Chi-square	42.59		294.43	
df	14		22	

* p<.05 ** p<.01 *** p<.001

However, for the Asian born, as for those permanent residents born elsewhere, other variables including duration, level of degree, age, and specialization condition their overall employment profile. One "common sense" way of understanding this is to calculate the probabilities of being out of the labor force, unemployed or employed for specific combinations of characteristics. This is done in Table 6, which calculates probabilities for men age 45, whose major fields of study is electrical engineering, and which indicates the variations in employment profiles that are produced by Asian vs non-Asian region of birth, level of degree (bachelor, masters, Ph.D.) and duration in Canada. These variations generate three conclusions regarding the employment profiles of immigrants arriving at age 28 or later vis-a-vis the Canadian born. First, for all levels of degrees and periods of duration, the employment profiles of immigrants born in Asian versus those born elsewhere are not very different. As suggested by basic data presented in Table 3, the Asian born have slightly higher percentages out of the labor force and slightly lower percentages unemployed or employed compared to permanent residents who are not born in

Asia. The differences are minuscule however with advanced degrees and increasing length of time spent in Canada. In fact a second conclusion supported by the probabilities in Table 6 is that after approximately 10 years in Canada, the employment profiles of both Asian and non-Asian groups are remarkably similar , and closely correspond to those observed for the Canadian born men who are age 45 and have studied electrical engineering. A third conclusion is that for the Asian and non-Asian born permanent residents, advanced degrees afford some protection again being unemployed or out of the labor force.

Table 6: Chances out of 100[(a)] of Being Employed, Unemployed or Not in the Labor Force,for Men Age 45, with Major Field of Study as Electrical Engineering for Canadian born and Permanent Residents Immigrating Age 28+, by Level of Degree and Place of Birth, Canada, 1996

	Total	Currently Employed	Un-employed	Not in LF
Bachelor Degrees				
Canadian Born	100.0	95.1	1.8	3.1
Foreign Born Asian Birthplace				
2-4	100.0	75.1	8.6	16.2
5-9	100.0	82.9	5.4	11.6
10-14	100.0	90.4	3.1	6.5
15+	100.0	92.9	2.0	5.2
Non Asian Birthplace				
2-4	100.0	76.7	12.1	11.2
5-9	100.0	84.4	7.6	8.0
10-14	100.0	91.3	4.3	4.4
15+	100.0	93.8	2.7	3.5
Masters Degrees				
Canadian Born	100.0	96.3	1.3	2.4
Foreign Born Asian Birthplace				
2-4	100.0	80.4	7.9	11.7
5-9	100.0	86.9	4.9	8.2
10-14	100.0	92.8	2.7	4.5
15+	100.0	94.8	1.7	3.5
Non Asian Birthplace				
2-4	100.0	81.1	10.9	8.0
5-9	100.0	87.7	6.7	5.6
10-14	100.0	93.3	3.7	3.0
15+	100.0	95.3	2.3	2.4
Ph.D. Degrees				
Canadian Born	100.0	95.9	0.9	3.2
Foreign Born Asian Birthplace				
2-4	100.0	87.9	5.5	6.6
5-9	100.0	92.2	3.3	4.5
10-14	100.0	95.8	1.8	2.4
15+	100.0	97.0	1.1	1.9
Non Asian Birthplace				
2-4	100.0	88.0	7.5	4.5

5-9			100.0			92.4				4.5			3.1			
10-14	100.0			96.0				2.4			1.6					
15+			100.0			97.2				1.5			1.3			

Source: Table 5.

Occupational Profiles: Birthplace, Degrees and Duration

Compared to Canadian born men, permanent residents immigrating age 28 or later have lower percentages holding managerial or engineering occupations in 1996 ands higher percentages employed in technical or other occupations. Again, as with employment patterns, there is little difference between the profiles observed for the Asian born and those observed for the non-Asian born (Table 3). Multinomial analysis confirms the similarities between migrants in these different regions of birth (Table 7, columns 4-6). Here the analysis includes language spoken at home and major CMA residence, which were found to be significantly associated with occupational outcomes along with other variables. The results show that the effects of being born in Asian countries versus being born in non-Asian countries incenses the (log) likelihood of holding non-engineering occupations (other) versus engineering occupations, but that the likelihood of being a manager or a technical worker compared d to holding an engineering occupation did not differ from the non-Asian born.

