ESTIMATING THE IMPACT OF FOREIGN-BORN LABOUR ON WAGE RATES IN CANADA

by

Samuel Amartei Laryea

B.A., University of Ghana, 1986
M.A., Simon Fraser University, 1989

A THESIS SUBMITTED IN PARTIAL FULFILMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

in the

Department of Economics

SIMON FRASER UNIVERSITY
September 1997

APPROVAL

Name: **SAMUEL AMARTEI LARYEA**

Degree: **PhD (Economics)**

Title of Thesis: **Estimating the Impact of Foreign-Born Labour on Wage Rates in Canada**

Examining Committee:

Chair: Dr. Stephen Easton

Dr. Don DeVoretz
Senior Supervisor

Dr. Dennis Maki
Supervisor

Dr. Jane Friesen
Supervisor

Dr. Steven Globerman
Internal Examiner

Dr.Alan Green
External Examiner

Date Approved: Tuesday, September 16, 1997

ABSTRACT

When foreign-born workers enter the labour force, three outcomes are possible. Canadian-born workers can be displaced from their jobs or their wages suppressed or both. Previous Canadian research on the labour market performance of immigrants has focused primarily on the unemployment effects. This thesis in contrast, focuses on the impact of foreign-born labour on the wages of Canadians and other immigrant cohorts, circa 1988-1990. Specifically, this thesis had four main objectives. Firstly, a new methodology developed by Suen which uses age-cohorts, was employed to model the wage impacts of foreign-born labour. The novelty of Suen's approach amongst others, includes the resolution of the endogeneity problem caused by the possibility of immigrants self-selecting into cities with higher wages. Suen's methodology also allows an indirect test of the Foot-Stoffman hypothesis regarding the competition between the boom and echo generations and their attendant impact on wages. Secondly, an empirical analysis of foreign-born wage impacts is tested by industry using a panel analysis. Thirdly, this thesis investigated the substitution and complementarity relationships between new foreign-born, old foreign-born and Canadian-born workers as labour inputs in a generalized Leontief production function. This exercise was also extended to investigate the substitution and complementarity relationships amongst different occupational groups. Finally the role of institutions, specifically unions, and how they affected the wage gap between foreign-born and Canadian-born workers was also examined. The main findings were as follows. A simulation exercise under the estimated Suen's model suggests that a 20% increase in immigration levels has an insignificant impact on native-born wages economy-wide. Also,

the Foot-Stoffman hypothesis was not borne out by the data. Furthermore, evidence of wage suppression was observed in the primary, communication and utilities, transportation and construction industries using the total sample. But there were variations across gender lines. Finally, increased unionization led to a wage gap in favour of Canadian-born workers and varied across white collar and blue collar jobs and public/private sectors. Specifically, the blue collar unions appeared to be more discriminatory and the wage-gap in favour of Canadian-born workers was larger in the public sector.

ACKNOWLEDGEMENTS

I am extremely indebted to Dr. Don DeVoretz, my senior supervisor, for his encouragement, dedication and optimism which made this thesis a reality. I would also like to express my sincere gratitude to Dr. Dennis Maki for his valuable comments and suggestions at various stages of this thesis. My sincere thanks also goes to Dr. Jane Friesen for her valuable comments and programming assistance in SAS. I also note with deep appreciation the warm friendship extended by my peers especially John Hayfron, Isaac Abiola, and Rashid Summaila during the final stages of this thesis. Special thanks also goes to Reo Audette for his programming assistance in SPSS and tips on manipulating large data files. I am also grateful to Miss Sydney Preston for editing the final drafts of this thesis, thereby bringing precision and coherence to my writing skills.

I also acknowledge with gratitude the financial assistance of the Department of Economics and Simon Fraser University, in the form of teaching assistantships, instructorships and the President's Ph.D. Research stipend. I am also grateful to the Vancouver Center of Excellence on Immigration for additional financial support through research assistantships.

I am also sincerely indebted to my family and in-laws for their moral and spiritual support. These are my parents, Mr. Amar Laryea (Papaa) and Mrs. Matilda Laryea (Mamaa); my brothers and sister; Amartey, Amarkwei and Dolly; my in-laws Mr. and Mrs. R. K. Ayitey (Papa and Dada). Even though far away in Ghana, they have always supported me through letters, phone calls and prayers.

My greatest debt of gratitude goes to my dear wife Vilma for her love, understanding, constant support and sacrifices, without which this thesis would not have been possible. For choosing to put her own academic and professional pursuits on the back burner and raise our children, Ahiney and Nii Amar, I was able to pursue my studies in relative peace, devoid of the constant demands of parenting and household chores. This remarkable display of love and sacrifice is indeed humbling, and I share with you every bit of the Ph.D. degree. Thank you my dear and may God bless and reward you abundantly.

DEDICATION

To Vilma, Ahiney and Nii Amar for their patience and immense sacrifices

Table of Contents

List of Tables

List of Figures

CHAPTER 1

INTRODUCTION

1.1 Background

According to the 1991 census, 4.3 million immigrants were living in Canada at that time and immigrants comprised 16.1% of Canada's population, roughly the same share as in 1951. However, between 1986 and 1991, the size of Canada's immigrant population increased by 11%, compared with only 2% between 1981 and 1986. In the past decade and a half, the total number of immigrants admitted into Canada fell from 129,000 in 1981 to 84,000 in 1985. Since 1986, however, annual levels have risen, reaching almost 231,000 in 1991. According to Statistics Canada, this was the highest annual number of immigrants entering Canada in 35 years. Furthermore, the labour force participation rate for immigrants rose from 64.7% in 1986 to 65.2% in 1991.[1]

These successive waves of immigrants have increased Canada's population and altered its ethnic and cultural composition. They have also contributed significantly to the social and economic development of the country. However, it is becoming increasingly clear that many Canadians perceive current immigration levels to be too high. Though one could counter with anecdotal stories of successful immigrants, the pessimistic beliefs appear to reflect the views of many Canadians. Inherent in this pessimism over perceived high immigration levels is the belief that it could potentially lead to loss of Canadian jobs,

wage reductions or increased unemployment insurance and welfare rolls, thereby putting pressure on the public treasury (Baker and Benjamin:1995). Evidence of these pessimistic beliefs is also provided by Dirks (1995) who writes,

> *While Canada is seen as a traditional state of immigration, the policies that have been in place during this country's existence have not been particularly popular with society generally. Even under the 1976 Immigration Act, which almost achieved consensus among informed organizations at its passage, 42 percent of those surveyed during 1980 believed too many immigrants were arriving, while only 44 percent felt that the numbers permitted to enter were appropriate. Seven years later, in a similar poll, only 42 percent of those polled supported the annual immigration levels. (Dirks 1995, 15)*

Furthermore, a survey conducted in February 1994 by Ekos Research Associates Inc. indicated that 53% of those interviewed thought that immigration levels were too high, compared with 44% two years previously and just 31% in February 1989.[2]

The perception that foreign-born workers displace Canadian-born workers in the job market and in the process depress their wages is referred to in the literature as the immigrant displacement hypothesis (Dales 1964, 1966). The shift in immigration policy towards the family reunification class during the 1980s may have led to a decline in the skill levels of recent immigrants (Coulson and DeVoretz 1993), with potentially adverse consequences for Canadian wage rates. These and other economic forces are the subject of this thesis.

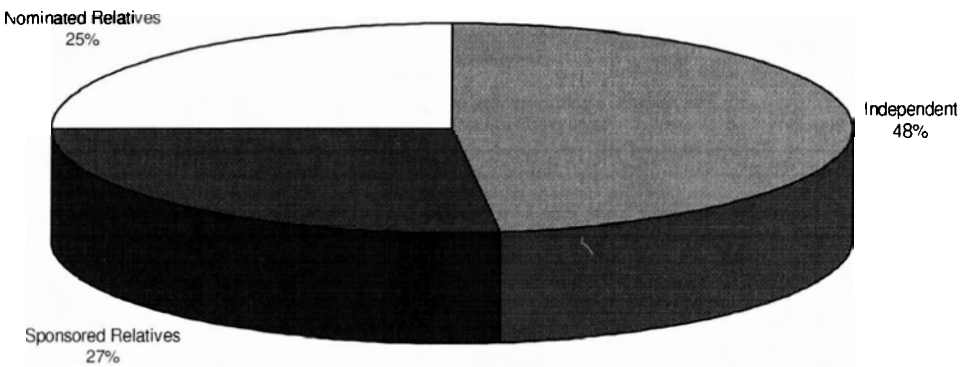
Since 1967, potential immigrants have been able to enter Canada via three gates: through the independent or "points assessed" gate, through the family reunification

---

[1] See Statistics Canada-Catalogue No. 96-311E.

(nominated or sponsored) gate, or through the refugee gate. Figure 1.1 shows the distribution of immigrants by various entry gates for the period 1968-78.

Figure 1.1 Landings by Entry Class, Canada: 1968-1978

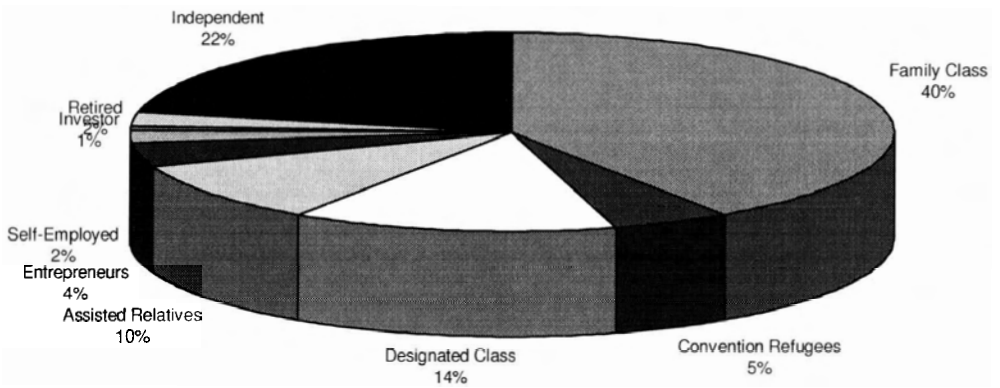


Source: Author's Calculations based on data derived from Marr (1992, page 28).

The independent or point-assessed immigrant group represented 48 percent of the total immigrant population for the period.

[2] See *Maclean's*, 25 July 1994, 16.

Figure 1.2 Landings by Entry Gate, Canada: 1980-1991



Source: Author's Calculations based on figures from Citizenship and Immigration Canada.

Figure 1.2 however, shows a reversal in this trend for the period 1980-1991. By the 1980s the independent (point-assessed) immigrant group fell to 22 percent of the total immigrant population.

In spite of public concerns over immigration levels, relatively little research has addressed the impact of foreign-born workers on wages in Canada. Recent studies of the displacement hypothesis focused primarily on the employment effects of increased immigration levels and ignored any wage effects. For example, Roy (1987) and DeVoretz and Akbari (1992) found no economy-wide displacement effects of native-born workers

by foreign-born workers. A logical step was to find out if there were any price or wage effects. They, however, did not pursue this avenue of research. Secondly, since both these studies adopted a macro approach, they failed to capture regional differences in urban labour markets and the role of individual immigrant characteristics or industries in influencing wage rates.

Another motivation for this thesis is attributed to the observed decline in the economic attributes of recent immigrants and the underlying implication for wages. To appreciate the link between immigration policy, immigrant quality decline and wages, a review of the stylized facts of labour market performance by skill level and year of entry is imperative. Table 1.1 summarizes the social and economic attributes for males and females combined, while Table 1.2 concentrates on only males. Comparing the entire foreign-born population to the Canadian-born population in Table 1.1 yields several comparative differences. First, the stock of foreign-born circa 1991 is relatively older. This group also worked fewer hours, fewer weeks and earned $2000 less than its Canadian-born counterpart. Furthermore, the foreign-born population was more concentrated in low-skilled occupations. Finally, the total number of years spent in school is lower for the 1991 stock of foreign-born than for Canadian-born, but a greater proportion of the foreign-born possessed university degrees. This apparent difference in skill levels of the foreign-born population can potentially reduce the wages of Canadians as well as earlier foreign-born workers.

Earlier immigrant vintages in 1991 differed from newer arrivals (Table 1.2: columns 4 and 5). This could be attributed to the fact that the older foreign-born (column 4) have been fully assimilated into Canadian society. The comparison between Canadian-born (column 2) and post-1986 foreign-born i.e. more recent foreign-born, (column 5) indicates large differences. Though the more recent foreign-born are younger and have accumulated more education, a much greater proportion of them are concentrated in low-skilled occupations (i.e. 54.9% of the foreign-born in low-skilled occupations versus 42.1% for the Canadian-born). Furthermore, 34.5% of the recent foreign-born possessed university degrees versus 22.9% for the Canadian-born. Table 1.2 reports similar observations for males only. These differences for the total 1991 stock (Table 1.1) and males only (Table 1.2), as revealed by the stylized facts and labour market performance by period of entry, argues for a careful study of wage determination by skill level and year of entry. The issue here is the alleged quality decline (see Coulson and DeVoretz 1993), which implies lower wages and competition of the unskilled portion of the labour force. This will be addressed in chapter 5 of this thesis.

In their recent book[3] on the role of demographics in shaping the political, social and economic lives of Canadians, authors David Foot and Daniel Stoffman observed that if immigration policy did not take into account demographic factors when setting immigration levels and selection criteria, this may prove counter productive for Canada. According to Foot and Stoffman, immigrants in their 20s are coming in at a time when the number of Canadians in this age group has declined. However, the implication of this

current immigration policy is that, as the echo generation enters the labour market in the first decade of the next century, Canada will have to consider curtailing immigration levels. This is because bringing in a group of 20-year-old immigrants to compete for scarce jobs just when large numbers of Canadian-born 20-year-olds are also entering the labour market could be a policy which exacerbates unemployment. Thus, the simple question being posed by Foot and Stoffman is whether age matters in immigration policy. Furthermore, has the competition between the echo generation and new immigrants had any adverse impacts on the labour market in terms of lower wages or unemployment as predicted by the authors? In chapter 3 of this thesis an age-cohort approach is used to model the impact of foreign-born workers on wages in Canada. This approach in chapter 3 addresses in part the labour market consequences (i.e. wage suppression) of age-specific immigration flows.

With the increasing levels of immigration and higher labour force participation rates among immigrants and its potential implications for Canadian jobs, one would have expected unions and other forms of organized labour to be vocal on immigration matters, especially composition and levels. However, they have been conspicuously absent from forums which manage and advise government on yearly immigration inflows. One possible reason for this lack of union participation in the immigration review process may be linked to wage premiums, which unions expect to receive from foreign-born workers. A real-world anecdote can be used to illustrate union behavior and its impact on wages from an insider-outsider scenario.

---

[3] D.K. Foot and D. Stoffman, *Boom, Bust and Echo: How to Profit from the Coming Demographic*

In 1994, Simon Fraser University decided to recontract out its cleaning and janitorial services. The cleaning workers, who were mostly immigrants (the outsiders), were rehired by the new contractor at a lower effective wage and with very few benefits in the context of a union environment. Thus, the question one might ask is: why did the insiders (in this case SFU unionized workers) not block this recontracting? One can interpret the union's actions in the context of a perceived economic gain over time with less subsequent demands on the university's wage portion of the budget. Similar examples appear in British Columbia's farming sector with coalitions forming to take advantage of recently arrived immigrant labour as harvest labour. In chapter 6 of this thesis, I will address the effect of unionization on the wage differential between Canadian and foreign-born workers.

Finally, this study will relate changes in Canada's immigration policy to any observed wage effects in the urban labour market. For example, currently immigration flows are urbanized and emphasize immigrants in the family class in some cities (Toronto) but not others (Vancouver). The impact of this policy can now be partially assessed by the wage performance of the new urban immigrants by city and the effect, if any, on older immigrant or Canadian-born workers' wages. Different outcomes are anticipated for males and females due to Canada's peculiar immigration policy, which screens mostly the male family heads and not females. Thus, where possible, all the tests will make this gender distinction because of this policy.

Shift. (Toronto: Macfarlane Walter and Ross, 1996).

Table 1.1
Social and Economic Attributes by Place of Birth (Both Sexes): 1991

Variable	Canadian-Born[a]	All Foreign-Born[b]	Earlier Foreign-Born[c]	New Foreign-Born[d]
Age	40.84	42.83	45.15	37.21
	(10.97)[e]	(10.99)	(10.65)	(9.70)
Education	12.40	12.20	12.32	12.86
	(3.30)	(3.97)	(4.13)	(4.14)
Hours Worked	27.88	26.26	27.82	23.19
	(21.42)	(21.46)	(21.01)	(21.48)
Weeks Worked	43.59	41.81	44.20	36.30
	(14.38)	(15.58)	(13.85)	(18.14)
Family Size	2.85	3.08	3.12	3.02
	(1.32)	(1.38)	(1.36)	(1.47)
Wages and Salaries	21421.26	19486.03	22403.48	12086.96
	(21349.26)	(20976.89)	(22619.41)	(16049.99)
Married	64.1	74	76.4	73
Prof. Occupation	26.1	25.3	27.3	21.3
Skilled Occup.	31.8	29.6	30.2	23.8
Low-Skilled Occupation	42.1	45.1	42.5	54.9
LFACT[f]	80.6	78.6	80.4	76.2
Full-Time Work	85.6	87.3	87.9	87.0
Highest level of Schooling				
Elementary	51.8	49.2	48.4	43.2
Non-Univ.	25.4	24.7	24.8	22.3
University	22.9	26.2	26.8	34.5

Source: Author's calculations from 1991 Canadian census public use sample tapes.

[a] All persons aged 25-64 who were born in Canada.
[b] All persons aged 25-64 who were born outside Canada.
[c] All persons aged 25-64 who immigrated to Canada before 1960.
[d] All persons aged 25-64 who immigrated to Canada after 1986.
[e] The figures in parentheses are Standard Deviations.
[f] Labour force activity/Labour force participation rate.

Table 1.2
Social and Economic Attributes by Place of Birth (Males): 1991

Variable	Canadian-Born[a]	All Foreign-Born[b]	Earlier Foreign-Born[c]	New Foreign-Born[d]
Age	40.86	43.66	45.88	37.48
	(10.19)[e]	(10.15)	(9.76)	(8.48)
Education	12.66	12.62	12.81	13.75
	(3.25)	(3.9)	(4.05)	(3.72)
Hours Worked	37.36	35.83	36.62	33.48
	(18.22)	(18.78)	(17.71)	(19.96)
Weeks Worked	46.36	44.78	46.71	40.41
	(11.24)	(12.75)	(10.83)	(15.13)
Family Size	2.96	3.24	3.26	3.17
	(1.33)	(1.34)	(1.34)	(1.40)
Wages and Salaries	36374.59	34308.37	38017.52	24036.86
	(22416.52)	(22725.01)	(23819.7)	(20486.13)
Married	73.1	83.9	84.8	83.8
Prof. Occupation	28.1	28.7	31.0	26.3
Skilled Occupation	34.6	34.3	34.3	29.5
Low-Skilled Occupation	37.3	37.0	34.7	44.2
LFACT[f]	96.4	95.9	96.3	94.7
Full-Time Work	96.3	96.1	96.6	93.6
Highest Level of Schooling				
Elementary	49.0	44.2	42.8	34.7
Non-Univ.	26.3	26.8	26.8	23.5
University	24.7	29.1	30.4	41.8

Source: Author's calculations from 1991 Canadian census public use sample tapes.
Notes: See Table 1.1.

In summary, I propose to investigate the wage impacts of the foreign-born population on the Canadian-born and the older foreign-born based on data from the 1991 Canadian census and the 1988-1990 Labour Market Activity Survey (LMAS) data. The major point of departure from existing research is the emphasis placed on selected urban labour

markets as opposed to the entire labour market (economy-wide). Thus, the central questions to be addressed in this thesis are as follows: has recent immigration significantly affected wage rates for either the older foreign-born or Canadian-born? And, does the wage effect vary by city/industry/skill? The importance of the answers to these questions is revealed in the observation that Canada has essentially one national immigration policy with many possible labour market outcomes. An immigration policy, therefore, could be judged positively in one city but negatively in another.[4] This focus on urban areas is also derived from a new literature that indicates differences in key earning variables for immigrants across Canadian cities and also the occupational distribution (Hiebert 1997).

The focus on industry/skill groups in this thesis is important as it is linked to the following issues. First, Hiebert (1997) observes that the labour market is highly segmented by gender, ethnicity, birth status, occupation and by skills. This means that segments of the population will be either under-represented or over-represented in certain industries or occupations. Secondly, under Canada's immigration policy, prospective immigrants admitted through the independent class are awarded points based in part on their labour market characteristics, such as education, skills, language proficiency occupation, etc. Thus, through this point system the government can influence the occupational and industrial distribution of immigrants. It follows that the concentration or under- concentration of foreign-born workers in certain occupations or industries, due to

[4] See D. DeVoretz, "Ethics, Economics and Canada's Immigration Policy" Vancouver Centre of Excellence: Research on Immigration and Integration in the Metropolis (RIIM), Commentary Series, #97-02, March 1997.

segregation or policy, could obviously impact on wages. In chapters 4 and 5 of this thesis, I will conduct various tests to highlights these issues.

To justify the concentration on urban labour markets an attempt is also made to document the degree of urbanization of immigrants and Canadians. Table 1.3 shows the percentage of immigrants as a proportion of the population of various census metropolitan areas (CMAs)[5] between 1986 and 1991. The table reveals that for the three largest cities, that is Toronto, Montreal and Vancouver, the ratio of immigrants as a proportion of the total population in these cities rose between 1986 and 1991. In Toronto, it rose from about 36% in 1986 to 38% in 1991, from 15.7% to 16.8% in Montreal and 28.4% to 30% in Vancouver.

Table 1.3
Immigrants as a Percentage of Census Metropolitan Areas (1986 and 1991)

CMA	Immigrant % of CMA (1986)[a]	Immigrant % of CMA (1991)[b]
Calgary	20.6	20.3
Chicoutimi-Jonquiere	0.8	0.7
Edmonton	18.2	18.4
Halifax	7.0	6.5
Hamilton	24.1	23.5
Kitchener	20.7	21.5
London	18.2	18.8
Montreal	15.7	16.8
Oshawa	17.2	17.2
Ottawa-Hull	13.4	14.8
Quebec	2.3	2.2
Regina	9.4	8.4
Saskatoon	9.3	8.2

[5] CMA is the acronym for Census Metropolitan Area. Statistics Canada describes it as a large urban area with adjacent urban and rural areas that have a high degree of economic and social integration with the urban area in question. A CMA is usually delineated around an urban core with population of at least 100,000.

Sherbrooke	3.4	3.8
St. Catharines Niagara	20.4	18.9
St. John's	3.1	2.8
Saint John	4.7	4.3
Sudbury	10.0	8.2
Thunder Bay	15.2	13.2
Toronto	36.0	38.0
Trois-Rivieres	1.4	1.3
Vancouver	28.4	30.1
Victoria	20.7	19.5
Windsor	20.0	20.8
Winnipeg	18.0	17.5

Sources:

a. Statistics Canada, Census Metropolitan Areas, Dimensions. 1986 Census of Canada, Catalogue No. 93-156.
b. Statistics Canada, Immigration and Citizenship. 1991 Census of Canada, Catalogue No. 93-316.

I now focus on Toronto, Vancouver and Montreal from the list of twenty-five cities or census metropolitan areas since, in 1991, more than one-half of Canada's foreign-born (57%) lived in these three census metropolitan areas. In contrast, just over one-quarter of the Canadian-born population lived in these CMAs. Toronto had the largest foreign-born population in 1991. About 1.5 million foreign-born individuals lived in the Toronto CMA, accounting for 38% of Toronto's population. The foreign-born represented 30% of Vancouver's and 17% of Montreal's populations (Statistics Canada Report No. 96-311E).

Two-thirds of those who came to Canada between 1981 and 1991 were living in Toronto, Montreal or Vancouver in 1991. In contrast, 43% of immigrants who arrived before 1961 resided in these urban areas. Once again, Toronto attracted the largest share

of recent immigrants with 39% settling there, while 14% settled in Montreal and 13% in Vancouver.

Since recent immigrants are highly concentrated in several urban centers, it will also prove instructive to compare the social and economic attributes of the urban foreign-born to urban Canadians on a city-by-city basis. Tables 1.4 to 1.9 below report important demographic and economic variables for the populations of Vancouver, Toronto and Montreal by birth status for 1986 and 1991.

Table 1.4
Social and Economic Attributes of Vancouver's Population by Birth Status:1986

Variable	Canadian-born[a]	All Foreign-born[b]	Econ. Canadian[c]	Econ. Foreign-born[d]
Age	31.37	44.15	38.81	42.18
	(20.75)[e]	(19.20)	(10.68)	(10.34)
Education	12.54	11.98	13.31	13.03
	(3.00)	(4.42)	(2.86)	(4.05)
Highest Level of Schooling				
Elementary	50.3	51.5	39.7	40.1
Non-University	25.8	23.2	29.8	28.7
University	23.9	25.3	30.6	31.1
Family Size	2.95	2.98	2.56	3.11
	(1.44)	(1.52)	(1.30)	(1.41)
Married	40.4	63.1	65.0	78.7
Wages and Salaries	9711.13	11170.65	20940.96	19155.06
	(15090.75)	(16051.34)	(17243.92)	(17589.48)
Hours Worked	21.92	20.86	33.16	32.88
	(21.16)	(21.78)	(18.29)	(19.23)
Weeks Worked	38.88	38.99	43.03	42.26
	(17.44)	(17.33)	(14.86)	(15.19)
Full-Time Work	75.5	77.8	82.9	83.1
Prof. Occupation	27.8	27.1	33.0	29.6
Skilled Occup.	20.3	21.3	21.4	22.5

Low-Skilled Occupation	51.9	51.6	45.6	47.9

Source: Author's calculations from 1986 Canadian census public use sample tapes.

[a] All persons in all ages born in Canada.
[b] All persons in all ages born outside Canada.
[c] All persons aged 25-65 born in Canada and in the labour force.
[d] All persons aged 25-65 born outside Canada and in the labour force.
[e] Figures in parentheses are the standard deviations.

Table 1.5
Social and Economic Attributes of Vancouver's Population by Birth Status:1991

Variable	Canadian-born[a]	All Foreign-born[b]	Econ. Canadian[c]	Econ. Foreign-born[d]
Age	31.87	43.26	38.95	42.04
	(21.18)[e]	(19.18)	(9.84)	(10.19)
Education	12.79	12.38	13.49	13.29
	(2.87)	(4.12)	(2.69)	(3.69)
Highest Level of Schooling				
Elementary	46.6	47.0	35.9	36.4
Non-University	26.6	23.6	31.4	28.3
University	26.7	29.4	32.6	35.4
Family Size	2.94	2.94	2.57	3.05
	(1.44)	(1.46)	(1.30)	(1.38)
Married	35.2	59.5	56.3	73.3
Wages and Salaries	18365.46	14902.82	28462.45	23452.41
	(21743.41)	(20018.0)	(22793.78)	(21449.38)
Hours Worked	23.07	21.15	33.74	33.13
	(21.01)	(21.30)	(17.77)	(18.11)
Weeks Worked	40.9	39.59	44.79	42.53
	(16.14)	(16.90)	(13.13)	(14.92)
Full-Time Work	78.4	82.0	86.5	86.8
Prof. Occupation	24.2	24.0	29.5	26.5
Skilled Occup.	29.1	28.3	31.5	29.7
Low-Skilled Occupation	46.7	47.7	39.0	43.8

Source: Author's calculations from 1991 Canadian census public use sample tapes.
Notes: see Table 1.4.

Table 1.6
Social and Economic Attributes of Toronto's Population by Birth Status 1986

Variable	Canadian-born[a]	All Foreign-born[b]	Econ. Canadian[c]	Econ. Foreign-born[d]
Age	28.64	42.97	38.6	42.42
	(20.17)[e]	(17.98)	(10.98)	(10.43)
Education	12.75	11.40	13.53	12.33
	(3.29)	(4.81)	(3.29)	(4.58)
Highest Level of Schooling				
Elementary	52.2	58.1	41.4	48.5
Non-University	21.4	20.6	24.3	25.0
University	26.4	21.3	34.4	26.6
Family Size	3.19	3.11	2.71	3.19
	(1.44)	(1.50)	(1.32)	(1.39)
Married	37.3	65.2	67.5	79.1
Wages and Salaries	10756.09	13149.03	23975.93	20798.02
	(16579.17)	(16280.11)	(19039.88)	(16887.48)
Hours Worked	25.53	25.10	36.56	36.88
	(20.84)	(21.42)	(15.96)	(16.05)
Weeks Worked	40.97	42.41	46.03	45.27
	(16.45)	(15.60)	(12.35)	(13.0)
Full-Time Work	79.4	85.6	88.1	90.3
Prof. Occupation	31.6	25.8	39.0	28.2
Skilled Occup.	19.7	30.7	19.1	31.9
Low-Skilled Occupation	48.7	43.5	41.9	39.9

Source: Author's calculations from 1986 Canadian census public use sample tapes.
Notes: see Table 1.4.

Table 1.7
Social and Economic Attributes of Toronto's Population by Birth Status:1991

Variable	Canadian-born[a]	All Foreign-born[b]	Econ. Canadian[c]	Econ. Foreign-born[d]
Age	29.30	42.11	38.70	41.74
	(20.74)[e]	(18.29)	(10.44)	(10.32)
Education	13.05	11.97	13.77	12.85
	(3.05)	(4.31)	(2.87)	(3.95)

Highest Level of Schooling				
Elementary	48.1	54.0	36.8	44.3
Non-University	22.1	20.9	26.5	24.9
University	29.8	25.1	36.7	30.8
Family Size	3.14	3.01	2.68	3.09
	(1.42)	(1.46)	(1.30)	(1.38)
Married	33.4	60.5	59.2	73.4
Wages and Salaries	21171.89	18003.51	32601.61	26646.88
	(24500.17)	(21686.42)	(25590.70)	(22400.23)
Hours Worked	24.64	22.90	35.74	34.09
	(20.89)	(21.12)	(16.51)	(17.21)
Weeks Worked	42.13	42.12	46.62	44.62
	(15.68)	(15.68)	(11.46)	(13.58)
Full-Time Work	33.4	86.9	89.4	91.3
Prof. Occupation	28.7	23.4	35.7	25.6
Skilled Occup.	26.4	26.4	28.2	27.5
Low-Skilled Occupation	44.8	50.2	36.1	46.9

Source: Author's calculations from 1991 Canadian census public use sample tapes.
Notes: see Table 1.4.

