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Public Transit Use Among Immigrants

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ABSTRACT

Using data from the 1996 and 2001 Censuses of Canada, we examine the propensity of immigrants and the Canadian-born to use public transit. We find that recent immigrants are much more likely to use public transit to commute to work than Canadian-born persons even after for controlling for demographic characteristics, income, commute distance and residential distance from the city centre. This higher propensity falls with time spent in Canada. We also find that recent cohorts of immigrants are more likely to take public transit than past cohorts of immigrants. Implications for public transit services are discussed.

Keywords: Immigrants, public transit

1. Introduction

Population growth and changes in population composition typically have implications for public services provision. For example, the birth of the baby boom generation was one of the factors that contributed to the expansion of the elementary, secondary and post-secondary education systems across Canada through the 1960s. Similarly, there is now ongoing public policy discussion regarding the implications of population aging on health care, pension plans and other programs.

Immigration is also an important consideration in this respect. In 2001, the share of Canadians who were born outside of the country – at 18% – was higher than it had been in 70 years. Moreover, immigration has become increasingly concentrated in Canada's largest cities, with almost three-quarters of 'recent immigrants' now residing in Montreal, Toronto and Vancouver.[1] In absolute terms, more than 1.3 million recent immigrants now reside in these three cities, with almost 800,000 in Toronto alone. As a result of this trend, the fraction of the population that was made up of recent immigrants rose between 1991 and 2001 from 11.8% to 17% in Toronto and from 9.3% to 16.5% in Vancouver (Statistics Canada, 2003).

This dramatic shift in population composition towards recent immigrants in Canada's largest cities has important implications for the provision of many public services. This paper examines the importance of immigration for the provision of public transit. Specifically, the objective of this study is to examine the extent to which recent immigrants use public transit to commute to work compared with Canadian-born people, and whether the difference diminishes with length of residence in Canada.

The central finding is that the propensity to use public transit to commute to work is far higher among recent immigrants than Canadian-born persons and that this difference remains when gender, age, income, distance to work, and distance from the city centre are taken into account. One implication is that population growth based on immigration, will place greater demands on public transit systems than growth based on natural increase.

The evidence also indicates that immigrants who have been in Canada for more than 20 years typically have a similar likelihood to commute via public transit as Canadian-born persons. This suggests that either immigrant transit use 'integrates' towards the level of the Canadian-born population, or that newer cohorts of immigrants have a higher likelihood of using public transit than past cohorts. Our results suggest that both integration and cohort effects are important.

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[1]   Recent immigrants are defined as those who arrived in Canada during the 10 years prior to the census.

2. Data

This study uses a descriptive approach to quantify the differences in public transit usage between immigrants and other residents of Canada's cities[2]. The analysis is based on data from the 1996 and 2001 Census micro data files. Specifically, it uses data from the Census "long form", which collected detailed information from approximately 1 in 5 households. On the Census questionnaire, individuals were asked about how they *usually* get to work; specifically, whether they commute by car, truck or van as either a driver or a passenger; by public transit (e.g., bus, streetcar, subway, light rail transit, commuter train, ferry); or by other means, including walking, by bicycle, motorcycle or other modes. This paper is focused on the use of public transit as the mode of transport usually used to get to work. Note that the paper is only concerned with the use of public transit in the commute to work. The census does not collect information on public transit use for other types of trips.

Certain groups are excluded from our analysis; specifically, those who were not employed on or after January 1st, 2000 (and on or after January 1st,1995 for data derived from the 1996 census); those under 15 years of age; residents of institutions; individuals whose place of work is at home or outside of Canada; and non-permanent residents. Furthermore, our analysis focuses on 'recent immigrants,' defined as immigrants who arrived in Canada during the 10 years prior to the census – that is, during the years 1991 to 2001 inclusive for data derived from the 2001 Census, and during the years 1986 to 1996 for data derived from the 1996 Census. We analyze results at the Census Metropolitan Area level[3].

Most of our analysis is focused on Montreal, Toronto and Vancouver. This is done to limit the amount of data presented in the paper, and because almost three-quarters of recent immigrants reside in these three cities. It is important to note that a transit strike was ongoing in Vancouver at the time the 2001 Census was in the field. This strike, which began April 1st 2001 and ended August 1st 2001 will undoubtedly have affected the number of commuters reporting that they usually used public transit to get to work. In the analysis that follows, we discuss the potential effect of the transit strike on our results when it is appropriate.

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[2]   While the present paper is concerned only with descriptive differences, it should be noted that the issue of inter-group differences in public transit usage typically arises in one of two contexts: the modal choice literature, which is concerned with quantifying the determinants mode of commuting choice (see Asensio (2002) for a recent example); and the literature regarding spatial mismatch in access to employment which examines the commuting times of women, immigrants and ethnic minorities relative to other groups and the role this plays in labour market decisions (McLafferty and Preston, 1996, Zax, 1998, and Preston, McLafferty and Liu, 1998 for example).

[3]   A small number of observations where distance to work was reported as zero kilometres was also dropped. Definitions of census geographic concepts, and other census concepts used in this paper are available at www.statcan.ca.

3. Descriptive Results

3.1 Immigrants and public transit usage

Although private vehicles remain the primary means by which individuals in Canadian cities commute to work, public transit is an important mode of transportation. Indeed, across Canada's 27 CMAs, more than 1.6 million people usually take public transit to work.

