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Asian Immigrant Engineers in Canada

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The high-skilled and professional component of immigrant flows is a major topic in current North American immigration policy developments. Such emphasis reflects the broader context of economic globalization, based on worldwide networks of communication, transportation, economic transactions, and the market and production strategies of companies (Reich 1991; Thurow 1992). Starting in the 1980s, both Canada and the United States actively sought agreements such as the General Agreement on Trade and Services (GATS) and the North American Free Trade Agreement (NAFTA) in order to regulate and institutionalize their participation in this new international system. Economic competitiveness in a knowledge-based society has thus become the mantra of the early twenty-first century, highlighting the importance of high-skilled labor in postindustrial economies.

Engineering is a professional occupation that not only plays an important role in the attempts of firms and nations to position themselves in the new world order, but it also relies on a global labor supply. In North America, exporting engineering services is a core activity for many firms. Engineers (and scientists) trained outside of North America are also frequently viewed as part of a global labor supply by high-technology firms. 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 Bozorgmehr 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 list engineering as a post-secondary major field of study. Most (97 percent) are permanent residents (unpublished tabulations from the 1996 2B census database).

Most studies of foreign-born engineers in the North American workforce adopt a supply-side perspective found in immigrant integration research. In documenting similarities and discrepancies between natives and the foreign-born in employment and earnings, this research frequently attributes immigrant disadvantages to human capital stock (including language knowledge and recency of arrival), as well as to ethnic or racially based discrimination. For example, U.S. studies that examine the experience of engineers, particularly those in California's "Silicon Valley," find that the skills of these workers are not always well matched to their jobs. Instead, immigrants may experience underemployment 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 (Alarcón 1999; Fernandez 1998; Lim, Waldinger, and Bozorgmehr 1998; Tang 1993a, 1993b, 1995).

These findings generate two additional questions not systematically considered by researchers to date. First, is the experience of underemployment of Asian-born engineers unique to the United States, or are such findings also observed in other postindustrial economies, suggesting that foreign-trained immigrants, particularly from Asia, are by definition or design not likely to be fully utilized? Second, what do such findings of "mismatch" or under-utilization imply for immigration policy debates, which often are fueled by labor demand considerations?

In this chapter, the first question about the uniqueness or generality of studies on the American labor force is answered by examining the employment patterns of foreign-born Asian engineers who are permanently residing in Canada. As a postindustrial country characterized by a growing knowledge-based economy, Canada has many similarities with the United States. Moreover, in both countries immigration from Asia increased in the last quarter of the twentieth century as a result of new immigration policies first adopted in the 1960s (Boyd 1976; Keely 1971). During the 15-year period from 1980 to 1995, migration flows from Asia represented about one-third of all foreign-born men age 25 to 64 who entered Canada as permanent residents, listed engineering as an intended occupation, and had at minimum a bachelor's degree (unpublished tabulations from Citizenship and Immigration Canada, Landed Immigrant Data System, April 2000). As in the United States, engineers from Asia are a significant share of the inflow of engineers in general. Whether foreign-born engineers also are mismatched in the Canadian labor market is the empirical question to be investigated here.

The second question asks what the implications of the answers to the first question are for immigration policy debates. This is addressed in the concluding section of the chapter. Like the United States, Canada has an immigration policy that emphasizes permanent settlement and uses economic factors as one of its three admissibility criteria (the other two being family reunification and humanitarian considerations). Compared to the non–Asian-born intending to work in engineering occupations, Asian-born engineers are more likely to be admitted on the basis of economic criteria than on humanitarian or family reunification grounds. Between 1980 and 1995, 90 percent of Asian-born men intending to enter engineering and related occupations (managerial and technical occupations) were admitted in the economic class, in contrast to 73 percent of their non–Asian-born counterparts.[1] Such trends suggest that the immigration of engineers in general, and Asian engineers in particular, reflects current Canadian labor market demands. Recent immigration policy changes also indicate continued recruitment in the near future of high-skilled labor—both permanent and temporary. At the same time, concerns are mounting over Canada's ability to retain high-skilled labor, including foreign-born and Canadian-born engineers. In contrast, such concerns are notably absent in the U.S. policy arena, where debate and controversy focus on the revisions to the H–1B visa program (see Lochhead 2000; Lowell, this volume; Krikorian 1998; Usdansky and Espenshade, this volume; Valbrun 2000).

