Dimensions and dynamics of residential segregation by income in urban Canada, 1991–1996

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This paper examines the trends in residential segregation by income (post-transfer, pretax income) in the thirty-nine largest Canadian urban areas between 1991 and 1996. The study is motivated by the relative lack of attention paid to residential segregation by income in the Canadian context and by conceptual arguments linking compromised life chances and increased social tensions for the populations of highly segregated cities. We investigated several dimensions of segregation using five different measures (we focus on three of these here given the correlation structure of the measures) to examine changes in segregation between 1991 and 1996, a period characterised by economic recession, cutbacks in social programs and a widening of inequality in market incomes at the national scale. Overall, income segregation increased in most urban areas across all dimensions of segregation during the time period, with particularly high degrees of segregation observed in

Cet article décrit l'évolution de la ségrégation économique au Canada du début au milieu des années '90. Cette étude est justifiée par l'absence relative d'attention portée à la ségrégation résidentielle basée sur les revenus dans un contexte canadien et par une argumentation conceptuelle qui met en relation l'augmentation des tensions sociales et la diminution des chances dans la vie pour les gens vivant dans des villes démontrant un plus haut niveau de ségrégation. L'approche consiste à décrire différentes dimensions de la ségrégation économique en calculant cinq mesures différentes. Ensuite, on étudie le changement observé dans ces mesures pour la période de 1991 à 1996 qui comprend une récession économique. De façon générale, la ségrégation économique a augmenté dans la plupart des villes et pour toutes les dimensions durant la période à l'étude alors qu'il n'y a pas de changement mesurable dans l'inégalité du revenu au niveau national. Les résultats suggèrent que la

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prairie cities (Winnipeg, Saskatoon and Regina). Of the three largest metropolitan areas (Vancouver, Toronto and Montréal), Montréal was the most consistently segregated. We also find that increases in spatial separation and spatial concentration by income occurred despite the fact that at the national scale, the tax and transfer system appeared to be adequately redressing a rise in inequality in labour and market incomes (as demonstrated by the lack of change in post-transfer national income inequality measures during a period when inequality in market and labour incomes rose sharply). This implies that the lived experience of changes in income distribution are unlikely fully captured by aspatial, national-scale measures and that intra-urban measures with a spatial dimension are an important indicators of inequality in Canadian society.

concentration et la séparation spatiales selon la situation socio-économique peuvent exister et être ressenties par les résidents des grandes villes canadiennes sans se refléter par une perturbation équivalente dans les mesures traditionnelles d'inégalité.

Introduction

The study of residential segregation has long been a staple of Anglo-American urban research. Racial segregation tends to be the overriding concern of studies of residential segregation in the United States (Farley *et al* 1978; Denton and Massey 1988; Logan and Alba 1995; Darden *et al*. 1997; Krivo *et al*. 1998; Alba *et al*. 2000; St. John and Clymer 2000). The few exceptions include Jargowsky's (1996) provocatively titled study of residential segregation by income (independent of race) and work by Waitzman and Smith (1998) examining the relationship between residential segregation by income and mortality in the thirty-three largest cities in the United States. As for Britain, the main emphasis often has been on the segregation of social classes, dating even before Frederick Engels' well-known descriptions of residential patterns in Manchester in the 1840s (Ley 1983).

In Canada, due mainly to changes in the social landscape produced by post-1970 immigration policy, segregation by ethnicity and immigration status has become the subject of most studies of urban residential segregation (Fong 1994, 1996; Hou and Balakrishnan 1996; Ley and Smith 1998; Murdie 1998; Ley 1999; Fong and Shibuya 2000; Bauder and Sharpe 2002). There has been a disproportionately small quantity of research that has focused explicitly on residential segregation in Canadian cities by income and/or class,[1] a condition that has existed for some time (Harris 1984). The few studies that do exist suggest that residential segregation by income increased in the late 1980s and early 1990s (Hajnal 1995; Bourne 1997) or, at the very least, that poverty is becoming more concentrated in Canadian cities (Maclavchlan and Sawada 1997; Kazemipur and Halli 2000;Myles *et al*. 2000).

This paper seeks to fill this gap by investigating temporal trends and spatial patterning of residential segregation by income in thirty-nine of Canada's largest urban areas for the period 1991–1996. During the period spanning 1991–1996, the combination of an economic recession and substantial cutbacks in social services, especially income transfer programs, contributed to the widespread perception that the gap between rich and poor was widening. However, when we examine trends in income inequality at the national level (as measured by the Gini coefficient) during that time period, we see that there was a steady rise in labour and market income inequality between 1991 and 1996, but that taxes and transfers succeeded in keeping post-transfer income inequality and disposable income inequality from increasing during the period (Figure 1). In fact, inequality in post-transfer

1 Although clearly, the separation and segregation of income groups has been a long time focus of those studying urban social ecology (Davies and Murdie 1993).