Commuting to work on public transit is especially prevalent among recent immigrants. In Toronto, for example, over one-third of recent immigrants (36.3%) usually commute by this means, while this is the case for one-fifth of Canadian-born persons (20.7%) (Table 1). In Montreal, the share of recent immigrants who usually commute to work on public transit (at 48.6%) is more than twice that of Canadian-born persons (at 20.9%). A similar pattern is evident in virtually every CMA in which a significant number of recent immigrants reside. In fact, a monotonically declining relationship between years since immigration and public transit usage is observed in all CMAs, with public transit usage rates about the same for immigrants who have resided in Canada for more than 20 years and the Canadian-born.
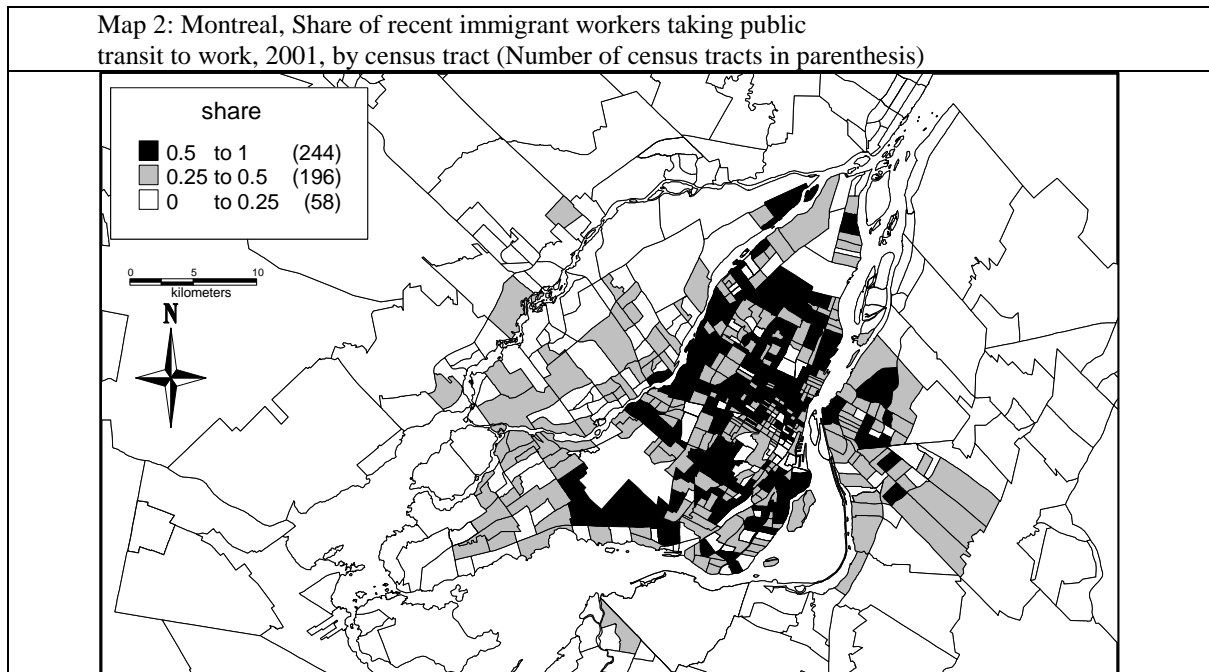
Table 1.
Percent of persons who use public transportation to commute to work, by immigration status, selected CMAs, 2001

	Canadian-born	Immigrated within past 10 years	Immigrated 11 to 20 years earlier	Immigrated more than 20 years ago	Total
Montréal	20.9	48.6	35.5	24.5	23.6
Toronto	20.7	36.3	26.8	19.9	24.0
Ottawa-Hull	18.5	33.8	26.5	18.9	19.9
Calgary	13.6	25.8	17.0	13.5	14.8
Winnipeg	14.1	24.5	16.4	12.7	14.5
Vancouver	11.4	21.1	14.7	11.0	13.1
Edmonton	9.4	19.6	11.8	7.8	9.9
Victoria	10.8	18.3	13.9	8.9	11.0
Hamilton	8.5	16.7	10.8	6.5	8.8
London	6.8	15.1	8.0	4.0	6.9
Windsor	3.3	9.8	5.3	1.8	3.6
Kitchener	4.5	9.0	6.1	2.5	4.6

The difference in rates of commuting by public transit between recent immigrants and the Canadian-born can be investigated using a series of thematic maps[4]. Map 1 shows census tracts in Montreal, each of which is shaded according to the share of Canadian-born workers that use public transit to get to work. In most census tracts on the island of Montreal and in Saint-Lambert to the east, more than 25% of workers use public transit to get to work (a total of 405 tracts). And in 34 census tracts, primarily near the downtown core, more than 50% of workers take public

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[4] For this analysis, the dataset is further restricted to those census tracts with a sample population of more than 250 persons. Public transit usage rates among recent immigrant commuters are only reported when there is a sample population of more than 40.

transit to work. In further outlying areas, the share of workers taking public transit to work is typically less than 25%. Map 2 shows results for recent immigrants. The difference between the two maps is striking. The number of census tracts in which more than 50% of recent immigrants commute via public transit is far higher – at 244 tracts. Moreover, in areas further from the downtown core, including Beaconsfield and Pointe-Claire to the south and Laval to the north, more than 25% of recent immigrants commute via public transit. In short, public transit utilization is higher among recent immigrants than among other groups in Montreal, with this evident in the extent to which utilization rates exceed 50% in many 'central' census tracts and in the extent to which utilization rates exceed 25% in areas further outside the downtown core.

Map 1: Montreal, Share of Canadian-born workers taking public transit to work, 2001, by Census tract (Number of census tracts in parenthesis)

share		
0.5 to 1	(34)
0.25 to 0.5	(371)
0 to 0.25	(326)

Map 2: Montreal, Share of recent immigrant workers taking public transit to work, 2001, by census tract (Number of census tracts in parenthesis)

share		
0.5 to 1	(244)
0.25 to 0.5	(196)
0 to 0.25	(58)
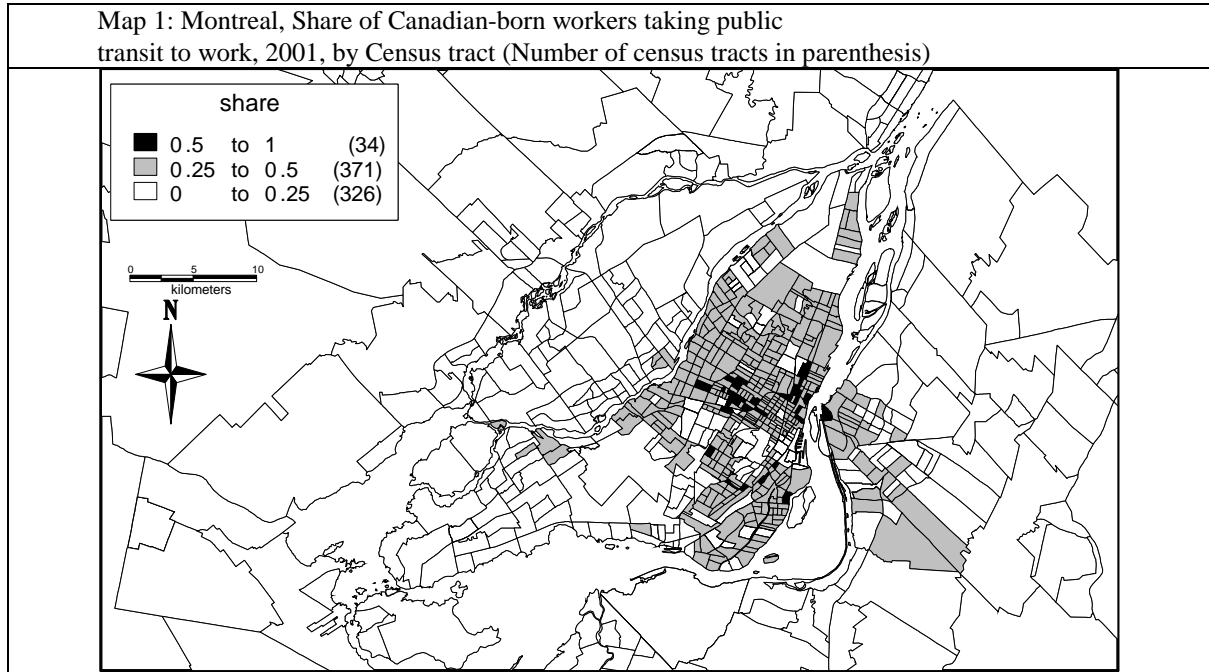
Maps 3 and 4 provide corresponding information for Toronto. As with Montreal, transit usage is highest in the downtown core. In 43 census tracts, more than 50% of Canadian-born workers commute to work via public transit and in 305 tracts, between 25% and 50% of workers commute in this way. Among recent immigrants, transit utilization is again more extensive (see Map 4). Indeed, in a total of 150 census tracts, more than 50% of recent immigrants commute via public transit, and in another 338 tracts, between 25% and 50% of recent immigrants commute in this way. Moreover, public transit utilization is more geographically dispersed. In many census tracts north of highway 401, in the western cities of Mississauga and Brampton, and the eastern cities of Pickering and Ajax, at least 25% of recent immigrants commute via public transit.