Table 7: Multinomial Logit Estimates of Occupations Held by Employed Men Aged 30-54 With Engineering as a Major Field of Study, Bachelor Degrees or Higher, Canadian born and Permanent Residents Arriving at Age 28+, Canada, 1996

	Canadian born			Foreign Born			Foreign born		
	Manager Vs Engineer	Technical Vs Engineer	Other Vs Engineer	Manager Vs Engineer	Technical Vs Engineer	Other Vs Engineer	Manager Vs Engineer	Technical Vs Engineer	Other Vs Engineer
	(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8) (9)
Intercept	-3.384 ***	1.461 ***		-2.002 ***	-4.697 ***	0.960	-3.149 ***	-4.163 ***	-1.201 * -3.348 ***
Age	0.057 ***	0.000		0.027 ***	0.072 ***	-0.019 *	0.026 ***	0.070 ***	-0.017 -0.471 ***
Highest Degree									
Bachelors Degree	0.931 ***	0.469 **		0.642 ***	1.346 ***	0.990 ***	1.935 ***	1.302 ***	0.978 *** 1.751 ***
Masters Degree	0.994 ***	0.337		0.397	0.839 ***	0.642 ** *	1.070 ***	0.850 ***	0.637 *** 0.973 ***
Ph.D. Degree	(rg)	(rg)		(rg)	(rg)	(rg)	(rg)	(rg)	(rg)
Specialization									
Electrical	-0.429 ***	0.089		-0.847 ***	-0.630 ***	0.126	-0.448 ***	-0.600 ***	0.116 -0.471 ***
Mechanical	-0.151 **	-0.490 ***		-0.455 ***	-0.501 ***	-0.372 **	-0.134	-0.457 ***	-0.389 ** -0.192
Civil	-0.124 *	-0.349 ***		-0.530 ***	-0.011	-0.190	-0.002	-0.002	-0.204 0.014
Chemical	-0.085	-0.411 ***		-0.274 **	0.005	-0.378	0.242	0.042	-0.399 0.210
Other	(rg)	(rg)		(rg)	(rg)	(rg)	(rg)	(rg)	(rg)
Place of Residence									
Mont.,Tor.,Vanc.	(rg)	(rg)		(rg)	(rg)	(rg)	(rg)	(rg)	(rg)
All Other Areas	-0.076	-0.152 **		-0.157 **	-0.329 ***	-0.151	-0.381 ***	-0.382 ***	-0.129 -0.375 ***
Years in Canada									
2-4					0.471 **	0.514 **	0.927 ***	0.548 ***	0.490 ** 0.889 ***
5-9					0.533 ***	0.310 *	0.888 ***	0.633 ***	0.265 0.914 ***
10-14					0.264	0.174	0.469 ***	0.301 *	0.157 0.537 ***
15+					(rg)	(rg)	(rg)	(rg)	(rg) (rg)
Official Language(s) Spoken at Home									
Yes					(rg)	(rg)	(rg)	(rg)	(rg) (rg)
No					-0.810	0.229 *	0.184 *	0.054	0.173 0.261 **
Region of Birth									
Asian					0.040	0.107	0.227 **		
All Other Areas					(rg)	(rg)	(rg)		
Country or Region of Birth									
China								-0.809 ***	0.437 * 0.154
Hong Kong								-0.678 **	0.488 * -0.140
Philippines								-0.722 *	0.942 ** 2.090 ***
India								-0.644 **	0.109 0.429 *