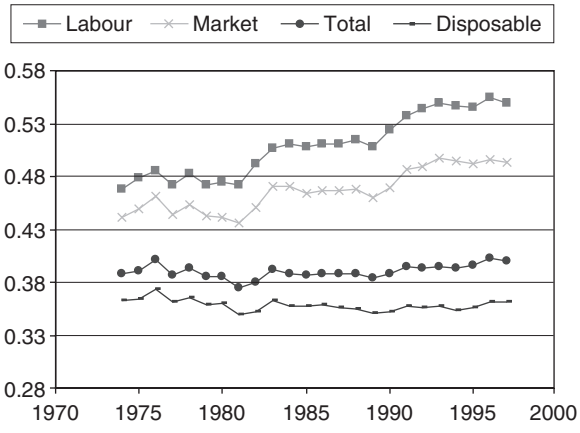

Figure 1
Trends in the Gini coefficient by income type in Canada, 1971–1997

family has remained more or less constant over the entire period from 1974 to 1997 (Wolfson and Murphy 1998). Perhaps, any perception of a widening gap between rich and poor is borne out of changes to urban neighbourhoods, in terms of their increasing economic homogeneity, despite what the national figures tell us about post-transfer, pretax income inequality.

Background and Rationale

As has been argued elsewhere (Wilson 1987; Mayer and Jencks 1989; Ross *et al.* 2002), the stark spatial separation of income groups within urban environments sets up the possibility that the most disadvantaged income groups will become spatially isolated from life-enhancing opportunities such as good quality education and emerging employment opportunities that are often located in high-growth suburban areas. Residential segregation by income can become particularly problematic in jurisdictions where there is heavy reliance on local property taxes for the funding of locally provided public goods and infrastructure. This effect is amplified in the American context because local governments bear a large social welfare burden and rely heavily on locally generated tax revenues, especially residential property taxes. The result has been the creation of substantial intra-metropolitan fiscal disparities and a highly uneven distribution of investment in public goods for U.S. cities (Orfield 1998, 2002).

Although residential segregation by income may have less severe consequences for investments in public goods in Canada than in the U.S. (due to lower levels of municipal fragmentation and municipal autonomy, lower reliance on property tax revenues relative to service responsibilities and more generous transfers of income from federal and provincial governments direct to individuals), it may still seriously undermine social cohesion and exacerbate social exclusion. One of the more damaging effects of segregation demonstrated in the U.S. is its capacity to undermine life chances by various measures, for example, adult employment outcomes, incarceration rates, welfare dependency, educational outcomes and teen pregnancies (Wilson 1987; Massey *et al.* 1991; Bauder 2001). Both elevated income inequality and income segregation have also been linked to high mortality rates for the working age population in U.S. metropolitan areas (Lynch *et al.* 1998; Ross *et al.* 2002), although the relationships were not evident for Canadian metropolitan areas (Ross *et al.* 2000, 2002). Despite the null findings for Canada, it is certainly theoretically possible that segregation may lead to reduced life chances for poorer individuals in Canadian cities as well.

It might also be argued that because neighbourhoods provide psycho-social benefits in terms of identity and belonging (Kearns and Parkinson 2001), the decline in income heterogeneity within a neighbourhood can lead to damaging stigmatisation and discrimination of residents living in neighbourhoods of high poverty concentration. This in turn has implications for democratic decision-making in that homogeneous neighbourhoods limit the opportunities for what Putnam (2000) has termed 'bridging social capital'. Bridging social capital—or the extension of high-quality reciprocal social relations to people who differ from one another on any number of characteristics—becomes far more difficult if urban residential environments limit the interactions of disparate economic groups. Instead, homogeneous neighbourhoods tend to foster bonding social capital, which solidifies social relationships between like individuals. Bonding social capital, in Putnam's words, 'bolsters our narrower selves' (Putnam 2000, 23) and therefore does little to enhance political decision-making based on a shared understanding of others' situations. In a 1996 essay, Massey goes so far as to make a rather dire

prediction along these lines, suggesting that, 'the juxtaposition of geographically concentrated wealth and poverty [in urban areas] will cause an acute sense of relative deprivation among the poor and heightened fears among the rich, resulting in rising social tension and a growing conflict between haves and have-nots' (Massey 1996, 395). A similar hypothetical future of Canadian cities has been described by Bunting and Filion (2001).