Map 3: Toronto, Share of Canadian-born workers taking public transit to work, 2001, by census tract (Number of census tracts in parenthesis)

Map 4: Toronto, Share of recent immigrant workers taking public transit to work, 2001, by census tract (Number of census tracts in parenthesis)
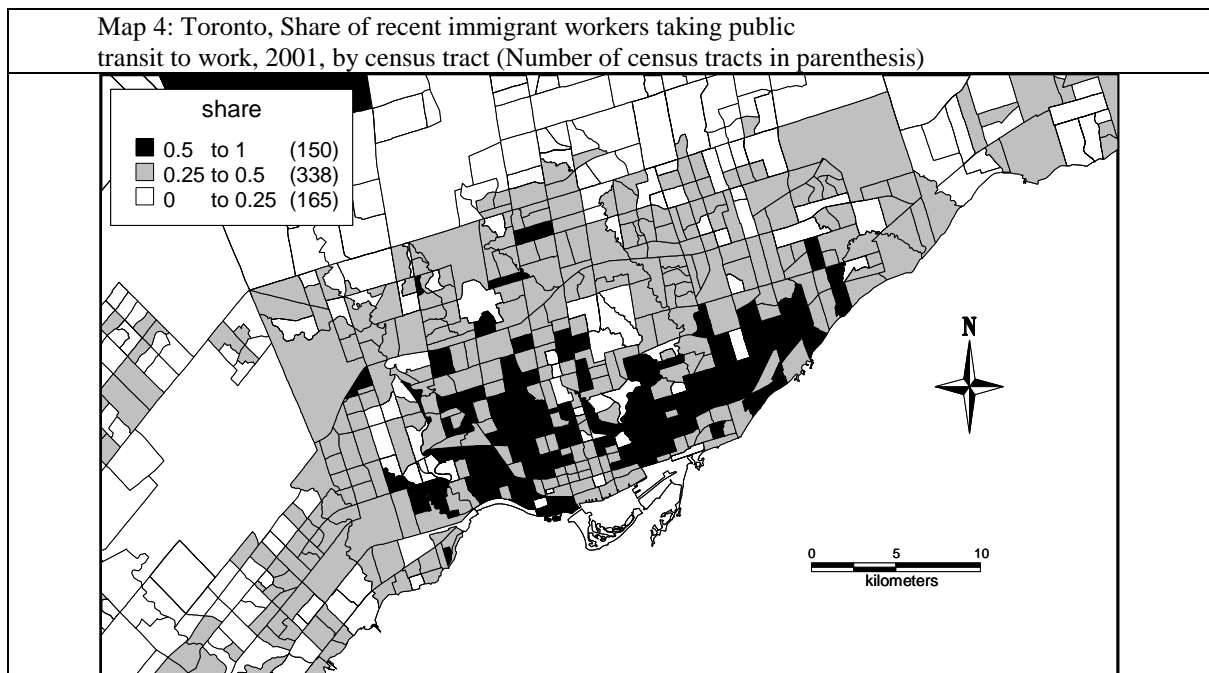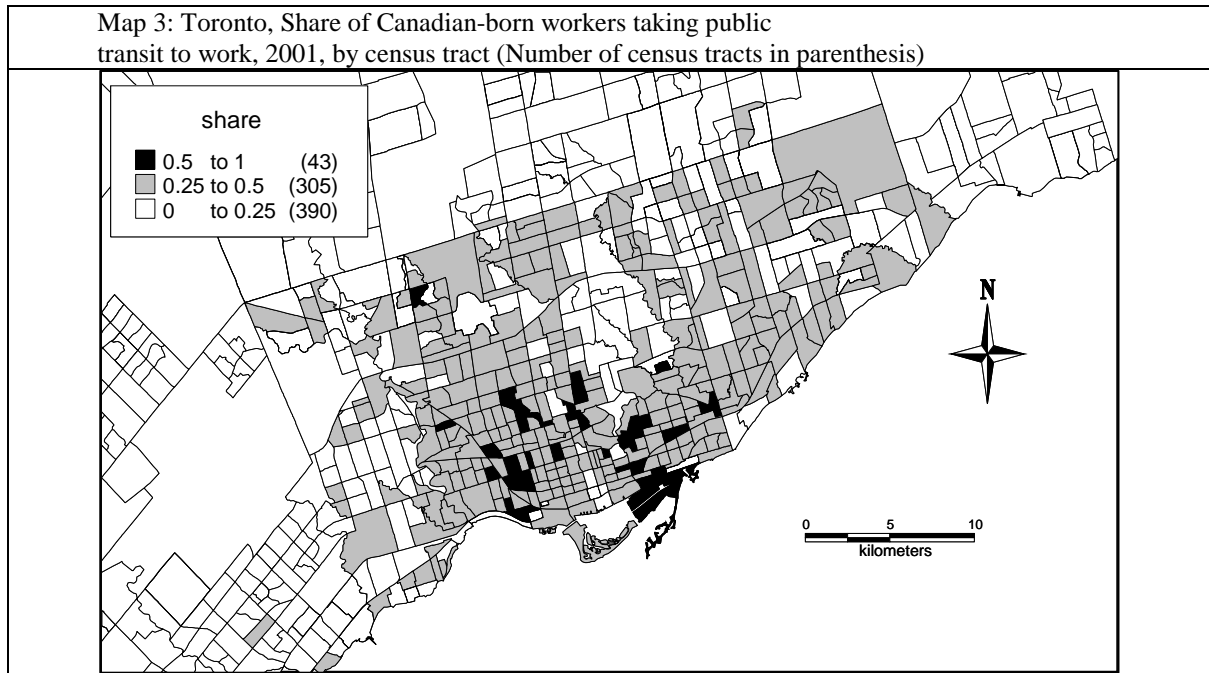
In Vancouver, significantly fewer workers take public transit to work. In only 22 census tracts do more than 25% of Canadian-born workers commute in this way, with these tracts mostly situated along the Sky Train corridor (see Map 5). Rider ship is more prevalent among recent immigrants, with more than 25% of recent immigrants in 74 census tracts commuting in this way. Many of these census tracts are found in North, East and Central Vancouver, Surrey and New Westminster, concentrated near routes serviced by the Sky Train and Sea Bus systems. While these numbers are likely affected by the Vancouver transit strike, it remains clear that recent immigrants are more likely to commute on public transit than the Canadian born, and that they commute from a more geographically dispersed area.