How Do Asian-Born Engineers Differ?

Studies find that Asian-born immigrants are more likely than white, American-born engineers in the United States to be under-employed. Four explanations exist for the observed disparities between engineers demarcated by national origin and race. One explanation for disparities between groups of engineers is that specific national origin or racially

[1] The occupational categorization of "intended engineering occupations" is based on the Canadian Classification and Dictionary of Occupations (CCDO) list of occupational titles, and it includes management occupations in engineering, all engineering occupations, and related technical occupations. Data are from the Citizenship and Immigration Canada, Landed Immigrant Data System (April, 2000) for men aged 25 to 64 with bachelor's degrees or higher. Although the data are consistent with the interpretation that the admission of foreign-born engineers reflects Canada's labor market demands, flow data do not necessarily capture the entire population of immigrant residents who are engineers. Immigrants with engineering training also can enter Canada under family and humanitarian criteria, and in some instances, their occupations may not be recorded in administrative data on admissions.

defined groups lack the requisite human capital skills, represented by training, work experience, and high levels of language proficiency. A second is that these workers have fewer social capital–based resources than their white American-born colleagues. Asians and other migrants may have fewer professional networks to draw upon in their job searches, and they may be less likely to have English 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 access to networks, job searches, and language skills. This supposition implies that differences between Asian-born immigrants and other groups should diminish as time spent in the host society increases.

A third explanation is that immigrants face discrimination in the host society (Alarcón 1999; Fernandez 1998; Lim, Waldinger, and Bozorgmehr 1998; Tang 1993b, 1995, 1997). In U.S. studies, discrimination is frequently 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, leading to racial and country of origin–based discrimination. In such circumstances, differences should be observed in the labor market outcomes of Asians (and other non-white groups) compared to whites.

Discrimination can also result from structural barriers. In Canada, the term "systemic discrimination" refers 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 that are universally applied to the Canadian-born and foreign-born alike, but that have disproportionate effects in restricting access to a trade or profession among the foreign-born (Bolaria 1992; Mata 1992, 1994, 1999; McDade 1988).

For the foreign-born who studied engineering outside Canada, the requirement of within-Canada accreditation is the fourth possible explanation for under-employment or occupational mismatches. The Canadian engineering profession is a publicly regulated occupation with its own "reserve" title.[2] This means that, by law, no one may offer engineering services to the public unless they first obtain a license from one of the twelve provincial and territorial engineering associations (*ordres* in Quebec) that have been mandated by provincial/territorial law. Per-

[2] See www.nspe.org for information on comparable licensing in the United States by the National Society of Professional Engineers.

sons may do engineering work without accreditation, but it must be under the direct supervision of a licensed professional engineer, who is legally entitled to use the designation "P.Eng." ("Ing." in Quebec) after their name. Figures suggest that the majority of those trained as engineers are licensed. As of the year 2000, approximately 157,000 engineers were licensed.[3] According to the most recent census (1996), 262,000 persons age twenty-one and older who had at least a bachelor's degree gave engineering as their major field of study (Schwanen 2000: table 1).

These four explanations imply that engineers immigrating 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, or they may be more likely to be unemployed as compared to Canadian-trained engineers. Second, when employed, immigrants with foreign engineering training also may be 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. Third, with increasing years of residency in the host country, immigrants should improve their labor market profiles and narrow the gaps that exist between training and occupations. This third expectation rests on two inputs. The first derives from the general literature on immigrant adaptations, observing that downward mobility and unemployment are not uncommon shortly after arrival. Researchers argue, however, that these gaps should disappear over time to the extent that language skills and job-related networks improve and knowledge about the new society increases. The second is specific to professions with accreditation requirements, emphasizing that re-accreditation takes time, during which courses must be taken, exams passed, and host-country experience obtained.