In sum, there are a number of important arguments for documenting changes in income segregation in the Canadian context. Not only has there been comparatively little research on residential segregation by income in Canada, but the conceptualisation and measurement of segregation has not been well developed. The relatively larger body of research in the U.S. is reflected in the sophisticated conceptualisation and measurement of segregation. In particular, Massey and Denton (1988) derived five empirically distinct dimensions of residential segregation using factor analysis. Three of these dimensions—evenness, concentration and centralisation—are focused upon in the following analysis to investigate changes in income segregation between 1991 and 1996 in thirty-nine Canadian metropolitan areas.

Methods

Income data

The data came from specially prepared microdata files of the 1991 and 1996 Census of Canada. The definition of household was the same for the two censuses: that is, the term refers to a person or group (related or unrelated) who share a common dwelling. Collective households, such as hospitals, jails, army camps, nursing homes, hotels and motels, were excluded from the analysis. The income definition used in both Censuses of Canada includes income from the following sources: total wages and salaries; net self-employment income (non-farm); net farm self-employment income; family allowances; federal child tax credits; Old Age Security pension and Guaranteed Income Supplement; benefits from Canada or Québec Pension Plan; benefits from Unemployment Insurance; other income from government sources; dividends and interest on bonds, deposits, savings certificates and other investment income; retirement pensions, superannuation and annuities; and other money income.

Defining the minority group

Segregation indices were calculated for thirty-nine Canadian urban areas[2] with populations over 50,000 and with census tract level information available. A key concept in the development of segregation indices is the definition of the 'minority group'. In the case of income segregation, the minority group is typically defined as households below some low-income threshold. In the present analysis, a household was considered low income if its total post-transfer, pretax income was less than half the median household income for households with the same number of people in the urban area in which the household was located. In each urban area, separate cutpoints for seven different sizes of household (i.e., one-person, two-person to seven or more persons) were calculated. Each household in the metro area was then classified as a member of the minority group if its income was below half the median for households of the same size in the metro area. Table 1 summarises the importance of using household-size-specific cutpoints in each metro area. The cutpoints vary widely by metropolitan area for a given household size (e.g., min = $ 26,986, max = $ 35,287, SD = $ 2,328 for four-person households), and the differences between cutpoints for differently sized households are substantial. For example, comparing the two columns of Table 1 shows that the difference in the cutpoint between one-person and four-person households is approximately $ 20,000 for most Canadian urban areas.

The definition of minority group we are using is a relative measure of low income and, in a country with large variations in both metropolitan labour markets and the cost for food and housing and other subsistence goods, a relative definition of low income is more appropriate than an absolute measure. Moreover, relative measures such as this one enhance the prospects for international comparisons.

2 The thirty-nine urban areas are formally termed census metropolitan areas and census agglomerations by Statistics Canada. In the paper, the terms urban area and metropolitan area are used interchangeably to represent this group of CMAs and CAs.

Table 1
Minority group (low income) cutpoints for single- and four-person households in thirty-nine Canadian urban areas, 1996

	Single-person household	Four-person household
St. John's	$8,334	$28,352
Halifax	$9,951	$29,951
Moncton	$8,742	$27,227
Saint John	$8,332	$27,570
Chicoutimi-Jonquière	$7,219	$26,986
Québec	$8,466	$29,736
Sherbrooke	$7,323	$27,061
Trois-Rivières	$6,994	$27,849
Montréal	$8,320	$28,756
Hull/Ottawa	$12,688	$34,557
Kingston	$10,152	$30,962
Peterborough	$8,399	$29,315
Oshawa	$11,696	$35,287
Toronto	$12,152	$32,940
Hamilton	$9,703	$34,159
St. Catharines-Niagara	$8,608	$30,594
Kitchener	$10,559	$32,363
Brantford	$8,553	$28,719
Guelph	$10,652	$32,405
London	$10,152	$32,050
Windsor	$9,731	$35,249
Sarnia	$10,159	$32,839
North Bay	$8,160	$29,366
Sudbury	$8,423	$33,020
Sault Ste. Marie	$8,196	$31,331
Thunder Bay	$9,652	$34,003
Winnipeg	$9,152	$29,239
Regina	$10,686	$31,095
Saskatoon	$8,754	$28,317
Lethbridge	$8,779	$28,785
Calgary	$11,680	$32,274
Red Deer	$9,499	$29,926
Edmonton	$10,152	$30,033
Kelowna	$9,152	$28,058
Kamloops	$9,592	$30,719
Abbotsford	$8,976	$29,877
Vancouver	$11,152	$30,961
Victoria	$10,817	$31,869
Prince George	$13,072	$32,666
Minimum	$6,994	$26,986
Maximum	$13,072	$35,287
SD	$1,459	$2,328

Segregation indices

For more than twenty years, the dissimilarity index (Duncan and Duncan 1955) served as the standard segregation measure, routinely employed to measure spatial separation between social groups. In the late 1970s, the publications of a review of segregation measures and a critique of the dissimilarity index by Cortese *et al.* (1976, 1978) indirectly sparked new thought on the issue of measurement and, in turn, the conceptualisation of residential segregation. In 1988, Massey and Denton distilled twenty potential measures of racial residential segregation into five basic dimensions of spatial variation, using the five axes from a factor analysis based on sixty U.S. metropolitan areas. The five axes were described as evenness, exposure, concentration, centralisation and clustering.