Map 5: Vancouver, Share of Canadian-born workers taking public transit to work, 2001, by census tract (Number of census tracts in parenthesis)

Map 6: Vancouver, Share of recent immigrant workers taking public transit to work, 2001, by census tract (Number of census tracts in parenthesis)
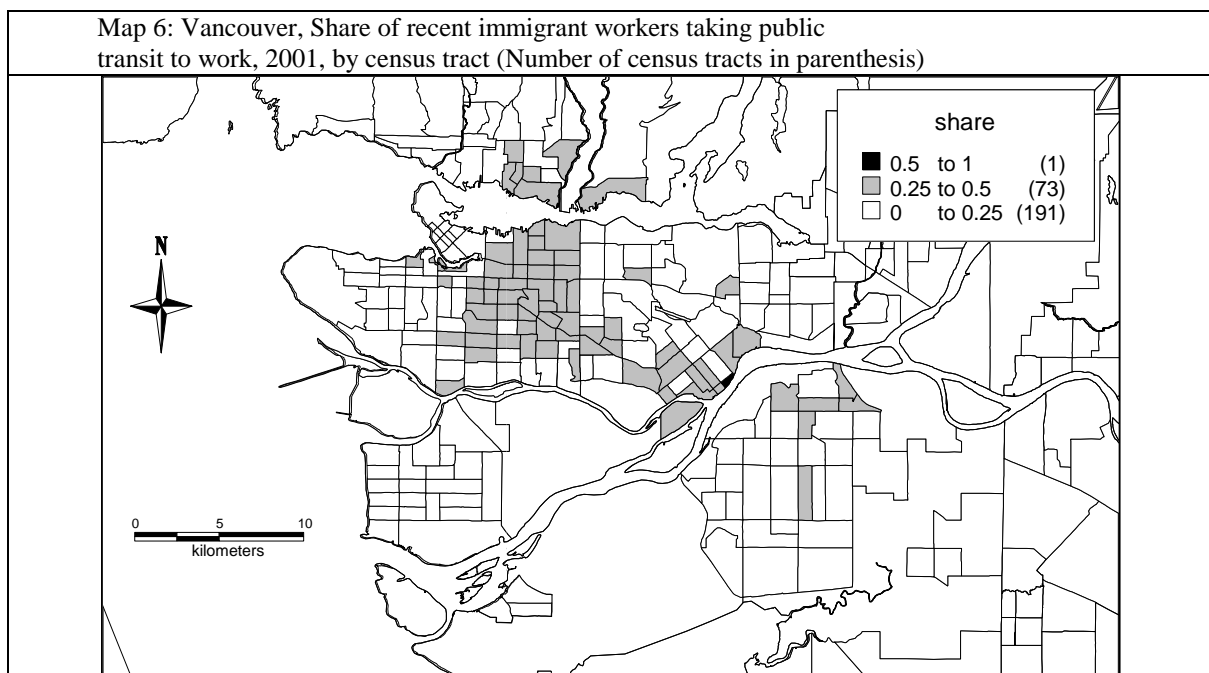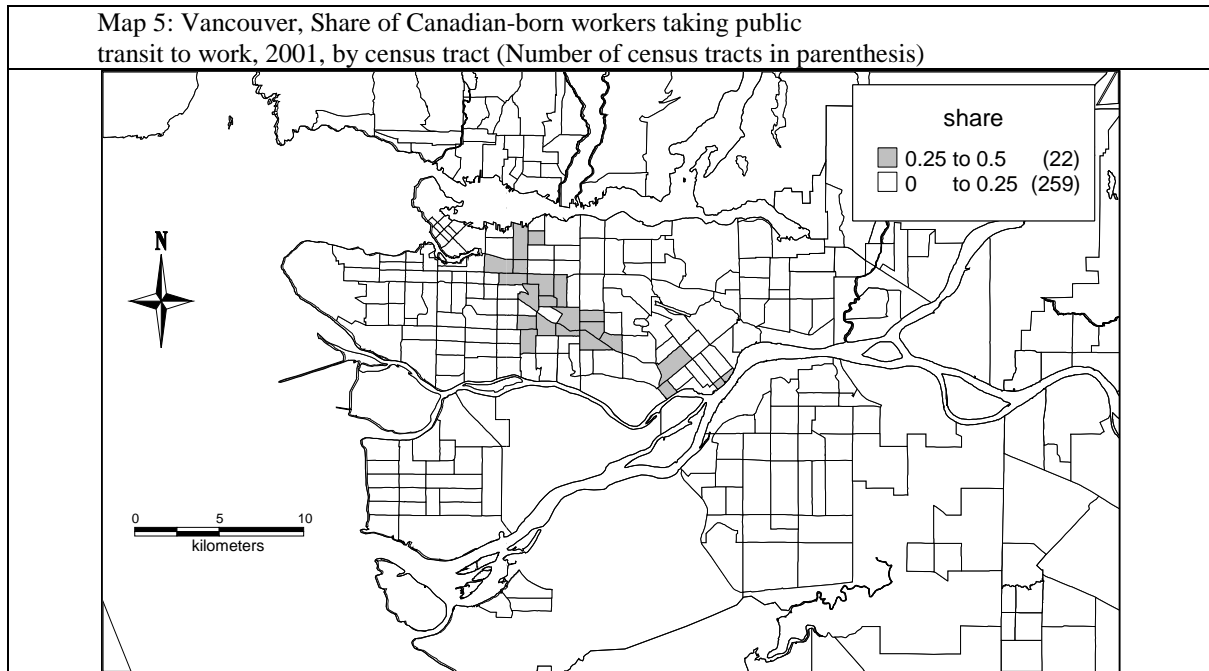
3.2 Other correlates of public transit usage

A number of other factors in addition to immigration are associated with commuting on public transit. Descriptive statistics on selected characteristics are provided in Table 2 for persons residing in Toronto, while identical tables for Vancouver and Montreal are provided in the Appendix.