Table 1.8
Social and Economic Attributes of Montreal's Population by Birth Status:1986

Variable	**Canadian-born**[a]	**All Foreign-born**[b]	**Econ. Canadian**[c]	**Econ. Foreign-born**[d]
Age	32.74	43.56	39.25	42.45
	(20.48)[e]	(18.68)	(10.54)	(10.41)
Education	11.56	10.89	12.54	11.96
	(3.95)	(5.19)	(3.70)	(5.01)
Highest Level of Schooling				
Elementary	58.4	58.4	48.4	48.7
Non-University	21.4	16.5	23.6	18.2
University	20.1	25.1	28.0	33.1
Family Size	3.00	3.04	2.74	3.16
	(1.38)	(1.52)	(1.29)	(1.41)
Married	43.3	62.6	69.1	77.4
Wages and Salaries	9367.98	10752.40	20610.30	18422.14
	(14424.76)	(15635.64)	(16365.28)	(17171.32)

Hours Worked	20.60	20.96	33.09	33.86
	(20.55)	(21.33)	(16.80)	(17.64)
Weeks Worked	40.38	40.53	44.51	42.92
	(16.81)	(16.63)	(13.67)	(14.93)
Full-Time Work	80.7	85.9	86.7	89.5
Prof. Occupation	30.6	29.2	35.1	31.5
Skilled Occup.	21.9	30.6	22.3	31.5
Low-Skilled Occupation	47.5	40.2	42.6	37.0

Source: Author's calculations from 1986 Canadian census public use sample tapes.
Notes: see Table 1.4.

Table 1.9
Social and Economic Attributes of Montreal's Population by Birth Status:1991

Variable	**Canadian-born[a]**	**All Foreign-born[b]**	**Econ. Canadian[c]**	**Econ. Foreign-born[d]**
Age	33.73	42.73	39.53	42.10
	(20.93)[e]	(19.08)	(10.11)	(10.27)
Education	11.96	11.39	12.98	12.39
	(3.75)	(4.74)	(3.35)	(4.47)
Highest Level of Schooling				
Elementary	56.1	55.8	46.3	46.0
Non University	21.7	17.0	23.8	19.1
University	22.2	27.2	29.9	34.9
Family Size	2.90	3.02	2.67	3.10
	(1.34)	(1.50)	(1.23)	(1.41)
Married	34.4	58.1	52.4	70.5
Wages and Salaries	16279.00	12808.00	26260.61	20812.17
	(19793.12)	(18941.54)	(20639.23)	(21157.92)
Hours Worked	21.31	19.03	32.95	31.53
	(20.40)	(21.08)	(16.76)	(18.84)
Weeks Worked	41.51	39.65	44.95	41.98
	(15.96)	(16.98)	(13.15)	(15.56)
Full-Time Work	81.5	85.9	88.0	89.8
Prof. Occupation	25.1	26.7	29.4	28.8
Skilled Occup.	28.4	24.9	30.2	25.8
Low-Skilled Occupation	46.5	48.4	40.4	45.4

Source: Author's calculations from 1991 Canadian census public use sample tapes.
Notes: see Table 1.4.

The second and third columns of each table report the average characteristics of the entire Canadian-born and foreign-born populations respectively unfiltered for labour force participation. The last two columns present similar information for the economically active populations.[6] In analyzing the data in these tables, my focus will be on the economically active populations since this segment contains the labour force members who will potentially affect the wage structure.

Vancouver's economically active foreign-born population earned approximately $2000 less on average in 1986 than the Canadian-born cohort, or 91.5% of the Canadian-born average. The Vancouver stock of foreign-born were also older (42.18 versus 38.81), with a greater percentage married (78.7% versus 65%) and with larger families (3.11 versus 2.56). On average, the Vancouver foreign-born also had a year less education than the Canadian-born in Vancouver, although a greater percentage of the foreign-born had a university education. Focusing on employment patterns, the Vancouver foreign-born population worked slightly fewer hours (32.9 versus 33.2) and fewer weeks (42.3 versus 43.0). Finally, a slightly greater percentage of Vancouver's economically active foreign-born worked full-time (83.1 versus 82.9), however the foreign-born were more concentrated in low-skilled and high-skilled occupations rather than professions. The major change between 1986 and 1991 was a substantial widening of the wage differential to the relative detriment of the foreign-born. In 1991, Vancouver's

foreign-born population earned on average almost $5000 less or only 82.4% of the earnings of the Canadian-born cohort.

Tables 1.6 and 1.7 provide mean values for selected social and economic variables for Toronto's foreign-born and Canadian-born populations in 1986 and 1991 respectively. The patterns mirror those observed in Vancouver, with only minor exceptions. For example, in 1986, Toronto's economically active foreign-born population earned approximately 86.7% of the average earnings of the Canadian-born cohort, a difference of approximately $3000. Exceptions to the trends in Vancouver are noted in the hours worked, percentage employed in low-skilled occupations and percentage with university education categories for Toronto. In these three categories, the reported differences were opposite to that found in Vancouver. Most importantly, as with Vancouver, in 1991 the wage gap of Toronto's foreign-born population grew, with the foreign-born earning almost $6000 less or 81.7% of what the Canadian-born earned in Toronto.

The characteristics of Montreal's foreign and Canadian-born populations are reported in Tables 1.8 and 1.9, and follow the general trend reported for Vancouver and Toronto. Once again, members of the economically active foreign-born population earn less money on average, are older, and a greater percentage are married and have larger families. The foreign-born in Montreal also spent less time in school on average, though a greater percentage had a university education when compared to the Canadian-born population in Montreal. Also in 1986, Montreal's foreign-born population on average

[6] The economically active population is defined as those aged 25 to 65 and attached to the labour force,

worked longer hours per week (33.9 versus 33.1) than the Canadian-born population. A smaller percentage of foreign-born individuals worked in low-skilled occupations (37 versus 42.6). These characteristics are in sharp contrast to those of Vancouver and Toronto. One central feature, however, is in agreement with that of the other cities. By 1991 the Montreal wage gap between the foreign-born population and the Canadian-born had widened. In 1986, the wage gap was $2188 in favour of the Canadian-born in Montreal. Thus, the foreign-born in Montreal earned approximately 89.4% of the average Canadian-born earnings. By 1991, the wage gap had widened to $5448 with the foreign-born earning 79.2% of the earnings of the average Canadian-born person.

In sum, the differences in the social and economic attributes of the foreign-born population across the three cities were quite limited. However, each city did have its own particular variants. In Vancouver, for example, the stock of the foreign-born in the low-skilled occupations fell from 47.9% in 1986 to 43.8% in 1991. The situation over time in Toronto and Montreal moved in the opposite direction. In these cities the stock of the foreign-born employed in low-skilled occupations increased between 1986 and 1991. For example, in 1986, 39.9% of Toronto's foreign-born population were employed in low-skilled occupations. By 1991 this figure had risen to 46.9%. For Montreal, the proportion of the foreign-born population employed in low-skilled occupations increased from 37.0% in 1986 to 45.4% in 1991. Vancouver also recorded the largest percentage change in the wage gap between 1986 and 1991. The gap moved from 91.5% of the Canadian average in 1986 down to 82.4% in 1991. Furthermore, the change in the wage

---

i.e. employed and unemployed.

gap between 1986 and 1991 in Toronto and Montreal was small (86.7% and 81.7% in 1991 for Toronto) and (89.4% and 79.2% in 1991 for Montreal). These key differences in the wage and skill structures of the foreign-born and Canadian-born population across Canada's major urban areas justify the use of Census Metropolitan Areas (CMAs), which are proxies for urban labour markets, in the examination of the impact of foreign-born labour on wages in Canada.

1.2 Objectives of the Study

Given the above narrative, the following questions emerge:

(1) Do recent immigrants raise or lower wages for previous immigrants and/or Canadians in urban areas? The popular economic framework for analyzing this question is a production framework. Increasing the supply of immigrants raises the supply of this particular input. Depending on the patterns of substitutability or complementarity in the production process, demand for Canadian-born workers may rise or fall, which will subsequently reduce their wages. Specifically, an increase in the number of immigrants in an area increases the supply of immigrant labour, which will decrease immigrants' wages, *ceteris paribus*. Of course, one should not lose sight of the role of capital flows into various CMAs or industries, which will increase the demand for foreign-born labour, thereby negating any wage reductions. This could be the case in Vancouver and Toronto, which has attracted huge capital flows from immigrants, but not the case in Montreal.

(2) Does the impact of immigration on wages vary by city and industry/skill level? The stylized facts presented earlier suggest heterogeneous urban labour markets necessitating separate examination of the wage impacts of immigrant flows by cities and skill level. Furthermore the analysis of wage impacts by industry is necessary due to various industry characteristics that could affect the degree of substitution/complementarity for the various types of labour. Some of these characteristics include the degree of unionization (see Maki and Meredith 1987) and tariff levels (Dales 1964). In addition, certain industries provide entry level jobs for particular types of immigrants (Seward and Tremblay 1989), thus, concentrations of immigrant labour will obviously impact on wages in those industries.

(3) Have institutions mitigated or exacerbated the impact of immigration on wages? For example, has unionization widened or closed the wage gap between the foreign-born and native-born workers? Also, does the wage gap vary by gender or between the private and public sector? Answers to these types of questions can obviously provide a basis for an informed debate on the justification for affirmative action programs for immigrants and other minorities in the public sector.

1.3 Methodology

To model the impact of foreign-born labour on wages, researchers typically require variations in immigration levels across cities or census metropolitan areas to examine the consequent change relative to wages of foreign-born and native-born workers. This

approach has limitations. For example, the distribution of immigrants across CMA's is not exogenous. To the extent that immigrants have a choice in which city to reside, differences in relative wages across cities may not reflect responses to differences in labour supply. This problem can be addressed in two ways. One approach is instrumental variable estimation. This methodology involves the choice of appropriate instruments for the foreign-born shares in each CMA to deal with the endogeneity problem. Another novel approach developed by Suen (1994) is to use an immigrant age-cohort approach.

In this thesis, Suen's technique is applied for the first time to aggregate Canadian data. Under this approach, variations in the fraction of immigrants across age cohorts are employed to model the impact of immigration on wages. Immigrant groups, therefore, are aggregated by age cohorts, and aggregate cohorts into effective labour supply in order to examine the substitution relationships between age cohorts and immigrant groups. The advantage of this approach is that the mobility of immigrants across age cohorts is impossible at any point in time.

To address the second set of questions, that is, whether the wage effects of immigration vary by industry/skill, a panel analysis is employed using data from the Labour Market Activity Survey (1988-1990). The panel/longitudinal approach allows for the tracking of labour market activities of various individuals over various years. This obviously allows the exploitation of the extra efficiency provided by the time-series/cross-section connection in the data. Under the panel analysis, three competing models are considered. The first is the simple pooled cross-sectional time series model which is

estimated using ordinary least squares. The other two models under the panel analysis arise based on the assumptions made about the error term. This can lead to the fixed effects model or the random effects model. For example, under the random effects model (the error components model), there are two error terms, the traditional one and a second one which represents the extent to which the intercept of the *i*th cross-sectional unit differs from the overall intercept. Due to the non-sphericalness of the error term, a two-stage generalized least squares estimation procedure is adopted for the random effects model.

To answer the final set of questions, that is, how unionization has impacted on the wage gap between foreign-born and native-born workers, we use micro data from the Labour Market Activity Survey.[7] The basic methodology involves regressing the hourly wage on an array of socioeconomic characteristics and simultaneously accounting for the extent of unionization by birth status. To estimate the wage gap, separate estimations are carried out for the native-born and foreign-born samples and also by gender and private/public sector status. The estimation procedures follow those of Ashenfelter (1972).

The thesis is organized as follows. Chapter 2 reviews the literature on the impact of immigration on labour markets, with a brief section on unionization and the wage gap. In chapter 3, I present models of the impact of immigration on wages in Canada using the age-cohort approach including some simulations. Chapter 4 discusses the various models

[7] This is one of the few data sets available in the public domain which has a union variable.

and empirical results from the panel/longitudinal analysis. Chapter 5 discusses the calculations of Hicksian elasticities to determine whether the old/new foreign-born and native-born workers are substitutes or complements in production. This analysis is also extended to various skill groups. Chapter 6 is devoted to the impact of unionization on the wage gap between foreign-born and native-born workers. Chapter 7 provides the summary and conclusions from this thesis.

CHAPTER 2

LITERATURE REVIEW

Introduction

The primary aim of this chapter is to review both the theoretical and empirical economic literature on the impact of the foreign-born in the labour market of the receiving countries. In addition a special emphasis will be placed on the impact of foreign-born labour on wages. The literature on the impact of unionization on wages will also be reviewed. The organization of this chapter is as follows. First, a general review on the impact of immigration on the labour market will be presented. This will be followed by a discussion of a theoretical model of the displacement literature. Third, an empirical survey of the impact of immigration on native-born wages is presented. Fourth, I will present an empirical review of the impact of the foreign-born on employment. This will be followed by a review of the Canadian literature on displacement. Finally, a brief survey of the impact of unionization on wages will take up the remaining section.

2.1 A General Review of the Labour Market Impacts of Immigration

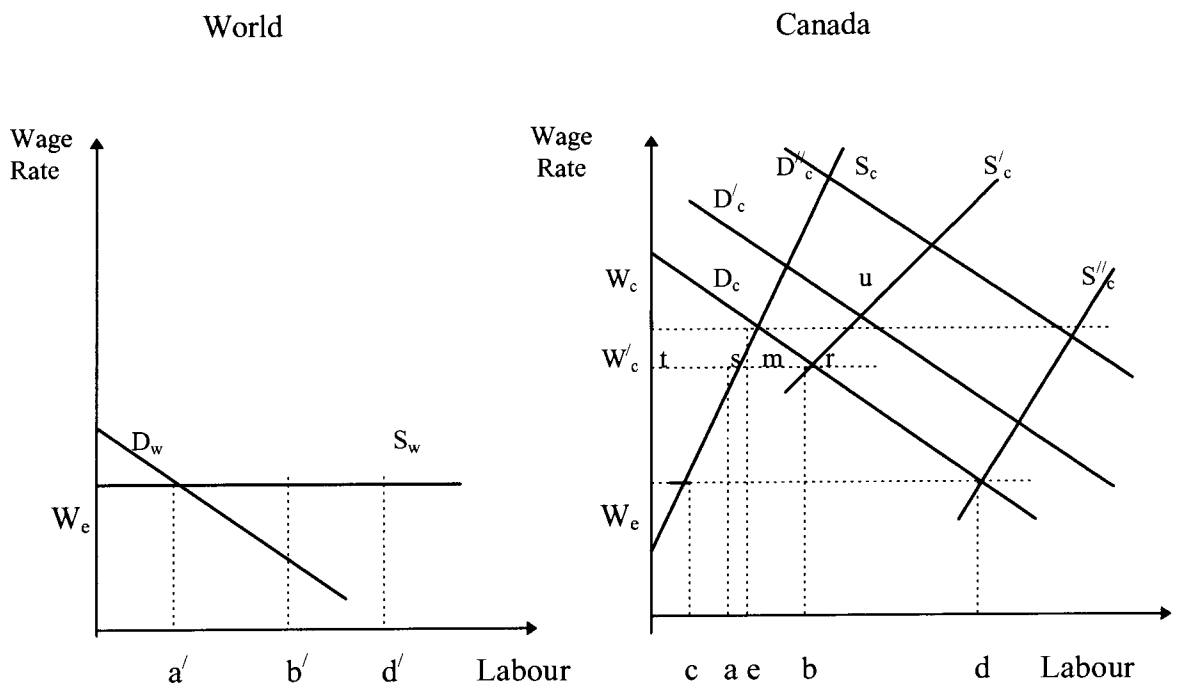
The literature on the economics of immigration has in the past decade been dominated by the analyses of two questions:

(1) How *do* immigrants perform in the labour market. That is, do immigrants catch-up and eventually outperform or overtake their native-born cohorts in terms of earnings

performance? The empirical literature has typical dealt with this question by the estimation of age-earnings profiles, beginning with the work of Chiswick (1978) and Borjas (1985). Some of the important Canadian research on earning differentials include; Carliner (1981), Meng (1987), Bloom and Gunderson (1991), Baker and Benjamin (1994), DeSilva (1992, 1997), Abbot and Beach (1993), Beach and Worswick (1993) and Bloom, Grenier and Gunderson (1995). However, this vast literature on earning profiles will not be emphasized since the life-cycle earnings of the population is not under investigation.

(2) What do immigrants do *to* the labour market in the receiving countries? That is, do immigrant workers cause the reduction of domestic wage rates and displace domestic workers from their jobs (displacement hypothesis)? If so, are the effects concentrated in certain industries and occupations? In other words, are immigrants and native workers substitutes or complements in production? The empirical evidence on job displacement effects and wage impacts of immigration flows to Canada has, however, been limited.

Figure 2.1
Wage and Displacement Effects of Immigration



Before reviewing the theoretical and empirical literature on labour market impacts of immigration, I present a diagramatical exposition of this phenomenon (see Figure 2.1).

The Displacement Phenomenon

Consider an immigrant receiving country such as Canada, that produces a single non-exported output using two inputs, namely capital and homogeneous labour. The left panel of Figure 2.1 depicts a situation in which the world supply of labour is perfectly elastic at the wage rate W_e. The right panel shows the labour market in the country of immigration, Canada. If labour were to seek its maximum earnings with negligible transportation and other costs, and with no institutional impediments, then (cd or $a'd'$) workers will migrate to Canada. Thus, the labour supply in Canada would increase from S_c to S''_c and its wage rate will fall to the world equilibrium level W_e. On the other hand, if Canada succeeded in closing its borders completely, its wage rate would be W_c.

Furthermore, if there is an increase in product price or an increase in the amount of complementary capital in the economy, then the labour supply shifts induced by immigration could be offset by labour demand shifts. For example, even with open immigration (i.e. supply shifts to S''_c) the original equilibrium wage of W_c could be maintained by a shift in the demand curve equal to D''_c. This will result in no domestic displacement and a constant wage rate.

Given immigration to Canada, albeit with a binding quota of ($ab = a'b'$) workers, an increase in the labour supply will result. Specifically, labour supply will increase from S_c to S'_c. This increase in the labour supply through immigration has two main consequences. First, the domestic wage rate will fall to W'_c, and total employment rises from (oe) to (ob). However, domestic employment falls from (oe) to (oa). Thus, (ae) immigrants, to some extent have displaced domestic (Canadian) workers. Second, when the wage rate falls from (W_c) to (W'_c), labour earnings change from (oxze) to (otrb), of which (otsa) accrues to native-born workers and (asrb) to immigrants. The earnings of native-born workers have fallen from (oxze) to (otsa). On the other hand, returns to non-labour factors, e.g capital, have risen from (xyz) to (tyr). Hence, certain factors in Canada (capital) benefit from immigration, while others (native-born labour) are injured. Finally, the existing wage differential of ($W'_c - W_e$), relative to the immigrant's opportunity cost is no doubt substantial. Given such a substantial wage differential, the continued build-up of demand for entry to Canada from abroad would be expected.

The actual wage and employment changes resulting from any immigration flow depend on the domestic elasticities of labour demand and supply, the magnitude of the quota, and other assumptions embedded in figure 2.1. In general, the more inelastic the demand and supply relationships, the greater the reduction of domestic wages resulting from any given amount of immigration. Moreover, the more elastic the labour supply and the less elastic the labour demand, the greater the displacement effect.

2.2 The Displacement Literature: A Theoretical Model

The theoretical predictions of the impact of the foreign-born on native wages depend on whether the host economy is closed or open to international trade and the degree of substitutability or complementarity between the foreign-born and natives. (Friedberg and Hunt, 1995).

In a closed economy model, immigrants will lower the price of factors with which they are substitutes, and raise the price of factors with which they are complements. Thus in an economy which employs capital, skilled labour and unskilled labour in production, a rise in the immigration of unskilled workers will lead to the fall in the wages of unskilled workers. This is because unskilled labour substitutes perfectly for the other two factors. The fall in the unskilled wage will entice employers to use more unskilled labour, but less capital and skilled labour. The resulting increase in supply of unskilled labour will lead to an increase in the optimal output level, leading to an increase in the employment of all inputs. Friedberg and Hunt (1995) characterize this phenomenon as the scale effect. An increase in the level of skilled immigration on the other hand will lead to a fall in the wage of skilled workers due to competing substitution and scale effects. Finally, a fall in the skilled wage would lead to the employment of more skilled workers. Since skilled labour and capital are complementary inputs, the demand for capital rises as well, resulting in the rise to the return on capital.

I now employ a theoretical model originally attributed to Altonji and Card (1991) and aptly summarized by Borjas (1994) to illustrate some of the above results. Following Borjas (1994), consider a closed economy with the following characteristics:

(1). A single competitive industry endowed with a linear homogeneous production technology to produce Q units of a good.

(2). The production process employs only skilled and unskilled workers with wage rates w_s and w_u respectively.

(3). The unit cost function is given by $c(w_s, w_u)$.

Then the cost function for this economy is summarized by $Qc(w_s, w_u)$. In a perfectly competitive market the price of output, p, should equal the unit cost of production. Thus:

$$p = c(w_s, w_u) \tag{2.1}$$

Furthermore each type of worker has an output demand function given by $D_i(w_i, p)$, $i = s, u$. Now suppose we have N_s skilled workers and N_u unskilled workers, then product market equilibrium requires the following:

$$Q = N_s D_s (w_s, p) + N_u D_u (w_u, p) \tag{2.2}$$

Assuming the labour supply function of each type-i worker is $L_i(w_i, p)$, then the following labour market equilibrium conditions can be invoked to close the model:

$$N_s L_s (w_s, p) = Q c_s(w_s, w_u) \tag{2.3}$$

$$N_u L_u (w_u, p) = Q c_u(w_s, w_u) \tag{2.4}$$

where $c_i = \delta c/\delta w_i$.

Consider the effect of increasing the level of immigration exogenously by ΔN. Supposing the fraction of unskilled workers in the immigrant flow is β and the fraction of unskilled workers in the population is b, then under some simplifying assumptions[8] Borjas (1994, p. 1696) shows that the resulting change in the wages of skilled and unskilled workers is given by:

$$\Delta \log w_s = \{\lambda/(\varepsilon_s - \delta_s)\}.\{(\beta - b)/b(1-b)\}.\{(\Delta N)/N\} = \alpha_s\{(\Delta N)/N\} \tag{2.5}$$

$$\Delta \log w_u = \{(1-\lambda)/(\varepsilon_u - \delta_u)\}.\{(b - \beta)/b(1-b)\}.\{(\Delta N)/N\} = \alpha_u\{(\Delta N)/N\} \tag{2.6}$$

where $\lambda = N_u D_u(w_u, p)/Q$; $\varepsilon_i \geq 0$ is the labor supply elasticity of type-i workers; and $\delta_i < 0$ is the labour demand elasticity for type-i workers.

From equations (2.5) and (2.6) above, if the fraction of unskilled workers in the immigrant flow (β) equals the fraction of unskilled workers in the population (b), then neither the skilled or unskilled wage changes as a result of immigration, because the

production function is linearly homogeneous. On the other hand, if $\beta > b$, then immigration increases the skilled wage and decreases the unskilled wage.

In an open economy model, such as the Heckscher-Ohlin model, the impact of immigration on wages is different from the closed economy case. Specifically, if technology is assumed to be the same across countries, trade will be driven by factor endowments and factor price equalization will occur across countries. In this case, immigration will lead to increased production of the more labour intensive good, but factor prices will be unchanged.

Thus if factor price equalization occurs, there is no economic rationalization for migration to occur between countries. The exception identified by Friedberg and Hunt (1995), is the case where rich countries have tariffs on goods and make intensive use of unskilled labour, in an attempt to raise the domestic wage of unskilled labour above the world level, in which case migration from poor to rich countries will occur, even with factor price equalization.

Native wage impacts also differ depending on short run and long run considerations, Greenwood and McDowell (1986). During the short run, physical capital is fixed and time is insufficient for the immigrants to accumulate additional human capital. During the long run, however, general capital accumulation and intersectoral shifts of capital may be induced by immigration, and the immigrants themselves may invest in

[8]See Altonji and Card (1991), pp. 204-205 for more on these assumptions and algebraic simplifications.

human capital, such as through increased education and the acquisition of English language skills. The domestic groups with which the immigrants initially competed in the domestic labour market may therefore differ from those with which they ultimately compete.

The conceptual experiment summarized by Altonji and Card's (1991) model, indicates precisely how the impact of immigration on native employment and wages can be measured. If a number of closed labour markets which immigrants penetrate randomly can be observed, then the change in the wage of skilled and unskilled workers can be related to the proportion of immigrants in the population (after adjusting for the skill composition of both the native population and the immigrant flow). The estimated parameters would summarize the impact of immigrants on native employment opportunities.

2.3 Empirical Evidence on the Impact of Immigration on Wages

The popular approach to measuring the impact of immigration on native wages has been to examine a cross-section of cities or (Census Metropolitan Areas) in a country and then use variations in immigrant densities to model the impact on wages. That is, almost all the empirical studies in the literature, starting with Grossman (1982), examine the wage impacts of immigration by treating a city or Census Metropolitan Area (CMA) as the empirical counterpart of the closed labour market in the theoretical analysis. The typical study then regresses a measure of the native wage in the locality on the relative quantity of

immigrants in that locality (or the change in the wage in the locality over a specified time period on the change in the number of immigrants in the locality).

Grossman's (1982) study offered several major hypothesis surrounding the displacement issue in the United States. Using 1970 cross-sectional data, a translog production function is employed to determine the displacement between capital, employed native workers, employed second generation native workers and employed foreign-born workers. The exercise also set bounds on immigration liberalization effects on employment and wages by examining two extreme situations: a short run in which adjustment occurs through native employment and a long run where adjustment is effected via relative price changes. Grossman finds in both cases, insignificant adverse effects on natives. For example the employment elasticity turned out to -0.08. This means that a 10% increase in the number of immigrants will reduce the employment opportunities of natives by 0.8%. Grossman also concluded from this study that a 10% increase in the number of immigrants will reduce native wages by 1%. Table 2.1 below summarizes the results of representative studies in the United States.

Table 2.1
Elasticity of Native Wages with Respect to the Number of Immigrants in Locality (US)

Study	Impact of Immigration on:	Dependent Variable	Elasticity Estimate
Altonji and Card (1991, p. 220)	Less Skilled Natives	Weekly Wages	+0.01
Bean, Lowell, and Taylor (1988, p.44)	Native Mexican Men	Annual Earnings	-0.005 to +0.05
	Black Men	Annual Earnings	-0.003 to +0.06
Borjas (1990, p.87)	White Native Men	Annual Earnings	-0.01

	Black Native Men	Annual Earnings	-0.02
Grossman (1982, p.600)	All Natives	Factor Share of Native Workers	-0.02
Lalonde and Topel (1991, p.186)	Young Black Natives	Annual Earnings	-0.06
	Young Hispanic Natives	Annual Earnings	-0.01

Source: Borjas (1994, p. 1697).

The across-city correlations in the United States generally indicate that the point estimates of the elasticity of the native wage with respect to the number of immigrants ranges between -0.01 to -0.02. Thus, if one city has 10% more immigrants than another, the native wage in the city with more immigrants is only about 0.2% lower.

There are other notable studies of the wage impacts of immigration outside the United States. See for example DeNew and Zimmermann (1994), regarding the German labour market. DeNew and Zimmermann demonstrate that immigration had depressed wages of German blue collar workers and increased the earnings of white-collar workers in the 1980s. Specifically, they concluded that a 1% increase in the overall share of foreign-born labour results in a 4.1% reduction in the average hourly wage of all workers. They also discovered that the wages of blue-collar workers would decline by about 5.9%, but those of white-collar would increase by about 3.5%. The overall effect from DeNew and Zimmermann's study seems to be somewhat stronger than what obtains in the United States. However, it should be pointed out that DeNew and Zimmermann used industry as the unit of observation, as opposed to the fraction of immigrants in CMA's which is typically associated with the United States studies. Furthermore, some of the US studies do not address the potential endogeneity problem associated with immigrant shares, and

that could partly explain why some of the estimated wage elasticities were relatively small. I will address the endogeneity problem later in this chapter.

Studies of specific labour markets also confirm the finding that immigration seems to have little impact on the receiving areas even when the market receives large immigration flows. I will now use specific examples to corroborate these assertions. On April 20, 1980, Fidel Castro declared that Cuban Nationals wishing to move to the United States could freely move from the port of Mariel. By September 1980, about 125,000 Cubans, mostly unskilled workers responded positively to Castro's request (now referred to the Mariel boat lift), unexpectedly increasing Miami's labour force by 7%. Card's (1990) analysis of this flow of Cuban immigrants to the US indicated that the time-series trends in wages and employment opportunities for Miami's workers, including its black population, was barely influenced by the Mariel flow.

In another study, Hunt (1992) examines the repatriation to France of Algerians of European origin, prompted by Algerian independence in 1962. During this period about 900,000 persons returned to France increasing the French labour force by almost 2%. Hunt finds that a 1% point increase in the repatriate share of the labour force reduced the wage of a region by at most 0.8% (zero in some specifications), and raised the unemployment rate of natives by 0.2 percentage points.

A final example along these lines is the return of Portuguese colonialists from Africa after a Marxist revolution in 1974, studied by Carrington and deLima (1994). They

report inconclusive results when they analyze the impact of the 600,000 refugees who entered Portugal after the country lost the African colonies of Mozambique and Angola in the mid 1970's, increasing Portugal's population by almost 7%.

2.4 Empirical Evidence on the Impact of Immigration on Employment

Though most of the studies focus on the relationship between native earnings/wages and the immigrant share in the local labour market, some studies, especially in the United States also estimate the correlation between immigration and labour force participation rates, hours worked, and unemployment rates. The results of these studies have summarized in Table 2.2 below:

Table 2.2
Elasticity of Native Employment with Respect to the Number of Immigrants in Locality (US)

Study	Impact of Immigrants on:	Dependent Variable/Remarks	Elasticity Estimate
Altonji and Card (1991, p. 220)	Less Skilled Natives	Employment-population ratio	-0.038
		Weeks worked	-0.062
Borjas (1990, p. 92)	White Native Men	Labour force p. rate	-0.01
	Black Native Men	Labour force p. rate	+0.04
Thomas Muller and Thomas Espenshade (1985, p.100)	Black Natives	Unemployment rate	-0.01
Julian Simon, Stephen Moore and Richard Sullivan (1993)	Natives	Unemployment rate	+0.001

C. Winegarden and Lay Khor (1991, p.109)	Young White Natives	Unemployment rate	0.01
	Young Black Natives	Unemployment rate	-0.003

Source: Borjas (1994, p. 1698)

The above table shows estimates of the effect of immigration on native-born labour force participation rates, hours worked and unemployment rates. It is apparent that immigration has a weak effect on the employment of natives. This is because the estimated elasticities range from -0.01 to +0.04.