Evenness is the degree to which the percentage of minority members within residential areas approaches the minority percentage of the entire urban area; as areas depart from the ideal of evenness, segregation increases. *Exposure* is the degree of potential contact between minority and majority members within neighbourhoods; it reflects the extent to which groups are exposed to one another by virtue of sharing common residential areas. *Concentration* is the relative amount of physical space occupied by a minority group. As segregation increases, minority members are confined to increasingly compact geographical areas. *Centralisation* is the degree to which minority members settle in and around the centre of an urban area, usually defined as the primary intersection of the central business district. The intersections of streets that best identify the central business district were located by telephone interviews with planning officials in each of the thirty-nine urban areas in the study. These intersections were then geocoded for the calculation of the centralisation index. *Clustering* is the extent to which minority areas adjoin one another in space. It is maximised when minority neighbourhoods cohere to form one large, contiguous ghetto and is minimised when they are scattered widely in space, as on a checkerboard.

Massey *et al.* (1996) recommend a single best indicator for each segregation dimension based on their update of the original Massey and Denton (1988) study. Their recommendations come from an empirical analysis of 318 metropolitan areas using the 1990 U.S. Census. These five best indicators were calculated for the work presented here. Specifically, these measures and the dimensions they represent are as follows: the index of dissimilarity (*D*) (evenness); the isolation index (*xP*y*) (exposure); the relative concentration index (*RCO*) (concentration); the absolute centralisation index (*ACE*) (centralisation) and White's index of spatial proximity (*SP*) (clustering). Detailed definitions and formulas are found in the Appendix.

Results

Correlation structure of the measures

Although five dimensions were extracted from segregation analyses of U.S. data, the correlation structure for the leading indicators on these five dimensions would suggest only three identifiable dimensions for Canadian income segregation (Table 2). The indices representing evenness (*D*), exposure (*xP*y*) and clustering (*SP*) were very highly correlated (Pearson correlation coefficients all 0.76 or higher), indicating that they effectively capture the same dimension of segregation for Canadian cities. On the other hand, the indices representing concentration (*RCO*) and centralisation (*ACE*) were not highly correlated with the other indices, suggesting that concentration and centralisation are empirically distinct dimensions of income segregation in the Canadian context. Given the correlation structure, we focus on results for evenness, concentration and centralisation.

The dimensions of income segregation, 1991

In 1991, the most segregated metropolitan area, on average, was Winnipeg MN (Table 3). Winnipeg ranked near the top (most segregated) for many of the measures and was the metropolitan area with the greatest uneven distribution and clustering of its low-income residents. Regina and Saskatoon, two other major prairie urban areas, also were highly segregated by income as indicated by their mean rankings, 8.7 and 11.3, respectively. Winnipeg, Regina and Saskatoon each have large Aboriginal populations, which is highly suggestive of an interaction between ethnicity and socioeconomic position in the creation of the spatial patterns of residential segregation in these urban areas.

Of the three most populous metropolitan areas (Toronto, Montréal and Vancouver), Montréal was the most highly segregated by income. This fits with previous studies using another measure of income segregation (Ross *et al.* 2002). Montréal ranked in the top ten on all three dimensions of segregation and was particularly high in concentration, suggesting that poorer households reside in a relatively compact amount of urban space in that city (see page 439). Other studies have shown that Montréal has the lowest degree of residential sprawl of any city in North America (Razin and Rosentraub 2000). Montréal, furthermore, is situated on an island, which also likely restricts sprawl and possibilities for the spread of low-income neighbourhoods outside of the inner city. Toronto also ranks near the top on both unevenness and concentration but is very low on the centralisation measure and drops its overall score. This low score

Table 2
Correlations between segregation indices in thirty-nine Canadian urban areas, 1991

	Evenness (index of dissimilarity)	Exposure (isolation index)	Concentration (relative concentration index)	Centralisation (absolute centralisation index)	Clustering (spatial proximity index)
Evenness (index of dissimilarity)	1.00	0.77	0.41	0.36	0.86
Exposure (isolation index)	0.77	1.00	0.24	0.28	0.76
Concentration (relative concentration index)	0.41	0.24	1.00	0.00 (approximately)	0.38
Centralisation (absolute centralisation index)	0.36	0.28	0.00 (approximately)	1.00	0.28
Clustering (spatial proximity index)	0.86	0.76	0.38	0.29	1.00

on centralisation for Toronto likely reflects the spread of low-income neighbourhoods outside of the traditional downtown core into older suburban areas.