In principle, these scenarios should describe the experiences of all foreign-trained engineers. However, as found in American studies, the possible existence of discrimination implies that larger discrepancies in employment and occupational patterns may be observed for Asian-born immigrants compared to immigrants born elsewhere. Discrimination may result when race or ethnicity is used as a criterion of hiring or occupational placement. Furthermore, accreditation requirements can play a role. Knowledge of engineering programs and the Canadian Council of Professional Engineers (CCPE) list of acceptable engineering institutions is likely to favor engineering programs in the United States,

[3] See the Canadian Council of Professional Engineers Web site: www.ccpe.ca.

the United Kingdom, and Europe.[4] As a result, occupational gaps should be especially pronounced for the Asian-born, assuming that most obtain their degrees in their countries or regions of origin.

These considerations generate three specific questions to be answered. First, do the labor market profiles of Asian immigrants with foreign training in engineering differ from those of immigrants born elsewhere or from those of the Canadian-born? Second, do Asian immigrants with foreign engineering training have the same occupational patterns observed for the those born elsewhere, including the Canadian-born with similar credentials? Third, does increased time spent in Canada lessen the differences in employment and occupational profiles that may exist between the Asian-born and other immigrant groups, or between the Asian-born and the Canadian-born?

Data Sources and Methods

The analysis associated with these questions extends U.S. research in three ways. It examines the employment of foreign-born engineers in another country; it provides an updated analysis; and it analyzes a database that removes some of the difficulties associated with American sources of data. 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. U.S. 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, includes 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 over selective sample attrition over time (Tang 1995, 1997).

In Canada, data on the economic performance of immigrant engineers are collected by the Census of Population. 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. As is true for U.S. census data, occupational titles can be classified into those that are managerial, engineering, those that are of a technical nature, or

[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).

those unrelated to engineering skills. However, 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)?"[5] This question on major field of study permits identifying those who underwent training in engineering fields, an identification that 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 restricted to persons employed in engineering and related occupations.

The focus of this chapter is on the labor market experiences of men between the ages of 30 and 54 who have bachelor's 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 area of birth. The age parameters are chosen because the period between the ages of 30 and 54 is the core of the productive life for most people. It is also the period when they typically are well established in their careers. The focus on this age group also removes variation associated with school completion and selective early retirement. The restriction of the population under study to those with bachelor's degrees or higher and a minimum of 16 years of schooling ensures that the population analyzed corresponds to the group eligible for CCPE accreditation.

Most discussions of the immigration of highly skilled labor assume that these workers trained abroad. As previously discussed, it is this group that is most likely to face re-certification requirements in professions such as engineering or medicine, have greater language problems, face employers who are unfamiliar with their credentials, or be trained in programs that differ from those in North America. In order to better capture the group that was most likely trained outside of Canada, permanent residents[6] are restricted to those who immigrated at age 28 or

[5] Bold print appears on the questionnaire.

[6] "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. They are a diverse group that includes students, persons on short-term work authorization permits, and refugee claimants. Non-permanent residents represented about 1 percent of the population enumerated in the 1996 census. Although overall 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.

later and arrived by 1994.[7] 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. Because education generally is completed by one's 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, it minimizes the initial impact of arrival, which for the general immigrant population is associated with high unemployment (Badets and Howatson-Leo 1999). It is assumed that most if not all of the Canadian-born have received degrees from Canadian (or American) institutions.

In this chapter, employment states are defined as follows: out of the labor force, unemployed, or currently employed. Occupational location consists of working in one of four main types of work: managers, engineering occupations, technical occupations that are related to engineering activities, and all other occupations. This categorization follows U.S. research on engineers (Fernandez 1998; Lim, Waldinger, and Bozorgmehr 1998; Tang 1993a, 1993b, 1995, 1997). For some, engineering occupations are steps on the ladder to managerial occupations. Alternatively, some find a glass ceiling between engineering and managerial jobs that restricts such mobility. In addition to employment in managerial and engineering occupations, some individuals trained in engineering will find employment in occupations that are further removed from engineering 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, a four-category classification of over 500 occupational titles into manager, engineer, technical, and all other occupations was constructed (see Boyd and Thomas 2000: appen. A).