2.5 A Review of the Canadian Literature on Displacement

The study of the employment effects of immigration flows on the Canadian labour force has been a rich source of policy debate since at least the turn of the century in Canada. According to Dales (1966), Canada's turn of the century National Economic Policy was three-pronged, made up of higher tariffs, railroad investment and increased immigration. The impact of immigration on wages and employment in particular has attracted critical assessment by Dales. The problems arising from immigration according to Dales, were twofold. First, immigration became increasingly urbanized resulting in lower urban Canadian wages. The effect of this wage decline was allegedly to displace Canadian workers to the United States in search of higher wages. Thus, although Canadian gross national product increased through immigration, Dales argues that Canadian per capita income lagged behind the United States. This is because the higher paid skilled workers who left for the United States in search of higher wages, were replaced by the lower paid

immigrants. Secondly, the emigration of Canadians to the United States in search of higher wages led to inefficient immigrants flows. That is, it took more and more gross flows of immigrants to achieve a given amount of net population growth.[9]

Since the publication of Dales's historical seminal piece on the displacement effects of immigration, there have been a series of modern studies in Canada addressing the employment effects of immigration. These studies can be classified under two main categories as either cross-sectional or time-series analysis. Examples of cross-sectional studies include Clark and Thompson (1986), Roy (1987,1997) and Akbari and DeVoretz (1992), who provide modern econometric estimates of the displacement effect in Canada. Clark and Thompson (1986) found Canadian immigrants around 1970 to be general substitutes for the existing labour force and complementary to capital. Specifically, they found all professional groups substituted for all remaining less skilled Canadian labour force, with the greatest degree of substitution occurring between highly trained labour and service/primary workers.

Following Clark and Thompson (1986), Roy (1987) also investigates the displacement effects of increased immigration. Using data from the 1981 population census, he estimates wage equations from a multi-factor generalized production function. Roy's results indicate that immigrants in the aggregate (i.e. pooled together irrespective of their country of origin), are neither substitutes nor complements to the Canadian-born

[9] Others have dissented from this negative interpretation of the historical impact of increased immigration flows. Chambers and Gordon (1966) have argued that increased immigration allowed the Canadian

in the workforce. However, when disaggregated by country of origin the results reveal that US born immigrants and Canadian-born workers are substitutes for one another in the labour market. Extending the analysis to specific occupational categories, Roy also found European-born immigrants and Canadian-born labour are substitutes in clerical, services and processing occupations, while they have complementary skills in natural sciences and transportation occupations. Furthermore, the Canadian-born and immigrants from Third World countries (i.e. Asia, Africa, South and Central America and the Carribean) are substitutes in machining and transportation occupations. Finally, European-born immigrants and immigrants from third world countries have complementary skills in machining and transportation occupations.

Roy's study significantly improves on that of Clark and Thompson by incorporating place of origin effects in his analysis. However, one serious caveat from his work is the omission of capital from the production function. Furthermore, Roy's study did not produce any elasticities, making it difficult or impossible to quantify the substitution and complementary relationships observed between the various types of labour[10]. Thus, Roy's study could be enhanced by incorporating these additions.

The deficiencies in Roy's study was first rectified by DeVoretz (1989) and then subsequently by Akbari and DeVoretz (1992) using the same methodology. Using a translog production function the impact of immigrant workers on the employment of

---

manufacturing sector to grow after 1900, because the increased labour supply and constant real wage increased profits for investment.

Canadian-born workers was analyzed for 125 industries, circa 1980. Their estimated cross elasticities suggest no economy wide displacement of Canadian born workers by immigrants. However, they also point out that displacement did occur in subsectors of the Canadian economy, that is, in the labour intensive industries.

Examples in the Canadian literature employing time-series analysis are Nakamura, Nakamura and Percy (1992), Denton, Feaver and Spencer (1989) and Marr and Siklos (1995). Using time-series analysis for example, Marr and Siklos (1995) provide a series of tests to detect any relationships between unemployment and immigration for the years 1926-92. These tests included simple cross correlations, Granger causality and vector autoregressive (VAR) modeling. Siklos and Marr came to several conclusions. First, they discovered that immigration and unemployment were inversely related. In addition, past unemployment rates had a quantitatively smaller impact on immigration than past immigration had on current unemployment. Finally, they concluded that allowing for a substantial increase in immigration flows, the impact of immigration on the unemployment rate is never large enough to justify the alarm that is occasionally expressed about the possible influence of immigration on future unemployment rates. Furthermore, they concluded that the inverse relationship between immigration and unemployment in Canada was stronger after 1946 than for the entire sample period i.e. 1926-1992.

One conclusion which can be reached from all the Canadian studies is that immigrant labour has no economy-wide effects on displacement. This implies that there

[10] It should be pointed out however, that Roy (1997) calculated just one elasticity between US-born

has to be wage effects, which is the primary motivation for this thesis. Secondly, a review of the Canadian literature reveals that the endogeneity of immigrant shares is rarely discussed. The endogeneity problem arises because, immigrants, likely to be the most mobile of workers, will probably move to those regions/cities or industries whose demand shocks have led to higher wages. Because of this endogeneity, a naïve econometrician might conclude that greater immigrant density leads to higher wages. Thus, the endogeneity problem involves the issue of reverse causation, i.e. higher immigrant densities in cities or industries can explain changes in wages, and higher wages can also immigrant shares.

The literature identifies three methods of confronting the endogeneity problem. One solution is to find suitable instruments for the change in immigrant density. If a variable can be found that is sufficiently correlated with the change in immigrant density, but does not directly influence the outcome variables, one can use instrumental variables technique to remove the bias due to immigrant choice of regions/cities or industries with improving outcomes. For example, Altonji and Card (1991) use the stock of immigrants in 1970 as an instrument for the change in the fraction of foreign-born individuals in the population from 1970 to 1980. Their logic is that in this period, new immigrants tended to move to places where similar immigrants already resided, and that this initial concentration of immigrants does not directly influence the outcome variables.

---

immigrants and Canadian-born workers. The estimated elasticity was 0.09.

Another solution to the endogeneity problem involves cross-section differencing, where a differenced equation is estimated using data from two time periods. See Goldin (1994). A relatively newer solution to the endogeneity problem has been advanced by Suen (1994). According to Suen if one modeled the changes in immigrant densities along age-cohorts, factor price equalization stemming from endogeneity will be solved. The simple rationale behind Suen's method is that, an immigrant cannot change his/her age-cohort upon arrival in the host country. Thus, the city of residence should have no effect, if what is driving the model is the number of immigrants in a particular age-cohort.

2.6 The Impact of Unionization on the Wage Gap

One personal characteristic to which union and non-union wages have been applied is gender. There have been a large number of studies in the United States using micro data bases to investigate the impact of unions on the male-female wage gap. In reviewing forty-eight of such studies, Lewis (1986) concludes that the union-nonunion wage differential for females was generally estimated to be similar to that for males.

In the Canadian context, the role of trade unions on the gender wage differential has been addressed by Simpson (1985), Maki and Ng (1990), Doiron and Riddell (1994) and Shamsuddin (1996). For example, Simpson (1985) found that the male-female wage differential was 22.9% in the union sector and 20.3% in the nonunion sector, implying that unions may have widened the gap between male workers and female workers.

Maki and Ng (1990) using data from the 1984 Survey of Union Membership, also estimated the overall contribution of unionization to the male-female wage gap to be about 30 cents per hour, with the membership effect accounting for about 13 cents per hour, and the wage effect for the remaining 17 cents per hour. Extending their analysis to the private and public sectors, Maki and Ng (1990) concluded that unlike the private sector unions, the public sector unions reduced the gender wage gap in Canada circa 1984. However, Doiron and Riddell (1994) derived a different result. Analyzing random samples from the 1981 Survey of Work History, the 1984 Survey of Union Membership, and the 1988 Labour Market Activity Survey, Doiron and Riddell concluded that unionization reduced the gender wage gap, and a fall in gender differences in union membership was an important factor in reducing the gender wage gap over the period 1981-1988.

Shamsuddin (1996) using aggregated data from the 1971 and 1981 Canadian censuses and various reports from the Corporation and Labour Returns Act, concluded that for 1971 unionization increased the annual earnings of males more than females. However, by 1981 unionization had reduced the gender wage gap.

From the foregoing discussion, it is apparent that the role of Canadian trade unions in gender discrimination has attracted some attention. However, to the best of my knowledge the role of Canadian unions in racial discrimination is an unresearched area. This thesis also therefore extends the Canadian literature on the impact of unionization on

the wage gap, by doing a parallel study incorporating birth status using a methodology developed by Ashenfelter (1972).

CHAPTER 3

ESTIMATES OF FOREIGN-BORN WAGE IMPACTS: AN AGE-COHORT APPROACH

Introduction

Most existing research on the effects of immigration on wages, for example Grossman (1982), Lalonde and Topel (1991), Altonji and Card (1991), and Roy (1987, 1997), relies on variations in immigration levels across cities or census metropolitan areas to identify the consequent change in relative wages of immigrants and the native-born. This approach has several shortcomings. First, the distribution of immigrants across census metropolitan areas is not exogenous. To the extent that immigrants have a choice in which city to reside, differences in relative wages across cities may cause rather than be caused by differences in labour supply. Second, this approach assumes independence across local labour markets, thus general equilibrium conditions for local labour markets are ignored. Hence, the possibility that Canadians may move out of immigrant-intensive cities and thereby depress wages in the destination cities is ruled out.

To address these shortcomings, this chapter employs a relatively new technique developed by Suen (1994) to estimate the effects of immigration on wages. This technique uses variations in the fraction of immigrants across age cohorts rather than variations in immigration levels across cities to model the impact of immigration on wages. The additional benefits of Suen's methodology is incorporated in the Foot-Stoffman

critique that warns of adverse labour market impacts as a result of the clash between the boom generation fueled by immigration, and the echo age generation. To wit, age-specific impacts of immigration in the labour market, especially wage impacts, must be tested. Suen's model, therefore, allows for the testing of the Foot-Stoffman critique. Furthermore, a two-stage Constant Elasticity of Substitution (CES) model that aggregates immigrant groups by age cohorts and aggregate cohorts into effective labour is used to study the substitution relationships between age cohorts and between immigrant groups. One advantage of this immigrant cohort size approach is that the mobility of immigrants across age cohorts is impossible at any point in time. Moreover variations in immigration rates by age is mainly driven by human capital concerns. Thus, inter-cohort variations in relative wages are likely to reflect exogenous differences in immigration rates rather than differences in the unobserved skills of immigrants. Suen's method also takes into account the fact that variations in intra-cohort immigrant/Canadian labour supplies will influence inter-cohort relative wages. In addition to the cohort size effect, substitution between immigrants and natives within an age cohort is also modeled. Hence, the two effects are implanted in a two- stage production function so that they can be estimated together.

A recurring policy question which motivates my age-cohort approach is: what should be the optimal age structure associated with Canada's immigration policy? The reason for this query is that if immigrants admitted under the current policy are too "old" they will not be suitable for employment. On the other hand, if they are too young, Canadians will have to absorb their schooling costs. Figures from the 1991 Canadian census show that 37% of immigrants were aged between 25 to 44 years at the time of

arrival in Canada. Another 27% arrived when they were aged 15 to 24 years, while 28% were younger than 15 years of age. Furthermore, 8% of all immigrants were 45 years and above and the median age of Canada's immigrant population at the time of immigration was 23.6 years.

Although approximately 62% of recent immigrants were aged 15 to 44 years when they arrived in the country, the proportion of older people immigrating to Canada is also on the rise. For example, 15% of immigrants who came to Canada between 1981 and 1991 were 45 years or older when they arrived compared with 2% of those who came before 1961. Of those who immigrated before 1961, less than 1% were aged 65 years and over. In contrast, 3% of recent immigrants were aged 65 years or older at the time of entry. This trend towards older immigrants is also reflected in the median age at immigration. For people who arrived in Canada before 1961, the median age at immigration was 21.1 years. This increased to 23.4 years for those who came during the 1960s, to 23.7 years for those arrived in the 1970s, and to 26.7 years for those who came within the last decade. This trend of an increasing percentage of immigrants arriving at older ages is partly due to Canada's immigration policy, which facilitates reunification of family members. This may have led to an increasing number of older relatives, such as parents or grandparents, reuniting with their adult children in Canada.[11] Thus, the crucial issue which has to be explored is whether this overall median age of Canada's immigrant population, i.e. 23.6 years, has resulted in any wage effects on the resident population?

[11] Canada's Changing Population, Statistics Canada-Catalogue No. 96-311E, pages 31-32.

This chapter uses an age-cohort approach to empirically estimate the impact of immigration on relative wages in Canada.

The organization of this chapter is as follows. First, I will present the model and its limitations. Second, the estimation procedures of the wage model will be discussed. This will be followed by a discussion of the data and estimation results. Finally, the two-stage CES model is used to simulate the wage impacts of increasing immigration levels.

3.1 The Model

Following Suen (1994), I assume an aggregator function of the CES form so that the total labour supply is

$$L = \left(\sum_{j=1}^{J} M_j^{\rho_1} \right)^{\frac{1}{\rho_1}} \tag{3.1}$$

where M_j is the labour supply from age cohort j. The effective labour supply from each age cohort is also a function of the composition of workers, not just the cohort size. If N_{jk} represents the number of workers from immigrant group k in age cohort j, then the effective cohort labour supply is given by

$$M_j = \left(\sum_{k=1}^{K} N_{jk}^{\rho_2} \right)^{\frac{1}{\rho_2}} \tag{3.2}$$

This two-stage formulation is simple because only two parameters ρ_1 and ρ_2 have to be estimated. The parameters ρ_1 and ρ_2 are less than one and may be negative if the aggregator functions are concave. The aggregate production function is given by

$$Y = F(L, K, \ldots), \tag{3.3}$$

where L is defined by (1) and (2) above, and K is capital.

This two-stage formulation embodies several assumptions or limitations that must be borne in mind when interpreting the results. These include the following:

(a) The production function is separable in labour and other inputs. Due to a lack of information pertaining to the use of other inputs, such as capital by age or immigrant groups, it is impossible to model the interactions between the composition of the labour force and other inputs.

(b) The labour aggregator function is separable in age cohorts. Thus, variations in the native- immigrant mix within a cohort will affect wages in other cohorts only insofar as they influence the effective cohort labour supply.

(c) The elasticity of substitution between any two-age cohorts or immigrant groups is constrained to be equal. This constraint simplifies the estimation procedure greatly since only two parameters ρ_1 and ρ_2 have to be estimated.[12] Regrettably, the assumption of constant elasticity of substitution implies that 50-54 year-olds are equally substitutable for 25-29 year-olds as are 30-34 year-olds. Furthermore, this assumption also implies that the

substitutability between Canadian workers and, say, early immigrants is the same as that for recent immigrants.

(d) Finally, the subaggregator function for the immigrant groups in each cohort is assumed to be identical. This assumption could be relaxed by employing a different $\rho 2$ for every cohort j. However, such a procedure, while meaningful and attractive, will definitely complicate the estimation procedure.

Since variations in the sizes of immigrant-cohorts are exogenous, increases in labour supply affect relative wages via the labour demand or marginal product curves. The wage of immigrant group k in age cohort j is as follows, assuming the wage rate equals the marginal product of labour:

$$W_{jk} = \frac{\partial F}{\partial L}\frac{\partial L}{\partial M_j}\frac{\partial M_j}{\partial N_{jk}} \tag{3.4}$$

Taking the derivatives and subsequently the logarithms on both sides of equation (3.4) yields the following:

$$\log W_{jk} = \log F_L + (1 - \rho_1)\log L + (\rho_1 - \rho_2)\log M_j + (\rho_2 - 1)\log N_{jk} \tag{3.5}$$

Equation (3.5) can also be employed to calculate the partial elasticities of wages with respect to changes in the supply of one factor holding other factors constant. These elasticities of complementarity are as follows:

---

[12] If a more flexible functional form such as a translog production function is employed, the number of

$$\frac{\partial \log W_{jk}}{\partial \log N_{lm}} = \begin{cases} (1-\rho_1)\left(\frac{M_l}{L}\right)^{\rho_1}\left(\frac{N_{lm}}{M_l}\right)^{\rho_2} & \text{if } l \neq j, \\ (1-\rho_1)\left(\frac{M_l}{L}\right)^{\rho_1}\left(\frac{N_{lm}}{M_l}\right)^{\rho_2} + (\rho_1-\rho_2)\left(\frac{N_{lm}}{M_l}\right)^{\rho_2} & \text{if } l = j, m \neq k; \\ (1-\rho_1)\left(\frac{M_l}{L}\right)^{\rho_1}\left(\frac{N_{lm}}{M_l}\right)^{\rho_2} + (\rho_1-\rho_2)\left(\frac{N_{lm}}{M_l}\right)^{\rho_2} + (\rho_2-1) & \text{if } l = j, m = k. \end{cases}$$

(3.6)

In the above formula, the effect of N_{lm} on the marginal product of aggregate labour, F_L is ignored since it would be absorbed in the intercept and hence cannot be estimated.

3.2 Estimating the Wage Model

An iterative method can now be employed to estimate the wage model summarized by equation (3.5). In a cross section of individuals, log F_L and log L will be identical for everybody. The third term, log M_j , is the same for all individuals in the same age cohort. Thus, although the parameter $\rho 2$ enters M_j in a non-linear fashion, the term log M_j can be replaced by dummy variables, β_j's, for each age cohort. With this modification, equation (3.5) becomes

$$\log W_{jk} = \alpha + \beta_j + (\rho 2 - 1) \log N_{jk} \qquad (3.7)$$

which can be estimated using ordinary least squares. One plus the estimated coefficient on log N_{jk} will produce an estimate of $\rho 2$.

---

parameters to be estimated would be intractable.

Using the estimate of $\rho 2$, the value of log M_j can be computed from equation (3.2). With this computed value of log M_j , equation (3.5) can be estimated directly using ordinary least squares, producing a new value of $\rho 2$. This new estimate of $\rho 2$ is subsequently employed to recompute log M_j. This process continues until the coefficients on log M_j and log N_{jk} converge. It turns out that only a couple of rounds of iterations suffice for convergence.

The wage model also has to control for demographic characteristics since wages are influenced by human capital endowments. Let the wage of individual i in age cohort j and immigrant group k be w_{ijk}, and the human capital endowment of this person be H_{ijk} = $\exp\{X_{ijk} \ \gamma\}$, where X_{ijk} refers to the demographic characteristics and γ is a vector of parameters to be estimated. Assume $w_{ijk} = W_{jk} \ H_{ijk}$, then the wage equation to be estimated in the first stage becomes

$$\log w_{ijk} = \alpha + X_{ijk} \gamma + \beta_j + (\rho 2 - 1) \log N_{jk} \qquad (3.8)$$

and the equation to be estimated in the second stage is

$$\log w_{ijk} = \alpha + X_{ijk} \gamma + (\rho 1 - \rho 2) \log M_j + (\rho 2 - 1) \log N_{jk} \qquad (3.9)$$

Thus, the key equations employed in the actual econometric estimation are summarized by equations (3.8) and (3.9). In the next section, these models will be fitted to data from the Canadian 1991 census.

3.3 Data and Estimation Results

The data set is drawn from the microdata contained in the 1/100 public use sample tape of the individual file of the 1991 Canadian census. For the purposes of this study, the data set is filtered to include only family heads born in Canada or abroad who were between the ages of 25 and 64 at the time of the census. Restricting the analysis to this age group reduces the possibility that the estimates are unduly influenced by observations at either end of the age distribution. Furthermore, this age restriction ensures that only the economically active groups are being captured.

This sample is further classified into eight five-year cohorts that range from the 25-29 year-old age group to the 60-64 year-old group, which will add to the analysis of the policy question, i.e., what is the optimal age for immigrant admission to Canada? Individuals are also classified into four groups based on birth status. These are: (1) Canadians, (2) early immigrants (those who came to Canada before 1970), (3) middle immigrants (those who came to Canada between 1971 and 1980), and (4) recent immigrants (those who arrived after 1981). The raw count of the number of persons in these 8 x 4 subgroups gives the variable N_{jk} used in the wage model.

The variables included in the set of demographic variables X_{ijk} are as follows: marital status dummies, experience, experience squared, total years of schooling and dummies for each immigrant group to control for differences within each immigrant group.

Table 3.1 shows the iterated least squares estimates of the two coefficients of interest, i.e. log N_{jk} and log M_j. The parameter ρ_2 can be computed as one plus the estimated coefficient on log N_{jk}; and ρ_1 can be recovered from ρ_2 plus the coefficient on log M_j. The first-stage estimate of ρ_2 using equation (3.8) is almost identical to the final estimates using equation (3.9). With both industry and occupation controls (i.e. the last column of Table 3.2), the estimated values for ρ_1 and ρ_2 are (0.954, 0.999). For the remainder of the chapter, I use these point estimates of ρ_1 and ρ_2 to calculate the elasticities of complementarities and also carry out the simulations.

With 32 immigrant-cohort groups, there are 1024 elasticities of complementarity. All these elasticities can be easily tabulated from the estimated values of ρ_1 and ρ_2. Instead of displaying a 32 by 32 matrix, Table 3.3 shows the estimated values of $(N_{lm}/M_l)^{\rho 2}$ and of $(M_l/L)^{\rho 1}$; so one can compute any elasticity with the formula in equation (3.6). The first three rows in the table may be interpreted as a fraction of the effective labour supply contributed by each immigrant group to the age cohort. Similarly,

the last row shows the fraction of the effective labour supply contributed to the economy by each age cohort.

The partial elasticities of complementarity are all small. For example, let us consider the effects of increasing the number of new immigrants in the 35-39 year old age cohort. A one hundred percent (100 log points, to be precise) increase in the supply of these workers will increase the wage of workers in other age groups by 0.054%. (This figure is derived by substituting the relevant numbers in the topmost expression of equation (3.6). The increase in wage arises because workers in different age groups are complementary inputs in production. On the other hand, native-born, early and middle immigrants in this age cohort will experience a wage decrease of 0.22% (i.e. using the middle expression of equation (3.6). This is because the increase in the supply of recent immigrants reduces the relative wage for that cohort. The group of workers most affected by this change are the existing recent immigrants in the 35-39 year old age cohort because they are in direct competition with the new flow of immigrants. They suffer a wage cut of 0.32% (i.e. using the bottom expression in equation (3.6).

Table 3.2 gives some clues as to why these wage impacts are relatively small. From the table we observe that recent immigrants constitute only 5.1% of the effective labour supply of the 35-39 year-old cohort, which in turn make up 19.2% of the effective aggregate labour supply. A similar exercise involving an increase in the number of recent immigrants in the 45-49 year-old age cohort produced similar results, that is, the wages of other age groups increase by 0.022%, while those of native-born, early and middle

immigrants in the 45-49 year old age cohort fall by 0.113%. The wages of existing recent immigrants experience the biggest reduction of 0.213% in wages. The reasons advanced earlier to explain the significance of these elasticities apply here equally.

3.4 Policy Simulation

In this section, I conduct a simulation exercise involving a 20 percent increase in the number of recent immigrants. This figure is derived from the annual immigration flows to Canada between 1990 and 1993 (the last year statistics were available). In 1990, 214,230 immigrants were admitted into Canada. This number increased to almost 251,000 by 1993, representing approximately a 20% increase (17.2% to be precise). Thus, the policy issue being addressed under this simulation exercise is: are wages in Canada being adversely affected by this increase in immigration flows emanating from all age groups? Since the additional immigrants will come from all age cohorts, the partial elasticities of complementarity (which gives the wage effects of an increase in immigration levels in a particular age cohort, holding immigration levels in all other cohorts fixed) estimated in the previous section are of limited use in simulating or analyzing any increases in immigration levels.

Following Suen (1994), I assume that the age distribution of the additional immigrants is the same as that of recent immigrants, thus $N'_{jk} = 1.2\ N_{jk}$. Given this assumption coupled with estimates for ρ_1 and ρ_2 , the new labour aggregate L' and new labour subaggregate M'_j can be calculated directly from the CES functions (3.1) and

(3.2). Furthermore, using equation (3.5) in conjunction with the assumption that F_L remains unchanged, we obtain the following expression:

$$\Delta \log W_{jk} = (1 - \rho_1) \Delta \log L + (\rho_1 - \rho_2) \Delta \log M_j + (\rho_2 - 1) \Delta \log N_{jk} \quad (3.10)$$

Table 3.3 summarizes the results of the simulation. The relatively small figures obtained point to the fact that the wage effects of a 20 percent increase in immigration levels on native-born and early immigrants are minimal. The effects on existing recent immigrants are slightly bigger. (See row 4 of Table 3.3). The figures range from a low of -0.037% for the native-born and early immigrants in the 60-64 year-old age cohort, to a high of -0.120% for recent immigrants in the 40-44 year-old age cohort. The numbers also appear to be decreasing as one moves towards the older age cohorts irrespective of birth status. How do these estimate stack up against the predictions of Foot and Stoffman (1996)? The simulation results do not corroborate their predictions as the age-cohort that came out worse off was the 40-44 year-olds not the younger cohorts - the 25-29 year-olds - as predicted by Foot and Stoffman. This is because the native-born 40-44 year-olds experienced the biggest reduction in their wages (i.e. -0.102) compared with -0.079 experienced by the native-born 25-29 year-olds. Moreover, the wage reductions experienced by the resident population was relatively small, ranging from -0.102% for the native-born population to -0.120% for recent immigrants.

In summary, this chapter addressed two questions. First, the age issue and its impact on wages. Second, a new method has been provided for estimating the impact of

immigration on the labour market that does not require variations in immigration levels across Canadian cities. This alternative method employs a two-stage CES model that aggregates immigrant groups by age cohorts and aggregate cohorts into effective labour. With the aid of data from the 1991 Canadian census, the elasticities of complementarity associated with increased immigration levels was estimated. A simulation exercise was also performed to ascertain the impact of a 20 percent increase in new immigrants on wages. The results indicate that a 20 percent increase in the stock of new immigrants will reduce wages by no more than one percent. Thus, the general observations seem to point to increased immigration levels having no deleterious effects on Canada's labour markets, at least as expressed as a wages effect. These results, however, must be carefully interpreted in the light of the severe restrictions embedded in the estimation procedure.

One conceptual problem not addressed adequately in this chapter is the issue of labour aggregation. A more careful handling of labour aggregation is particularly warranted here as the CES model imposes severe restrictions on substitution and complementarity relationships among the labour subaggregates.

Table 3.1
Iterated Least Squares Estimates of CES wage model

	8 Age Cohorts x 4 Immigrant Status			
Variables	(1)	(2)	(3)	(4)
Log N_{jk}	-0.0072	-0.0079	0.0009	-0.0005
	(0.0125)	(0.012)	(0.0123)	(0.0118)
Log M_j	-0.0873	-0.0777	-0.0488	-0.0447
	(0.0325)	(0.0313)	(0.0321)	(0.0307)
Industry Controls	No	Yes	No	Yes
Occupation Controls	No	No	Yes	Yes
S.E.R.	0.576	0.55	0.567	0.542
Adjusted R^2	0.123	0.191	0.149	0.223
N	39275	39275	39275	39275

Standard errors are in parenthesis.

Table 3.2
Fraction of Effective Labour Supply from Immigrant-Cohort Groups

$(N_{lm} / M_l)^{\rho 2}$	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Natives	0.901	0.867	0.820	0.758	0.737	0.708	0.690	0.681
Old Immigrants	0.033	0.044	0.061	0.113	0.160	0.205	0.250	0.273
Middle Immigrants	0.030	0.043	0.068	0.092	0.079	0.065	0.044	0.033
New Immigrants	0.037	0.047	0.051	0.038	0.025	0.022	0.016	0.013
$(M_l / L)^{\rho 1}$	0.127	0.187	0.192	0.189	0.158	0.121	0.091	0.053

Table 3.3
The Impact of a 20% Increase in Recent Immigrants on Wages

	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Native-born	-.079%	-.047%	-.076%	-.102%	-.085%	-.070%	-.047%	-.037%
Early Immig.	-.079%	-.047%	-.076%	-.102%	-.085%	-.070%	-.047%	-.037%
Recent Immig.	-.086%	-.069%	-.095%	-.120%	-.103%	-.088%	-.066%	-.056%

CHAPTER 4

NATIVE WAGE IMPACTS OF FOREIGN-BORN LABOR: A PANEL/LONGITUDINAL ANALYSIS

Introduction

In the previous chapter, an immigrant-cohort size approach was adopted to empirically estimate the impact of foreign-born labor on relative wage rates in Canada. By aggregating the foreign-born by age cohorts, and aggregate cohorts into the effective labor force, the substitution relationships between age cohorts and foreign-born groups were analysed using data from the 1991 Canadian census.

Though this approach sheds some light on the substitution relationships between Canadian-born and foreign-born workers, it is far from complete. In this chapter, I examine the robustness of earlier results, and extend them by examining the substitution relationships among various industries and also by gender.

To do so, I estimate the effect of foreign-born labour on Wages in Canada using a panel (longitudinal) data set, the 1988-1990 wave of the Labour Market Activity Survey (LMAS). The analysis is performed on both men and women across different industries. This industrial breakdown further introduces the possibility of testing for wage effects in industries which are often assumed to be immigrant entry level points. Furthermore, the longitudinal approach allows for the tracking of labor market activities of individuals over three years. This approach represents a significant improvement over the pure cross-

sectional analysis using the census data, where one cannot exploit the extra efficiency provided by a time-series/cross-section connection. There is also a consistency issue if fixed effects are correlated with the exogenous variables.

This chapter begins with a discussion of the theoretical framework used in examining the issue of substitutability. The next section discusses the dependent and independent variables used in the various estimations followed by a discussion of the data, estimation equations and methods. This is followed by a discussion of the results and their interpretation. Finally, the results from the instrumented wage regressions are discussed and then the conclusion.

4.1 The Theoretical Framework

This section draws from the discussion of production theory by Grossman (1982) Hamermesh (1993) and De New and Zimmermann (1994). In this framework, differences between the Canadian-born and foreign-born workers are modeled by treating them as separate production inputs with potential differences in productivity. However, differences in productivity can be magnified or diminished by the quality of production inputs, especially labor. To this end, a distinction is made between the quantity of labor (L) and quality of labor (H) in the analysis. H in this context therefore captures human capital, which can be proxied by the level of education or the total years of schooling.

If different individuals work in different sectors of the economy by combining the relevant factors to produce the sectoral output (Y_j), then the standard neoclassical production function could be specified as follows:

$$Y_j = F_j (L_j, H_j, K_j) \tag{4.1}$$

where K denotes capital. The subscript j refers to the sector in which individual i is working. The production function summarized by equation (4.1) is assumed to exhibit constant returns to scale. This implies that if various factors or inputs are increased by a factor k, output will also increase k-fold.[13]

Under the conditions of profit maximization and perfect competition, the return to factors will equal the value of their marginal products. That is:

$$\begin{aligned} R_L^j &= \frac{\partial F^j}{\partial L}(L_j, H_j, K_j) ; \\ R_H^j &= \frac{\partial F^j}{\partial H}(L_j, H_j, K_j) ; \\ R_K^j &= \frac{\partial F^j}{\partial K}(L_j, H_j, K_j) ; \end{aligned} \tag{4.2}$$

[13]Due to restrictions on international labor mobility, it is reasonable to assume that quantities are fixed rather than prices. This justifies the adoption of a production function rather than a cost function to discern the underlying substitution relationships. See Grossman (1982) page 597.

where $R's$ represent the real rate of return to the various factors. From the above framework, any individual's (i) wage in a given sector (j) may be expressed as:

$$w_{ij} = R_L^j + R_H^j H_i \tag{4.3}$$

Differentiating equation (4.3) with respect to L_j, the following expression is obtained:

$$\frac{\partial w_{ij}}{\partial L_j} = \frac{\partial R_L^j}{\partial L_j} + \frac{\partial R_H^j}{\partial L_j} H_i \tag{4.4}$$

To determine the sign of equation (4.4), some assumptions have to be made regarding the second expression on the right hand side of equation (4.4). The first expression on the right hand side is unambiguously negative. That is, increasing the amount of labor employed in a particular sector will depress the real return to labor in that sector. However, the sign of the second expression depends on the relationship between L and H. Specifically, it hinges on whether L and H are q-complements or q-substitutes as discussed by Hicks (1970). Two factors are q-complements if $\delta R_x/dZ > 0$, and q-substitutes if $\delta R_x/dZ < 0$ and $X, Z = L, H, K$ and $X \neq Z$. Thus if L and H are q-complements, an increase in the stock of labor (L) will increase the productivity of human capital (H).