Both Toronto and Montréal (along with Vancouver), however, share the relatively unique feature (at least by North American standards) of the enduring presence of elite neighbourhoods in their downtown cores (Ley 1993). The extent to which this exacerbates the overall degree of residential segregation by income for these urban areas is unknown but will be illuminated better by planned future Canada–U.S. comparative work on the degree of urban income segregation in the two countries.

Beyond the largest urban areas, Ottawa-Hull ON/QC, Hamilton ON, and Calgary AB also had distinct configurations. Ottawa-Hull ranked second and third on unevenness and centralisation, respectively, but ranked very low (twenty-seventh) on concentration. Ottawa-Hull is a bit of an exceptional case, however, given that the indicators changed quite dramatically when analyses were conducted for Ottawa and Hull separately (data not shown). This is the only metropolitan area that crosses a provincial boundary, and although there are strong economic ties between the two cities, variations in the provincial tax policy, cost of living differences and non-cash provincial benefit structures may make it problematic to use the same cutpoint for defining the minority group across the entire metropolitan area. Hamilton's pattern was somewhat like its large neighbour Toronto in that it shows a relatively high pattern of unevenness and concentration of poor census tracts, but these areas are not centralised. Calgary ranked first in centralisation which echoes the findings for other prairie cities, but does not share with Winnipeg the high scores on unevenness or concentration. Sherbrooke QC and Windsor ON are the most segregated, on average, of the smaller urban areas. Urban areas scoring the lowest on indices of income segregation (Kelowna BC, Abbotsford BC, Chicoutimi-Jonquiere QC, Moncton NB and Sudbury ON) were all counted among the smaller cities.

The dynamics of income segregation, 1991–1996

Sudbury ON, Kingston ON and Regina SK scored the largest increases in unevenness in the distribution of low-income households during the period while St. John NB, Sarnia ON and Red Deer AB had the largest increases in the concentration of low-income households (Table 4). Kamloops BC, Kelowna BC and St. John had the largest increases in the centralisation of low-income households between 1991 and 1996. On average, St. John NB was the Canadian metropolitan area with the largest increase in income segregation between 1991 and 1996 across the multiple dimensions. Generally, urban areas with the largest increases were those that were not already relatively highly segregated in 1991, and these tended also to be among the smaller metropolitan areas. Metropolitan areas like Guelph ON, Sherbrooke QC and Lethbridge AB showed comparatively little increase in income segregation during the same period. As for the largest Canadian metropolitan areas, Toronto showed comparatively large increases in both the unevenness and the concentration of low-income households. On the other hand, Toronto measured the lowest increase in centralisation, suggesting that while poverty is relatively concentrated in Toronto, it is not as centralised as poverty in Montréal, and poverty did not become more centralised in Toronto during the early mid-

Table 3
Scores and ranks on multiple dimensions of segregation in thirty-nine Canadian urban areas, 1991