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

[7] 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 (ages 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.

education, defined as level of degree (bachelor's, master's, and Ph.D.) and duration in Canada for those arriving in Canada as adults. Control variables include age; residence in large Census Metropolitan Areas (CMAs, specifically Montreal, Toronto, and Vancouver) as opposed to other areas; specialized fields of study within engineering; and, for those arriving at 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.[8]

Demographic and Human Capital Characteristics

Stock data from the 1996 census 2B form (representing one in five Canadian households) show that most permanent residents with engineering as a major field of study are recent arrivals to Canada. Over two-thirds of those born in Asia and elsewhere who have bachelor's degrees or higher have lived in Canada for less than 10 years (table 4.1). 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 less likely to speak English and/or French (Canada's two official languages) at home.

Compared to the Canadian-born population that studied engineering, immigrants with foreign training are more likely to have received master's and Ph.D. degrees rather than just bachelor's degrees. However, those who are Asian-born are more likely than immigrants born elsewhere to have only a bachelor's degree. If they have advanced degrees, they are more likely to have a Ph.D. degree than those born elsewhere (11 percent of Asian-born men have Ph.D. degrees, compared to 8 percent of those born in other countries and 2 percent of the Canadian-born).

Asian-born men are also slightly more likely than others to specialize in electrical and civil engineering (table 4.1). Electrical, mechanical, and civil engineering are the three "core" fields in engineering. Electri-

[8] 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. Unlike the Australian and U.S. census questions, Canadian census questions in general do not provide good measures of linguistic skill (for further discussion, see Boyd 1999; Boyd, DeVries, and Simkin 1994). 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 indicated they speak English and/or French well enough to carry on a conversation.

Table 4.1
Selected Characteristics of Men, Ages 30 to 54, with a Bachelor's Degree or Higher, with Engineering as Their Major Field of Study, Canadian-Born and Permanent Residents, Arriving at Age 28+, Canada, 1996

Characteristics	Canada-born (1)	Permanent Residents: Asia-born (2)	Permanent Residents: All Other Birthplaces (3)
Highest degree	100.0	100.0	100.0
Bachelor's	82.2	68.1	58.3
Master's	15.4	20.7	33.8
Ph.D.	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
Other	36.2	29.8	29.3
Labor force activity	100.0	100.0	100.0
Not in labor 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 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 more		10.4	6.2
Mean age	39.7	42.7	42.5

NA = not applicable.
Source: Statistics Canada, 1996 Census 2B database.

cal engineering includes expertise in electronics which, as in 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 because it includes construction activities that affect public safety.

Employment Patterns by Country of Origin, Degree, and Years of Residence

In addition to the social and demographic differences discussed above, Asian-born, engineering-trained immigrants differ from the Canadian-born with respect to their employment and occupational profiles. At the time of the census, those born in Asian countries had lower employment percentages, and they were more likely than non-Asian immigrant groups to be out of the labor force (table 4.1). 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/non-French language in the home. However, the permanent resident Asian-born population has other characteristics that should enhance their employment opportunities, such as higher percentages with 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, so these two variables were excluded from the results presented in table 4.2. For Canadian-born men with engineering training, level of degree and specialization were not important predictors of the (log) likelihood of being out of the labor force or being unemployed compared to being employed. However, these other variables did significantly influence the (log) likelihood of not being in the labor force or of being unemployed versus being employed for the permanent resident population. In addition, the coefficients for place of birth indicate that, compared to non-Asian immigrants, those born in Asia have greater (log) likelihood of not being in the labor force versus being employed, but they are less likely to be unemployed than employed (table 4.2).