All Other Asia			-0.174	0.057	0.483 **
U.S., U.K. and Europe		(rg)	(rg)	(rg)	
All Other Places of Birth			-0.708 ***	0.261	0.388 **
Parameters					
Log Likelihood	6073.09	10453.96	11054.55		
Chi-square	817.98	654.18	1052.18		
df	24	39	54		

_____* p<.05 ** p<.01 *** p<.001 (rg) Reference group

Again, transforming the various logits into hypothetical probabilities confirms similarity in occupational profiles between the Asian born and the non-Asian born (Table 8).For those with bachelor's degrees and electrical engineering as the major field of study, not speaking any English or French in the home slightly increases the chances of being employed in technical or other occupations. But as was true for the employment profiles, the most dramatic change in the occupational profile is associated with increased residence in Canada. The longer the duration in Canada, the higher the chances that the Asian born and non-Asian born alike will be employed in engineering occupations.

Table 8: Chances out of 100[(a)] of Employment in Manager, Engineering, Technical or All Other Occupations, for Men Age 45, with Bachelor Degrees and Electrical Engineering as Major Field of Study, Residing in Montreal, Toronto, and Vancouver, for Canadian born and Permanent Residents Immigrating at Age 28+, by Language Spoken at Home and Duration in Canada, 1996

Region of Birth		Occupation Group			
Language, Yrs in Canada	Total (1)	Manager (2)	Engineer (3)	Technical (4)	Other (5)
Canadian Born	100.0	29.1	39.9	16.2	14.8
Foreign Born Speaks English/Fr. At Home Asian Birthplace					
2-4	100.0	17.1	21.5	19.9	41.6
5-9	100.0	18.9	22.4	16.9	41.8
10-14	100.0	18.3	28.3	18.6	34.7
15+	100.0	17.6	35.5	19.6	27.2
Non Asian Birthplace					
2-4	100.0	18.4	24.2	20.1	37.3
5-9	100.0	20.4	25.2	17.0	37.4
10-14	100.0	19.5	31.4	18.5	30.6
15+	100.0	18.4	38.7	19.2	23.7
Speaks No English/Fr. at Home Asian Birthplace					
2-4	100.0	14.0	19.1	22.3	44.6
5-9	100.0	15.7	20.1	19.1	45.1
10-14	100.0	15.3	25.7	21.2	37.8
15+	100.0	14.9	32.5	22.6	30.0
Non Asian Birthplace					
2-4	100.0	15.3	21.7	22.7	40.3
5-9	100.0	17.1	22.8	19.4	40.7
10-14	100.0	16.4	28.6	21.3	33.7
15+	100.0	15.7	35.7	22.3	26.3

(a) If divided by 100, data converts to probabilities.Source: Table 7, columns 1-6.

However, the aggregating of permanent residents into those born in Asian countries and those born elsewhere maskers considerable internal diversity. Multinomial logistic regression which includes specific groups shows that relative to those born in the U.S., U.K. and Europe, permanent resident men who are born in the Philippines are the most likely to been holding technical or other occupations. Hypothetical probabilities also show this pattern, which persists despite increasing duration in Canada this (Table 9). After fifteen years residency in Canada, the chances of employment in engineering occupations for men born in China, Hong Kong, India, the U.S. U.K. and in Europe as well as in all other countries is identical or slightly exceeds the chances observed for Canadian born men. At the same time, however, these Asian born men are less likely than the Canadian born to be employed as mangers, suggesting that a glass ceiling phenomena may be at work (Tang, 1997).