Hence if L and H are q-complements, $dw_{ij}/dL_j > 0$ is more likely the larger the value of H_i, but would be unambiguously negative if L and H are substitutes. An influx of immigrants, therefore, may increase the wages of well educated Canadians and decrease

the wages of less qualified Canadians in particular.[14] Thus the central issue under investigation is not just the human capital content of immigration but whether the foreign-born are actually substitutes for Canadian workers.

In the empirical analysis, the general framework of equation (4.1) - (4.4) is employed to estimate the impact of foreign-born labour on the wages of Canadians. The supply effect of foreigners is modeled by the share of foreign-born labor in each major industry to account for size differences between industries. If the foreign-born share is positive, then it implies that foreign-born workers and Canadian-born workers are complements in production. A negative relationship on the other hand, signifies that they are substitutes. The magnitudes of these relationships can also be inferred from the wage elasticities using the estimated coefficients of the foreign share variables.

4.2 Dependent and Independent Variables

Based on the theoretical framework, the natural logarithm of hourly wages is employed as the dependent variable[15], and the standard variables used in earnings functions estimations are employed as independent variables. These include *experience*, *experience squared, marital status* and *years of schooling*, which measure human capital.

---

[14] Although skill differences are not emphasized in this chapter, the production function in equation 4.1 could be modified as $Y_j = F_j(G_u(L_j^u, H_j^u), G_s(L_j^s, H_j^s), K_j)$, where G_u refers to unskilled workers and G_s refers to skilled workers. (See De New and Zimmermann 1994, page 180).

[15] The log linear specification or functional form is used, because it facilitates the calculation of the wage elasticities.

Other explanatory variables to capture industry differences are included by way of dummy variables. The following industry classifications were used: *primary* (includes agriculture, forestry, fishing and mining) *communications, construction, finance & insurance, government, manufacturing, services, transport*, and *trade*.[16] The omitted category is government. The industry dummies have been included to account for size differences across industries. This is because theory suggests that production functions and complementarity/substitutability measures may be sensitive to absolute size. This implies that industries with large firms, for a variety of reasons, in particular technology, may use different techniques than industries with smaller firms and thus may experience different degrees of substitutability for the various inputs. Hence there could be a tendency for small firms to be both labour-intensive and free from institutional barriers such as unions, enabling easy job entry for immigrants. On the other hand, industries with large firms require more capital intensive techniques, and are less flexible in altering labour requirements due to the presence of institutional barriers (see Maki and Meredith 1987). Furthermore, a dummy variable for firm size is also incorporated following De New and Zimmermann (1994). Citing efficiency wage arguments, they postulated that larger firms were more likely to pay higher wages. That is, the bigger the firm the more difficult it is to effectively monitor the effort of workers; thus, higher wages serve as an incentive to minimize shirking. The variable *fsize* (firm size) takes on the value 1 for firms with 500 employees or more and 0 otherwise.

[16] It was possible to use a lower level of aggregation for the industry dummies. For example in the LMAS data set there were about 51 industry classifications. However, due to the small foreign-born sample size, the use of the entire 51 industries often produced cells with very few foreign-born workers. Hence the data had to be aggregated using guidelines from the 1980 Standard Industrial Classification codes.

In addition to the above explanatory variables, the proportion of foreign workers was calculated for each industry classification in each year. Wages should respond positively to this variable if Canadian and foreign-born workers are complements and negatively if they are substitutes.

4.3 Data, Estimating Equations and Methods

In this section, three estimating techniques that are normally employed in panel analysis will be discussed.

(a). The first technique is to combine all cross-section and time-series data and perform ordinary least squares regression on the entire data set. This is the pooled time-series cross-section model (TSCS pooled). This model is specified as:

$$w_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} \qquad (4.5)$$

where w_{it} is the hourly wage rate of individual i in year t; X_{it} is a set of explanatory variables, α and β are a vector of parameters to be estimated and ε_{it} is the error term.

(b). A second procedure involves the recognition that omitted variables may lead to changing cross-section and time series intercepts. In the immigration context, a policy change such as a higher skill requirement for admission or more accompanying human

capital, could be interpreted as one type of an omitted variable which would affect the magnitude of the constant term in the wage equation. Thus, differences across units can be captured in differences in the constant term. This is accomplished through the addition of dummy variables to the model to accommodate these changing intercepts. This way of analyzing panel data is called the fixed effects model.[17] The fixed effects model is specified as

$$w_{it} = \alpha_1 d_{1it} + \alpha_2 d_{2it} + \ldots + \beta' X_{it} + \varepsilon_{it}$$

$$= \alpha_i + \beta' X_{it} + \varepsilon_{it} \qquad (4.6)$$

where the α_i's are individual specific constants, and the d_j's are group specific dummy variables which equal 1 only when $j = i$.

(c). The third way of analyzing panel data gives rise to the random effects or the error components model. The fixed effects model is a reasonable approach when we can be confident that the differences between units can be viewed as parametric shifts of the regression function. In other settings, it might be more appropriate to view individual specific constant terms as randomly distributed across cross-sectional units. This would be appropriate if one believed that sampled cross-sectional units were drawn from a large population, as is the case for the Labour Market Activity Survey data set used for the panel estimation. The random effects model is specified as follows:

$$w_{it} = \alpha + \beta' X_{it} + \varepsilon_{it} + u_i \qquad (4.7)$$

[17] It should be pointed out, however, that nothing happened by way of significant changes in immigration policy within the time period under investigation (1988-1990), or to the business cycle to cause a shift in the intercepts and warrant the use of the fixed effects model.

where

$$\varepsilon_{it} \sim N(0,\sigma_{\varepsilon}^2);\ u_{it} \sim N(0,\sigma_{u}^2);\ COV(\varepsilon_{it}, u_j) = 0,\ \forall i, t, j;\ COV(\varepsilon_{it}, e_{js}) = 0,$$

$$if\ t \neq s\ or\ i \neq j;\ COV(u_i, u_j) = 0,\ if\ i \neq j. \tag{4.8}$$

Thus, the random effects model has an overall intercept (α) and an error term with two components: $\varepsilon_{it} + u_i$. The ε_{it} is the traditional error term unique to each observation. The u_i is an error term representing the extent to which the intercept of the ith cross-sectional unit differs from the overall intercept.[18] (Kennedy 1992, p. 222).

Equation (4.7) is estimated by an implicit two-stage generalized least squares (GLS) technique. In the first stage, the variance components are estimated using the residuals from an ordinary least squares (OLS) regression. In the second stage, the estimated variances from the OLS regression are subsequently used to generate the GLS estimates. The generalized least squares estimation procedure is used in the context of the random effects model due to the error structure. The errors are apparently not homoskedastic. Use of the OLS procedure will therefore bias the estimated standard errors.

In the next section, the results for only the simple pooling model and the random effects model (i.e. "1-way" random effects model) are presented. Due to the presence of

[18]Sometimes a third error is included, representing the extent to which the tth time period intercept differs from the overall intercept. This addition gives rise to the "2-way" random effects model. Greene (1990), does not prefer this variant of the random effects model. He cites amongst other reasons the cost in terms of degrees of freedom lost.

time invariant regressors such as industry dummies, marital status, firm size etc. the fixed effects estimator could not be computed. This constraint is imposed by the LIMDEP computer program which was used for all the estimations.[19]

Which of the simple pooling and the random effects models is better? A Lagrange multiplier test for the random effects model developed by Breusch and Pagan (1980) provides an answer. The test is based on the OLS residuals. For

$$H_0: \sigma_u^2 = 0$$

$$H_1: \sigma_u^2 \neq 0$$

the LM test statistic under the null hypothesis, is distributed as chi-squared with one degree of freedom $\chi^2(1)$[20]. The 5% critical values from the chi-squared distribution with one degree of freedom is 3.842. Therefore, if the calculated LM test statistic is greater than 3.842 then the null hypothesis would be rejected. The rejection of the null hypothesis implies that the panel GLS model is appropriate and simple pooling has to be rejected. The LM test statistics will also be provided with the estimation results.

The following random effects panel model was estimated for the whole sample, then separately for both males and females, with the individual specific component in the error term:

[19]See Greene W. H., (1992) *LIMDEP Version 6.0, User's Manual and Reference Guide*, (New York: Econometric Software Inc.), page 301.
[20] See Greene (1990) pages 491-492.

$$\text{Ln WAGE}_{it} = \beta_0 + \beta_1 \text{EXP}_{it} + \beta_2 \text{EXP2}_{it} + \beta_3 \text{EDUC}_{it} + \beta_4 \text{MARRIED}_{it} + \beta_5 \text{FSIZE}_{it} + \beta_6 \text{FSHARE}_{it} + \beta \text{ INDUSTRY DUMMIES} + \varepsilon_{it} + u_i \quad (4.9)$$

The standard time series-cross section (TSCS) pooled regression is also estimated for reference purposes.

The data used in the estimation comes from the Labour Market Activity Survey (1988-89-90) or LMAS, conducted by Statistics Canada in conjunction with Citizenship and Immigration Canada. This survey replaced the Survey of Union Membership. In selecting the individual observations, only employed Canadian-born workers aged between 20 and 65 years were selected. This is to ensure that only those workers who are active in the labour force are selected. Furthermore, I worked with a 10 percent random sample of all cases and also limited my analysis to individuals who had a complete set of variables for all 3 waves (1988, 1989 and 1990). This yielded a sample of 1018 males (3054 observations over 3 year period) and 877 females (2631 observations over 3 year period).

All variables used in equation (4.9) are defined and sample means given in Table 4.1. The hypothesized signs from equation (4.9) are as follows:

(1). $\beta_1 > 0$, $\beta_2 < 0$: Wage profile is concave in experience.

(2). $\beta_3 > 0$: Education or schooling increases wages.

(3). $\beta_4 > 0$: Marriage implies more financial responsibility. That means greater effort on the part of individuals and thus higher wages.

(4). $\beta_5 > 0$: Increasing firm size means additional compensation, invoking efficiency wage arguments.

(5) $\beta_6 > 0$: If Canadian and foreign-born workers are complements in production.

(6). $\beta_6 < 0$: If Canadian and foreign-born workers are substitutes in production.

Table 4.1
Variable Definitions and their Sample Means

		Sample Means	
Variable	Variable Definition	Males	Female
WAGE	Hourly wage	1488	1136
LNWAGE	Natural Log of hourly wage	7.21	6.91
EDUC	Total years of schooling	12.94	13.46
EXP	Experience	20.49	18.46
EXP2	Experience Squared	554.8	468.8
MARST	Marital status, Married = 1; other = 0	81%	72%
FSIZE	Firm size, More than 500 employees =1; less than 500 = 0	41%	35%
PRIM	Agriculture, forestry, fishing & mining = 1; other = 0	9%	2%
MANUF	Manufacturing = 1; other = 0	25%	10%
CONST	Construction = 1; other = 0	8%	1%
TRANS	Transportation & storage = 1; other = 0	7%	2%
TRADE	Wholesale & Retail Trade = 1; other = 0	14%	15%
FINAN	Finance, Insurance & Real Estate = 1; other = 0	3%	6%
SERV	Health, Education, Religious, Business, Personal & Food Services = 1; other = 0	17%	51%

COMM	Communication & Utilities = 1; other = 0	6%	4%
GOVT	Federal, Provincial & Local Administration = 1; other = 0	11%	8%
FSPRIM	Foreign-born share primary industries	8.2%	8.3%
FSCOM	Foreign-born share communication industries	8.4%	8.4%
FSMAN	Foreign-born share manufacturing industries	9%	8.6%
FSTRANS	Foreign-born share transportation industries	8.2%	8.3%
FSGOVT	Foreign-born share government sector	8.2%	8.3%
FSTRADE	Foreign-born share trading sector	8.4%	8.3%
FSCONST	Foreign-born share construction industries	8.3%	8.4%
FSFIN	Foreign-born share financial sector	8.5%	8.5%
FSERV	Foreign-born share service industries	8.7%	9.3%
FSHARE	Average foreign-born share in all sectors	8.4%	8.4%

Source: Labour Market Activity Survey (1988-1990) and Author's calculations.

4.4 Empirical Results

Tables 4.2 to 4.4 report the results of wage function estimations for the total sample, male sample and female sample. The standard time series-cross section (TSCS pooled) regression for each category is also included. The first and third columns of each table contain all the usual variables described in table 4.1 together with average industry foreign-born share. In columns two and four, I once again include all the usual variables but this time disaggregate the effect of the foreign-born share by industry. The difference has to do with the overall impact of foreign-born labour share averaged across all industries versus industry specific impacts. This is because the overall average impact does not portray the entire story since positive wage impacts in one industry could be offset by negative impacts in others and vice versa. For example Akbari and DeVoretz (1992) detected some displacement of native-born workers in selected foreign-born

labour-intensive industries, although their prior estimated cross elasticities suggested no economy-wide displacement of native-born workers by foreign-born workers.

The tables also contain the Breusch-Pagan Lagrange multiplier (LM) test statistics. At the critical level of χ^2 (1, 0.05) = 3.84, the LM test statistics are overwhelmingly significant. This supports the random effects model specification and rejects the TSCS simple pooling model; consequently, I will only focus on the random effects results in the interpretation.

The usual empirical finding of an "inverted-U" shaped wage profile, consistent throughout all the regression estimates, results from the positive and significant effect of experience, and the negative and significant effect of experience squared. This concavity in the wage profile compares with other Canadian studies, especially the earnings performance literature. See, for example, DeSilva (1997), Abbot and Beach (1993), Meng (1987), Bloom and Gunderson (1991), and Pendakur and Pendakur (1996). Years of schooling also have a significant and positive influence thereby adding to the human capital stock. In addition, marital status and firm size also had a positive and significant effect on hourly wage rates in the total sample equation. In the males equation, though, firm size was negative, contrary to theoretical predictions. It was however insignificant. The marital status variable was also positive and significant. For the female regression estimates, both the marital status and firm size variables were positive, but insignificant.

The key variable of interest in this study is the share of foreign-born labour in the various industries. A higher share should impact positively on wages if foreign-born workers and native-born workers are complements, and negatively if they are substitutes. Using the estimated coefficients on the foreign share variables and their means, the wage elasticities for each industry and for the total samples can be calculated. The wage elasticity is simply the product of the estimated coefficient and its mean. Table 4.5 summarizes the results from these calculations.

With regard to the total sample, the wage elasticity on average is positive, meaning that the foreign-born and native-born are complements. The wage elasticity was estimated to be around 0.5. This means that a 1% increase in the flow of foreign-born workers into the country will increase the wage rates of native-born workers by about 0.5%. It should be noted that a standardized test was not conducted to directly test for the significance/insignificance of these elasticities, but rather my focus was on the significance of the estimated coefficients that went into calculating the elasticities. Thus, it would be more reassuring if the coefficients on the foreign share variables turned out to be significant. For males, the overall elasticity was negative (-0.55), meaning that foreign-born workers and natives are substitutes. For females, the elasticity was also positive (0.67), indicating a complementary relationship. This compares closely with the results by De New and Zimmermann (1994) who carried out a similar study in Germany. Using the same estimation techniques, they calculate the overall foreign share elasticity to be -0.35. Examining job displacement effects of Canadian immigrants by country of origin and occupation, Roy (1997) also found US immigrants and Canadians to be substitutes in the

labour market. Specifically, a 10 percent increase in the number of immigrants from the United States would reduce the wage rates of native-born Canadians by 0.9%. He attributed this result to the similarities between the US and Canadian labour markets vis-à-vis technology in the work place, the institutional structure etc. The study by Akbari and DeVoretz (1992) found foreign-born workers and native-born workers to be neither substitutes nor complements in production economy-wide in 1980 for Canada. However, the focus of their study was on employment effects and not wage effects; consequently it cannot be compared to this study. They also estimated share equations from a translog production function; hence their methodology is also different from that being adopted in this chapter.

Wage elasticities calculated from aggregated data can mask industry specific effects; therefore, it is imperative that the results are also replicated for specific industries. Some of the theoretical issues that suggest that disaggregation by industry size have already been alluded to. These include scale effects and varying capital-labour ratios with implications on substitutability and wage effects in the various industries (see DeVoretz (1989, 15). Furthermore, studies by Hiebert (1997) also suggest that the foreign-born are often concentrated by industry. The figures for the total sample reveals that wage suppression occurs in the primary, communication, transportation, trade, and construction industries. In all these industries the wage elasticity is negative. On the other hand, there are wage increases in manufacturing, government, finance and insurance and the service industries. The wage elasticities are all positive, ranging from 0.0013 in finance and insurance to 0.0081 in the service industries.

For the male sample, wage suppression occurs in all industries with the exception of government, finance and insurance, and the service industries which all experienced wage gains. The results for females are very similar to that of males, except one also observes wage increases in manufacturing as well.

Endogeneity of Foreign-share Variable

The empirical analysis has been conducted so far on the premise that the proportion of foreign-born labour in the various industries is exogenous. However, the distribution of foreign-born workers in the various industries may be attributed to high wages, and therefore, stem from reverse causation. This implies that the foreign share variables could be endogenous. One way of handling this problem is to find suitable instruments[21] to confront the endogeneity issue of industry selection. To test for endogeneity, the Hausman specification test is used. The version of the Hausman test used here is in two stages. In the first stage, the foreign share variable is regressed on all the instruments and the predicted values are saved for the second stage. In the second stage, the predicted values for the foreign share variable are used in the wage regressions and t-test is used to test whether the fitted value of the predicted foreign share variable is significantly different from zero. According to the Hausman specification test, simultaneity is not a problem in the model if the coefficient on the predicted value (in this case foreign share) is not

[21] These include industry dummies, industry growth rates and an overall time trend.

significantly different from zero.[22] Table 4.6 to 4.8 summarizes the results from the instrumented wage regression. An examination of the foreign share variables (i.e. FSHARE and its industry counterparts FSPRIM to FSERV), especially for the random effects model, indicate that at the critical level of 1.96, the null hypothesis that the coefficients on the foreign share variables is zero must be rejected. This is because almost all the t-values with very few exceptions were greater than 1.96. Therefore, this indicates that simultaneity was indeed a problem and instrumentation was warranted.

Comparing the instrumented regressions with the non-instrumented ones, one observes a significant improvement in the results, both in terms of the absolute values of the estimated coefficients and the level of statistical significance. For example, looking at only the total sample (i.e. Table 4.2 and Table 4.6), the foreign share variable was estimated to be 0.063 and a t-value of 13.07 in the non-instrumented regression. However, referring to the instrumented regressions in Table 4.6, the coefficient of the foreign share variable in the random effects model has increased from 0.063 to 0.135, and the t-value is now 16.31.

The LM test statistics reported in Tables 4.6 to 4.9 are overwhelmingly significant and support the appropriateness of the random effects specification in all cases instead of the simple pooled time series cross sectional model (i.e. TSCS Pooled). Thus, the interpretation of the instrumented wage equations will be limited to the random effects model. All the traditional human capital variables such as education, experience, marital

[22] Because this test is a large sample test, the critical value that must be used is derived from the normal

status were all significant and had the expected signs. However, the variable of primary interest is the foreign share variables. For ease of interpretation the wage elasticities have also been calculated using the estimated coefficients form the instrumented regressions. The results have been summarized in Table 4.9.

The results from Table 4.9 indicate that the wage elasticity for the total sample on average is 0.011. This means that foreign-born workers and native-born workers are complements. Specifically, a 1% increase in the number of foreign-born workers will increase the hourly wage rates of Canadians by 0.011%. For the male and female samples, a similar complementary relationship between foreign-born workers and native-born workers was discerned. The corresponding elasticities for males and females are 0.013 and 0.014. This implies that a 1% increase in the number of foreign-born workers will increase the hourly wages of Canadian male and female workers by 0.013% and 0.014% respectively.

When the wage elasticities were calculated for the various industries one discovers new patterns of complementary and substitution relationships between foreign-born and native-born workers. In all three different samples i.e. total, male and female samples wage suppression was observed in the primary, transportation and storage, and wholesale and retail trade industries. This is because the wage elasticities were all negative suggesting a substitution relationship. The elasticities were -0.011, -0.032 and -0.019 respectively for the total sample; -0.009, -0.059 and -0.019 respectively for the male

---

distribution. At the 5% significance level, the corresponding critical level of this test is 1.96.

sample and -0.006, -0.017 and -0.022 respectively for the female sample. In all the other industries the wage elasticities were positive for all three samples.

In summary, this chapter focused on the impact of foreign-born labour on native-born wage rates, using a longitudinal data set from the 1988-1990 Labour Market Activity Survey. The principal objective is to investigate any substitution and complementarity relationships between foreign-born and native-born workers by industries. The estimation is carried out for both males and females in addition to the overall sample in different industries. Furthermore, because of the probable endogeneity of the foreign share variable, an instrumental variable approach was used to deal with the endogeneity problem. The results indicate that years of experience, years of schooling, industry of employment, marital status and firm size have a significant impact on wages, using both the instrumented and non-instrumented regressions. Finally, immigration, which is proxied by the share of foreign-born workers overall and also in the various industries in which Canadians work, appears to have an overall positive effect on Canadian/native-born wages for all 3 samples using the instrumented regressions. However, wage compression was detected in the primary, transportation and storage and the trade industries. Thus although on average, there appears to be a complementary relationship, it has been definitely masked by developments in specific industries.

Table 4.2
Impacts of Foreign-Born Labour on Canadian Wages (Total Sample)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.068	0.068	0.034	0.027
	(29.57)	(29.39)	(15.18)	(12.28)
EXP	0.022	0.022	0.017	0.017
	(11.08)	(11.09)	(6.356)	(6.414)
EXP2	-0.0003	-0.0003	-0.00024	-0.00024
	(-7.54)	(-7.55)	(-4.297)	(-4.438)
MARST	0.085	0.085	0.044	0.037
	(6.015)	(5.98)	(3.814)	(3.31)
FSIZE	0.167	0.167	0.018	0.016
	(13.6)	(13.6)	(3.101)	(2.892)
PRIM	-0.038	-0.082	-0.141	-0.25
	(-1.305)	(-0.908)	(-2.912)	(-4.672)
MANUF	0.036	-0.007	-0.047	-0.15
	(1.531)	(-0.127)	(-1.183)	(-3.577)
CONST	0.054	0.036	-0.079	-0.142
	(1.581)	(0.42)	(-1.39)	(-2.36)
TRANS	0.049	0.005	-0.014	-0.117
	(1.561)	(0.019)	(-0.273)	(-1.35)
TRADE	-0.233	-0.276	-0.33	-0.411
	(-9.745)	(-6.45)	(-8.272)	(-10.04)
FINAN	-0.182	-0.228	-0.208	-0.284
	(-5.895)	(-3.844)	(-4.006)	(-5.291)
SERV	-0.191	-0.313	-0.214	-0.414
	(-9.042)	(-3.76)	(-6.051)	(-10.11)
COMM	0.07	0.042	0.059	0.007
	(2.207)	(0.933)	(1.105)	(0.138)
FSHARE	0.053		0.063	
	(2.921)		(13.07)	
FSPRIM		-0.008		-0.023
		(-0.203)		(-2.311)
FSCOMM		-0.0038		-0.0073
		(-0.1)		(-0.771)
FSMAN		0.007		0.019
		(0.421)		(4.644)
FSTRANS		-0.0062		-0.017
		(-0.059)		(-0.657)
FSGOVT		0.015		0.026
		(0.866)		(5.935)
FSTRADE		-0.042		-0.064
		(-1.102)		(-6.737)
FSCONST		0.01		-0.0019
		(0.145)		(-0.11)
FSFIN		0.011		0.015

		(0.454)		(2.536)
FSERV		0.056		0.091
		(1.302)		(8.341)
CONSTANT	5.431	5.583	6.005	6.366
	(34.07)	(27.48)	(87.32)	(83.01)
N	5670	5670	5670	5670
R^2	0.244	0.245	0.182	0.168
σ_ε^2			0.01	0.009
σ_u^2			0.193	0.198
LM (d.f. = 1)			4848.78	4859.49

T-values are in parenthesis.

Table 4.3
Impacts of Foreign-Born Labour on Canadian Wages (Males Only)
Dependent Variable: Natural Logarithm of Hourly Male Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.046	0.046	0.023	0.015
	(16.58)	(16.42)	(9.41)	(6.573)
EXP	0.027	0.027	0.002	0.019
	(10.58)	(10.59)	(5.842)	(5.881)
EXP2	-0.00046	-0.00046	-0.00032	-0.00032
	(-8.902)	(-8.913)	(-4.801)	(-4.943)
MARST	0.093	0.093	0.038	0.034
	(4.703)	(4.694)	(2.742)	(2.649)
FSIZE	0.0003	0.0003	-0.00002	-0.00005
	(0.935)	(0.893)	(-0.284)	(-0.673)
PRIM	-0.0003	-0.067	-0.045	-0.158
	(-0.009)	(-0.649)	(-0.807)	(-2.634)
MANUF	-0.063	-0.163	-0.105	-0.249
	(-2.316)	(-2.612)	(-2.301)	(-5.248)
CONST	-0.803	-0.132	-0.125	-0.228
	(-2.304)	(-1.542)	(-2.125)	(-3.725)
TRANS	-0.109	-0.32	-0.154	-0.339
	(-2.993)	(-0.95)	(-2.488)	(-3.713)
TRADE	-0.225	-0.292	-0.269	-0.367
	(-7.408)	(-5.452)	(-5.245)	(-7.013)
FINAN	-0.065	-0.13	-0.041	-0.12
	(-1.341)	(-1.433)	(-0.507)	(-1.436)
SERV	-0.209	-0.397	-0.2003	-0.435
	(-7.297)	(-2.984)	(-4.113)	(-7.874)
COMM	-0.01	-0.065	-0.021	-0.091
	(-0.278)	(-1.206)	(-0.322)	(-1.412)
FSHARE	0.06		-0.066	

	(2.544)		(12.55)	
FSPRIM		-0.006		-0.016
		(-0.131)		(-1.809)
FSCOMM		-0.004		-0.011
		(-0.092)		(-1.233)
FSMAN		0.02		0.029
		(1.167)		(8.271)
FSTRANS		-0.062		-0.041
		(-0.476)		(-1.58)
FSGOVT		0.03		0.037
		(1.411)		(8.695)
FSTRADE		-0.031		-0.05
		(-0.596)		(-4.88)
FSCONST		0.003		-0.023
		(0.048)		(-1.692)
FSFIN		0.0068		0.011
		(0.167)		(1.425)
FSERV		0.079		0.102
		(1.081)		(7.038)
CONSTANT	5.827	6.083	6.222	6.648
	(28.34)	(22.74)	(75.23)	(75.54)
N	3054	3054	3054	3054
R^2	0.166	0.167	0.139	0.124
σ_ε^2			0.009	0.093
σ_u^2			0.165	0.17
LM (d.f. = 1)			2678.81	2690.94

T-values are in parenthesis.

Table 4.4
Impacts of Foreign-Born Labour on Canadian Wages (Females Only)
Dependent Variable: Natural Logarithm of Hourly Female Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.077	0.077	0.036	0.025
	(21.98)	(21.81)	(10.96)	(8.059)
EXP	0.019	0.019	0.014	0.014
	(6.842)	(6.85)	(3.596)	(3.783)
EXP2	-0.0003	-0.0003	-0.00023	-0.00025
	(-5.074)	(-5.089)	(-2.792)	(-3.092)
MARST	-0.0014	-0.002	0.012	0.005
	(-0.072)	(-0.093)	(0.703)	(0.349)
FSIZE	0.138	0.138	0.0024	0.0008
	(7.415)	(7.416)	(0.306)	(0.113)
PRIM	-0.299	-0.283	-0.397	-0.461
	(-4.62)	(-1.33)	(-3.639)	(-3.88)

MANUF	-0.153	-0.246	-0.263	-0.406
	(-3.718)	(-2.588)	(-3.803)	(-5.63)
CONST	-0.425	-0.453	-0.554	-0.641
	(-4.454)	(-1.858)	(-3.441)	(-3.776)
TRANS	-0.063	-0.295	-0.174	-0.388
	(-0.971)	(-0.476)	(-1.595)	(-2.196)
TRADE	-0.307	-0.371	-0.397	-0.5
	(-8.094)	(-5.375)	(-6.234)	(-7.654)
FINAN	-0.258	-0.315	-0.295	-0.38
	(-5.653)	(-3.559)	(-3.816)	(-4.781)
SERV	-0.151	-0.296	-0.182	-0.431
	(-4.591)	(-2.657)	(-3.282)	(-7.074)
COMM	0.082	0.033	0.086	0.017
	(1.576)	(0.439)	(0.984)	(0.195)
FSHARE	0.065		0.08	
	(2.415)		(11.87)	
FSPRIM		0.034		0.006
		(0.338)		(0.269)
FSCOMM		-0.0065		-0.013
		(-0.105)		(-0.995)
FSMAN		0.019		0.026
		(0.64)		(3.896)
FSTRANS		-0.073		-0.051
		(-0.3)		(-0.944)
FSGOVT		0.027		0.035
		(0.94)		(5.402)
FSTRADE		-0.037		-0.065
		(-0.645)		(-4.937)
FSCONST		0.021		-0.006
		(0.102)		(-0.132)
FSFIN		0.004		0.007
		(0.127)		(1.013)
FSERV		0.056		0.108
		(1.057)		(8.842)
CONSTANT	5.224	5.44	5.807	6.301
	(22.03)	(18.46)	(57.85)	(58.88)
N	2631	2631	2631	2631
R^2	0.259	0.26	0.194	0.171
σ_ε^2			0.01	0.009
σ_u^2			0.2	0.21
LM (d.f. = 1)			2238.48	2246.29

T-values are in parenthesis

Table 4.5
Wage Elasticities by Industries and Gender (Using Coefficients from Non Instrumented Regressions)

Variable	Total Sample Coefficient	Elasticity	Male Sample Coefficient	Elasticity	Female Sample Coefficient	Elasticity
FSPRIM	-0.023	-0.0019	-0.016	-0.0013	0.006	0.0005
FSCOMM	-0.073	-0.0061	-0.011	-0.00092	-0.014	-0.0012
FSMAN	0.019	0.0016	-0.029	-0.0026	0.026	0.0022
FSTRANS	-0.017	-0.0014	-0.041	-0.0034	-0.051	-0.0042
FSGOVT	0.026	0.0021	0.037	0.003	0.035	0.0029
FSTRADE	-0.064	-0.0053	-0.05	-0.0042	-0.065	-0.0054
FSCONST	-0.0019	-0.00016	-0.023	-0.0019	-0.0062	-0.00052
FSFINAN	0.015	0.0013	0.011	0.00093	0.0075	0.00064
FSERV	0.091	0.0081	0.102	0.0088	0.109	0.01009
FSAVERAGE	0.063	0.0053	-0.066	-0.0055	0.0803	0.0067

Table 4.6
Impacts of Foreign-Born Labour on Canadian Wages (Total Sample and Using Instruments for Foreign Share Variables)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.072	0.072	0.028	0.028
	(32.72)	(32.76)	(11.75)	(12.41)
EXP	0.016	0.016	0.015	0.014
	(8.16)	(8.15)	(5.25)	(5.18)
EXP2	-0.0002	-0.0002	-0.0002	-0.0002
	(-4.73)	(-4.72)	(-3.75)	(-3.67)
MARST	0.062	0.062	0.024	0.026
	(4.03)	(4.03)	(1.79)	(1.99)
FSIZE	0.15	0.15	0.016	0.016
	(11.67)	(11.67)	(2.51)	(2.48)
PRIM	-0.004	-0.24	-0.121	-0.42
	(-0.143)	(-0.71)	(-2.61)	(-4.14)
MANUF	-0.092	-0.16	-0.18	-0.29
	(-4.04)	(-3.47)	(-4.86)	(-7.41)
CONST	-0.043	-0.005	-0.17	-0.12
	(-1.28)	(-0.055)	(-3.14)	(-1.97)
TRANS	0.029	-0.056	-0.073	-1.12
	(0.96)	(-0.03)	(-1.43)	(-2.22)
TRADE	-0.32	-0.37	-0.41	-0.54
	(-13.54)	(-6.27)	(-10.64)	(-12.84)
FINAN	-0.29	-0.58	-0.32	-0.82
	(-8.45)	(-1.19)	(-5.40)	(-5.73)
SERV	-0.201	-0.28	-0.21	-0.34
	(-9.68)	(-5.30)	(-6.06)	(-9.14)

COMM	0.012	-0.014	0.009	-0.037
	(0.37)	(-0.30)	(0.18)	(-0.66)
FSHARE	0.075		0.135	
	(2.73)		(16.31)	
FSPRIM		-0.109		-0.13
		(-0.63)		(-2.85)
FSCOMM		0.029		0.05
		(0.57)		(3.59)
FSMAN		0.022		0.031
		(1.86)		(9.44)
FSTRANS		-0.024		-0.39
		(-0.033)		(-2.002)
FSGOVT		0.013		0.024
		(0.76)		(5.11)
FSTRADE		-0.097		-0.23
		(-0.79)		(-6.77)
FSCONST		0.059		0.094
		(0.703)		(4.16)
FSFIN		0.15		0.27
		(0.54)		(3.52)
FSERV		0.03		0.05
		(1.44)		(8.80)
CONSTANT	5.21	5.21	5.44	8.58
	(22.56)	(0.75)	(64.62)	(4.59)
N	5670	5670	5670	5670
R^2	0.26	0.26	0.18	0.18
σ_ε^2			0.011	0.011
σ_u^2			0.19	0.196
LM(d.f. = 1)			4760.1	4761.39

T-values are in parenthesis.