Women are far more likely than men to commute to work on public transit and this is the case for immigrants as well as for persons born in Canada. However, gender differences are far larger among recent immigrants. In Toronto, for example, there is a six percentage point difference in the shares of Canadian-born women and men who commute to work on public transit, while among recent immigrants, there is a 17 percentage point difference. The same pattern is evident in Vancouver and Montreal (see Appendix Tables 1 and 2). That being said, recent immigrant women are more likely than Canadian-born women to commute using public transit. The same holds true for men.

Use of public transit is also correlated with age, as young people are more likely than individuals in older age groups to commute to work in this way. Even so, in Toronto, recent immigrants in their forties or fifties are about twice as likely as Canadian-born persons in the same age group to commute via public transit, and the same pattern is evident in Vancouver and Montreal.

Economic family income is another factor associated with the likelihood of commuting via public transit. In Toronto, for example, individuals in families with incomes under $40,000 are about twice as likely as those in families with incomes of $80,000 or more to take public transit to work. It is important to note that through the 1980s and 1990s, immigrants fared quite poorly in the Canadian labour market (Frenette and Morissette, 2003), and consequently, their relatively high rate of public transit utilization may reflect their over-representation at the bottom of the income distribution. However, the descriptive statistics do not support this hypothesis. Consider, for example, individuals in Toronto who reside in families with incomes between $60,000 and $80,000. Within this income category, the incidence of public transit utilization among recent immigrants (at 31.7%) is 13 percentage points higher than the incidence among Canadian-born persons (at 19.1%). Similar differences are evident in other income categories.

The distance that one must travel to work is associated with the likelihood of commuting via public transit. The likelihood of using public transit increases as the distance to work increases, and then tapers off as the distance to work exceeds about 10 kilometres. However, recent immigrants in Toronto are far more likely to commute to work using public transit than Canadian-born persons regardless of the distance to work, and likewise, the same pattern is evident in Vancouver and Montreal.

The distance from one's residence to the city centre also impacts on the likelihood of using public transit to commute. Fully 40.1% of commuters living within 3 kilometres of Toronto's city centre commute by public transit, while this is the case for 12.2% of those living 20 kilometres or more from the city center. As with other indicators, the likelihood of taking public transit is higher for recent immigrants than other groups for all distances from the downtown core.

Table 2.
Percent of persons in Toronto who use public transportation to commute to work,
 by immigration status and selected characteristics, Toronto 2001

	Canadian-born	Immigrated within past 10 years	Immigrated 11 to 20 years earlier	Immigrated more than 20 years ago	Total
Total	20.7	36.3	26.8	19.9	24.0
Gender					
Men	17.7	28.2	18.3	12.9	18.8
Women	23.5	44.8	35.3	27.0	29.3
Age Group					
15 to 29	26.5	42.8	35.6	32.3	30.6
30 to 39	19.6	34.8	23.3	22.4	24.2
40 to 49	16.3	31.5	23.6	18.3	20.5
50 to 59	14.6	32.8	25.5	19.1	19.2
Family Income					
$1 to $19,999	37.9	49.5	41.5	34.0	42.1
$20,000 to $39,999	32.7	41.8	35.7	31.0	35.6
$40,000 to $59,999	24.2	35.2	28.1	23.4	27.2
$60,000 to $79,999	19.1	31.7	25.3	19.8	22.3
$80,000 or more	16.4	28.9	21.8	16.0	18.1
Distance to Work					
Less than 5 km	19.8	34.8	25.2	17.4	22.8
5 to 9.9 km	27.0	38.9	28.1	21.3	28.5
10 to 19.9 km	19.5	38.7	28.2	20.8	24.6
20 km or more	16.5	29.7	25.1	19.8	19.7
Distance from City Centre					
0 to 2.9 km	36.9	52.4	43.0	34.2	40.1
3 to 5.9 km	45.0	58.8	49.1	40.1	46.8
6 to 9.9 km	35.5	51.7	43.0	33.2	39.0
10 to 14.9 km	27.8	43.9	35.9	25.7	32.3
15 to 19.9 km	21.9	35.1	27.5	20.8	26.1
20 or more	10.0	20.9	15.1	11.0	12.2

Finally, it is important to note that there are significant differences in the utilization of public transit among immigrants from different source countries. In both Toronto and Montreal, the incidence of public transit utilization is highest among immigrants from the Caribbean, Southeast Asia, Central and South America, and Africa, while it is lowest among immigrants from East Asia, Europe, West Asia and North America and Oceania (Table 3).

Table 3.
Percent of recent immigrants who use public transportation to commute to work,
by region of birth, selected CMAs, 2001

	Toronto	Vancouver	Montreal
Caribbean	47.2	22.4	60.4
Southeast Asia	44.9	30.1	51.9
Central and South America	42.5	29.1	53.5
Africa	41.2	21.1	58.1
South Asia	35.2	16.8	51.2
Eastern Europe	32.9	23.9	41.4
Northern, Western and Southern Europe	31.5	18.0	38.4
East Asia	30.8	19.1	42.1
West Asia	29.1	23.4	36.9
North America, Oceania and other	27.2	13.3	29.7
Total recent immigrants	36.3	21.1	48.6
Canadian-born	20.7	11.4	20.9

4. Multivariate analysis

4.1 Cross-sectional analysis

Having considered the factors associated with public transit utilization in descriptive terms, we now provide a more detailed analysis. This section examines public transit usage among immigrants and others using a logistic model, in which the individual probability of using public transit to commute to work is expressed as a function of individual characteristics and immigration status:

$$P(Y_i = 1) = \beta_o + \sum_{k=1}^{K} \beta_{1k} X_{ki} + \sum_{c=1}^{C} \beta_{2c} I_{ci} + \varepsilon_i \qquad (1)$$

In equation (1) Y denotes whether the individual (i) takes public transit. Included in X, the first component of the model, are a series of background characteristics which are assumed to influence the probability of taking public transit. These include gender, age, economic family income, distance traveled to work, and distance from place of residence to the city centre. The second component of the model, I, represents a series of three immigrant dummy variables indicating whether the immigrant is a recent immigrant (0-10 year(s) before the census year), a medium-term immigrant (11 to 20 years in Canada), or a long-term immigrant (more than 20 years in Canada). Hence, the reference group is the Canadian born. These three *time since immigration* dummy variables are also interacted with age, economic family income, distance traveled to work, and distance from the city centre to allow the impacts of these factors to be different for different groups of immigrants. The error term ε is assumed to be randomly distributed. Models are estimated separately for Montreal, Toronto and Vancouver.