Table 9: Chances out of 100[(a)] of Employment in Manager, Engineering, Technical or All Other Occupations, for Men Age 45, with Bachelor, Degrees and Electrical Engineering as Major Field of Study, Residing in Montreal, Toronto, and Vancouver, for Canadian born and Permanent Residents Immigrating at Age 28+,with English and/or French Language Spoken at Home, by Country/Region of Birth and 2-4or 15+ Years in Canada, 1996

Occupational Group	Total	Managers	Engineers	Technicians	Other
Canadian Born	100.0	29.1	39.9	16.2	14.8
Foreign Born, 2-4 years duration					
China, P.R	100.0	15.1	26.8	28.4	29.7
Hong Kong	100.0	18.0	27.9	31.1	23.0
Philippines	100.0	5.6	9.1	15.9	69.5
India	100.0	17.1	25.8	19.6	37.5
Other Asian Born	100.0	24.6	23.1	16.7	35.5
U.S., U.K. Europe	100.0	32.5	25.7	17.5	24.3
All Other Areas	100.0	16.0	25.6	22.7	35.7
Foreign Born, 15+ years duration					
China, P.R.	100.0	13.4	41.2	26.7	18.7
Hong Kong	100.0	15.6	41.8	28.5	14.2
Philippines	100.0	6.4	17.9	19.2	56.5
India	100.0	15.7	40.8	19.0	24.4
Other Asian Born	100.0	22.9	37.2	16.5	23.5
U.S., U.K. Europe	100.0	28.8	39.4	16.5	15.3
All Other Areas	100.0	14.6	40.4	21.9	23.2

(a) If divided by 100, data converts to probabilities. Source: Table 7, columns 1-3,7-9.

Conclusion

Overall, census data that matches field of study to employment profiles and occupational distributions does not find the same degree of difference between the Asian born and the non-Asian born observed in many American studies. To the extent that differences are observed they are between men who immigrated as adults versus those who are Canadian born, and presumably Canadian trained, and even these differences attenuate with advanced degrees and increasing years of residency. Several reasons may account for such divergent findings relative to American research. First, it is possible that the mix of "Asian " engineers differs in Canadian and in the United States. American researchers do not always identify the specific origins of "Asian" engineers, but discussion suggests that many of them are of Indian origin, particular when employed in the high-technology firms , Second, the limited dis-aggregation that was done in this paper, does suggest wide differences between origin groups within a common area group. Averaging the profiles of different groups may underlie the apparently similarities in the employment and occupational profiles of Asian and non-Asian born men whose major field of study was engineering. This suggests that future studies should examine the specific country of origin of their professional workers.

It is likely that interest in the matching of professional workers, such as engineers to jobs, will persist given that the issue of procuring high skill labor through immigration is still under debate. As well, NAFTA includes the provision for the free movement of services, thereby facilitating temporary employment of non-residents in both Canada and the United States. New developments include a pilot project just completed in Canada designed to facilitate the employment of spouses accompanying high skilled principle applicants who have been granted temporary employment authorizations. In the United States, the numbers of H-1B visas for temporary high skilled foreign workers was increased in 1998 and amendments to further increase the quota are currently being debated. Both the Canadian and United States governments also have recently increased the numbers of high skilled permanent residents who may be admitted. The latest development occurred on April 6, 2000 when the Canadian Minister of Citizenship and Immigration introduced a new Immigration and Protection Act to replace the Immigration Act of 1996. Included in this new act are provisions that will move away from an occupation-based model to one focused on flexible and transferable skills. This will be accomplished in part by assigning more weight to education and increasing the relative weight of knowing either French or English, which are Canada's two official languages. The intent of such changes are "to attract 'the best and the brightest' to Canada...." (Citizenship and Immigration Canada, 2000). The act also contains provisions to increase temporary high skill labor and to facilitate the permanent residency of recently graduated foreign students. The purpose of such changes is to strengthen Canada's economic competitiveness.8

8 This act also will expand the Temporary Worker Program in the following ways: a) a more service oriented approach designed to facilitate the entry of temporary workers; b) creating an in-Canada landing class for temporary workers; c) allowing recently graduated foreign students who meet the criteria for economic integration, have a permanent job off and have been working in Canada to land from within Canada and d) pursuing agreements with sectors and firms to identify and met short term labor market needs. The intent of these initiatives is to meet the immediate needs of employers faster; to expand Canada access to the global labor market and to attract and keep the world's 'best and brightest' (Citizenship and Immigration Canada, 2000).

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