Table 4.7
Impacts of Foreign-Born Labour on Canadian Wages (Male Sample and Using Instruments for Foreign Share Variables)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.042	0.042	0.018	0.018
	(15.06)	(15.11)	(6.35)	(6.92)
EXP	0.025	0.025	0.023	0.022
	(9.86)	(9.83)	(6.56)	(6.23)
EXP2	-0.0004	-0.0004	-0.0004	-0.0003
	(-8.45)	(-8.42)	(-5.67)	(-5.31)
MARST	0.101	0.101	0.036	0.039
	(5.19)	(5.22)	(2.17)	(2.64)
FSIZE	0.17	0.18	0.011	0.007

	(11.32)	(11.29)	(1.39)	(0.96)
PRIM	-0.0024	-0.19	-0.053	-0.34
	(-0.076)	(-0.52)	(-0.96)	(-3.05)
MANUF	-0.077	-0.19	-0.11	-0.24
	(-2.91)	(-3.41)	(-2.55)	(-5.25)
CONST	-0.024	-0.042	-0.13	-0.12
	(-0.70)	(-0.429)	(-2.21)	(-1.91)
TRANS	-0.11	-1.56	-0.16	-2.03
	(-3.04)	(-0.73)	(-2.75)	(-3.77)
TRADE	-0.19	-0.33	-0.27	-0.43
	(-6.67)	(-4.17)	(-5.49)	(-7.95)
FINAN	-0.071	-0.42	-0.038	-0.49
	(-1.49)	(-0.63)	(-0.48)	(-2.68)
SERV	-0.18	-0.31	-0.19	-0.34
	(-6.47)	(-3.98)	(-4.11)	(-6.70)
COMM	-0.044	-0.105	-0.027	-0.095
	(-1.20)	(-1.94)	(-0.44)	(-1.51)
FSHARE	0.121		0.15	
	(3.47)		(14.58)	
FSPRIM		-0.072		-0.11
		(-0.36)		(-2.28)
FSCOMM		0.069		0.066
		(1.21)		(4.65)
FSMAN		0.025		0.029
		(1.93)		(8.93)
FSTRANS		-0.55		-0.72
		(-0.65)		(-3.37)
FSGOVT		0.031		0.037
		(1.46)		(6.84)
FSTRADE		-0.19		-0.23
		(-1.14)		(-5.62)
FSCONST		0.038		0.076
		(0.47)		(3.74)
FSFIN		0.17		0.23
		(0.44)		(2.35)
FSERV		0.039		0.046
		(1.12)		(5.24)
CONSTANT	5.32	10.04	5.58	11.71
	(18.12)	(1.22)	(53.34)	(5.70)
N	3054	3054	3054	3054
R^2	0.20	0.20	0.14	0.14
σ_ε^2			0.009	0.009
σ_u^2			0.166	0.168
LM(d.f. = 1)			2570.4	2566.84

T-values are in parenthesis

Table 4.8
Impacts of Foreign-Born Labour on Canadian Wages (Female Sample and Using Instruments for Foreign Share Variables)
Dependent Variable: Natural Logarithm of Hourly Canadian Wage

Variable	TSCS Pooled FS-Average	TSCS Pooled FS-Industry	Random Effects FS-Average	Random Effects FS-Industry
EDUC	0.077	0.077	0.026	0.028
	(21.79)	(21.84)	(7.66)	(8.67)
EXP	0.019	0.019	0.014	0.014
	(6.86)	(6.84)	(3.78)	(3.64)
EXP2	-0.0003	-0.0003	-0.0003	-0.0002
	(-5.09)	(-5.08)	(-3.09)	(-2.92)
MARST	-0.002	-0.002	0.004	0.007
	(-0.1)	(-0.096)	(0.24)	(0.46)
FSIZE	0.14	0.14	0.002	-0.0004
	(7.43)	(7.41)	(0.22)	(-0.054)
PRIM	-0.29	-0.42	-0.41	-0.59
	(-4.62)	(-0.46)	(-3.74)	(-2.58)
MANUF	-0.15	-0.25	-0.28	-0.41
	(-3.74)	(-2.92)	(-4.11)	(-5.69)
CONST	-0.43	-0.45	-0.57	-0.54
	(-4.46)	(-1.49)	(-3.53)	(-3.12)
TRANS	-0.063	1.04	-0.19	-0.77
	(-0.98)	(0.24)	(-1.78)	(-0.78)
TRADE	-0.31	-0.42	-0.41	-0.56
	(-8.11)	(-4.39)	(-6.46)	(-8.43)
FINAN	-0.26	-0.58	-0.30	-0.94
	(-5.66)	(-1.07)	(-3.92)	(-6.43)
SERV	-0.15	-0.28	-0.18	-0.36
	(-4.59)	(-3.68)	(-3.30)	(-6.19)
COMM	0.082	0.031	0.081	0.017
	(1.57)	(0.41)	(0.92)	(0.19)
FSHARE	0.111		0.17	
	(2.73)		(16.1)	
FSPRIM		-0.038		-0.068
		(-0.081)		(-0.64)
FSCOMM		0.072		0.069
		(0.89)		(3.77)
FSMAN		0.024		0.03
		(0.99)		(5.47)
FSTRANS		0.46		-0.21
		(0.27)		(-0.53)
FSGOVT		0.026		0.033
		(0.86)		(4.94)
FSTRADE		-0.17		-0.26
		(-0.94)		(-6.13)
FSCONST		0.021		0.082
		(0.079)		(1.33)

FSFIN		0.16		0.34
		(0.52)		(4.7)
FSERV		0.048		0.067
		(1.98)		(12.23)
CONSTANT	4.85	0.76	5.23	5.87
	(14.05)	(0.049)	(46.11)	(1.67)
N	2631	2631	2631	2631
R^2	0.26	0.26	0.17	0.17
σ_ε^2			0.009	0.01
σ_u^2			0.21	0.21
LM(d.f. = 1)			2243.4	2243.8

T-values are in parenthesis

Table 4.9
Wage Elasticities by Industries and Gender (Using Coefficients from Instrumented Regressions)

Variable	Total Sample Coefficient	Elasticity	Male Sample Coefficient	Elasticity	Female Sample Coefficient	Elasticity
FSPRIM	-0.13	-0.011	-0.11	-0.009	-0.068	-0.006
FSCOMM	0.05	0.004	0.066	0.006	0.069	0.006
FSMAN	0.031	0.003	0.029	0.003	0.03	0.003
FSTRANS	-0.39	-0.032	-0.72	-0.059	-0.21	-0.017
FSGOVT	0.024	0.002	0.037	0.003	0.033	0.003
FSTRADE	-0.23	-0.019	-0.23	-0.019	-0.26	-0.022
FSCONST	0.094	0.008	0.076	0.006	0.082	0.007
FSFINAN	0.27	0.023	0.23	0.019	0.34	0.029
FSERV	0.05	0.004	0.046	0.004	0.067	0.006
FSAVERAGE	0.135	0.011	0.15	0.013	0.17	0.014

CHAPTER 5

THE SUBSTITUTABILITY OF CANADIAN AND FOREIGN-BORN LABOUR

Introduction

This chapter analyses the extent of labour substitutability and complementarity among Canadians, old foreign-born and new foreign-born workers. It also investigates labour substitutability by various skill groups or occupations. This differentiates itself from the earlier chapters which focused on wage impacts by age cohorts and industries. Furthermore, the analysis of wage impacts by occupations will allow the evaluation of some policy issues. For example, under the points system, occupation related characteristics play a key role. Specifically, points for occupational skill, experience and demand, plus special points for designated occupations make up 43 out of the possible 100 points[23] (see Green and Green 1995; page 1009). In addition, changes in the occupational distribution of immigrants is the direct route through which the government attempts to affect earning patterns of the host population. Thus, in evaluating the impact of immigration on the labour market, especially how immigrants affect the wages of Canadians and themselves, an examination of the immigrant occupational distribution is imperative. The objective of this chapter, therefore, is to estimate the Hicksian elasticities between the different types of workers and also by occupational groups. The signs and magnitudes of these elasticities will enable the prediction of wage impacts by the various

[23] Prospective applicants must obtain at least 70 out of 100 to be admissible.

types of labour and by occupations. A generalized Leontief production function is employed to estimate a tractable system of input demand functions using data from the 1991 Canadian census.

Supposing immigration flows can be interpreted as exogenous shifts in the supply of labour to geographically defined labour markets. Then an increase in the supply of labour through increased immigration in a given labour market would initially lead to intense competition for jobs amongst foreign-born workers. This would lead to a reduction of foreign-born wages. Since foreign-born labour is now relatively cheap, employers will likely substitute this cheaper foreign-born labour for native-born workers, depending on their skill requirements. If variations in the number of foreign-born workers relative to the native-born workers across labour markets indicate that a higher ratio of foreign-born to native-born workers is associated with a lower native-born wage rate, then foreign-born and native-born workers are substitutable labour inputs in production. In this scenario, the foreign-born workers can be viewed as having an adverse impact on the wages of native-born workers.

On the other hand, one can envisage a situation where increased immigration flows to local labour markets could lead to increased wages for the native-born workers. This can occur if skill shortages exist in the host country. Under these circumstances, foreign-born workers with the requisite skills can alleviate these skill shortages and expand job opportunities in general, which would result in an increased demand for labour culminating

in higher wages for native-born workers. In this case, foreign-born and native-born workers are complementary inputs in production.

Whether foreign-born and native-born workers are complements or substitutes in production, and what the magnitudes of such effects are, is purely an empirical issue. Essentially, it involves the measurement of how a change in the relative quantities of the different types of labour inputs interact with each other and affects their relative prices. This is what the calculation of the Hicksian elasticities of complementarity entails. The basic question under investigation in this chapter, therefore, is whether foreign-born workers cause the reduction of native-born wage rates or their wages, and whether these wage impacts vary by skill groups or occupations.

Most existing research on the effects of the foreign-born labour on wages requires variations in the foreign-born population across cities to model the consequent change in relative wages of the foreign-born and Canadians (see, for example, Roy 1987 and 1997). The problem here is that the foreign-born, who are likely to be the most mobile of workers, will probably move to those regions where demand shocks have led to higher wages (see Friedberg and Hunt 1995; and Newbold 1996). For example, using data from the 1986 Canadian census, Newbold found that the foreign-born have higher in- and out-migration rates than primary migrants (native-born), with Ontario having a strong ability to attract and retain the foreign-born. As a result, there is an endogeneity problem, i.e. relative foreign-born densities can explain changes in wages, but changes in relative

foreign-born densities are also explained by higher wage rates. The problem can be dealt with by adopting an instrumental variable estimation procedure.

One of the major points of departure in this chapter is the recognition of this endogeneity problem and dealing with it in an appropriate manner. This potentially produces unbiased estimates. This chapter is organized as follows. The next section discusses the theoretical and econometric model. This is followed by an examination of the data and empirical results. Thereafter, a discussion of the endogeneity problem ensues along with the interpretation of the re-estimated regressions. The chapter concludes with a discussion of the empirical results by skill or occupational groups.

5.1 Model Specification

Let us suppose there are three inputs in the short-run production function in a given labour market. In this chapter, as in the others, the local labour markets have been proxied by Census Metropolitan Areas (CMAs). The inputs are Canadian-born labour (L_c), new foreign-born labour (L_n), and old foreign-born labour (L_o). The new foreign-born are defined as all immigrants who came to Canada after 1978,[24] and the old foreign-born are those who immigrated to Canada before 1978. If the short-run production function, $f(L_c, L_o, L_n)$, exhibits the usual neoclassical properties and is linearly homogeneous in the three types of labour, then the profit-maximizing conditions can be specified as follows:

[24] The year 1978 was chosen as the cutoff for the distinction between old foreign-born and new foreign-born because in that year a new immigration policy, which, among other things, emphasized family re-unification, came into force.

$$w_i = f_i (p_c, p_o, p_n), \qquad (i = c, o, n) \tag{5.1}$$

where

w_i = wage rate of input i

$f_i = \delta f (L_c, L_o, L_n) / \delta L_i$

$p_i = L_i / (L_c + L_o + L_n)$

P_i is defined as the proportion of type i workers in the working age population in the kth labour market; thus, equation (5.1) assumes that type i workers are paid the value of their marginal product. Hence, the productivity and wage rates of Canadians not only depend on the relative number of Canadian-born workers, but also on the relative proportions of the other labour types as well. The degree of substitutability among the various types of labour will, therefore, be an important determinant of wage levels in the local labour market. Equation (5.1) also implies that there are no scale effects in the demand system. That is, the relative proportions of workers are invariant to scale.

The determination of wage rates depends not only on the demand functions in (5.1), but also on the relative supply of the labour types to the local labour market. Initially, it is assumed that the relative supplies of all labour types are perfectly inelastic for ease of estimation of the production function parameters. However, it is perfectly feasible that in the long run, type i workers will likely migrate to high wage CMAs. Thus, an endogeneity problem exists, which will be tackled in another section in this chapter.

Given the assumption of perfectly inelastic relative labour supplies, the demand system in (5.1) describes the wage-determination process in the particular labour market. It is then relatively easy to predict the effect on wages when relative supplies shift exogenously.

The measurement of the actual extent of substitutability or complementarity requires further specification of the production technology's structure. Following Borjas (1983) and Roy (1987, 1997), the generalized Leontief production function is adopted as it yields an empirically tractable system of input demand functions. The generalized Leontief production function[25] is specified as:

$$f(L_c, L_o, L_n) = \sum_j \sum_i \gamma_{ij} (L_i L_j)^{1/2}, \qquad (i, j = c, o, n) \qquad (5.2)$$

where the technology parameters are restricted so that $\gamma_{ij} = \gamma_{ji}$.

The functional form given by equation (5.2) can be interpreted as a second-order approximation to a concave, neoclassical production function with constant returns to scale. Equating wage rates and marginal products for the three labour types in the context of profit maximization, one can derive the following empirical specification:

[25] See Diewert (1971) and Hamermesh (1986) for a discussion on the generalized Leontief production function and its derivation from the dual cost function.

$$w_c = \gamma_{cc} + \gamma_{co}(p_o/p_c)^{1/2} + \gamma_{cn}(p_n/p_c)^{1/2} \quad (5.3a)$$

$$w_o = \gamma_{oo} + \gamma_{oc}(p_c/p_o)^{1/2} + \gamma_{on}(p_n/p_o)^{1/2} \quad (5.3b)$$

$$w_n = \gamma_{nn} + \gamma_{nc}(p_c/p_n)^{1/2} + \gamma_{no}(p_o/p_n)^{1/2} \quad (5.3c)$$

The production technology summarized by equation (5.3) implies a set of cross-equation restrictions. In particular, if γ_{ij}^{m} is the estimate of the technology parameter γ_{ij} in the m^{th} equation ($m = c, o, n$), then the cross equation restrictions are given by:

$$\gamma_{co}^{c} = \gamma_{oc}^{o}, \gamma_{cn}^{c} = \gamma_{nc}^{n}, \gamma_{no}^{n} = \gamma_{on}^{o} \quad (5.4)$$

The unconstrained version of equation (5.3) can be estimated using ordinary least squares. To impose the cross-equation restrictions in equation (5.4) however, a nonlinear estimation procedure is employed. This technique allows one to directly incorporate the parameter restrictions in the equation system and to be estimated jointly. By estimating both unconstrained version using equation (5.3) and the constrained version incorporating the restrictions in equation (5.4), a likelihood ratio or Wald test can be performed to test the validity of the cross-equation restrictions.

The system of equations derived in equation (5.3) above gives the determination of wage levels in a particular labour market. To apply the model to micro data available in the census, it is necessary to control for individual differences in productive skills. If it is

assumed that the individual characteristics can be approximated by a vector of socioeconomic variables, then the empirical specification of equation (5.3) can be modified as:

$$w_c = \gamma_{cc} + \gamma_{co}\,(p_o/p_c)^{1/2} + \gamma_{cn}\,(p_n/p_c)^{1/2} + \Sigma\beta_c X_c + \varepsilon_c \qquad (5.5a)$$

$$w_o = \gamma_{oo} + \gamma_{oc}\,(p_c/p_o)^{1/2} + \gamma_{on}\,(p_n/p_o)^{1/2} + \Sigma\beta_o X_o + \varepsilon_o \qquad (5.5b)$$

$$w_n = \gamma_{nn} + \gamma_{nc}\,(p_c/p_n)^{1/2} + \gamma_{no}\,(p_o/p_n)^{1/2} + \Sigma\beta_n X_n + \varepsilon_n \qquad (5.5c)$$

where X_i is a vector of skill characteristics. An additive disturbance term ε_i has also been appended to reflect a stochastic framework. The disturbance term assumes the usual properties. The empirical definition of p_i is the proportion of the working age population in the individual's local labour market, which belongs to group i. The variables p_c, p_o, *and* p_n were computed for each local labour market using the entire data set.

The vector X_i is composed of the standard socioeconomic and human capital variables (e.g., education, experience, marital status etc.). The vector X_i also includes a vector of industry dummies to control for wage differentials arising from differences in job environments. Furthermore, the industry dummies also capture the different capital/labour ratios which are bound to differ across the various industries and partially control for omitted capital variables.

An important motivation for estimating (5.3) is to obtain a measure of the Hicksian elasticity of complementarity. This measures the effects on the relative price of factor i of a change in the relative quantity of that factor, holding marginal cost and the quantities of

other factors constant. Since this chapter focuses on the effects of changes in the quantities of inputs (immigrant flows) on relative factor prices (wages), the elasticity of complementarity (as opposed to the Allen elasticity of substitution) is the appropriate measure to capture these effects.[26] The elasticity of complementarity will be positive (negative) if the inputs are complements (substitutes). The elasticity of complementarity implied by the generalized Leontief function in equation (5.2) is defined as:

$$C_{ij} = \frac{\gamma_{ij}\,\bar{w}}{2w_i w_j (p_i p_j)^{1/2}}, \qquad i \neq j \tag{5.6a}$$

$$C_{ii} = \frac{(\gamma_{ii} - w_i)\,\bar{w}}{2p_i w_i^2}, \qquad i = j \tag{5.6b}$$

where $\bar{w} = p_c w_c + p_o w_o + p_n w_n$.

5.2 Data and Sample Selection

The data used in this empirical analysis came from the individual file of the Public Use Sample Tape (PUST) of the 1991 Canadian Census. The sample size of the PUST

[26]The Allen elasticity of substitution measures the effect of a change in the relative price of factor *i* on the relative quantity of that factor, holding output and prices of other factors constant. For a discussion on the relationship between the elasticities of complementarity and substitution, see Sato and Koizumi (1973).

individual file is one-in-fifty of the original census file. This amounts to about 500,000 individuals.

For regression purposes, the following additional set of criteria were also imposed: individuals aged 20-64 (both men and women); annual earnings greater than $500 during the reference year 1990; positive weeks worked and positive hours worked during the reference week. The rationale behind this selection criteria is to target the economically active population. When this selection criteria was applied to the data set, the sample now comprised 143,557 Canadians, 33,021 old foreign-born and 15,457 new foreign-born individuals.

Table 5.1 presents selected summary statistics for the three population subgroups.

Table 5.1 Insert

From Table 5.1, one observes that the new foreign-born hourly wage is lower compared with their Canadian and old foreign-born cohorts, that is $16.19 compared with $18.07 and $20.12 respectively. This could be attributed to the fact that on average the new foreign-born worked less in the reference week, 43.75 compared with 45.72 and 47.24 hours respectively. It also takes a while for new immigrants to acquire language skills and assimilate into the labour market. Furthermore, one can also point to the fact that most of the new immigrants are concentrated in low-paying low-skilled occupations. For example 51.9% of the new foreign-born population are in clerical, sales/service, semi-

skilled/manual and other manual occupations. This compares with only 43.1% and 40.6 % for the Canadian-born and old foreign-born populations respectively.

The new foreign-born are also comparatively younger, 35.4 years compared with 37.04 and 43.83 years for the Canadian-born and old foreign-born respectively, more educated (13.37 compared with 13.06 and 12.96 years respectively) and much more likely to be resident in a census metropolitan area: 91% percent of the new foreign-born population reside in CMAs compared with 59.6% and 83.4% for the Canadian and old foreign-born populations respectively. The census metropolitan area serves as a proxy for the local/urban labour market. In the 1991 census, there were 19 CMAs.[27]

5.3 Empirical Results

The results from estimating equations 5.5a-5.5b are summarized in Tables 5.2 and 5.3. Table 5.2 summarizes the results for the unconstrained regression using ordinary least squares estimation procedure. Table 5.3 summarizes the results for the constrained regression.

Table 5.2 Insert

[27] The CMAs in the 1991 census are Halifax, Quebec City, Montreal, Sherbrooke, Ottawa, Oshawa, Toronto, Hamilton, St. Catharines, Kitchener, London, Windsor, Sudbury, Winnipeg, Regina, Calgary, Edmonton, Vancouver and Victoria.

From Table 5.2, one observes that the results for the socioeconomic variables are of the expected sign and significant. The human capital variables, namely, EDUC and EXP, were highly significant. For example, an additional year of schooling adds $1.01 to the hourly Canadian wage and 94 and 61 cents to the hourly wage of the old and new foreign-born respectively. The marital status variable, MARRIED, also has a positive effect as expected, indicating the propensity of married individuals to strive for higher wages due to increasing financial responsibilities. The positive and highly significant values for the YSM (years since migration) variable in both foreign-born samples points to the strong effects on wage rates of the assimilation experience. The variables of interest in this chapter are those indicating how the relative size of both foreign-born populations affects the wages of the Canadian-born workers. These effects are captured by the variables $(P_n/P_c)^{1/2}$, $(P_o/P_c)^{1/2}$ etc. One cannot sign the employment variables *a priori*, because this will depend on whether the labour types are substitutes or complements in production. However, the results from Table 5.2 show that new foreign-born workers and Canadian-born workers are substitutes in production. This is because the coefficients on the variables $(P_n/P_c)^{1/2}$ and $(P_c/P_n)^{1/2}$ are negative. For purposes of interpretation however, estimates from the constrained wage equations and the corresponding Hicksian elasticities will be the primary focus. This is because the theoretical restriction of symmetry is a necessary condition for the derivation of the demand system in equation 5.3. Thus, the estimated wage regressions can be interpreted in terms of the theoretical model only if the symmetry conditions are imposed.

Table 5.3 Insert

Table 5.3 summarizes the results from the constrained wage equations. The numbers are qualitatively similar to those encountered in Table 5.2.

Table 5.4 Insert

Table 5.4 presents the estimated technology coefficients and the Hicksian elasticities of complementarity after the imposition of the theoretical restrictions of symmetry, using equations 5.6a and 5.6b. With the exception of γ_{oc}, all the other elasticities were negative. If γ_{oc} is positive, then it implies that old foreign-born and Canadian-born workers are complements. The corresponding Hicksian elasticity was 0.112. This implies that a 10% increase in the number of old foreign-born workers will increase the wage rates of Canadians by 1.12%. This result is not surprising, because by definition the old foreign-born workers were those who immigrated to Canada before 1978 and therefore may have fully assimilated and acquired skills complementary to those of Canadians. The estimate of γ_{nc}, the parameter measuring the substitution possibilities between new foreign-born workers and Canadian-born workers, is -0.31, but insignificant. This implies that new foreign-born and Canadian-born workers are neither substitutes nor complements in production. The Hicksian elasticity implied by this estimate is -0.028. The same applies to the relationship between new foreign-born workers and old foreign-born workers. The technological parameter estimate is insignificant and the corresponding elasticity is -0.04.

All the own elasticities were negative as conforms to theory. The own elasticities are also much bigger in absolute terms, ranging from -1.09 for the Canadian-born workers to -5.40 for the old foreign-born workers, compared with the cross-elasticities. The cross-elasticity estimates compare in magnitude to those obtained by Borjas (1983) who obtained elasticities ranging in magnitude between 0.0026 and 0.1579, while examining the substitutability of black, hispanic and white labour for the United States. Roy (1987) was also not able to distinguish whether foreign-born and native-born workers were substitutes or complements in aggregate because the elasticities were insignificant. However, when he disaggregated his study by area of origin, he found significant substitution between third world foreign-born and the native-born labour force.

5.4 Endogenous Labour Supply

The empirical analysis in the previous section was based on the assumption that the relative employment values given by $(P_i/P_j)^{1/2}$ $(i \neq j)$ were exogenous. However, the distribution of both Canadian and foreign-born populations across CMAs is not exogenous. To the extent that individuals have a choice over city of residence, differences in wage rates across cities may not reflect differences in labour supply. Thus, over time, migration patterns may respond to regional wage differentials creating a correlation between the employment variables and the disturbance term. There are several solutions to this problem. One approach is to estimate a differenced wage equation if one has data from two time periods. Another approach is to find suitable instruments for the

employment variables. The latter approach is adopted because data from only one time period, i.e. 1990, are being used.

The instruments are obtained by first regressing $(p_i/p_j)^{1/2}$ $(i \neq j)$ in the relevant sample on a set of exogenous variables affecting migration decisions and then using the predicted values in the wage determination equations. Instruments include both individual and area characteristics.[28] Tables 5.5 and 5.6 summarize the results from the instrumental variable estimation. Table 5.5 is devoted to the constrained results from the instrumental variables estimation, whilst Table 5.6 focuses on the estimated Hicksian elasticities based on the instrumented and constrained wage equations.

Tables 5.5 Insert

The results summarized in Tables 5.5 and 5.6 are qualitatively similar to those in Tables 5.3 and 5.4. The only difference now is that in Table 5.5, one observes an improvement in the level of significance on the employment variables in particular. The variable $(p_n/p_c)^{1/2}$ is now significant at the 10% level. The coefficient estimate is also bigger in absolute terms i.e. -1.04 compared with the value of -0.31 obtained in the non-instrumental regression. Table 5.6 summarizes the Hicksian elasticity results using the coefficients from the instrumented constrained wage equations.

[28]The individual characteristics included age, education, knowledge of either official languages and marital status. The area characteristics included the unemployment rate in the CMA, the proportion of families earning below the poverty line in the CMA, the proportion of individuals in government jobs by CMA, and the average level of social assistance receipts in the CMA. Most of these instruments were adapted from the existing empirical literature, especially Borjas (1983).

Table 5.6 Insert

Comparing these results to those in Table 5.4, one finds them qualitatively similar in terms of the signs. The exception here is that the elasticities are slightly larger in magnitude. As a result, some conclusions from the interpretation of the elasticities have also changed. The results from Table 5.6 indicate that γ_{nc} is -1.04 and significant. This means that new foreign-born workers and Canadian-born workers are substitutes in production. The corresponding Hicksian elasticity of complementarity is -0.093. This also implies that a 10% increase in the number of new foreign-born workers through immigration will reduce Canadian wage rates by 0.9%. The conclusions regarding the other substitution possibilities between the other types of workers remain the same as those obtained from Table 5.4. That is, old foreign-born workers and Canadian-born workers are complements in production, but the relationship between old foreign-born and new foreign-born cannot be discerned. This is because the estimated technology parameter is insignificant, i.e. -0.55. Apparently, the improvement in the significance and magnitude of the technological estimates proves that endogenous nature of the employment variables might have negatively affected earlier results and hence instrumentation is warranted.

5.5 Substitutability by Occupation/Skill Groups

The regression results presented in Tables 5.2, 5.3 and 5.5 are for all occupation groups pooled together. This could conceal the substitutability/complementarity by occupation.

The other important rationale for testing substitutability/complementarity by occupation is due to its policy implications. Canada's immigration policy, especially the 1967 changes to the regulatory system, has impacted significantly on the occupational distribution of immigrants. According to Green and Green (1995), the 1967 changes created a regulatory system, including the points system, that still forms the framework for Canadian immigration policy. Furthermore, Green and Green also state that an examination of occupational inflows broken down by occupations indicates shifts away from less-skilled categories, such as labourers, towards professionals, after the 1967 changes. Other researchers, on the other hand, have observed a quality decline in the newer vintages of Canadian immigrants (see, for example, Borjas 1988, and Coulson and DeVoretz 1993). Coulson and DeVoretz calculated the value of human capital brought into Canada by immigrants with professional and technical education over the period 1967 to 1987. They observed that the total value of human capital brought in declined over this period, even though the real value of human capital per immigrant remained roughly constant. This implies a shift towards less skilled occupations over time, which Coulson and DeVoretz attribute to the squeezing out of the assessed portion of the immigrant inflow. Despite these opposing views, there is no doubt that the point system continues to be employed as a tool to influence the occupational composition of immigration flows. It follows, therefore, that the relative flow of immigrants into various occupations can potentially alter the observed substitutability and complementarity relationships between various workers of different skill backgrounds, and also ultimately impact on their wages.