Table 4 shows results of the regressions for public transit usage. The first column shows results for Montreal. Immigrants remain more likely to commute by public transit after controlling for gender, age, family income and distance to work. Estimates indicate that compared to Canadian-born persons in Montreal, recent immigrants are 1.91 times more likely to take public transit to work, medium-term immigrants are 1.46 times more likely, and long-term immigrants are 1.06 times more likely. The model confirms that transit usage declines with age, is lower for women than men, declines with family income, and declines with distance traveled to work. Interaction terms between these variables and immigration status indicate that while transit use declines with age and distance to work for all groups, they decline less for recent immigrants than Canadian-born persons. This means that, relative to their Canadian-born counterparts, immigrants in Montreal become relatively more likely to use public transit as they get older and reside further from work. In contrast, interaction terms with income suggest that public transit usage declines faster among recent immigrants than it does among Canadian-born persons as family income rises. This may reflect a number of factors, such as greater preference to substitute private transportation for public transit as income increases, or differences in where immigrants and Canadian-born persons in different income categories decide to live. The gender-immigration interaction terms are strong and significant, confirming our earlier finding that gender differences in the likelihood of taking public transit are larger among immigrants in Montreal than among Canadian-born persons in that city. Finally, the distance between residence and city centre interaction terms indicate that, for Montreal, living further from the downtown core is less of a factor for public transit use among recent immigrants than Canadian born.[5]

The results of the logistic regressions for Toronto and Vancouver (columns 2 and 3 in Table 4) are very similar in qualitative terms to those for Montreal. Estimates suggest that recent immigrants in Toronto are 1.46 times more likely to commute to work using public transit than Canadian-born persons, while medium-term immigrants are 1.20 times more likely and long-term immigrants are 1.03 times more likely. In Vancouver, recent immigrants are 1.64 times more likely to use public transit to commute and medium-term immigrants are 1.14 times more likely. The difference between long-term immigrants and Canadian born is not significant. Earlier it was shown that in Montreal, commuters are less likely to use public transit when they must travel longer distances to work. In Toronto and Vancouver the opposite is true, as the likelihood of commuting via public transit is positively correlated with distance to work.

To help interpret the results in Table 4, predicted probabilities of commuting on public transit for recent immigrants and Canadian-born persons with various age, income and distance to work values are presented in Table 5. For example, consider a male commuter in Montreal who is aged 25, with an economic family income of $50,000, traveling 5 km to work, and living 10 km from the city centre. A Canadian-born male with these characteristics has a predicted probability of 0.29 of taking public transit, while a recent immigrant with the same characteristics has a predicted probability of 0.43, or 47% more likely than the Canadian-born. Probability of commuting via public transit is lower for workers aged 35 (who otherwise have the same characteristics) but falls less for recent immigrants. Consequently, a 35 year old immigrant with

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[5]   Other models were estimated which allowed the impact of age, economic family income and distance to work to enter the model non-linearly. While the higher order terms were often significant, they yielded little additional insight to the results, so they are not reported here.

Table 4:
Logistic regression results, probability of commuting via public transit

	Montreal (1)	Toronto (2)	Vancouver (3)
Constant	-0.228*	-0.194*	-1.502*
	(0.011)	(0.011)	(0.018)
Immigrated 0-10 years ago	0.439*	0.551*	0.513*
	(0.040)	(0.025)	(0.039)
Immigrated 11-20 years ago	0.304*	0.327*	0.197*
	(0.046)	(0.030)	(0.050)
Immigrated more than 20 years ago	-0.047	0.034	-0.174*
	(0.042)	(0.026)	(0.047)
Age	-0.274*	-0.235*	-0.157*
	(0.005)	(0.005)	(0.010)
Female	0.497*	0.367*	0.343*
	(0.012)	(0.012)	(0.023)
Economic family income	-0.040*	-0.023*	-0.057*
	(0.001)	(0.001)	(0.003)
Distance to work	-0.011*	0.007*	0.012*
	(0.002)	(0.002)	(0.002)
Distance from city centre	-0.088*	-0.067*	-0.039*
	(0.001)	(0.001)	(0.001)
Immigrated 0-10 years ago* economic family income	-0.043*	-0.020*	0.025*
	(0.006)	(0.003)	(0.005)
Immigrated 11-20 years ago* economic family income	-0.030*	-0.005	0.014+
	(0.006)	(0.003)	(0.007)
Immigrated more than 20 years ago* economic family income	-0.029*	-0.012*	-0.009
	(0.004)	(0.003)	(0.007)
Immigrated 0-10 years ago*age	0.070*	0.091*	0.088*
	(0.019)	(0.010)	(0.020)
Immigrated 11-20 years ago*age	0.064*	0.090*	0.104*
	(0.021)	(0.013)	(0.027)
Immigrated more than 20 years ago*age	0.279*	0.116*	0.151*
	(0.018)	(0.011)	(0.023)
Immigrated 0-10 years ago* distance to work	-0.001	0.002	0.002
	(0.005)	(0.004)	(0.004)
Immigrated 11-20 years ago* distance to work	0.010	0.021*	-0.007
	(0.007)	(0.005)	(0.005)
Immigrated more than 20 years ago* distance to work	0.013*	0.036*	-0.002
	(0.005)	(0.005)	(0.004)
Immigrated 0-10 years ago* female	0.225*	0.418*	0.301*
	(0.036)	(0.022)	(0.043)
Immigrated 11-20 years ago* female	0.399*	0.586*	0.412*
	(0.044)	(0.027)	(0.060)
Immigrated more than 20 years ago* female	0.520*	0.576*	0.355*
	(0.037)	(0.025)	(0.052)
Immigrated 0-10 years ago* distance from city centre	0.027*	-0.003+	0.004
	(0.003)	(0.001)	(0.002)
Immigrated 11-20 years ago* distance from city centre	0.012*	-0.005*	-0.002
	(0.004)	(0.002)	(0.003)
Immigrated more than 20 years ago* distance from city centre	0.010*	0.000	0.008*
	(0.003)	(0.001)	(0.002)
N	308,276	425,645	165,898
log likelihood	-144,547	-204,438	-60,424