The analysis indicates that for those permanent residents born elsewhere, other variables—including length of stay, level of degree, age, and specialization—condition their overall employment profile. Once these factors are taken into account, what is the actual impact of being Asian-born on employment possibilities? One "common sense" way of

Table 4.2
Multinomial Logit Estimates of Labor Force Status for Men Aged 30 to 54, with Engineering as a Major Field of Study, Bachelor's Degree or Higher, Canadian-born and Permanent Residents Arriving at Age 28+, Canada, 1996

	Canada-born		Foreign-born	
	Not in Labor Force versus Employed (1)	Unemployed versus Employed (2)	Not in Labor Force versus Employed (3)	Unemployed versus Employed (4)
Intercept	−4.760***	−4.274***	−5.021***	−4.843***
Age	0.031***	−0.007	0.020*	0.022*
Highest degree				
Bachelor's	−0.150	0.659	1.054***	0.609**
Master's	−0.277	0.293	0.659**	0.447*
Ph.D.	(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				
Asia			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
(rg) = Reference group.
Source: Statistics Canada, 1996 Census 2B database.

answering this question is to calculate the probabilities of being out of the labor force, unemployed, or employed for specific combinations of characteristics, using the multinomial regression equations. This is done in table 4.3, which calculates probabilities for men age 45, whose major field of study is electrical engineering. Table 4.3 also shows the variations in employment profiles that are produced by Asian versus non-Asian region of birth, level of degree (bachelor's, master's, Ph.D.), and duration in Canada. These variations generate three conclusions regarding the employment profiles of Asian-born and other immigrants arriving at age 28 or later vis-à-vis each other and compared to the Canadian-born. First, for all levels of education and years of residence, the employment profiles of immigrants born in Asia versus those born elsewhere are not very different. As suggested by the logits (table 4.2) and data presented in table 4.3, Asian-born men 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 4.3 is that, after approximately 10 years in Canada, the employment profiles of both Asian and non-Asian groups are remarkably similar and correspond closely to those observed for Canadian-born men who are age 45 and have studied electrical engineering. A third conclusion is that for Asian-born and non–Asian-born permanent residents alike, advanced degrees afford some protection against being unemployed or out of the labor force.

Occupational Profiles: Birthplace, Degree, and Date of Arrival

Compared to Canadian-born men, permanent residents who immigrated at age 28 or later had lower percentages holding managerial or engineering occupations in 1996, and higher percentages employed in technical or other occupations. Again, as with employment patterns, relatively small differences exist in the actual occupational profiles observed for the Asian-born and non–Asian-born immigrants (table 4.1). The main difference is a slightly lower percentage of the Asian-born in engineering occupations and a corresponding slightly higher percentage in occupations other than managerial, engineering, or technical work compared to the occupational profile of other immigrant men. However, both Asian-born and non–Asian-born immigrants are much less likely than the Canadian-born to hold managerial occupations, and they are almost twice as likely to be employed in occupations that are

Table 4.3
Chances Out of 100[a] of Being Employed, Unemployed or Not in the Labor Force, for Men Aged 45, with Electrical Engineering as Major Field of Study, for Canadian-born and Permanent Residents Immigrating at Age 28+, by Level of Degree and Place of Birth, Canada, 1996

	Total	Currently Employed	Unemployed	Not in Labor Force
Bachelor's Degrees				
Canada-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
Foreign-born, 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
Master's Degrees				
Canada-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
Foreign-born, 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				
Canada-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
Foreign-born, 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

(a) If divided by 100, data convert to probabilities.
Source: Table 4.2.

not engineering or technically related. The under-representation of the foreign-born in managerial occupations parallels U.S. research that emphasizes the likely existence of a glass ceiling (Fernandez 1998; Tang 1997).

Multinomial analysis confirms the similarities in the occupational profiles of Asian-born and non–Asian-born migrants (table 4.4, columns 4 to 6). Here the analysis includes language spoken at home and major CMA residence, given that these variables were found to be significantly associated with occupational outcomes along with other variables. The results show that being born in Asian countries as opposed to being born in non-Asian countries increases the (log) likelihood of holding a non-engineering occupation (other) versus an engineering occupation. However, the likelihood of being a manager or a technical worker, compared to holding an engineering occupation, does not differ between Asian-born and non–Asian-born immigrants.