To test substitutability/complementarity by occupations, three broad occupational groups are identified for both foreign-born and Canadian-born workers. These are: professionals, skilled, and unskilled workers, definitions of which are based on the 1991 occupational classifications in the 1991 census dictionary. Professional workers comprises those with skill level 4 (senior and middle level managers and professionals). The skilled workers were identified as those with skill level 3 (semi-professionals and technicians, supervisors, skilled trades and crafts etc.). The unskilled category was classified as those with skill level 1 and 2. These include sales and service workers, clerical, semi-skilled and other manual workers. These three broad skill groups, combined with the two types of workers, that is, foreign-born and Canadian-born workers, resulted in six estimating equations similar to those summarized in the equation system of 5.3 and 5.5. They are as follows:

$$
\begin{aligned}
W_{cp} &= \alpha_{cpcp} + \alpha_{cpcs}(P_{cs}/P_{cp})^{1/2} + \alpha_{cpcu}(P_{cu}/P_{cp})^{1/2} + \alpha_{cpip}(P_{ip}/P_{cp})^{1/2} + \alpha_{cpis}(P_{is}/P_{cp})^{1/2} + \alpha_{cpiu}(P_{iu}/P_{cp})^{1/2} + \varepsilon_{cp} \\
W_{cs} &= \alpha_{cscs} + \alpha_{cscp}(P_{cp}/P_{cs})^{1/2} + \alpha_{cscu}(P_{cu}/P_{cs})^{1/2} + \alpha_{csip}(P_{ip}/P_{cs})^{1/2} + \alpha_{csis}(P_{is}/P_{cs})^{1/2} + \alpha_{csiu}(P_{iu}/P_{cs})^{1/2} + \varepsilon_{cs} \\
W_{cu} &= \alpha_{cucu} + \alpha_{cucp}(P_{cp}/P_{cu})^{1/2} + \alpha_{cucs}(P_{cs}/P_{cu})^{1/2} + \alpha_{cuip}(P_{ip}/P_{cu})^{1/2} + \alpha_{cuis}(P_{is}/P_{cu})^{1/2} + \alpha_{cuiu}(P_{iu}/P_{cu})^{1/2} + \varepsilon_{cu} \\
W_{ip} &= \alpha_{ipip} + \alpha_{ipcp}(P_{cp}/P_{ip})^{1/2} + \alpha_{ipcs}(P_{cs}/P_{ip})^{1/2} + \alpha_{ipcu}(P_{cu}/P_{ip})^{1/2} + \alpha_{ipis}(P_{is}/P_{ip})^{1/2} + \alpha_{ipiu}(P_{iu}/P_{ip})^{1/2} + \varepsilon_{ip} \\
W_{is} &= \alpha_{isis} + \alpha_{iscp}(P_{cp}/P_{is})^{1/2} + \alpha_{iscs}(P_{cs}/P_{is})^{1/2} + \alpha_{iscu}(P_{cu}/P_{is})^{1/2} + \alpha_{isip}(P_{ip}/P_{is})^{1/2} + \alpha_{isiu}(P_{iu}/P_{is})^{1/2} + \varepsilon_{is} \\
W_{iu} &= \alpha_{iuiu} + \alpha_{iucp}(P_{cp}/P_{iu})^{1/2} + \alpha_{iucs}(P_{cs}/P_{iu})^{1/2} + \alpha_{iucu}(P_{cu}/P_{iu})^{1/2} + \alpha_{iuip}(P_{ip}/P_{iu})^{1/2} + \alpha_{iuis}(P_{is}/P_{iu})^{1/2} + \varepsilon_{iu}
\end{aligned}
\tag{5.7}
$$

The above equations are subject to the appropriate cross-equation restrictions. The subscripts in the above system of equations are also defined as follows:

cp = Canadian professionals; *cs* = Canadian skilled workers; *cu* = Canadian unskilled workers; *ip* = immigrant professionals; *is* = immigrant skilled workers; *iu* = immigrant unskilled workers.

Table 5.7 and 5.8 Insert

Tables 5.7 summarizes the results from the unconstrained wage equations using equation 5.7. Table 5.8 on the other hand summarizes the results from constrained wage equations, while simultaneously employing the appropriate instruments for the employment variables.

Table 5.9 Insert

However, the estimates of primary interest in this section are the Hicksian elasticities reported in Table 5.9. These elasticities were calculated from the technological parameters derived from the constrained regressions with instruments for the employment variables. Out of the 15 cross elasticities reported in Table 5.9, only 7 of their estimated corresponding technological parameters were statistically significant or nearly significant. These cross elasticities are $\alpha_{cs,cp}$, $\alpha_{cu,cp}$, $\alpha_{ip,cp}$, $\alpha_{iu,cp}$, $\alpha_{cu,cs}$, $\alpha_{iu,cs}$, and $\alpha_{ip,cu}$. This implies that Canadian skilled workers and Canadian professionals are substitutes in production, the same for immigrant professionals and Canadian professionals. Canadian unskilled workers and Canadian professionals are however complementary inputs, and the same applies to unskilled immigrants and Canadian professionals. Furthermore, unskilled immigrants and

Canadian-born workers are complementary to Canadian skilled workers, and professional immigrant workers are substitutes for Canadian unskilled workers. The rest of the other technological parameters associated with the cross elasticities were insignificant, implying that the corresponding workers belonging to those broad occupations were neither substitutes nor complements.

In order to examine the wage impacts of these underlying relationships one has to focus on the magnitudes of the cross elasticities. For example, the elasticity between professional immigrants and Canadian professionals is -0.71. Since the sign is negative (substitutes), it implies that a 10% increase in the number of professional immigrants will depress the wages of Canadian professionals by about 7.1%. This result is similar to a finding made by Roy (1997). He also concluded that U.S.-born immigrants for example, had large and statistically significant job displacement effects on Canadians in the major professional occupations (i.e. natural sciences, engineering, mathematics, managerial and related occupations).[29] The elasticity between unskilled immigrants and Canadian professionals is 0.31. This also implies that a 10% increase in the number of unskilled immigrants will increase the wages of Canadian professionals by 3.1%. Similarly, the cross elasticity between unskilled immigrants and skilled Canadian workers is 0.43, implying a 4.3% hike in the wages of skilled Canadian workers as a result of a 10% increase in the number of unskilled immigrants. Finally, cross elasticity between professional immigrants and unskilled Canadian workers is -0.33. This translates into a 3.3% drop in the wages of unskilled Canadian-born workers as a result of an increase in

the number of professional immigrant workers. This latter finding seems counter-intuitive at first sight, but it is not upon further reflection. One possible explanation for the drop in the wages of unskilled Canadian-born workers in the presence of immigrant professional may lie with the skill recognition in the Canadian labour market. Because some immigrants initially find it difficult to work in their field of expertise, they settle for menial jobs which are mainly unskilled. This can create an excess supply of unskilled labour thereby suppressing the wages of unskilled Canadian-born workers.

The own wage elasticities were all negative as suggested by theory, with the exception of $\alpha_{cp,cp}$, which was positive, i.e. 0.44. Immigrants also had a sizable impact on the determination of their own wage levels compared with that of Canadian workers. For example, a 1% increase in the number of professional immigrants reduces the wages of professional immigrants by 7.19%. Also a 1% increase in the number of unskilled immigrants will reduce the wages of unskilled immigrants by 2.19%.

To summarize, this chapter examined the issue of substitutability/complementarity between Canadian and two categories of foreign-born labor, new foreign-born and old foreign-born labour and also by broad occupational groups. The focus on occupational groups allowed for the evaluation of some aspects of Canada's immigration policy, especially the points system. The major point of departure from previous research on this topic in Canada is the recognition and attempted solution of the endogeneity problem. The other major contribution is the inferences on wages through the estimation of the

[29] It should be pointed out however that Roy's study focused primarily on displacement or employment

Hicksian elasticities and its impact on policy. The main findings amongst others from the constrained and instrumented regressions indicate that the new foreign-born and Canadian-born workers are substitutes in production. The corresponding Hicksian elasticity was also estimated to be -0.093. This means that a 10% increase in the number of new foreign-born workers will reduce the wages of Canadian-born workers by 0.9%. The old foreign-born workers on the other hand were found to be complements to Canadian-born workers. The corresponding elasticity was 0.112. This implies that a 10% increase in the number of old foreign-born workers will increase the wages of Canadian-born workers by 1.12%. New foreign-born and old foreign-born workers were neither substitutes nor complements in production. This is because the estimated technological parameter was insignificant. When the data were disaggregated by occupations, it was discovered that professional immigrants and Canadian professionals were substitutes with an elasticity of -0.71. The relationship between unskilled immigrants and Canadian professionals was complementary, with an elasticity of 0.31. Similarly, unskilled immigrants and skilled Canadian workers were found to be complementary with an elasticity of 0.43. Finally, professional immigrants and unskilled Canadian workers were substitutes with a corresponding elasticity of -0.33. All the own elasticities were negative with one exception and they were larger in absolute terms compared with the cross elasticities.

These results have some important policy implications. First, the results show that the new foreign-born and Canadian-born are substitutes in production with adverse

---

effects of immigration by source countries and not on wage impacts.

impacts on Canadian wages (i.e. Hicksian elasticity is -0.093). This may be attributed to the falling human capital content of newer immigrant vintages, which has been already alluded to (see Coulson and DeVoretz, 1993). To mitigate some of these adverse impact on wages, future immigration policy should give more priority to the independent (point assessed) class of immigrants. The results from the occupational groups were mixed. The results indicate that both skilled and unskilled immigrant workers have positive effects on the wages of Canadian professional and skilled workers. One can think of the example of Phillipino nurses and Canadian doctors. That is an example of a complementary relationship. On the other hand, the results also show that professional immigrants are substitutes to both Canadian professional and unskilled workers. I rationalize the latter relationship by observing that in situations where immigrant professional skills are not recognized in Canada, they may end up settling for menial jobs which may crowd out the unskilled Canadian workers. In other situations where immigrants have comparable professional skills to that of Canadians (especially those from the U.S. and western Europe), they will compete for professional jobs, and some Canadians might see their wages being depressed, as the results show. Thus, the point system under Canada's immigration policy can be used to regulate the flow of immigrants into various the occupations to minimize the adverse effects on wages.

Table 5.1
Summary Statistics

Variable	Native-Born	Old Foreign-Born	New Foreign-Born
Average Age (years)	37.04	43.83	35.4
Average Education (yrs)	13.06	12.96	13.37
Average Hourly Wage	18.07	20.12	16.19
Average Weeks Worked	45.72	47.24	43.75
Average Hours Worked in Reference Week	38.94	39.26	39.13
CMA (%)	59.6	83.4	91
Married (%)	58.7	74.5	67.9
Occupations:			
Senior Managers	1.1	1.5	0.8
Middle & Other Manag.	9.5	11.6	7.8
Professionals	15	16	13
Semi-Prof. & Techn.	6.3	5.5	5.6
Supervisors	1.7	1.7	1.2
Foremen/Women	3.3	3.2	1.7
Adm. & Snr. Clerical	7.4	6.3	4.6
Sales/Service (Skill Level 3)	4.4	5	5.7
Skilled Crafts/Trades	8.2	8.6	7.1
Clerical Workers	12	10.5	11.4
Sales/Service (SL. 2)	11.2	9.3	10.4
Semi-Skilled/Manual	10.5	10.5	14.7
Sales/Service (SL. 1)	6.2	6.7	10.6
Other Manual Workers	3.2	3.6	4.8
All Occupations	**100**	**100**	**100**
Industries:			
Agriculture	2.2	1.2	1.5
Other Primary Indus.	2.7	1.4	0.8
Manufacturing	14.5	19.5	22.6
Construction	5.9	6.3	4.7
Transportation	4.5	3.8	3
Communication	4.3	3.4	2
Wholesale Trade	4.7	4.4	4.7
Retail Trade	11.2	10.6	11.4
Finance, Insurance & Real Estate	6.7	7.1	7.7
Business Services	5.2	6	7.3
Govt. Services (Federal)	4.4	2.5	1.3
Govt. Services (Other)	5.6	4.1	2.3
Educational Services	8.4	9	4.7
Health & Social Services	10.2	9.7	8.9
Accom/Food/Beverage Services	4.4	5.3	9.6
Other Services	5.1	5.7	7.3
All Industries	**100**	**100**	**100**
No. of Observations	143557	33021	15457

Source: 1991 Census Public Use Sample Tapes and Author's Calculations.

Table 5.2
Unconstrained Wage Equations (Using OLS Estimation)
Dependent Variable: Hourly Wage

Variable	Canadians Coefficient	T-Statistic	Old F-B Coefficient	T-Statistic	New F-B Coefficient	T-Statistic
CONST.	-5.52	-2.26	-18.76	-3.22	-2.93	-0.58
EDUC	1.01	16.03	0.94	10.18	0.61	5.51
EXP	0.42	8.96	0.29	3.20	0.38	3.52
EXP2	-0.0049	-4.69	-0.0018	-1.02	-0.006	-2.56
MARRIED	1.14	3.26	2.20	3.11	1.85	2.31
YSM			0.089	3.56	0.14	2.59
$(P_o/P_c)^{1/2}$	1.42	3.48				
$(P_n/P_c)^{1/2}$	-1.27	-2.66				
$(P_c/P_o)^{1/2}$			4.32	1.01		
$(P_n/P_o)^{1/2}$			1.04	2.72		
$(P_c/P_n)^{1/2}$					-1.88	-0.47
$(P_o/P_n)^{1/2}$					36.03	1.58
Adj. R^2	0.048		0.018		0.0083	
No. of Obs.	143557		33021		15457	

Key to Variables

1. EDUC = Years of schooling
2. EXP = Experience = AGE - EDUC - 5 (Following the standard Mincer (1974) proxy)
3. EXP2 = Experience squared
4. MARRIED = 1 if married; and Zero otherwise.
5. YSM = Years since migration (for only foreign-born).
6. $(P_o/P_c)^{1/2}$ = ratio of old foreign-born workers to Canadian-born workers etc.
7. All regressions include a vector of industry dummies at the level of aggregation indicated in Table 1.

Table 5.3
Symmetry Constrained Wage Equations
Dependent Variable: Hourly Wage

Variable	Canadians Coefficient	T-Statistic	Old F-B Coefficient	T-Statistic	New F-B Coefficient	T-Statistic
CONST.	-11.70	-3.26	-3.24	-0.89	1.54	0.37
EDUC	0.97	8.59	0.86	9.59	0.62	5.94
EXP	0.52	6.00	0.35	4.10	0.38	3.39
EXP2	-0.0064	-3.38	-0.0031	-1.90	-0.006	-2.44
MARRIED	2.74	4.47	1.91	2.99	1.89	2.37
YSM			0.085	3.17	0.14	2.41
$(P_o/P_c)^{1/2}$	1.21	2.20				
$(P_n/P_c)^{1/2}$	-0.31	-0.51				
$(P_c/P_o)^{1/2}$			1.21	2.20		
$(P_n/P_o)^{1/2}$			-0.18	-0.79		

$(P_c/P_n)^{1/2}$	-0.31	-0.51
$(P_o/P_n)^{1/2}$	-0.18	-0.79

Key to Variables: See Table 5.2.

Table 5.4
Hicksian Elasticities of Complementarity Using Constrained Wage Equations

Technology Parameter	Estimate	Elasticity of Complementarity
γ_{oc}	1.21	0.112
	(2.20)	
γ_{nc}	-0.31	-0.028
	(-0.51)	
γ_{no}	-0.18	-0.04
	(-0.79)	
γ_{cc}	-11.70	-1.09
	(-3.26)	
γ_{oo}	-3.24	-5.40
	(-0.89)	
γ_{nn}	1.54	-3.16
	(0.37)	

T-ratios are in parenthesis.

Table 5.5
Constrained Wage Equations: Using Instruments for Employment Variables
Dependent Variable: Hourly Wage

	Canadians		Old F-B		New F-B	
Variable	Coefficient	T-Statistic	Coefficient	T-Statistic	Coefficient	T-Statistic
CONST.	-12.55	-4.02	-3.63	-1.003	1.79	0.42
EDUC	0.97	8.48	0.86	9.64	0.61	5.39
EXP	0.52	6.01	0.34	4.09	0.38	3.38
EXP2	-0.0065	-3.41	-0.0031	-1.89	-0.0059	-2.46
MARRIED	2.73	4.55	1.91	2.94	1.87	2.32
YSM			0.087	3.31	0.13	2.36
$(P_o/P_c)^{1/2}$	1.89	2.92				
$(P_n/P_c)^{1/2}$	-1.04	-1.46				
$(P_c/P_o)^{1/2}$			1.89	2.92		
$(P_n/P_o)^{1/2}$			-0.15	-0.55		
$(P_c/P_n)^{1/2}$					-1.04	-1.46
$(P_o/P_n)^{1/2}$					-0.15	-0.55

Table 5.6
Hicksian Elasticities: Instrumented Constrained Wage Equations

Technology Parameter	Estimate	Elasticity of Complementarity
γ_{oc}	1.89	0.175
	(2.92)	
γ_{nc}	-1.04	-0.093
	(-1.46)	
γ_{no}	-0.15	-0.033
	(-0.55)	
γ_{cc}	-12.55	-1.13
	(-4.02)	
γ_{oo}	-3.63	-5.49
	(-1.003)	
γ_{nn}	1.79	-3.10
	(0.42)	

T-ratios are in parenthesis.

Table 5.7
Unconstrained Wage Regressions Disaggregated by Selected Occupational Groups
Dependent Variable: Hourly Wage

Variable	Canadian Prof.	Canadian Skilled	Canadian Unskilled	F-Born Prof	F-Born Skilled	F-Born Unskilled
CONST.	-26.25	-17.82	-14.74	-6.35	16.59	10.03
	(-2.04)	(-2.17)	(-1.75)	(-0.71)	(1.49)	(1.25)
EDUC	1.37	0.59	0.42	0.94	0.41	0.32
	(9.81)	(8.09)	(4.89)	(8.09)	(4.14)	(3.50)
EXP	0.68	0.31	0.17	0.62	0.25	0.08
	(7.23)	(5.68)	(2.95)	(6.82)	(2.67)	(1.05)
EXP2	-0.0054	-0.0031	-0.0009	-0.0056	-0.0023	0.0002
	(-2.48)	(-2.69)	(-0.81)	(-2.85)	(-1.26)	(0.11)
MARRIED	1.17	0.67	1.02	2.15	1.52	0.91
	(1.89)	(1.76)	(2.15)	(3.51)	(2.16)	(1.31)
YSM				0.026	0.008	0.03
				(2.11)	(0.49)	(2.25)
$(P_{cs}/P_{cp})^{1/2}$	1.30					
	(1.08)					
$(P_{cu}/P_{cp})^{1/2}$	-0.46					
	(-0.63)					
$(P_{ip}/P_{cp})^{1/2}$	-0.57					
	(-0.36)					
$(P_{is}/P_{cp})^{1/2}$	2.08					

	(1.01)					
$(P_{iu}/P_{cp})^{1/2}$	-0.86					
	(-0.85)					
$(P_{cp}/P_{cs})^{1/2}$		135.01				
		(2.14)				
$(P_{cu}/P_{cs})^{1/2}$		0.77				
		(1.56)				
$(P_{ip}/P_{cs})^{1/2}$		-3.42				
		(-3.28)				
$(P_{is}/P_{cs})^{1/2}$		5.64				
		(4.47)				
$(P_{iu}/P_{cs})^{1/2}$		-2.09				
		(-3.18)				
$(P_{cp}/P_{cu})^{1/2}$			-153.20			
			(-1.63)			
$(P_{cs}/P_{cu})^{1/2}$			353.51			
			(2.91)			
$(P_{ip}/P_{cu})^{1/2}$			0.93			
			(0.59)			
$(P_{is}/P_{cu})^{1/2}$			-0.81			
			(-0.44)			
$(P_{iu}/P_{cu})^{1/2}$			0.28			
			(0.29)			
$(P_{cp}/P_{ip})^{1/2}$				22.38		
				(0.51)		
$(P_{cs}/P_{ip})^{1/2}$				20.69		
				(0.37)		
$(P_{cu}/P_{ip})^{1/2}$				-41.22		
				(-1.25)		
$(P_{is}/P_{ip})^{1/2}$				0.44		
				(0.49)		
$(P_{iu}/P_{ip})^{1/2}$				-0.19		
				(-0.42)		
$(P_{cp}/P_{is})^{1/2}$					19.61	
					(0.39)	
$(P_{cs}/P_{is})^{1/2}$					-21.34	
					(-0.33)	
$(P_{cu}/P_{is})^{1/2}$					1.28	
					(0.034)	
$(P_{ip}/P_{is})^{1/2}$					-86.62	
					(-1.08)	
$(P_{iu}/P_{is})^{1/2}$					-0.26	
					(-0.51)	
$(P_{cp}/P_{iu})^{1/2}$						-86.3
						(-1.41)
$(P_{cs}/P_{iu})^{1/2}$						189.6
						(2.39)
$(P_{cu}/P_{iu})^{1/2}$						-82.75
						(-1.71)

$(P_{ip}/P_{iu})^{1/2}$						-20.93
						(-0.21)
$(P_{is}/P_{iu})^{1/2}$						-61.02
						(-0.45)
Adj. R^2	0.026	0.023	0.011	0.039	0.008	0.006
No. of Obs.	41337	42272	59948	13595	14163	23211

Key to Variables:

1. $(P_{cs}/P_{cp})^{1/2}$ = ratio of Canadian skilled workers to Canadian professional workers.
2. $(P_{ip}/P_{cp})^{1/2}$ = ratio of immigrant (foreign-born) professional workers to Canadian professional workers etc.
3. All regressions include a vector of industry dummies at the level of aggregation indicated in Table 5.1.
4. T-ratios are in parenthesis.

Table 5.8
Symmetry Constrained and Instrumented Wage Regressions Disaggregated by Selected Occupational Groups; Dependent Variable: Hourly Wage

Variable	Canadian Prof.	Canadian Skilled	Canadian Unskilled	F-Born Prof.	F-Born Skilled	F-Born Unskilled
CONST.	27.91	-37.35	1.67	-7.67	-0.04	7.71
	(2.03)	(-1.78)	(0.73)	(-1.91)	(-0.0067)	(5.15)
EDUC	1.23	0.46	0.57	0.63	0.63	0.33
	(9.35)	(4.18)	(4.45)	(8.34)	(8.33)	(3.21)
EXP	0.68	0.45	0.23	0.66	0.23	0.16
	(7.54)	(6.03)	(2.45)	(6.83)	(2.38)	(1.44)
EXP2	-0.0068	-0.007	-0.0027	-0.0068	-0.0013	-0.0015
	(-3.28)	(-4.32)	(-1.35)	(-3.38)	(-0.67)	(-0.66)
MARRIED	2.86	2.18	2.11	2.13	1.54	1.18
	(5.03)	(4.08)	(2.99)	(3.42)	(2.24)	(1.18)
YSM				0.025	0.012	0.044
				(1.99)	(0.77)	(2.23)
$(P_{cs}/P_{cp})^{1/2}$	-7.02					
	(-2.41)					
$(P_{cu}/P_{cp})^{1/2}$	3.64					
	(1.81)					
$(P_{ip}/P_{cp})^{1/2}$	-5.01					
	(-2.62)					
$(P_{is}/P_{cp})^{1/2}$	1.11					
	(0.47)					
$(P_{iu}/P_{cp})^{1/2}$	1.89					
	(1.41)					
$(P_{cp}/P_{cs})^{1/2}$		-7.02				
		(-2.41)				

$(P_{cu}/P_{cs})^{1/2}$	3.01				
	(1.77)				
$(P_{ip}/P_{cs})^{1/2}$	-0.19				
	(-0.18)				
$(P_{is}/P_{cs})^{1/2}$	-2.33				
	(-0.96)				
$(P_{iu}/P_{cs})^{1/2}$	2.07				
	(1.43)				
$(P_{cp}/P_{cu})^{1/2}$		3.64			
		(1.81)			
$(P_{cs}/P_{cu})^{1/2}$		3.01			
		(1.77)			
$(P_{ip}/P_{cu})^{1/2}$		-1.93			
		(-1.40)			
$(P_{is}/P_{cu})^{1/2}$		1.33			
		(0.69)			
$(P_{iu}/P_{cu})^{1/2}$		0.65			
		(0.47)			
$(P_{cp}/P_{ip})^{1/2}$			-5.01		
			(-2.62)		
$(P_{cs}/P_{ip})^{1/2}$			-0.19		
			(-0.18)		
$(P_{cu}/P_{ip})^{1/2}$			-1.93		
			(-1.40)		
$(P_{is}/P_{ip})^{1/2}$			0.67		
			(0.79)		
$(P_{iu}/P_{ip})^{1/2}$			-0.09		
			(-0.15)		
$(P_{cp}/P_{is})^{1/2}$				1.11	
				(0.47)	
$(P_{cs}/P_{is})^{1/2}$				-2.33	
				(-0.96)	
$(P_{cu}/P_{is})^{1/2}$				1.33	
				(0.69)	
$(P_{ip}/P_{is})^{1/2}$				0.67	
				(0.79)	
$(P_{iu}/P_{is})^{1/2}$				0.06	
				(0.20)	
$(P_{cp}/P_{iu})^{1/2}$					1.89
					(1.41)
$(P_{cs}/P_{iu})^{1/2}$					2.07
					(1.43)
$(P_{cu}/P_{iu})^{1/2}$					0.65
					(0.47)
$(P_{ip}/P_{iu})^{1/2}$					-0.09
					(-0.15)
$(P_{is}/P_{iu})^{1/2}$					0.06
					(0.20)

T-ratios are given in parenthesis.

Table 5.9
Hicksian Elasticities from Constrained and Instrumented Wage Equations (Selected Occupational Groups).

Technology Parameter	Estimate	Elasticity of Complementarity
$\alpha_{cs,cp}$	-7.02	-0.80
	(-2.41)	
$\alpha_{cu,cp}$	3.64	0.39
	(1.81)	
$\alpha_{ip,cp}$	-5.01	-0.71
	(-2.62)	
$\alpha_{is,cp}$	1.11	0.19
	(0.47)	
$\alpha_{iu,cp}$	1.89	0.31
	(1.41)	
$\alpha_{cu,cs}$	3.01	0.41
	(1.77)	
$\alpha_{ip,cs}$	-0.19	-0.034
	(-0.18)	
$\alpha_{is,cs}$	-2.33	-0.52
	(-0.96)	
$\alpha_{iu,cs}$	2.07	0.43
	(1.43)	
$\alpha_{ip,cu}$	-1.93	-0.33
	(-1.40)	
$\alpha_{is,cu}$	1.33	0.28
	(0.69)	
$\alpha_{iu,cu}$	0.65	0.13
	(0.47)	
$\alpha_{is,ip}$	0.67	0.19
	(0.79)	
$\alpha_{iu,ip}$	-0.09	-0.023
	(-0.15)	
$\alpha_{iu,is}$	0.056	0.018
	(0.20)	
$\alpha_{cp,cp}$	27.91	0.44
	(2.03)	
$\alpha_{cs,cs}$	-37.35	-7.84
	(-1.78)	
$\alpha_{cu,cu}$	1.67	-1.59
	(0.73)	
$\alpha_{ip,ip}$	-7.67	-7.19

	(-1.91)	
$\alpha_{is,is}$	-0.04	-6.53
	(-0.007)	
$\alpha_{iu,iu}$	7.71	-2.19
	(5.15)	

T-ratios are given in parenthesis.

CHAPTER 6

THE EFFECT OF UNIONIZATION ON THE WAGE DIFFERENTIAL BETWEEN CANADIAN AND FOREIGN-BORN WORKERS

Introduction

This chapter investigates the impact of trade unions on the wage differential between Canadian and foreign-born workers. I pose the question as to whether trade unions have affected the wage gap between foreign-born and Canadian born workers after the traditional human capital and productivity characteristics have been controlled for. In other words, do unions raise the wages of native-born workers by more than they raise the wages of the foreign-born. The outcome of this test may help us understand why unions are neutral on immigration issues in contemporary Canada. The question is why this neutrality? In this chapter I demonstrate that a wage gap exists between foreign-born workers and native-born workers in the presence of unionization. And it is this wage advantage which the native-born workers enjoy under unionization which may explain union neutrality.

The remainder of the chapter is organized as follows. Section 2 outlines the theoretical framework. Section 3 develops the estimating equations and critically analyses the data. Section 4 deals with empirical results and the conclusions end this chapter.

6.1 Theoretical Framework

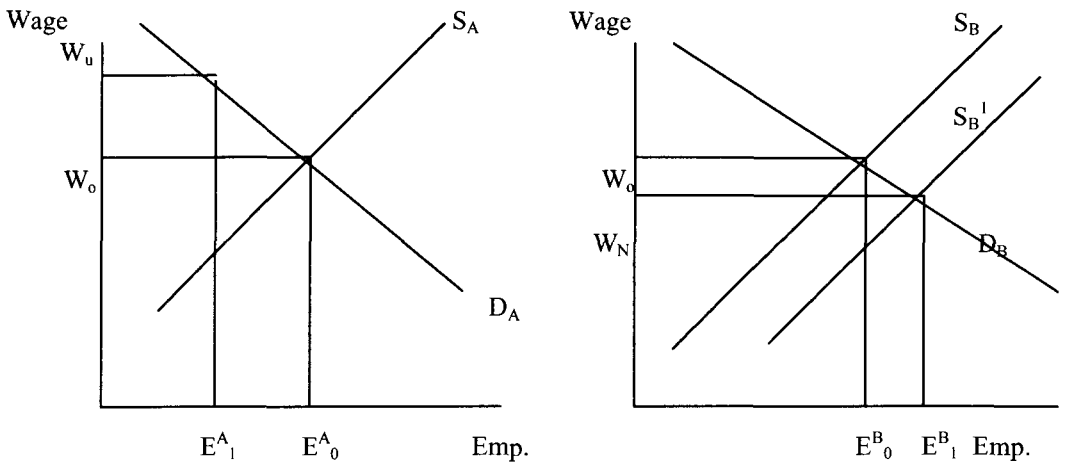
In this section I employ a variant of a typical model used to analyze the impact of unions on the gender wage gap. Thus, I examine the impact of unions on the wage gap between Canadian-born workers and foreign-born workers. In particular I ask; has unionism raised/lowered the relative wage of foreign-born workers and, if so, by how much?

Most unions attempt to improve the wages and working conditions of their members directly by bargaining with the employer using the strike threat as their primary source of bargaining power. However, craft unions[30] raise the wages of their members indirectly through controlling the labour supply into the various crafts. This is accomplished through the apprenticeship system, discrimination, nepotism, high union dues, and such devices as the closed shop (i.e. the worker has to be a member of the union before being hired). Professional associations behave very much like craft unions in their control over labour supply largely through the processes of occupational licensing and certification.