	Unevenness (*D*)		Concentration (*RCO*)		Centralisation (*ACE*)		
Urban area	**Raw**	**Rank**	**Raw**	**Rank**	**Raw**	**Rank**	**Average ranking**
St. John's	0.23	14	0.06	29	0.11	22	21.7
Halifax	0.22	18	0.04	30	0.14	6	18.0
Moncton	0.19	31	−0.10	39	0.10	27	32.3
Saint John	0.25	11	0.01	36	0.11	20	22.3
Québec	0.25	9	0.19	20	0.13	9	12.7
Sherbrooke	0.27	5	0.33	6	0.13	8	6.3
Chicoutimi-Jonquière	0.19	30	−0.08	38	0.09	31	33.0
Trois-Rivières	0.19	29	0.04	31	0.12	14	24.7
Montréal	0.26	7	0.34	5	0.13	10	7.3
Hull/Ottawa	0.30	2	0.10	27	0.16	3	10.7
Kingston	0.25	10	0.28	10	0.12	15	11.7
Peterborough	0.21	23	0.27	12	0.11	21	18.7
Oshawa	0.24	13	0.22	18	0.11	18	16.3
St. Catharines-Niagara	0.21	24	0.17	23	0.05	35	27.3
Toronto	0.27	4	0.32	7	−0.11	39	16.7
Hamilton	0.27	6	0.37	2	0.11	23	10.3
Brantford	0.22	20	0.22	17	0.09	30	22.3
Guelph	0.19	32	0.29	9	0.11	24	21.7
Kitchener	0.19	28	0.26	14	0.06	33	25.0
London	0.20	25	0.38	1	0.11	19	15.0
Sarnia	0.23	16	0.01	34	0.13	11	20.3
Windsor	0.29	3	0.36	4	0.12	13	6.7
North Bay	0.18	33	0.11	26	0.12	16	25.0
Sudbury	0.16	38	0.19	21	−0.06	38	32.3
Sault Ste. Marie	0.18	34	0.17	24	0.09	29	29.0
Thunder Bay	0.20	27	0.20	19	0.12	17	21.0
Winnipeg	0.32	1	0.37	3	0.14	7	3.7
Regina	0.25	8	0.27	13	0.14	5	8.7
Saskatoon	0.23	17	0.25	15	0.16	2	11.3
Edmonton	0.24	12	−0.02	37	0.15	4	17.7
Lethbridge	0.18	35	0.24	16	0.02	36	29.0
Red Deer	0.20	26	0.01	35	0.05	34	31.7
Calgary	0.23	15	0.14	25	0.16	1	13.7
Kelowna	0.14	39	0.02	32	0.01	37	36.0
Kamloops	0.18	36	0.18	22	0.10	26	28.0
Prince George	0.21	21	0.27	11	0.12	12	14.7
Abbotsford	0.17	37	0.02	33	0.08	32	34.0
Vancouver	0.22	19	0.30	8	0.11	25	17.3
Victoria	0.21	22	0.10	28	0.10	28	26.0

Higher scores indicate higher segregation.
SOURCE: Specially prepared microdata file of the 1991 Census of Canada.

1990s. Although Vancouver ranked fairly high in 1991 concentration, there was comparatively little change in any of the dimensions over the period.

Overall, the story of residential segregation by income in Canada's largest urban areas during the early mid-1990s was one of a rise in the spatial separation of income groups across the urban landscape (Table 5). The increase in segregation occurred in most urban areas and for most of the dimensions of segregation throughout the period. Indeed, there was an increase in the spatial unevenness of low-income households in more than two-thirds of the metropolitan areas, an increase in the spatial concentration of low-income households in more than 70 percent of the metropolitan areas and an increase in the centralisation

Table 4
Raw scores, percent and rank change scores across dimensions of segregation in thirty-nine Canadian urban areas, 1991–1996

	Unevenness (*D*)				Concentration (*RCO*)				Centralisation (*ACE*)			
Urban area	**1991**	**1996**	**% change**	**Rank**	**1991**	**1996**	**% change**	**Rank**	**1991**	**1996**	**% change**	**Rank**
St. John's	0.23	0.24	2	21	0.06	0.14	119	8	0.11	0.11	−3	37
Halifax	0.22	0.24	6	13	0.04	0.21	407	6	0.14	0.15	5	32
Moncton	0.19	0.22	15	4	−0.10	0.01	−113	38	0.10	0.11	15	8
Saint John	0.25	0.28	13	5	0.01	0.21	3,409	1	0.11	0.14	21	3
Chicoutimi-Jonquière	0.19	0.18	−4	32	−0.08	−0.09	18	19	0.09	0.10	19	6
Québec	0.25	0.25	−2	28	0.19	0.29	47	12	0.13	0.15	14	12
Sherbrooke	0.27	0.25	−8	34	0.33	0.25	−23	34	0.13	0.14	4	34
Trois-Rivières	0.19	0.19	−2	29	0.04	0.21	442	5	0.12	0.14	15	9
Montréal	0.26	0.27	4	18	0.34	0.36	5	26	0.13	0.14	11	21
Hull/Ottawa	0.30	0.31	3	19	0.10	0.16	57	11	0.16	0.17	7	28
Kingston	0.25	0.29	16	2	0.28	0.41	46	13	0.12	0.14	13	15
Peterborough	0.21	0.20	−5	33	0.27	0.20	−24	35	0.11	0.12	5	31
Oshawa	0.24	0.25	5	16	0.22	0.30	35	15	0.11	0.13	10	23
Toronto	0.27	0.29	6	14	0.32	0.42	31	16	−0.11	−0.13	−17	39
Hamilton	0.27	0.29	9	11	0.37	0.38	2	27	0.11	0.12	12	19
St. Catharines-Niagara	0.21	0.21	2	22	0.17	0.19	13	23	0.05	0.05	14	10
Kitchener	0.19	0.20	6	15	0.26	0.31	18	20	0.06	0.07	21	5
Brantford	0.22	0.22	1	26	0.22	0.21	−8	31	0.09	0.10	13	16
Guelph	0.19	0.15	−7	37	0.29	0.24	−15	33	0.11	0.11	4	33
London	0.20	0.21	5	17	0.38	0.45	20	18	0.11	0.13	12	17
Windsor	0.29	0.28	−3	30	0.36	0.32	−10	32	0.12	0.13	10	24
Sarnia	0.23	0.26	13	7	0.01	0.29	1,939	2	0.13	0.14	7	30
North Bay	0.18	0.20	10	9	0.11	0.13	15	22	0.12	0.14	14	11
Sudbury	0.16	0.22	37	1	0.19	0.19	−1	28	−0.06	−0.06	12	18
Sault Ste. Marie	0.18	0.14	−20	38	0.17	0.06	−65	36	0.09	0.11	21	4
Thunder Bay	0.20	0.21	8	12	0.20	0.28	42	14	0.12	0.13	12	20
Winnipeg	0.32	0.32	1	23	0.37	0.36	−2	29	0.14	0.15	9	26
Regina	0.25	0.30	16	3	0.27	0.50	87	10	0.14	0.15	9	25
Saskatoon	0.23	0.25	12	8	0.25	0.32	31	17	0.16	0.17	7	29
Lethbridge	0.18	0.18	1	24	0.24	0.23	−7	30	0.02	0.03	2	35
Calgary	0.23	0.24	1	25	0.14	0.29	105	9	0.16	0.15	−5	38
Red Deer	0.20	0.22	10	10	0.01	0.09	1,311	3	0.05	0.06	19	7
Edmonton	0.24	0.24	−1	27	−0.02	0.15	−681	39	0.15	0.15	1	36
Kelowna	0.14	0.12	−5	36	0.02	0.10	308	7	0.01	0.01	41	2
Kamloops	0.18	0.20	13	6	0.18	0.02	−89	37	0.10	0.15	49	1
Abbotsford	0.17	0.13	−4	39	0.02	0.09	451	4	0.08	0.09	13	14
Vancouver	0.22	0.21	−3	31	0.30	0.35	16	21	0.11	0.12	8	27
Victoria	0.21	0.19	−9	35	0.10	0.11	9	24	0.10	0.11	13	13
Prince George	0.21	0.22	3	20	0.27	0.29	9	25	0.12	0.14	11	22