Again, probabilities are calculated from multinomial regressions. These probabilities show very similar occupational profiles for Asian-born and non–Asian-born immigrants (table 4.5). Here the example is for those living in Canada's three largest cities, with electrical engineering as a major field of study, a field that leads to "Silicon Valley"–type jobs. For those with bachelor's degrees in electrical engineering, not speaking 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. At the same time, neither group fully "catches up" to the patterns found for Canadian-born men with engineering as a major field of study. Differences are especially pronounced with respect to managerial and other (non-engineering or non-related technical) occupations. Even among those who have resided 15 years or more in Canada and who speak English or French at home, foreign-born men—regardless of area of birth—are less likely than the Canadian-born to be employed in management occupations, and they are much more likely to be working in occupations unrelated to engineering (table 4.5, rows 1, 5, and 9).

Conclusions and Policy Implications

Overall, this study, which matches field of study to employment profiles and occupational distributions, does not find the same degree of difference between Asian and non-Asian immigrants observed in U.S. studies. Several reasons may account for such divergent findings rela-

Table 4.4
Multinomial Logit Estimates of Occupations Held by Employed Men Aged 30 to 54, with Engineering as a Major Field of Study, Bachelor's Degree or Higher, Canadian-born and Permanent Residents Arriving at Age 28+, Canada, 1996

	Canadian-Born			Foreign-Born		
	Manager versus Engineer (1)	Technical versus Engineer (2)	Other versus Engineer (3)	Manager versus Engineer (4)	Technical versus Engineer (5)	Other versus Engineer (6)
Intercept	-3.384***	-1.461***	-2.002***	-4.697***	-0.960	-3.149***
	0.057***	0.000	0.027***	0.072***	-0.019*	0.026***
Age						
Highest Degree						
Bachelor's	0.931***	0.469**	0.642***	1.346***	0.990***	1.935***
Master's	0.994***	0.337	0.397	0.839***	0.642***	1.070***
Ph.D.	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)
Specialization						
Electrical	-0.429***	0.089	-0.847***	-0.630***	0.126	-0.448***
Mechanical	-0.151**	-0.490***	-0.455***	-0.501***	-0.372**	-0.134
Civil	-0.124*	-0.349***	-0.530***	-0.011	-0.190	-0.002
Chemical	-0.085	-0.411***	-0.274 **	0.005	-0.378	0.242
Other	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)

continued

Table 4.4 continued

Place of Residence						
Montreal, Toronto,Vancouver	(rg)	(rg)	(rg)	(rg)	(rg)	(rg)
Other	-0.076	-0.152**	-0.157**	-0.329***	-0.151	-0.381***
Years in Canada						
2-4				0.471**	0.514**	0.927***
5-9				0.533***	0.310*	0.888***
10-14				0.264	0.174	0.469***
15+				(rg)	(rg)	(rg)
Official Language(s) Spoken at Home						
Yes				(rg)	(rg)	(rg)
No				-0.810	0.229*	0.184*
Region of Birth						
Asia				0.040	0.107	0.227**
Other				(rg)	(rg)	(rg)
Parameters						
Log Likelihood	6073.0			10453.96		
Chi-square	817.98			654.18		
df	24			39		

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

Table 4.5
Chances Out of 100[a] of Employment in Manager, Engineering, Technical, or All Other Occupations, for Men Age 45, with Bachelor's 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, Language, Years in Canada	Total (1)	Occupation Group: Manager (2)	Engineer (3)	Technical (4)	Other (5)
Canada-born	100.0	29.1	39.9	16.2	14.8
Foreign born, speaks English/French 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
Foreign-born, speaks no English/French 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 convert to probabilities.
Source: Table 4.4.