The union wage impact can be illustrated with a simple two-sector model as shown in Figure 6.1 below. The two sectors can be viewed as two industries employing the same type of homogeneous labour. There is a sufficiently large number of firms and workers that, in the absence of unions, the labour market is competitive.

[30] A craft union is a union that represents workers in a particular occupation or skill group.

Figure 6.1: Union Wage Impact in a Two-Sector Model



The equilibrium wage rate in the absence of collective bargaining is therefore W_o. Now, suppose a union organizes the workers in sector A and is able to raise the wage to W_u. Employment in sector A will therefore decline to E^A_1. The workers who are unable to find or retain jobs in sector A will look for jobs in sector B (nonunionised sector), increasing the labour supply in sector B. This is illustrated by the new supply curve S_B^1. The additional labour supply depresses the wage in sector B, resulting in a new equilibrium wage of W_N. Employment expands to E^B_1, an increase which is smaller than the reduction in employment in sector A. In this model, the union-nonunion wage differential would be given by $d = (W_u - W_N) / W_N$. Thus, according to this simple two-sector model, the magnitude of the union-nonunion differential depends on the elasticity of labour demand in each sector, the ability of unions to raise wages in the organized sector and the elasticity of labour supply. I now derive the equations to estimate the impact of unionization on the wage gap.

Following Maki and Ng (1990), Shamsuddin (1996) but with slight modifications,[31] and Ashenfelter (1972), the aggregate effect of unionism on the average wage of foreign-born labour relative to native-born labour can be expressed as:

$$\Delta^* = [(W_{fb} / W_{nb}) - (W^a_{fb} / W^a_{nb})] / (W^a_{fb} / W^a_{nb}) \qquad (6.1)$$

where (W_{fb} / W_{nb}) is the observed foreign-born/native-born wage ratio in the presence of unions and (W^a_{fb} / W^a_{nb}) is what the wage ratio would be in the absence of unionization. Rearranging (6.1) and taking logarithms of both sides we obtain:

$$\ln(1 + \Delta^*) = \ln(W_{fb} / W_{nb}) - \ln(W^a_{fb} / W^a_{nb}) \qquad (6.2)$$

Define $M_{fb} \equiv (W^u_{fb} - W^n_{fb}) / W^n_{fb}$ and $D_{fb} \equiv (W^n_{fb} - W^a_{fb}) / W^a_{fb}$, where W^u_{fb} is the average wage of unionized foreign-born workers, W^n_{fb} is the average wage of all foreign-born workers, and W^a_{fb} is the average wage of foreign-born workers in the absence of unionization. Hence, M_{fb} could be interpreted as the proportionate union/nonunion wage advantage (disadvantage) of organized foreign-born workers, and D_{fb}, the proportionate effect of unionization on the average wage of nonunion foreign-born workers.

[31] Note that these authors examined the impact of unionization on the gender earnings gap in Canada. Thus we have to interpret their estimating equations differently to accommodate our objectives.

Following Ashenfelter (1972), we also express the logarithm of the average wage of foreign-born workers in the presence of unionization as the weighted geometric mean of the wages of union and nonunion foreign-born workers. Thus:

$$\begin{aligned}\ln W_{fb} &= FB \ln W_{fb}^{u} + (1 - FB) \ln W_{fb}^{n} \\ &= FB \ln[W_{fb}^{a}(1 + D_{fb})(1 + M_{fb})] + (1 - FB)[W_{fb}^{a}(1 + D_{fb})] \\ &= \ln W_{fb}^{a} + FB \ln(1 + M_{fb}) + \ln(1 + D_{fb}) \qquad (6.3)\end{aligned}$$

where FB is the proportion of foreign-born workers unionized. A similar expression for native-born workers will also be written as:

$$\ln W_{nb} = \ln W_{nb}^{a} + NB \ln(1 + M_{nb}) + \ln(1 + D_{nb}) \qquad (6.4)$$

where NB is the proportion of native-born workers unionized, M_{nb} is the proportionate union/nonunion wage advantage (disadvantage) of organized native-born workers, and D_{nb} is the proportionate effect of unionization on the wage of nonunion native-born workers. Substituting equations (6.3) and (6.4) into (6.2) and rearranging yields:

$$\ln(1 + \Delta^{*}) = FB \ln(1 + M_{fb}) - NB(1 + M_{nb}) + \ln(1 + D_{fb}) - \ln(1 + D_{nb}) \qquad (6.5)$$

which can be approximated by

$$\Delta^* = (FBM_{fb} - NBM_{nb}) + (D_{fb} - D_{nb}) \tag{6.6}$$

if M_{fb}, M_{nb}, D_{fb} and D_{nb} are small.

From equation (6.6) the effect of unionization on the foreign-born/native-born wage differential is made up of three separate effects. These are the wage effects captured by the difference in M_{fb} and M_{nb}, the union membership effect captured by the differences in FB and NB, and the effects of unionism on the wages of nonunion foreign-born and native-born workers, $(D_{fb}-D_{nb})$. This latter effect is not directly observable because it is a function of the wage ratio between foreign-born and native-born workers in the absence of unionization. Thus, Δ^* cannot be estimated.[32] Instead, I propose to estimate the observable component of Δ^*. That is:

$$\Delta \equiv \Delta^* - (D_{fb} - D_{nb}) \equiv FBM_{fb} - NBM_{nb} \tag{6.7}$$

If the effects of unionization on nonunion wages, i.e. wages in the absence of unions, do not differ significantly by birth status, then $\Delta \approx \Delta^*$. It is important to point out that in the absence of discrimination this may be true, but with discrimination unions may mitigate the effects of discrimination as found in Pendakur and Pendakur (1996).

[32] See Ashenfelter (1972) page 438, and Lewis (1986) page 189.

Again following Ashenfelter (1972) and Lewis (1986), equation (6.7), which captures the effect of unionization on the foreign-born/native-born wage ratio relative to the wage ratio of their nonunion counterparts, can be decomposed into two components. If $FB < NB$ that is, foreign-born union membership is lower, then as long as $M_{fb} \leq M_{nb}$ and $M_{nb} > 0$, that is, as long as unions offer a wage advantage to native-born workers, Δ will be less than zero. On the other hand, M_{fb} may be larger or smaller than M_{nb}. If $M_{fb} < M_{nb}$, then Δ will again be less than zero as long as $FB \leq NB$.

Finally, it is important to note that the M's (i.e. the proportionate union-nonunion wage differentials) may vary by skill level, in which case the overall union impact will hinge on the distribution of both foreign-born and native-born workers by skill level as represented by occupational group. To account for these differences in interskill wage differentials, Ashenfelter (1972) modified equation (6.7) as follows:

$$\Delta = \sum E_{fbi} FB_i M_{fbi} - \sum E_{nbi} NB_i M_{nbi} \qquad (6.8)$$

where E_{fbi} is the proportion of total compensation received by foreign-born workers of the ith occupation-industry group and E_{nbi} is the proportion of total compensation received by native-born workers of the ith occupation-industry group.

6.2 Estimating Equations

The loglinear equation below was estimated separately for native-born and foreign-born workers and further disaggregated by gender:

$$\ln W = \sum_j A_j X_j + \sum_i M_i (V_i U) + e \qquad (6.9)$$

where V_i are a set of mutually exclusive occupation by industry dummy variables, U is a dummy variable that takes on the value one if the individual belongs to a union and zero if (s)he does not, X_j are a set of control variables, and e is the error term. The coefficient on the unionism variable (M_i) is interpreted as the proportionate union-nonunion wage differential in the ith occupation-industry category. A_j captures the estimated coefficients on the control variables.

The control variables are age, education, marital status, firm size, part time, industry and province of residence. All variables are defined and sample means given in Table 6.1. The data used in this estimation are from the 1988-1990 Labour Market Activity Survey (LMAS). For ease of estimation and external and internal memory constraints imposed by the computer program, a 10% random sample for the native-born population and the entire foreign-born sample was adopted. I further limited the analysis to individuals classified as employed. I also worked with individuals belonging only to the 1990 cross-section, that is those whose jobs did not end before 1990. These selection

criteria yielded a sample of 4204 males and 3862 females for the native-born population and 2085 males and 1837 females for the foreign-born population.

6.3 Empirical Results

Table 6.2 reports the regression results for the entire sample by birth status and gender using ordinary least squares. Using separate equations for native-born and foreign-born (male, female and the whole sample), the estimates were obtained by regressing the natural logarithm of the hourly wage on the stated control variable with an aggregated union variable. I repeat the same exercise in Tables 6.3 and 6.4, except that these estimates focus on the public and private sectors respectively. See Freeman (1986), Ehrenberg and Schwartz (1986) and Prescott and Wandschneider (1995) on the differences between the effects of unions in the private and public sectors. In Tables 6.5 the estimates were obtained by interacting the union variable with the white-collar occupations among other exogenous variables. Table 6.6 also includes interactions between blue-collar occupations, and public and private sectors respectively.

With regard to the variables of interest, that is the union variables, the coefficients are larger for the native-born sample than the foreign-born counterparts in Table 6.2. This could be attributed to the differences in the rates of unionization between the two populations. The results for the other variables are as expected and most of them are highly significant. Earnings appear to be peaking for the 45-54 year age group and workers with university degrees earn relatively higher wages than workers with other

qualifications. These results apply to all the other tables with few exceptions. For example, a negative coefficient was expected for the part-time variable; however, it was positive in the native-born male equation in Table 6.3 and Table 6.6. Both coefficients were insignificant.

Using coefficient estimates on the union variables (M_i's), combined with union densities and compensation shares (E_i's) summarized in Table 6.7, the impact of unionization on the foreign-born/native-born wage differential can be estimated using equation 6.8. The results have been summarized in Tables 6.8 and 6.9.

Looking at the last column in Table 6.8, one observes that Δ is negative throughout and ranges in value between -0.004 for females in the private sector and -0.07 for males in the public sector. This means that in the presence of unionization, the foreign-born earn between 0.4 % and 7% less than their native-born counterparts. What is intriguing is that the differences are bigger in the public sector. For the entire sample the foreign-born earned about 4% less than their native-born counterparts. The figures for the male and female samples are 7% and 5.2% respectively. I found the results surprising as I expected the public sector to implement affirmative action laws and other anti-discrimination regulations more steadfastly, and thus the wage differentials should have been much smaller. These results are in sharp contrast to others in the literature, for example Maki and Ng (1990) and Prescott and Wandschneider (1995). Maki and Ng estimated that unions increased the male-female differential in the private sector by about 31 cents, but reduced the same differential in the public sector by about $1.35 per hour.

Prescott and Wandschneider also found a 1% wage gap between immigrants and Canadians in the public sector in 1982. However by 1991, this wage gap in the public sector had essentially disappeared for all immigrants with up to 10 years of Canadian experience. On the other hand, the private sector wage gap between immigrants and Canadians remained constant at about 12% over the 1982-1991 period. Table 6.9 follows a similar pattern except that the wage differentials in the presence of unionization are much smaller. This could be attributed to the fact that the sample sizes are now much smaller as a result of all the disaggregation.

In this chapter I estimated the impact of unionization on the native-born/foreign-born wage differential using data from the labour market activity survey. The main advantage in using this data set over others such as the census, is because it is one of the few data sets that has a union status variable. For the total sample, the foreign-born population earned 2% less than the native-born (2.5% and 1.6% for males and females respectively). For the private sector the wage differentials in the presence of unionization ranged between 0.4% and 1.8% in favour of the native-born workers. The corresponding figures for the public sector were 4.2% and 7% in favour of the native-born workers. Disaggregating the data by occupations interacted with unionization, a similar pattern emerges, although the wage differentials estimated were much smaller.

On the whole, the blue-collar unions seem to be more discriminatory than white-collar unions. The wage differentials estimated were approximately 0.1% for white-collar workers and 0.3% for blue-collar workers. Thus, it has been established that a wage gap

exists in the presence of unionization, which may partly explain the apparent neutrality of the unions on immigration matters. The summary statistics in Table 6.1 also indicate that the foreign-born and native-born populations have an almost identical unionization rates. This implies that gatekeeping is absent and that immigrants can join the unions in the same proportions as the native-born workers. This latter point can also be adduced to explain union neutrality on immigration issues.

TABLE 6.1
Variable Definitions and Their Sample Means

Variable	Variable Definition	Native-Born Males	Native-Born Females	Foreign-Born Males	Foreign-Born Females
HWAGE	Hourly Wage	$13.4	$10.15	$15.5	$11.2
A20[a]	Age 20 years and below	28%	29%	14%	17%
A2534	Age 25 to 34 = 1; other = 0	30%	32%	23%	23%
A3544	Age 35 to 44 = 1; other = 0	23%	23%	26%	33%
A4554	Age 45 to 54 = 1; other = 0	12%	11%	22%	18%
A55	Age 55 and over = 1; other = 0	6%	4%	14%	8%
Educational Variables					
EDSEC[a]	Secondary education =1; other = 0	32%	22%	20%	19%
EDHS	High school completion = 1; other = 0	22%	27%	21%	25%
EDSPS	Some post-secondary education = 1; other = 0	14%	15%	12%	12%
EDDIP	Post secondary diploma = 1; other = 0	21%	25%	23%	24%
EDDEG	University degree = 1; other = 0	12%	11%	24%	20%
MARRD	Married = 1; other = 0	64%	65%	76%	70%
PTIME	Part-time worker = 1; full-time worker = 0	13%	33%	11%	33%
FSIZE	Firm with 500 employees or more = 1; other = 0	32%	28%	37%	34%
Union Variables					
UNION	Union member = 1; non-union member = 0	36%	29%	37%	29%
UMANAG	Union member in Managerial occupation = 1; other = 0	2%	2%	2%	2%
UPROF	Union member in professional occupation = 1; other = 0	5%	12%	7%	13%
UCLER	Union member in clerical occupation = 1; other = 0	2%	8%	2%	5%
USSERV	Union member in sales and service occupations = 1; other = 0	4%	5%	4%	5%
UPROC	Union member in processing and equipment operating occupations = 1; other = 0	9%	2%	7%	2%
UMACH	Union member in machining, mechanics, repairing, construction and other skilled occupations = 1; other = 0	12%	1%	13.5%	2%
UFARM[a]	Union member in farming and primary occupations = 1; other = 0	2%	0.4%	1%	0.1%

Industry Dummies					
PRIM[a]	Agric, forestry and Fishing = 1; other = 0	5%	3%	3%	2%
MINES	Mines and quarries = 1; other = 0	4%	0.4%	3%	0.5%
MFG	Manufacturing = 1; other = 0	19%	9%	24%	13%
CONS	Construction = 1; other = 0	13%	2%	9%	2%
TRANS	Transport, communication and storage = 1; other = 0	11%	4%	9%	3%
TRADE	Wholesale & retail trade, finance, insurance and real estate = 1; other = 0	19%	25%	16%	22%
SERV	Education, health, recreation, business, personal, accommodation and food services = 1; other = 0	20%	49%	28%	52%
PUBLIC	Public sector = 1; private sector = 0	9%	8%	8%	5%
Regional Dummies					
ATLAN[a]	Atlantic Canada = 1; other = 0	28%	26%	7%	7%
QUEB	Quebec = 1; other = 0	17%	16%	8%	8%
ONT	Ontario = 1; other = 0	17%	18%	37%	37%
PRARIE	Prairies = 1; other = 0	28%	30%	31%	30%
BC	British Columbia = 1; other = 0	9%	9%	17%	18%
N	Sample Size	4204	3862	2085	1837

Notes:
a = excluded or base category.

TABLE 6.2
Estimates of Hourly Wages (Total Sample)
Dependent Variable: Log of Hourly Wage

	Native-Born			Foreign-Born		
Variable	All	Males	Females	All	Males	Females
A2534	0.22	0.212	0.186	0.153	0.209	0.149
	(17.34)[a]	(11.68)	(11.06)	(6.03)	(5.74)	(4.52)
A3544	0.284	0.328	0.221	0.257	0.395	0.194
	(20.38)	(16.09)	(12.00)	(10.09)	(10.46)	(6.03)
A4554	0.298	0.315	0.214	0.283	0.402	0.192
	(18.20)	(13.32)	(9.50)	(10.50)	(10.37)	(5.43)
A55	0.290	0.334	0.170	0.300	0.376	0.167
	(13.23)	(11.34)	(5.37)	(9.95)	(9.05)	(3.90)
EDHS	0.077	0.101	0.127	0.095	0.081	0.120
	(6.07)	(5.91)	(7.23)	(4.27)	(2.67)	(3.99)
EDSPS	0.126	0.147	0.194	0.189	0.106	0.211
	(8.40)	(7.40)	(9.32)	(7.04)	(2.98)	(5.61)
EDDIP	0.230	0.201	0.294	0.249	0.181	0.277
	(17.80)	(11.56)	(16.25)	(11.15)	(6.08)	(8.89)
EDDEG	0.468	0.408	0.482	0.420	0.325	0.419
	(28.42)	(18.53)	(20.64)	(17.68)	(10.17)	(12.55)
MARRD	0.091	0.142	0.058	0.088	0.107	0.046

	(8.50)	(9.14)	(4.11)	(4.83)	(4.02)	(1.96)
PTIME	-0.134	-0.097	-0.068	-0.158	-0.124	-0.071
	(-12.34)	(-5.31)	(-5.36)	(-8.77)	(-3.90)	(-3.34)
FSIZE	0.120	0.107	0.121	0.108	0.100	0.091
	(11.63)	(7.61)	(8.71)	(6.83)	(4.75)	(4.08)
QUEB	0.161	0.139	0.147	0.089	0.007	0.188
	(11.59)	(7.59)	(7.73)	(2.41)	(0.14)	(3.67)
ONT	0.200	0.193	0.223	0.158	0.127	0.206
	(14.74)	(10.36)	(12.28)	(5.39)	(3.23)	(5.14)
PRARIE	0.125	0.124	0.124	0.062	0.056	0.069
	(10.59)	(7.68)	(7.76)	(2.09)	(1.41)	(1.68)
BC	0.228	0.218	0.189	0.173	0.169	0.177
	(13.82)	(9.71)	(8.27)	(5.46)	(3.96)	(4.07)
UNION	0.215	0.179	0.233	0.151	0.107	0.174
	(19.98)	(12.83)	(14.86)	(8.90)	(4.88)	(7.08)
MINES	0.438	0.324	0.344	0.542	0.390	0.619
	(12.41)	(8.13)	(3.55)	(7.81)	(4.81)	(4.20)
MFG	0.170	0.127	0.144	0.267	0.218	0.244
	(6.99)	(4.26)	(3.44)	(5.40)	(3.44)	(3.35)
CONS	0.286	0.208	0.162	0.460	0.344	0.410
	(10.82)	(6.80)	(2.80)	(8.34)	(5.08)	(4.14)
TRANS	0.162	0.158	0.191	0.364	0.262	0.416
	(6.13)	(4.93)	(4.07)	(6.59)	(3.79)	(4.75)
TRADE	0.030	-0.008	0.047	0.125	0.107	0.204
	(1.31)	(--0.270	(1.22)	(2.53)	(1.66)	(2.91)
SERV	-0.098	-0.0762	-0.032	0.028	0.001	0.123
	(-4.15)	(-2.41)	(-0.83)	(0.57)	(0.02)	(1.76)
PUBLIC	0.108	0.111	0.196	0.282	0.233	0.434
	(4.60)	(3.61)	(5.04)	(5.70)	(3.58)	(6.17)
CONSTANT	6.27	6.36	6.13	6.22	6.35	6.02
	(265.59)	(218.65)	(150.01)	(111.29)	(88.38)	(74.41)
Adjusted R^2	0.43	0.43	0.44	0.35	0.34	0.36
N	8039	4204	3862	3922	2085	1837

[a] t-values are in parenthesis.

Table 6.3
Estimates of Hourly Wages (Public Sector Sample)
Dependent Variable: Natural Logarithm of Hourly Wages

	Native-Born			Foreign-Born		
Variable	All	Males	Females	All	Males	Females
A2534	0.251	0.309	0.206	0.279	0.391	0.206
	(8.88)	(5.71)	(6.63)	(5.54)	(4.73)	(6.63)
A3544	0.335	0.463	0.263	0.364	0.557	0.262
	(11.68)	(8.36)	(8.14)	(7.53)	(6.82)	(8.14)
A4554	0.358	0.457	0.269	0.422	0.655	0.269
	(10.87)	(7.36)	(7.02)	(8.33)	(8.04)	(7.02)
A55	0.396	0.560	0.219	0.378	0.598	0.219
	(9.27)	(7.56)	(4.22)	(6.87)	(6.91)	(4.22)
EDHS	0.120	0.156	0.198	0.042	0.073	0.198
	(3.70)	(2.92)	(5.36)	(0.82)	(0.85)	(5.36)
EDSPS	0.222	0.248	0.249	0.171	0.179	0.249
	(6.44)	(4.32)	(6.06)	(2.95)	(1.95)	(6.06)

EDDIP	0.277	0.285	0.374	0.316	0.292	0.374
	(9.69)	(5.89)	(11.31)	(6.64)	(3.58)	(11.31)
EDDEG	0.546	0.519	0.570	0.510	0.525	0.570
	(18.81)	(11.79)	(16.36)	(11.4)	(7.09)	(16.36)
MARRD	0.099	0.100	0.063	0.055	-0.004	0.063
	(4.70)	(2.51)	(2.68)	(1.76)	(-0.075)	(2.68)
PTIME	-0.075	0.026	-0.028	-0.062	-0.143	-0.028
	(-3.74)	(0.60)	(-1.32)	(-2.17)	(-2.63)	(-1.32)
FSIZE	0.092	0.097	0.088	0.119	0.098	0.088
	(4.97)	(3.09)	(4.08)	(4.76)	(2.63)	(4.08)
QUEB	0.171	0.168	0.157	0.155	0.067	0.157
	(6.12)	(3.64)	(4.87)	(2.47)	(0.69)	(4.87)
ONT	0.175	0.149	0.206	0.112	0.123	0.205
	(6.33)	(3.09)	(6.60)	(2.42)	(1.83)	(6.60)
PRARIE	0.067	0.112	0.072	0.061	0.036	0.072
	(2.90)	(2.79)	(2.69)	(1.33)	(0.55)	(2.69)
BC	0.138	0.164	0.129	0.154	0.038	0.129
	(4.03)	(2.67)	(3.19)	(3.02)	(0.51)	(3.19)
UNION	0.192	0.138	0.265	0.129	0.022	0.265
	(10.28)	(4.18)	(12.29)	(5.09)	(0.56)	(12.29)
CONSTANT	6.31	6.34	6.23	6.37	6.44	6.23
	(182.86)	(116.64)	(153.41)	(92.41)	(58.28)	(153.41)
Adjusted R^2	0.37	0.40	0.41	0.33	0.39	0.41
N	2085	741	1346	1077	429	1346

Table 6.4
Estimates of Hourly Wages (Private Sector Sample)
Dependent Variable: Natural Logarithm of Hourly Wages

	Native-Born			Foreign-Born		
Variable	All	Males	Females	All	Males	Females
A2534	0.218	0.191	0.185	0.126	0.191	0.116
	(15.20)	(4.69)	(9.22)	(4.29)	(4.69)	(2.93)
A3544	0.270	0.385	0.202	0.237	0.385	0.157
	(16.83)	(9.04)	(8.87)	(7.90)	(9.04)	(4.04)
A4554	0.284	0.354	0.197	0.248	0.354	0.166
	(14.94)	(8.04)	(6.97)	(7.76)	(8.04)	(3.87)
A55	0.258	0.351	0.148	0.294	0.351	0.191
	(10.02)	(7.41)	(3.71)	(8.14)	(7.41)	(3.56)
EDHS	0.066	0.088	0.101	0.107	0.088	0.141
	(4.82)	(2.69)	(5.07)	(4.29)	(2.69)	(4.10)
EDSPS	0.101	0.103	0.177	0.197	0.103	0.246
	(6.12)	(2.62)	(7.28)	(6.44)	(2.62)	(5.57)
EDDIP	0.220	0.172	0.256	0.231	0.172	0.236
	(15.03)	(5.28)	(11.55)	(8.95)	(5.28)	(6.23)
EDDEG	0.421	0.255	0.396	0.355	0.255	0.366
	(18.63)	(6.80)	(10.09)	(11.86)	(6.80)	(8.03)
MARRD	0.086	0.128	0.049	0.097	0.128	0.057
	(6.97)	(4.22)	(2.79)	(4.42)	(4.22)	(1.94)
PTIME	-0.161	-0.132	-0.088	-0.205	-0.132	-0.113
	(-12.46)	(-3.50)	(-5.57)	(-9.06)	(-3.49)	(-4.19)

FSIZE	0.131	0.098	0.142	0.106	0.098	0.095
	(10.58)	(3.96)	(7.80)	(5.33)	(3.96)	(3.18)
QUEB	0.154	0.008	0.140	0.067	0.008	0.166
	(9.67)	(0.14)	(5.97)	(1.47)	(0.14)	(2.51)
ONT	0.208	0.133	0.232	0.164	0.133	0.233
	(13.35)	(2.83)	(10.41)	(4.45)	(2.83)	(4.39)
PRARIE	0.144	0.067	0.153	0.056	0.067	0.045
	(10.48)	(1.38)	(7.65)	(1.47)	(1.38)	(0.83)
BC	0.254	0.199	0.213	0.173	0.199	0.143
	(13.54)	(3.92)	(7.71)	(4.34)	(3.92)	(2.50)
UNION	0.226	0.126	0.185	0.154	0.125	0.132
	(17.01)	(4.77)	(7.94)	(7.003)	(4.77)	(3.65)
MINES	0.424	0.396	0.335	0.552	0.396	0.635
	(12.03)	(4.75)	(3.45)	(7.67)	(4.74)	(4.21)
MFG	0.165	0.223	0.145	0.267	0.223	0.239
	(6.82)	(3.42)	(3.45)	(5.19)	(3.42)	(3.19)
CONS	0.283	0.345	0.158	0.460	0.345	0.415
	(10.77)	(4.96)	(2.74)	(8.07)	(4.96)	(4.11)
TRANS	0.158	0.270	0.202	0.373	0.270	0.433
	(5.97)	(3.80)	(4.24)	(6.48)	(3.80)	(4.76)
TRADE	0.033	0.121	0.043	0.136	0.121	0.206
	(1.43)	(1.83)	(1.11)	(2.67)	(1.83)	(2.86)
SERV	-0.093	0.021	-0.039	0.042	0.021	0.124
	(-3.95)	(0.31)	(-0.99)	(0.83)	(0.31)	(1.75)
CONSTANT	6.28	6.34	6.16	6.24	6.35	6.06
	(259.64)	(82.02)	(144.45)	(101.33)	(82.02)	(67.01)
Adjusted R^2	0.42	0.31	0.30	0.32	0.31	0.23
N	5954	1656	2516	2845	1656	1189

Table 6.5
Estimates of Hourly Wages (White-collar Unions, All Industries)
Dependent Variable: Natural Logarithm of Hourly Wages

		Native-Born			Foreign-Born	
Variable	All	Males	Females	All	Males	Females
A2534	0.233	0.229	0.191	0.152	0.213	0.146
	(17.97)	(12.49)	(11.36)	(5.96)	(5.80)	(4.42)
A3544	0.293	0.347	0.223	0.257	0.401	0.191
	(20.73)	(16.83)	(12.14)	(10.09)	(10.58)	(5.97)
A4554	0.309	0.335	0.218	0.290	0.413	0.188
	(18.66)	(14.01)	(9.71)	(10.71)	(10.62)	(5.36)
A55	0.312	0.346	0.165	0.312	0.390	0.164
	(13.97)	(11.6)	(5.24)	(10.31)	(9.34)	(3.87)
EDHS	0.075	0.097	0.121	0.080	0.069	0.108
	(5.81)	(5.59)	(6.90)	(3.61)	(2.30)	(3.59)
EDSPS	0.118	0.138	0.185	0.170	0.090	0.195
	(7.75)	(6.89)	(8.91)	(6.33)	(2.53)	(5.18)
EDDIP	0.224	0.193	0.273	0.229	0.164	0.255
	(16.94)	(10.93)	(14.92)	(10.19)	(5.50)	(8.17)
EDDEG	0.437	0.365	0.438	0.378	0.282	0.387
	(25.15)	(15.72)	(18.08)	(15.58)	(8.66)	(11.41)

MARRD	0.097	0.148	0.056	0.092	0.110	0.046
	(8.97)	(9.45)	(4.02)	(5.07)	(4.13)	(2.01)
PTIME	-0.145	-0.103	-0.067	-0.168	-0.131	-0.075
	(-13.15)	(-5.52)	(-5.22)	(-9.28)	(-4.11)	(-3.55)
FSIZE	0.148	0.132	0.127	0.126	0.115	0.093
	(14.28)	(9.44)	(9.15)	(8.01)	(5.48)	(4.20)
QUEB	0.176	0.145	0.144	0.101	0.018	0.191
	(12.49)	(7.81)	(7.61)	(2.70)	(0.35)	(3.74)
ONT	0.200	0.196	0.221	0.168	0.135	0.217
	(14.49)	(10.37)	(12.15)	(5.72)	(3.43)	(5.42)
PRARIE	0.124	0.119	0.121	0.072	0.063	0.078
	(10.32)	(7.29)	(7.55)	(2.41)	(1.56)	(1.93)
BC	0.239	0.230	0.184	0.188	0.183	0.182
	(14.27)	(10.10)	(8.08)	(5.89)	(4.28)	(4.20)
UMANAG	0.213	0.147	0.387	0.168	0.088	0.250
	(6.77)	(3.46)	(8.21)	(3.19)	(1.33)	(3.24)
UPROF	0.185	0.169	0.304	0.194	0.144	0.284
	(9.57)	(5.29)	(13.45)	(6.90)	(3.37)	(8.19)
UCLER	0.066	0.094	0.178	-0.002	-0.031	0.141
	(2.99)	(2.07)	(7.26)	(-0.042)	(-0.42)	(3.12)
USSERV	0.141	0.124	0.164	0.052	0.003	0.124
	(6.17)	(4.01)	(5.52)	(1.44)	(0.065)	(2.75)
MINES	0.477	0.362	0.342	0.587	0.421	0.623
	(13.34)	(8.98)	(3.54)	(8.44)	(5.18)	(4.25)
MFG	0.216	0.172	0.175	0.299	0.235	0.288
	(8.77)	(5.74)	(4.18)	(6.04)	(3.70)	(3.99)
CONS	0.323	0.244	0.146	0.498	0.367	0.415
	(12.06)	(7.86)	(2.54)	(9.01)	(5.42)	(4.21)
TRANS	0.204	0.191	0.194	0.412	0.291	0.433
	(7.59)	(5.91)	(4.10)	(7.41)	(4.21)	(4.92)
TRADE	0.018	-0.016	0.032	0.120	0.099	0.210
	(0.77)	(-0.55)	(0.82)	(2.43)	(1.54)	(3.01)
SERV	-0.111	-0.084	-0.050	0.022	-0.006	0.126
	(-4.62)	(-2.62)	(-1.29)	(0.45)	(-0.095)	(1.81)
PUBLIC	0.121	0.128	0.169	0.276	0.234	0.407
	(5.01)	(4.04)	(4.30)	(5.51)	(3.53)	(5.80)
CONSTANT	6.28	6.37	6.16	6.23	6.37	6.03
	(261.80)	(215.88)	(150.98)	(111.19)	(88.36)	(74.96)
Adjusted R^2	0.42	0.42	0.44	0.35	0.33	0.36
N	8039	4204	3862	3922	2085	1837

Table 6.6
Estimates of Hourly Wages (Blue-collar Unions, Public Sector Industries)
Dependent Variable: Natural Logarithm of Hourly Wages

		Native-Born			Foreign-Born	
Variable	All	Males	Females	All	Males	Females**
A2534	0.274	0.339	0.245	0.298	0.399	

	(9.49)	(6.21)	(7.50)	(5.85)	(4.82)
A3544	0.363	0.505	0.309	0.387	0.566
	(12.46)	(9.14)	(9.14)	(7.92)	(6.93)
A4554	0.391	0.492	0.333	0.452	0.666
	(11.65)	(7.88)	(8.29)	(8.87)	(8.18)
A55	0.404	0.576	0.267	0.395	0.605
	(9.16)	(7.68)	(4.88)	(7.13)	(6.99)
EDHS	0.131	0.171	0.221	0.032	0.091
	(3.94)	(3.14)	(5.67)	(0.62)	(1.05)
EDSPS	0.231	0.266	0.268	0.155	0.191
	(6.50)	(4.56)	(6.17)	(2.65)	(2.05)
EDDIP	0.302	0.295	0.407	0.309	0.294
	(10.24)	(5.99)	(11.71)	(6.44)	(3.61)
EDDEG	0.581	0.529	0.616	0.509	0.539
	(19.33)	(11.35)	(16.82)	(11.18)	(7.13)
MARRD	0.113	0.107	0.085	0.057	-0.008
	(5.22)	(2.64)	(3.42)	(1.80)	(-0.15)
PTIME	-0.091	0.002	-0.056	-0.078	-0.146
	(-4.40)	(0.04)	(-2.47)	(-2.71)	(-2.73)
FSIZE	0.125	0.113	0.144	0.136	0.092
	(6.71)	(3.52)	(6.44)	(5.43)	(2.48)
QUEB	0.189	0.175	0.199	0.148	0.069
	(6.62)	(3.73)	(5.89)	(2.33)	(0.72)
ONT	0.171	0.152	0.192	0.096	0.125
	(6.02)	(3.10)	(5.85)	(2.04)	(1.86)
PRARIE	0.075	0.117	0.098	0.055	0.042
	(3.18)	(2.85)	(3.48)	(1.18)	(0.64)
BC	0.157	0.168	0.165	0.150	0.036
	(4.51)	(2.69)	(3.87)	(2.92)	(0.48)
UPROC	0.138	-0.076	-0.133	0.066	-0.041
	(2.43)	(-1.15)	(-0.68)	(0.48)	(-0.31)
UMACH	0.113	0.058	0.296	0.180	0.111
	(1.93)	(0.94)	(1.08)	(1.85)	(1.16)
UFARM	0.061	-0.016	0.432	-0.048	-0.146
	(0.39)	(-0.12)	(1.58)	(-0.33)	(-1.23)
CONSTANT	6.35	6.37	6.27	6.42	6.43
	(180.54)	(115.09)	(146.93)	(93.38)	(58.89)
Adjusted R^2	0.34	0.38	0.34	0.32	0.40
N	2085	741	1346	1077	429

** The female equation could not be estimated, because very few females were associated with the blue-collar unionized occupations in the public sector.