Positive values indicate an increase in segregation.
SOURCE: specially prepared microdata files of the 1991 and 1996 censuses of Canada.

of low-income households in all but four (90 ninety percent) of the metropolitan areas.

Discussion

Our objective in this paper was to provide a comprehensive characterisation of income segregation in Canadian urban areas in the early to mid-1990s. To do so, we used a variety of indices to capture multiple dimensions of segregation and measured these indices across two time periods, over the span of a major economic recession. The study was motivated by theoretical arguments suggesting that the separation of urban space into isolated pockets of affluence and poverty may be compromising the quality of everyday urban life,

Table 5
Summary of changes across multiple dimensions of segregation in thirty-nine Canadian Urban areas, 1991–1996*

	Evenness (index of dissimilarity)	Concentration (relative concentration index)	Centralisation (absolute centralisation index)
St. John's	+	+	–
Halifax	+	+	+
Moncton	+	+	+
Saint John	+	+	+
Chicoutimi-Jonquière	–	–	+
Québec	–	+	+
Sherbrooke	–	–	+
Trois-Rivières	–	+	+
Montréal	+	+	+
Hull/Ottawa	+	+	+
Kingston	+	+	+
Peterborough	–	–	+
Oshawa	+	+	+
Toronto	+	+	–
Hamilton	+	+	+
St. Catharines-Niagara	+	+	+
Kitchener	+	+	+
Brantford	+	–	+
Guelph	–	–	+
London	+	+	+
Windsor	–	–	+
Sarnia	+	+	+
North Bay	+	+	+
Sudbury	+	–	–
Sault Ste. Marie	–	–	+
Thunder Bay	+	+	+
Winnipeg	+	–	+
Regina	+	+	+
Saskatoon	+	+	+
Lethbridge	+	–	+
Calgary	+	+	–
Red Deer	+	+	+
Edmonton	–	+	+
Kelowna	–	+	+
Kamloops	+	–	+
Abbotsford	–	+	+
Vancouver	–	+	+
Victoria	–	+	+
Prince George	+	+	+
Percent change in expected direction	66.67	71.79	89.74

*1991 values subtracted from 1996.
+ indicates an increase; –indicates a decrease.

economic opportunity, social relations and health of urban residents. Moreover, although increases in national-level labour and market income inequality appear to be redressed by the Canadian tax and transfer system, our findings suggest that increasing market and labour income inequality appears to be expressed spatially in urban Canada, as indicated by rising segregation on multiple measures in most of the thirty-nine largest urban areas in the country between 1991 and 1996.