*Note: * indicates significance at the 1% level, + indicates significance at the 5% level*

these characteristics would be about 60% more likely than his Canadian-born counterpart to take public transit. Increases in income to $75,000 and increases in the distance traveled to work to 10 km have relatively little impact on the transit use of commuters. Doubling the distance of residence from the city centre from 10 to 20 kilometres decreases commute rates for both Canadian-born persons and recent immigrants, but the magnitude of the decline is smaller among recent immigrants. The major details of this story are essentially the same for Toronto and Vancouver. Recent immigrants appear much more willing to use public transit to commute to work than the Canadian-born, and this trend remains true when they are older, reside in families with higher incomes, travel further to work and live further from the city centre.[6]

Table 5:
Predicted probabilities of commuting via public transit – Men

Age	Economic family income	Distance to work (km)	Distance from city centre (km)	Predicted probability of commuting via public transit*		
				Canadian-born	Recent immigrant	Ratio
			Montreal			
25	$50,000	5	10	0.29	0.43	1.47
35	$50,000	5	10	0.24	0.38	1.59
25	$75,000	5	10	0.27	0.38	1.39
25	$50,000	10	10	0.29	0.42	1.47
25	$50,000	5	20	0.14	0.29	1.98
			Toronto			
25	$50,000	5	10	0.35	0.41	1.19
35	$50,000	5	10	0.29	0.38	1.28
25	$75,000	5	10	0.33	0.38	1.16
25	$50,000	10	10	0.35	0.41	1.19
25	$50,000	5	20	0.21	0.26	1.21
			Vancouver			
25	$50,000	5	10	0.16	0.18	1.18
35	$50,000	5	10	0.14	0.17	1.28
25	$75,000	5	10	0.14	0.17	1.25
25	$50,000	10	10	0.16	0.19	1.18
25	$50,000	5	20	0.11	0.14	1.23

*based upon regression results reported in Table 4

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[6] Results which discuss relative differences across groups at a point in time should not be affected by the Vancouver transit strike to the extent that the strike affected all groups in a proportionate manner. Furthermore, analyses using 1996 and 2001 census data yield similar findings for Vancouver.

4.2 Cohort analysis

The results presented in Table 4 imply that the likelihood of commuting on public transit declines as immigrants reside in Canada for longer periods of time. This may reflect rising incomes as individuals get settled into the labour market, acquired language skills in English or French, and the attainment of a Canadian driver's license, or a shift in values or preferences. Such factors can be termed an "integration effect". Alternatively, it may be that immigrants arriving in Canada in more recent years are more likely to take public transit for some other reason than those who arrived in the past. This could be due to a change in source region, or some other difference common to members of a subsequent cohort. This may be termed a "cohort effect". We assess the relative importance of these effects with the model:

$$P(Y_i = 1) = \beta_o + \sum_{k=1}^{K} \beta_{1k} X_{ki} + \sum_{r=1}^{R} \beta_{2r} S_{ri} + \beta_3 T_i + \beta_4 C_i + \varepsilon_i \qquad (2)$$

This model only includes immigrants, and pools data from both the 1996 and 2001 censuses. The pooling of census files from different years allows us to separate the effects of when an individual immigrated (the cohort effect) from how long the individual has resided in Canada (the integration effect), since cohorts are observed at two points in time. As in model (1), the first component of the model, X, includes gender, age, economic family income, distance to work and distance from place of residence to the city centre. The second component, S, is a series of source region dummy variables. These dummy variables control for the possibility that immigrants from different regions have different propensities to commute on public transit, and allow us to take the changing source region composition of immigrant cohorts into account. The third component, T, is a linear term that denotes the number of years the immigrant has resided in Canada. The fourth component, C, is also a linear term that denotes the immigration cohort (where C=immigration year). A negative coefficient for β_3 would indicate that the probability of taking public transit to work declines as immigrants live in Canada longer (the "integration effect"). A positive coefficient for β_4 would indicate that more recent cohorts of immigrants have higher probabilities of commuting on public transit (the "cohort effect"). Because we are using only two census cross sections for this analysis, it is not possible to separate the effects of years since immigration, from the possible effects of the Vancouver transit strike.[7] Hence, we do not report results for Vancouver.

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[7]   Information on mode of transportation to work was not collected prior to the 1996 Census.

Table 6:
Cohort and integration effects – Montreal and Toronto

	Montreal		
	(1)	(2)	(3)
Time since immigration	-0.023*	-0.021*	-0.010*
	(0.001)	(0.001)	(0.003)
Cohort of immigration			0.011*
			(0.003)
N	111,443	111,443	111,443
log-likelihood	-63,052	-62,200	-62,191
	Toronto		
Time since immigration	-0.024*	-0.021*	-0.016*
	(0.000)	(0.001)	(0.002)
Cohort of immigration			0.005*
			(0.002)
N	383,904	383,904	383,904
log-likelihood	-197,893	-195,099	-195,095
Constant, age, female, distance to work, and distance from city centre controls	Yes	Yes	Yes
Country of origin controls	No	Yes	Yes

Results are presented in Table 6 for Montreal and Toronto. The first column shows results from the first two components of the model (i.e. gender, age, income, distance to work, and distance from the city centre, as well as years since arrival) and it confirms that among immigrants, the likelihood of commuting to work on public transit declines as individuals reside in Canada for longer periods of time. The second column shows the results when source region variables are added. To simplify the table, we have not presented the results for the source region dummy variables. However, readers should note that many of these variables are significant, indicating important differences between immigrants from different regions. Most importantly, the coefficients associated with years since arrival change very little from column 1 and column 2. This suggests that it is not a simple shift in source region that underlies the higher transit use among more recent immigrants. Column 3 adds the immigration cohort variable. This variable enters the model significantly in both CMAs, reducing the years since immigration effect in Montreal by about 50% and in Toronto by about 25%. This indicates that about one-half of the higher public transit usage rate among recent immigrants in Montreal is associated with higher usage rates among newer arrival cohorts – independent of how long they have resided in Canada. And in Toronto, about one-quarter of the higher public transit usage rate among newer arrival cohorts is associated with a cohort effects while the remainder is associated with an integration effect.