Table 6.7
Estimates of the Proportion of Total Compensation Received by Employed Workers, by Occupational Groups (E_i's)

		Native-Born			Foreign-Born	
Occupation	All	Males	Females	All	Males	Females
Managerial	0.125	0.136	0.108	0.145	0.158	0.125
Professional	0.218	0.155	0.308	0.273	0.243	0.319

Clerical	0.149	0.050	0.289	0.126	0.048	0.248
Sales & Service	0.162	0.132	0.204	0.152	0.119	0.204
Farming	0.048	0.069	0.017	0.026	0.036	0.012
Processing	0.122	0.174	0.047	0.087	0.118	0.039
Machinists	0.176	0.281	0.025	0.188	0.275	0.051
Private						
Managerial	0.124	0.121	0.129	0.151	0.155	0.143
Professional	0.078	0.082	0.070	0.121	0.145	0.071
Clerical	0.155	0.052	0.365	0.137	0.048	0.331
Sales	0.171	0.118	0.281	0.165	0.117	0.271
Farming	0.066	0.083	0.029	0.034	0.039	0.022
Processing	0.165	0.207	0.079	0.123	0.147	0.071
Machinists	0.240	0.335	0.044	0.266	0.347	0.091
Public						
Managerial	0.126	0.193	0.081	0.133	0.169	0.102
Professional	0.529	0.427	0.597	0.591	0.553	0.623
Clerical	0.135	0.042	0.198	0.103	0.049	0.148
Sales	0.139	0.185	0.109	0.125	0.126	0.124
Farming	0.009	0.019	0.003	0.011	0.024	0.00
Processing	0.026	0.054	0.007	0.012	0.026	0.0009
Machinists	0.034	0.079	0.004	0.024	0.051	0.001

These estimates are obtained by weighting employment by mean wage rate for each category and then deflating the result by the sum of these quantities. For these calculations the entire sample in the data set were used.

Table 6.8
Estimates of the Effects of Unionization on the Average Wage of Native-born workers, Foreign-born Workers, and Foreign-born Workers Relative to Native-born Workers

	Native-Born *	Foreign-Born *	Δ**
Total Sample			
All	0.07	0.05	-0.02
Males Only	0.065	0.04	-0.025
Females Only	0.067	0.051	-0.016
Private Sector Sample			
All	0.053	0.039	-0.014
Males Only	0.058	0.04	-0.018
Females Only	0.026	0.022	-0.004
Public Sector Sample			
All	0.112	0.07	-0.042
Males Only	0.082	0.012	-0.07
Females Only	0.151	0.099	-0.052

*Calculated as the partial sum in equation (6.8) divided by $\sum E_{nbi}$ (or $\sum E_{fbi}$) for that group.
**Column (3) - Column (2).

Table 6.9
Estimates of the Effects of Unionization on the Average Wage of Native-born workers, Foreign-born Workers, and Foreign-born Workers Relative to Native-born Workers (Blue-collar and White-collar occupations)

	Native-born*	Foreign-Born*	Δ**
Blue-collar (Private)			
All	0.016	0.013	-0.003
Males	0.019	0.016	-0.0033
Females	0.0026	-0.0011	-0.0034
Blue-collar (Public)			
All	0.0028	0.00017	-0.0012
Males	0.0053	0.0051	-0.0004
White-collar			
All	0.0062	0.0056	-0.0008
Males	0.0192	0.017	-0.0023

(*), (**) See notes to Table 6.8.

CHAPTER 7

SUMMARY AND CONCLUSIONS

The labour market performance of immigrants has to date dominated the literature on the economics of immigration. This literature has focused in the main, on the foreign-born/native-born earnings differential and the earnings adjustment of immigrants. Specifically, researchers in this area try to estimate age-earnings profiles of both immigrants and natives with the aim of ascertaining how long it would take for immigrants to "catch-up" with their native-born cohorts. The other major strand of labour market literature is the impact of immigration on wages and employment. That is, what are the impacts of immigration on the host country's economy? The outcome of foreign-born workers entering the labour market manifests itself in three main forms. Firstly, Canadian workers can be displaced from their jobs; secondly, their wages could be suppressed or thirdly some combination of the two is also feasible. This literature has dealt extensively with the displacement effects/unemployment effects of foreign-born workers and very little on the wage impacts. Thus, my main motivation for embarking on this thesis was to contribute to this aspect of the immigration literature by focusing on the wage impacts of foreign-born labour. This thesis is also motivated by the increasing labour force participation rates of the foreign-born population and its potential impact on wages in Canada.

This thesis had four main objectives. My first objective was to employ a new methodology developed by Suen, which uses age-cohorts, to model the wage impacts of

foreign-born labour. This approach which was used on Hong Kong data has never been used in Canada. The novelty of Suen's age-cohort methodology amongst others, includes the resolution of the endogeneity problem caused by the possibility of immigrants self-selecting into cities with higher wages. Suen's methodology also allowed me to indirectly test the Foot-Stoffman hypothesis regarding the competition between the boom and echo generations and their attendant impact on wages.

Given that the literature identifies certain industries as entry level points for immigrants, the second objective of this thesis was to test the wage impacts of foreign-born labour by broad industrial classification, using longitudinal data from the 1988-1990 Labour Market Activity Survey (LMAS). A random effects model was estimated and used to analyze the wage impact of foreign-born labour by industry.

Thirdly, this thesis investigated the substitution and complementarity relationships between the new foreign-born (immigrants who came to Canada after 1978), old foreign-born (earlier immigrants who immigrated to Canada before 1978) and Canadian-born workers. Treating these three labour types as inputs in a generalized Leontief production function, the technological parameters were estimated and subsequently used to compute the Hicksian elasticities. These elasticities provided the basis to quantify the wage impacts of foreign-born labour on Canadian wage rates or the wages of themselves (i.e. foreign-born workers). This exercise was also extended to examine the substitution and complementarity relationships by broad occupational groups, i.e. professionals, skilled workers and unskilled workers. The focus on skill groups is important because it has

policy implications. This is because Canada's immigration policy is partly guided by a point system which can be used to influence the occupational composition of immigration flows, with potential impact on wage rates in the affected occupations.

Finally, the role of institutions, specifically unions, and how they have contributed to the wage gap between foreign-born and Canadian-born workers was also examined. The rationale for studying the union's contribution is to explore why at a policy level Canadian unions have remained neutral in the broad debate over immigration policy.

The main findings from this thesis could be summarized as follows. In chapter three, I use Suen's methodology which involved estimating a two stage CES model that aggregates immigrant groups first of all by age cohorts, and then subsequently aggregate cohorts into the effective labour supply. Thus, one's wage was not only driven by his/her human capital endowments but also by the number of workers in the particular age-cohort to which he/she belongs. A simulation exercise was also performed to ascertain the impact of a 20 percent increase in the number of new immigrants on wages in Canada. The results show that the wage impacts of a 20 percent increase in immigration levels on the native-born and other immigrant vintages are minimal. The wage decreases associated with this hypothetical inflow is no more than 1%, ranging from -0.037% for the native born and early immigrants in the 60-64 year-old age cohort, to a high of -0.120% for recent immigrants in the 40-44 year old age cohort. Part of the reason why these wage impacts are so small can be attributed to the relatively small percentages of immigrants making up the total labour force. For example, recent immigrants constitute only 3.8% of

the effective labour supply of the 40-44 year-old cohort, which in turn make up 18.9% of the effective aggregate labour supply. As I alluded to earlier, one of the advantages associated with Suen's approach is that it allows a test of the Foot-Stoffman hypothesis regarding the competition between boom and echo generations and the potential immigrant impact on wages. The results from the simulation exercise did not corroborate the Foot-Stoffman hypothesis, because the age-cohort that came out worse off was the 40-44 year-olds and not the younger ones (25-29 year-olds) as predicted by Foot and Stoffman. Specifically, the simulation exercise revealed that a 20% increase in the number of new immigrants will lead to a drop in the wage rate of native-born and early immigrants in the 40-44 year-old age cohort by 0.102%, and reduction in the wage rate of new immigrants belonging to that same age-cohort by 0.120%. On the other hand, native-born and early immigrants in the 25-29 year-old age cohort, experienced 0.079% reduction in wage rates, whereas new immigrants in the 25-29 year-old age cohort experienced a 0.086% decrease in their wage rates.

Chapter four dealt with wage impacts of foreign-born labour by broad industry groups using longitudinal data from the 1988-1990 LMAS. A random effects model was estimated and used to examine the wage impacts of foreign-born labour by industry. The analysis was also conducted on a gender basis to address the outstanding literature, which suggests that females in particular may suffer a double negative effect as a result of their foreign-born birth status and gender (see Beach and Worswick, 1993). Furthermore, because of the endogeneity of the foreign share variable, an instrumental variable approach was adopted to confront the endogeneity problem. Subsequently, a Hausman test

confirmed that the foreign share variables were endogenous, hence instrumentation was warranted under those circumstances. The results from the instrumented wage regressions show that for the total sample, the foreign-born and native-born were complements on average, with a corresponding wage elasticity of 0.011. This implies that a 1% increase in the number of foreign-born workers will increase the wages of Canadians by 0.011%. A similar complementary relationship was also discerned for the male and female samples, with corresponding elasticities of 0.013 and 0.014 respectively. When the foreign share variable was disaggregated by industry, I detected wage suppression in the primary, transport and storage and wholesale and retail trade industries. This finding appears in all three sub-samples, i.e. total, male and female samples. These findings are not surprising, because a closer examination of these industries by Hiebert (1997) reveal that they are mainly low skilled industries providing entry level jobs for new immigrants especially. This would potentially increase the labour supply in these sectors and the end result would be a drop in wages.

Chapter five examined the issue of substitutability/complementarity between Canadian, new foreign-born and old foreign-born workers. The analysis was also extended to broad occupational groups and simultaneously recognizing the endogeneity of the employment variables. The main finding from the constrained and instrumented regressions indicate that the new foreign-born and Canadian-born workers are substitutes in production. The corresponding Hicksian elasticity was estimated to be -0.093, implying that a 10% increase in the number of foreign-born workers will reduce the wages of Canadian workers by 0.9%. The old foreign-born workers and Canadian-born workers

were complements, with a corresponding Hicksian elasticity of 0.112. New foreign-born and old foreign-born workers were neither substitutes nor complements in production, due to the statistical insignificance of the underlying estimated technological parameters. When the data was disaggregated by occupations, it came to light that professional immigrants and Canadian professionals were substitutes with an elasticity of -0.71. On the other hand, unskilled immigrants and Canadian professionals were complements with an elasticity of 0.31. Furthermore, unskilled immigrants and skilled Canadians were complements with an elasticity of 0.43. In addition, professional immigrants and unskilled Canadian workers were substitutes with a corresponding elasticity of -0.33. Finally, all own elasticities were negative as dictated by economic theory, but they were larger in absolute magnitudes compared with the various cross elasticities.

Chapter six focused on unions because of their neutrality on policy debates on immigration which I have already alluded to. In addition, the focus on unions was necessary because the traditional view is that unions may or may not have caused wage gaps to occur across gender. In a parallel fashion, I ask if unions have contributed to the wage gap between foreign-born and Canadian-born workers. Increased unionization led to a wage gap in favour of Canadian-born workers and varied across white collar/blue collar jobs and public/private sectors. The results indicate that blue collar unions appeared to be more discriminatory and the wage gap in favour of Canadian-born workers was larger in the public sector.

This thesis has several policy implications. First of all, this thesis shows that although increasing the number of immigrants impacts on wage rates of Canadians, the effects are generally small, about 1% using various elasticity estimates. Thus, if one of the continuing goals of immigration policy (as articulated by Green 1976) is the successful absorption of immigrants, then the results indicate that this goal was met, where I define absorption in the context of minimal wage impacts. This suggests that the ongoing debate in the media and amongst policy analysts over the number of immigrants to admit, if partially predicated on the wage effects of foreign-born workers is misdirected. The focus should rather be on the composition of immigration flows through the various gates, that is family class, independent class, business class etc. This thesis found for example wage suppression in the primary, transportation and trading industries. To counteract some of these deleterious effects, the points system under Canada's current immigration policy could be fashioned to influence the distribution of immigrants away from the vulnerable industries. The same argument can also be made for occupational/skill impacts where my results show that Canadian professional and unskilled workers are substitutes for immigrant professionals with adverse impacts on wages.

Every extensive study of this kind has its fair share of limitations and shortcomings. This thesis is no exception, and I now point out some of these limitations of the empirical estimations. Firstly, the bulk of the empirical analysis was done under the assumption of strong separability between capital and the other labour inputs. But it is feasible that when the price of labour inputs increases, some employers may substitute capital for labour. Therefore, it would be useful to incorporate an appropriate measure of

capital stock into the production function and explore the substitution or complementarity relationships with the other labour inputs. However, the problem here is that the capital stock data is only available at the provincial level and not at the CMA level, which is the level of aggregation required for some of the estimations.

Secondly, Suen's methodology involves the estimation of a constant elasticity of substitution (CES) production function. This type of production function imposes a priori restrictions on the different kinds of substitution and complementarity relationships. Also other types of labour aggregation have to be explored to test the robustness of the results in chapter three.

Finally, this thesis addressed the wage impacts of foreign-born labour solely through a production framework or channel. That is, whether natives and immigrants are substitutes or complements in production and the attendant wage impacts. However, immigrants may also influence native workers through other channels apart from the production channel, and these additional influences may offset or reinforce any wage impacts exerted through the production structure channel. Examples of these other channels include local demand channels, a net export demand channel, the labour force participation channel and finally the internal migration channel. For example, under the local demand channel of immigration impacts, if immigrants bring along more wealth or other non-labour income on arrival, it can stimulate local final demand in the area. The enhanced local final demand will result in additional local output and therefore in additional labour demand. Also under the net export demand channel, an increased supply

of immigrants and the resulting fall in immigrant wage rates will lead to reduced unit production costs, all things being equal. The resulting decrease in wages would enhance the competitiveness of the local area's export sector. This could finally lead to an increase in the quantity of area net exports demanded and to increases in area labour demand. See Greenwood and Hunt (1995). Future research on this topic should incorporate these other channels and simulate the impact on the economy, if the data can be found.

BIBLIOGRAPHY

Abbot, M.G. and C.M. Beach (1993), "Immigrant Earnings Differentials and Birth-Year Effects for Men in Canada: Post-War-1972." *Canadian Journal of Economics*, August, Vol. 26, No. 3, p. 505-524.

Akbari, A. and D.J. DeVoretz (1992), "The Substitutability of Foreign-Born Labour in Canadian Production: Circa 1980." *Canadian Journal of Economics*, August, Vol. 25, No. 3, p. 604-614.

Altonji, J.G. and D. Card (1991), "The Effects of Immigration on the Labour Market Outcomes of Less-Skilled Natives." In J. Abowd and R. Freeman (eds.), *Immigration, Trade and the Labour Market,* (Chicago: University of Chicago Press).

Ashenfelter, O. (1972), "Racial Discrimination and Trade Unionism." *Journal of Political Economy*, Vol. 80, p. 435-464.

Baker, M. and D. Benjamin (1994), "The Performance of Immigrants in the Canadian Labour Market." *Journal of Labour Economics*, Vol. 12, p. 369-405.

_____. (1995), "Labour Market Outcomes and the Participation of Immigrant Women in Canadian Transfer Programs." In D.J. DeVoretz (ed.), *Diminishing Returns: The Economics of Canada's Recent Immigration Policy.* (C.D. Howe Institute, Toronto and Laurier Institution, Vancouver), p. 209-242.

Beach, C.M. and C. Worswick (1993), "Is There a Double-Negative Effect on the Earnings of Immigrant Women?" *Canadian Public Policy*, March, Vol. 19, No. 1, p. 36-53.

Bean, F.D., L.B. Lindsay and L.J. Taylor (1988), "Undocumented Mexican Immigrants and the Earnings of Other Workers in the United States." *Demography*, February, Vol. 25, No. 1, p.35-52.

Bloom, D.E. and M. Gunderson (1991), "An Analysis of the Earnings of Canadian Immigrants." In J. Abowd and R. Freeman (eds.), *Immigration, Trade and the Labour Market,* (Chicago: University of Chicago Press).

Bloom, D.E., G. Grenier and M. Gunderson (1995), "The Changing Labour Market Position of Canadian Immigrants." *Canadian Journal of Economics*, November, Vol. 28, No. 4b, p.987-1005.

Borjas, G.J. (1983), "The Substitutability of Black, Hispanic and White Labour." *Economic Inquiry*, January, Vol. 21, p. 93-106.

_____. (1985), "Assimilation, Changes in Cohort Quality and the Earnings of Immigrants." *Journal of Labour Economics*, October, Vol. 3, p. 463-489.

_____. (1988), *International Differences in the Labour Market Performance of Immigrants.* W.E. Upjohn Institute for Employment Research.

_____. (1990), *Friends or Strangers: The Impact of Immigrants on the U.S. Economy.* (New York: Basic Books).

_____. (1994), "The Economics of Immigration." *Journal of Economic Literature*, December, Vol. 32, p. 1667-1717.

Breusch, T. and A. Pagan (1980), "The LM Test and its Application to Model Specification in Econometrics." *Review of Economic Studies*, Vol. 47, p. 239-254.

Canada, Citizenship and Immigration Canada, *Immigration Statistics.* Various Years, (Ottawa: Supply and Services Canada).

Card, D. (1990), "The Impact of the Mariel Boatlift on the Miami Labour Market." *Industrial and Labour Relations Review*, January, Vol. 43, p. 245-257.

Carliner, G. (1980), "Wages, Earnings and Hours of First, Second and Third Generation American Males." *Economic Inquiry*, January, Vol. 18, No. 1, p. 87-102.

Carrington, W. and P. DeLima (1994), "Large-Scale Immigration and Labour Markets: An Analysis of the Retornados and their Impact on Portugal." Working Paper, John Hopkins University.

Chambers, E. and D. Gordon (1966), "Primary Products and Economic Growth." *Journal of Political Economy,* August.

Chiswick, B. (1978), "The Effect of Americanization on the Earnings of Foreign-Born Men." *Journal of Political Economy*, Vol. 86, p.897-921.

Clark, D.P. and H. Thompson (1986), "Immigration, International Capital Flows and Long Run Income Distribution in Canada." *Atlantic Economic Journal*, December, Vol. 14, No. 4, p.24-29.

Coulson, R.G. and D. DeVoretz (1993), "Human Capital Content of Canadian Immigration 1966-1987." *Canadian Public Policy*, December, Vol. 19, p. 357-366.

Dales, J.H. (1964), "The Cost of Protectionism with High International Mobility of Factors." *Canadian Journal of Economics and Political Science*, Vol. 30.

_____. (1966), *The Protective Tariff in Canada's Development.* (Toronto: University of Toronto Press).

De New, J.P. and K.F. Zimmermann (1994), "Native Wage Impacts of Foreign Labour: A Random Effects Panel Analysis." *Journal of Population Economics*, Vol. 7, p. 177-192.

Denton, F.T., C.H. Feaver and B.G. Spencer (1989), *MEDS-Models of the Economic-Demographic System.* (Hamilton: McMaster University. QSEP Research Report).

DeSilva, A. (1992), *Earnings of Immigrants: A Comparative Analysis.* (Ottawa: Economic Council of Canada).

_____. (1997), "Earnings of Immigrant Classes in the Early 1980s in Canada." *Canadian Public Policy*, June, Vol. 23, No. 2, p. 179-202.

DeVoretz, D.J. (1989), "Immigration and Employment Effects." Discussion Paper 89.B.3, *Institute for Research on Public Policy.*

_____. (1997), "Ethics, Economics and Canada's Immigration Policy." *Vancouver Centre of Excellence: Research on Immigration and Integration in the Metropolis (RIIM),* March, Commentary Series, No. 97-02.

Diewert, W.E. (1971), "An Application of the Shephard Duality Theorem: A Generalised Leontief Production Function." *Journal of Political Economy*, May/June, Vol. 79, p. 481-507.

Dirks, G.E. (1995), *Controversy and Complexity: Canadian Immigration Policy during the 1980s.* (Montreal and Kingston: McGill-Queens University Press).

Doiron, D.J. and W.C. Riddell (1994), "The Impact of Unionisation on the Male-Female Earning Differences in Canada." *Journal of Human Resources*, Vol. 29, p. 504-534.

Ehrenberg, R.G. and J.L. Schwarz (1986), "Public Sector Labour Markets." In O.C. Ashenfelter and R. Layard (eds.), *Handbook of Labour Economics*, Vol. 2, Elsevier.

Foot, D.K. and D. Stoffman (1996), *Boom, Bust and Echo: How to Profit from the Coming Demographic Shift.* (Toronto: Macfarlane Walter and Ross).

Freeman, R.B. (1986), "Unionism Comes to the Public Sector." *Journal of Economic Literature*, Vol. 24, p. 41-134.

Friedberg, R.M. and J. Hunt (1995), "The Impact of Immigrants on Host Country Wages, Employment and Growth." *Journal of Economic Perspectives*, Spring, Vol. 9, No. 2, p. 23-44.

Goldin, C. (1994), "The Political Economy of Immigration Restriction in the United States, 1890-1921." In C. Goldin and G. Libecap (eds.), *The Regulated Economy: A Historical Approach to Political Economy.* (Chicago: University of Chicago Press), p. 223-257.

Green, A.G. (1976), *Immigration and the Post-War Canadian Economy.* (Toronto: Macmillan of Canada).

Green, A.G. and D.A. Green (1995), "Canadian Immigration Policy: The Effectiveness of the Point System and Other Instruments." *Canadian Journal of Economics*, November, Vol. 28, No. 4b, p. 1006-1041.

Greene, W.H. (1990), *Econometric Analysis.* (New York: Macmillan Publishing Company).

_____. (1992), *LIMDEP Version 6.0, User's Manual and Reference Guide.* (New York: Econometric Software Inc.).

Greenwood, M.J. and J.M. McDowell (1986), "The Factor Market Consequences of U.S. Immigration." *Journal of Economic Literature*, December, Vol. 24, p. 1738-1772.

Greenwood, M.J. and G.L. Hunt (1995), "Economic Effects of Immigrants on Native and Foreign-Born Workers: Complementarity, Substitutability, and Other Channels of Influence." *Southern Economic Journal*, p. 1076-1097.

Grossman, J.B. (1982), "The Substitutability of Natives and Immigrants in Production." *Review of Economics and Statistics*, November, Vol. 64, p. 596-603.

Hamermesh, D.S. (1986), "The Demand for Labour in the Long Run." In O.C. Ashenfelter and R. Layard (eds.), *Handbook of Labour Economics*, Vol. 1, North-Holland.

_____. (1993), *Labour Demand.* (Princeton: Princeton University Press).

Hiebert, D. (1997), "The Colour of Work: Labour Market Segmentation in Montreal, Toronto and Vancouver, 1991." *Vancouver Centre of Excellence: Research on Immigration and Integration in the Metropolis (RIIM),* March, Working Paper No. 97-02.

Hunt, J. (1992), "The Impact of the 1962 Repatriates from Algeria on the French Labour Market." *Industrial and Labour Relations Review*, April, Vol. 45, p. 556-572.

Kennedy, P.E. (1992), *A Guide to Econometrics*. (Cambridge: MIT Press).

LaLonde, R.J. and R.H. Topel (1991), "Labour Market Adjustment to Increased Immigration." In J. Abowd and R. Freeman (eds.), *Immigration, Trade and the Labour Market,* (Chicago: University of Chicago Press).

Lewis, H.G. (1986), *Union Relative Wage Effects: A Survey.* (Chicago: University of Chicago Press).

Maki, D.R. and L.N. Meredith (1987), "A Note on Unionism and the Elasticity of Substitution." *Canadian Journal of Economics*, November, Vol. 20, No. 4, p. 792-801.

Maki, D.R. and I. Ng (1990), "Effects of Trade Unions on the Earning Differential between Males and Females: Canadian Evidence." *Canadian Journal of Economics*, May, Vol. 23, No. 2, p.305-311.

Marr, W.L. (1992), "Post War Canadian Immigration Patterns." In S. Globerman (ed.), *The Immigration Dilemma*, (Vancouver: The Fraser Institute).

Marr, W.L. and P.L. Siklos (1995), "Immigration and Unemployment: A Canadian Macroeconomic Perspective." In D.J. DeVoretz (ed.), *Diminishing Returns: The Economics of Canada's Recent Immigration Policy.* (C.D. Howe Institute, Toronto and Laurier Institution, Vancouver), p. 293-330.

Meng, R. (1987), "The Earnings of Canadian Immigrant and Native-Born Males." *Applied Economics,* Vol. 19, p. 1107-1119.

Muller, T. and T.J. Espenshade (1985), *The Fourth Wave.* (Washington DC: Urban Institute Press).

Nakamura, A., M. Nakamura and M. Percy (1992), "Macroeconomic Impacts of Immigration." In S. Globerman (ed.), *The Immigration Dilemma*, (Vancouver: The Fraser Institute).

Newbold, K.B. (1996), "Internal Migration of the Foreign-Born in Canada." *International Migration Review*, Vol. 30, No. 3, p. 728-747.

Pendakur, K. and R. Pendakur (1996), "The Colour of Money: Earnings Differentials Among Ethnic Groups in Canada." *Vancouver Centre of Excellence: Research on Immigration and Integration in the Metropolis (RIIM),* May, Working Paper No. 96-03.

Prescott, D. and B. Wandschneider (1995), "The Assimilation of Immigrants in the Canadian Labour Market 1981-1990." University of Guelph, Discussion Paper 1995-11.

Roy, A.S. (1987), "An Analysis of Substitutability and Complementarity of Immigrants and Canadian-born Work Force." *Labour Market Bulletin*, October, Vol. 4, p. 5-11.

_____. (1997), "Job Displacement Effects of Canadian Immigrants by Country of Origin and Occupation." *International Migration Review*, Vol. 31, No. 1, Spring, p.150-161.

Sato, R. and T. Koizumi (1973), "On the Elasticities of Substitution and Complementarity." *Oxford Economic Papers*, March, Vol. 25, p. 44-56.

Seward, S.B. and M. Tremblay (1989), "Immigrants in the Canadian Labour Force: Their Role in Structural Change." Discussion Paper 89.B.2, *Institute for Research on Public Policy.*

Shamsuddin, A.F.M. (1996), "The Effect of Unionisation on the Gender Earnings Gap in Canada: 1971-1981." *Applied Economics*, Vol. 28, p.1405-1413.

Simon, J.L., S. Moore and R. Sullivan (1993), "The Effect of Immigration on Aggregate Native Unemployment: An Across-City Estimation." *Journal of Labour Resources*, Summer, Vol. 14, p. 299-316.

Simpson, W. (1985), "The Impact of Unions on the Structure of Canadian Wages: An Empirical Analysis with Microdata." *Canadian Journal of Economics*, February, Vol. 18, No. 1, p. 164-181.

Statistics Canada (1994), *Canada's Changing Immigrant Population*, Catalogue No. 96-311E.

Statistics Canada, *Census Metropolitan Areas, Dimensions.* 1986 Census of Canada, Catalogue No. 93-156.

Statistics Canada, *Immigration and Citizenship.* 1991 Census of Canada, Catalogue No. 93-316.

Suen, W. (1994), "Estimating the Effects of Immigration in One City." University of Hong Kong Working Paper.

Winegarden, C.R. and L.B. Khor (1991), "Undocumented Immigration and Unemployment of U.S. Youth and Minority Workers: Econometric Evidence." *Review of Economics and Statistics*, February, Vol. 73, No. 1, p. 105-112.