tive to American research. First, it is possible that the mix of "Asian" engineers differs in Canada and in the United States. American researchers do not always identify the specific origins of "Asian" immigrant engineers, but discussions suggest that many of them are from India, particularly when employed in high-technology firms. Second, differences may exist among North American studies with respect to sites of employment and the population under study. This chapter focuses on the employment and occupational profiles of all immigrant men who have studied engineering as their major field. Most importantly, it is not restricted only to those who are currently employed either in engineering or management occupations or in a particular geographic area such as Silicon Valley. Finally, although further study is needed to determine its accuracy, a third possible explanation for the similar occupational profiles of Asian and non-Asian immigrant men may be differences in the United States and in Canada with respect to the impacts of employer and systemic discrimination. American labor history is fraught with racial divides and racial discrimination. Unlike the United States, Canada lacked a large black population for much of its history, and it is wrong to assume that the U.S. model of race relations accurately describes Canada. At the same time, in Canada greater emphasis may be placed on having certification as a professional engineer for employment purposes, a possibility supported by statistics suggesting that a majority of those with engineering training in Canada have a P.Eng.

Despite discrepancies between this study's findings and those of American researchers concerning Asian and non-Asian immigrant engineers, there exists one finding that is common in studies on the employment of foreign-born engineers. In both Canada and the United States, foreign-born engineers as a group are less likely than native-born engineers to be in jobs that correspond to their training (Boyd and Thomas 2000; Lim, Waldinger, and Bozorgmehr 1998; Tang 1995, 1997). These results are consistent with a large number of studies that examine the economic integration of all immigrants, not just the highly skilled. Such studies frequently find that the wage gaps between comparably educated native-born and foreign-born workers are slow to narrow, usually requiring at least 10 to 15 years of residency.

Interest in the matching of foreign-born professional workers, such as engineers, to jobs is likely to persist given policy developments aimed at procuring highly skilled labor through immigration. In both the United States and Canada, recruitment of high-skilled, permanent migrants has been a growing feature of legislative changes to immigration law. During the 1990s, immigration policy changes in both countries increased the levels of high-skilled permanent residents who may be admitted. The latest development in Canada 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 a model 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. The intent of such changes is "to attract 'the best and the brightest' to Canada" (Citizenship and Immigration Canada 2000).

Both the United States and Canada also admit skilled workers on a temporary basis. NAFTA includes a provision for the free movement of services, thereby facilitating temporary employment of non-residents in both Canada and the United States. In the United States, the numbers of H–1B visas for temporary high-skilled foreign workers was increased in 1998 and again in 2000. In Canada, new developments include a recently completed pilot project designed to facilitate the employment of spouses accompanying high-skilled principal applicants who have been granted temporary employment authorizations. Moreover, the new Immigration and Protection Act contains provisions to increase temporary highly skilled labor and to facilitate the permanent residency of recently graduated foreign students. The purpose of such changes is to strengthen Canada's economic competitiveness. This act also will expand the Temporary Worker Program by: (1) developing a more service-oriented approach designed to facilitate the entry of temporary workers; (2) creating an in-Canada landing class for temporary workers; (3) allowing recently graduated foreign students who meet the criteria for economic integration, who have a permanent job offer, and who have been working in Canada to land from within Canada; and (4) pursuing agreements with sectors and firms to identify and meet short-term labor market needs. The intent of these initiatives is to meet the immediate needs of employers faster—to expand Canada's access to the global labor market and to attract and keep the world's "best and brightest."

In both the United States and Canada, heated debates are ongoing regarding the flows of skilled migrant labor. In the United States, temporary workers are the group of concern, and the controversy focuses firmly on immigration policy. Points of debate are whether to increase the annual number of H–1B visas and whether such legislative changes should be tied to other specific immigration changes targeted at persons seeking permanent resident rights. Such changes would give permanent residency rights (green cards) to between 1 and 2 million persons by extending amnesty to migrants who entered the United States illegally before 1986 (instead of the current 1972 cutoff date) and granting green cards to immigrants fleeing civil strife in El Salvador,

Guatemala, Honduras, and Haiti (Lochhead 2000). By August 2000, it was apparent that the H–1B issue had crept into the presidential election campaign, with both the Democratic and Republican candidates seeking business and Latino electoral support with nuanced statements about the pending H–1B legislation (Lochhead 2000; Valbrun 2000).