To put these results in more concrete terms, we computed predicted values from the regressions in column 3 of Table 6.[8] Predicted values from the model suggest that one year after immigration, 34.5% of Montreal workers who immigrated in 1990 commuted on public transit. Ten years later, only 30.7% from this cohort still commute to work, indicating a considerable integration effect. However, one year after immigration, 37.1% of Montreal workers who immigrated in 2000 commuted to work, indicating that the 2000 cohort of arrivals are 2.6 percentage points more likely to take public transit than the 1990 cohort (measured one year after immigration). Measured one year after immigration, Toronto immigrants from the 2000 cohort are 1.1 percentage points more likely to take public transit than immigrants in the 1990 cohort.[9]

5. *Conclusions*

In this study, we examine the rate of public transit use among immigrant commuters in Montreal, Toronto and Vancouver using data from the 1996 and 2001 censuses. Comparisons are drawn with Canadian-born commuters as well as across immigrant cohorts. We find that recent immigrants are much more likely than the Canadian-born to use public transit to commute to work even after controlling for age, gender, income, distance to work, and distance between place of residence and city centre. We find that two factors seem to explain this high rate of transit usage. First, immigrants tend to use public transit in their commute to work more when they are new to Canada (independent of other factors such as age and income), but their rate of transit use declines as they reside in Canada for longer periods of time. Second, newer cohorts of immigrants have higher rates of transit use than earlier cohorts, suggesting that they may be different in some way that we have not observed.

The high rate of public transit utilization among recent immigrants, coupled with the fact that immigration has become the most important source of population growth in many CMAs, has two important implications for public transit. First, projections for future public transit needs could take into account the fact that the urban population is not only growing, but that it is also compositionally shifting towards a high use group. Second, immigrants have a high use rate no matter how far away they live from the downtown core. Unlike earlier cohorts who initially settled in the downtown areas of CMAs, many immigrants in the 1980s and 1990s tended to settle directly in suburban areas (Balakrishnan and Hou, 1999, Myles and Hou, 2003). A shift in the geographic concentration of immigrants from urban core to outlying areas has implications for where public transit services should be located, especially in CMAs with centralized transit systems.

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[8]   These predictions are for men, with economic family income of $50,000 commuting 5 kilometres to work and living 10 kilometres from the city centre. The persons are aged 24 at time of immigration. For comparison purposes, a Canadian-born person residing in Montreal with the same characteristics is predicted to have a 24% probability of commuting on public transit at age 35 in 2001.

[9]   Predicted results from the Toronto model suggest that one year after immigration, 37.1% of workers from the 1990 cohort took public transit to work compared to 38.2% of workers from the 2000 cohort.

Appendix Table 1:
Percent of persons in Vancouver who use public transportation to commute to work, by immigration status and selected characteristics, 2001

	Canadian-born	Immigrated within past 10 years	Immigrated 11 to 20 years earlier	Immigrated more than 20 years ago	Total
Total	**11.4**	**21.1**	**14.7**	**11.0**	**13.1**
Gender					
Men	9.6	15.7	10.0	7.6	10.2
Women	13.2	26.2	19.1	14.6	15.9
Age Group					
15 to 29	15.0	23.8	18.4	16.1	16.7
30 to 39	10.6	21.1	12.7	11.5	13.1
40 to 49	9.2	17.6	12.8	9.9	11.0
50 to 59	8.6	19.6	15.2	10.7	10.6
Family Income					
$1 to $19,999	22.5	25.4	20.8	21.8	23.1
$20,000 to $39,999	16.9	21.7	17.1	15.6	17.9
$40,000 to $59,999	12.3	21.8	15.4	13.1	14.4
$60,000 to $79,999	10.0	20.1	13.8	10.8	11.8
$80,000 or more	7.9	17.5	12.4	8.2	9.1
Distance to Work					
Less than 5 km	9.8	18.5	12.5	8.7	11.3
5 to 9.9 km	13.2	24.2	17.4	12.9	15.4
10 to 19.9 km	10.7	21.7	14.3	10.3	12.6
20 km or more	13.3	21.2	15.4	13.9	14.4
Distance from City Centre					
0 to 2.9 km	36.6	46.3	42.7	32.1	37.6
3 to 5.9 km	40.2	58.5	47.4	36.8	42.5
6 to 9.9 km	31.6	51.6	40.5	29.6	34.1
10 to 14.9 km	22.3	46.8	34.5	24.8	24.5
15 to 19.9 km	16.1	27.0	22.1	15.8	16.7
20 km or more	7.3	22.8	15.9	10.2	7.8

Appendix Table 2:
Percent of persons in Montréal who use public transportation to commute to work,
by immigration status and selected characteristics, 2001

	Canadian-born	Immigrated within past 10 years	Immigrated 11 to 20 years earlier	Immigrated more than 20 years ago	Total
Total	20.9	48.6	35.5	24.5	23.6
Gender					
Men	16.9	41.0	26.9	16.2	19.0
Women	24.7	57.7	45.7	34.6	28.3
Age Group					
15 to 29	30.5	58.6	49.0	37.3	33.2
30 to 39	16.9	45.0	28.9	23.0	20.7
40 to 49	16.8	42.2	31.8	23.0	19.5
50 to 59	15.9	42.7	31.5	24.5	18.7
Family Income					
$1 to $19,999	35.8	61.5	53.6	40.2	40.5
$20,000 to $39,999	27.8	51.2	41.4	34.7	31.5
$40,000 to $59,999	20.1	44.7	34.2	24.9	22.8
$60,000 to $79,999	17.1	39.4	29.3	23.3	19.0
$80,000 or more	15.8	35.8	25.3	17.3	16.8
Distance to Work					
Less than 5 km	20.2	46.6	35.4	22.9	23.2
5 to 9.9 km	30.4	58.1	41.8	31.0	33.3
10 to 19.9 km	18.6	44.5	32.0	22.9	20.8
20 km or more	11.9	26.2	20.3	14.4	12.6
Distance from City Centre					
0 to 2.9 km	15.5	21.3	15.8	15.0	16.2
3 to 5.9 km	18.8	29.0	22.0	15.5	20.2
6 to 9.9 km	15.7	25.9	19.0	13.5	17.7
10 to 14.9 km	12.5	20.9	13.3	10.5	14.2
15 to 19.9 km	13.4	21.7	15.8	11.0	14.6
20 km or more	6.9	13.6	9.0	7.6	7.8

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