We estimate that our findings are conservative. It is possible that we have underestimated the extent of the changes occurring in Canadian cities given that we compared the segregation of low-income

households from non-poor households. If we had compared the segregation of the most affluent households compared to lower income households, we may have witnessed an even larger increase in neighbourhood polarisation. There is the broad scope for future work that could examine the sensitivity of these segregation measures to the definition of minority and comparison groups.

In this paper, we have effectively characterised Canadian income segregation during the early 1990s here, but we have not attempted any systematic explanation of the patterns. Clearly, there is a need to further explore the role of local real estate markets, new housing development and the particular municipal governance and socioeconomic contexts of the individual urban areas studied to clarify both their relative positions at the outset of the study and the changes that occurred in the early mid-1990s. Urban economic cleavages are also interwoven with demographic, ethnic and lifestyle cleavages (Ley 1983) that require much more detailed analyses than those presented here. Future work will examine the determinants of income segregation and income segregation dynamics in Canada. The theoretical links between segregation and health will also be examined in future work that will compare income segregation in the U.S. and Canada, with a more in-depth analysis of the links between segregation and health in a North American context.

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Appendix (based on Massey and Denton 1988)

Formulas and definitions of specific indexes

The *Index of Dissimilarity* (*D*) measures departure from a perfectly even distribution of low-income households throughout a city's census tracts by taking the weighted mean absolute deviation of every census tract's proportion of the low-income population from the city's proportion of the low-income population and expressing this quantity as a proportion of its theoretical maximum (James and Taueber 1985). This index conceptually represents the proportion of low-income households that would have to move out of their current residential areas to achieve an even distribution. The number of low-income households needing to move is expressed as a proportion of the number that would have to move under conditions of maximum segregation (Jakubs 1977, 1981).

$$D = \sum_{i=1}^{n} \left[\frac{t_i \times |p_i - P|}{2TP(1-P)} \right]$$

where t_i and p_i are the total population and proportion of low-income households of census tract i and T and P are the population size and proportion of low income of the whole city, which is subdivided into n census tracts.

The formula for the *Relative Concentration Index* (*RCO*) is as follows:

$$RCO = \frac{\left[\left(\sum_{i=1}^{n} x_i a_i \Big/ X \right) \Big/ \left(\sum_{i=1}^{n} y_i a_i \Big/ Y \right) \right] - 1}{\left[\left(\sum_{i=1}^{n} t_i a_i \Big/ T_i \right) \Big/ \left(\sum_{i=n_2}^{n} t_i a_i \Big/ T_2 \right) \right] - 1}$$

where the areal units (census tracts) are ordered by geographic size from the smallest to the largest, a_i being the land area of unit i, and the two numbers n_1 and n_2 referring to different points in the rank ordering. The rank of the census tract where the cumulative total population of areal units equals the total minority population of the city, summing from the smallest unit up is n_1 and n_2 is the rank of the tract for which the cumulative total population of units equals the minority population summing from the largest unit down. T_1 represents the total population of tracts from 1 to n_1 and T_2 from n_2 to n. T_i refers to the total population of area i and X the number of group-X members (low income) in the city. This index represents the ratio of X members' (low income) to Y members' (non-low income) concentration and compares it with the maximum ratio that would be obtained if X were maximally concentrated and Y minimally concentrated. The quotient is standardised such that the index varies between -1.0 and 1.0. A score of 0 indicates that the two groups are equally concentrated in urban space. A score of -1.0 means that Y's concentration (the non-low-income households) exceeds X's (the low-income households) to the maximum extent possible, and, of course, a score of 1.0 would mean the converse. In other words, the relative concentration index measures the share of urban space occupied by low-income households compared to that share of urban space occupied by non-low-income households.

The *Absolute Centralisation Index* (*ACE*) measures a group's spatial distribution compared to the distribution of land area around the city centre. The formula for the *ACE* is as follows:

$$ACE = \left(\sum_{i=2}^{n} X_{i-1} A_i \right) - \left(\sum_{i=2}^{n} X_i A_{i-1} \right)$$

where the areal units (census tracts) are ordered by increasing distance from the central business district and A_i refers to the cumulative proportion of land area through unit i. X_i and Y_i are the respective cumulative proportions of X's (low-income households) and Y's (non-low-income households) population in tract i. This index varies between 1.0 and -1.0. Positive values indicate a tendency for group X members (low income) to reside close to the city centre, while negative values indicate a tendency for low-income households to occupy outlying areas. A score of 0 would mean that a group has a uniform distribution throughout the metropolitan area. A unique property of the *ACE* is that it represents the proportion of low-income households that would be required to change residence to achieve a uniform distribution of households around the central business district.