In Canada, little concern is voiced over policy proposals intended to increase the numbers of skilled foreign-born workers, admitted either as temporary workers or as permanent residents. Instead, the inflow and outflow of high-skilled workers has become central to a debate, not about immigration policy, but about fiscal policy, especially focused on personal taxation laws (Canadian Association of University Teachers 1999; Emery 1999; Globerman 1999). Proponents who seek to reduce tax rates at higher income levels and/or to alter rules governing the treatment of stock options emphasize both the outflow of Canadian skilled labor to the United States and the difficulty of attracting highly paid foreign CEOs. Given this stance, the debate has evolved into arguments over why Canadians move to the United States, and whether immigrant inflows replace outflows. In fact, the massive input into the debate and the intensity of media coverage have generated a Web site on the issue, including articles with opposing views.[9]

Those who seek reformulation of tax laws affecting high-income earners argue the following: (1) Canadian skilled workers are leaving for the United States because taxes are too high; (2) knowledge-based firms cannot recruit the best managers because of the Canadian tax structure; (3) high-skilled immigrants do not replace those leaving, in part because many recent arrivals lack linguistic skills and strategic knowledge about Canada's economy; and (4) the existing tax structure dampens employment opportunities and weakens the capacity to retain high-skilled workers (DeVoretz and Laryea 1998; Iqbal 1999; Schwanen 2000; Vanasse 2000; Watson 1999).

In contrast, critics of this stance argue that: (1) Canada's tax strategy is favorable compared to that of the United States; (2) taxes are not a major reason why Canadians leave for the United States (job opportunities in a larger market and higher salaries are the main reasons); (3) trend data do not support claims of an increased flow of Canadian graduates to the United States; and (4) the volume and characteristics of high-skilled immigration from elsewhere compensate both numerically and in skill level for outflows to the United States (Bank of Montreal 1999; Brown 2000; Frank and Belair 1999, 2000; Globerman 1999; Helliwell and Helliwell 2000; Nadeau, Whewell, and Williamson 2000; Zhao, Drew, and Murray 2000).

[9] See "Publicly Available Sites on Canada's Brain-Drain," under "Related Links and Reports," strategis.ic.gc.ca/sc_ecnmy/engdoc/homepage.html).

As in the United States, business interests are crucial elements in the debate. But unlike the United States, where high-technology firms lobby for legislative changes to increase inflows of knowledge workers, in Canada the objective is to restructure taxes so as to reduce tax burdens for those in higher income brackets. Questions about the labor market adjustment of skilled immigrants enter into this debate only to the extent that the results show that high-skilled inflows either replace or fail to substitute for the outflow of workers to the United States.

However, census-based studies of immigrant integration may not offer the best evidence for resolving replacement/substitution debates. In both Canada and the United States, the census does not collect information on class of admission (economic, family, or humanitarian criteria). As a result, analyses investigating the economic adaptation of highly skilled immigrants are not necessarily studies of immigrants recruited on the basis of labor market skills. This is an important point because discussions of substitutability of inflows to outflows often compare foreign-born permanent residents as a group to persons who have entered the United States[10] on temporary visas issued solely for economic reasons. Yet even among the highly skilled, permanent residents include those who entered on family reunification grounds or as refugees. Because census-based immigrant adaptation studies can include these groups, they may generate conservative conclusions, notably that specific occupational groups experience difficulties or delays in their labor market integration.

If Canadian replacement/substitution debates are to be resolved on empirical rather than ideological grounds, studies must satisfy at least two requirements. First, they should analyze the economic integration experiences over time of only those recruited explicitly for labor market needs. And second, they should compare results to similar studies in other countries, including the United States, in order to assess how exceptional or normal Canadian findings may be.

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[10] Among foreign born engineers aged 25 to 64, for example, one in five of the non–Asian-born men who were admitted between 1980 and 1995 with engineering occupations were admitted on humanitarian grounds, reflecting to a large extent the upheavals in Eastern Europe. Although only 2 percent of the Asian-born engineers were admitted in the humanitarian class during this period, earlier immigrants admitted in the aftermath of the Vietnam war also would have entered as refugees (unpublished tabulations from Citizenship and Immigration Canada, Landed Immigrant Data System, April 2000).

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