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# Can Rust Belt or Three Cities Explain the Sociospatial Changes in Atlantic Canadian Cities?

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Research on American secondary cities has largely focused on so-called "rust belt" cities and has found that they tend to have economic stagnation, racialization, and urban decay in their urban cores occurring after economic crises. Most urban research on Canadian cities has, by contrast, focused on the country's largest cities, Toronto, Montreal, and Vancouver, and has found that urban cores are getting richer, less diverse, and undergoing infrastructural improvements. We examine each model by looking at four secondary Atlantic Canadian cities (Halifax, Moncton, St. John's, and Charlottetown) that all faced major economic crisis in the 1990s to see whether these models can explain the sociospatial changes occurring in them. Analysis of 1996 and 2006 Canadian Census data finds unlike "rust belt" cities or changes seen in larger Canadian cities, there is no clear sociospatial concentration of change. Rather, change is seen through "hot spots" of economic and physical characteristics of neighborhoods.

## INTRODUCTION

Few studies analyze the impact of economic crises on secondary cities and the sociospatial changes occurring in their aftermath. Of the research that does exist, much has focused on American "rust belt" cities, which tend to experience a "hollowing out" of their urban core with an increase in poverty, decaying infrastructure, and population decline linked to it (Bluestone and Harrison 1982; Deitrick 2015; Hackworth 2016). The model has rarely been applied to cities in other countries or smaller regional cities. Studies looking

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at sociospatial transformation in Canadian cities over the last 30 years, by contrast, have focused on the largest urban centers and have found an emergence of a "three cities within a city" pattern, where urban cores have become increasingly affluent, less racially diverse, and experience rapid renewal and expansion of infrastructure. This is known as the "three cities" model (Hulchanski 2010). Yet, the model focuses on economically prosperous cities and the largest metropolitan centers and has not been applied to smaller secondary cities.

The patterns of urban change in midsized cities in Canada may deviate from those of the country's three largest cities (Toronto, Montreal, and Vancouver), which are characterized by the "three cities" model. Unlike these economically prosperous cities, many midsized cities in Canada are stagnating or declining as a result of economic restructuring and deindustrialization (Filion 2010). Some research shows that their urban cores are decentralized, and economic revitalization projects such as the development of downtown shopping malls have failed (Filion and Hammond 2008). Meanwhile, areas outside the urban cores are commercially successful, with suburban malls and major retail stores being built near highways (Bunting et al. 2007). Moreover, midsized cities are less diverse and have until recently been unsuccessful in attracting and retaining immigrants (Carter et al. 2008). Given that midsized cities (defined here as metropolitan areas with a population of 50,000–500,000) are home to a quarter of Canada's population, it is important to shed light on this understudied urban landscape (Lewis and Donald 2010).

To address these gaps, we examine how four midsized Atlantic Canadian cities (Halifax, Nova Scotia; St. John's, Newfoundland and Labrador; Moncton, New Brunswick; and Charlottetown, Prince Edward Island) changed after facing economic crisis and assess whether the "rust belt" or "three cities" models can help us understand the sociospatial changes they experienced. We analyze broad economic, sociocultural, and structural dimensions of change, focusing on sociospatial patterns between 1996 and 2006, which captures a 10-year period immediately following economic collapse in the region.

The paper begins by reviewing the literature on urban change and the "rust belt" and "three cities" models. Next, it describes the data and methods used and then reports results. It ends with a discussion that offers conclusions on the expendability of the "rust belt" and "three cities" models.

## UNDERSTANDING URBAN CHANGE

Much of the literature on urban change focuses on major cities like New York, London, or Toronto with far less scholarship on secondary centers. Of the research that looks at secondary centers, much is concentrated on "rust belt" cities that identify patterns of economic, social and cultural, and physical change as a result of economic disruption. The model has rarely been applied outside of the United States. The same dimensions are also examined by those looking at change in Canadian cities through the "three cities" model, which examines economic inequality in the country's largest urban centers. That model, however, has rarely been applied to secondary centers.

Research on midsize "rust belt" cities, such as Cleveland, Pittsburgh, Buffalo, and Detroit, shows that economic downturns and deindustrialization led to a "hollowing out" of their urban cores (Haller 2004; Linkon 2013; Perry and McLean 1991; Warf and Holly

1997). A consistent narrative across studies is the labeling of cities as part of the "rust belt" after the once-thriving city centers became impoverished ghost towns and "shrinking cities" (Deitrick 2015; Hobor 2012). Research on Chicago and Pittsburgh, for example, documented "middle-class flight" from the inner city (Morenoff and Sampson 1997; Rose and Twigge-Molecey 2013). Hartley (2013) found that 45 percent of the population was lost from Buffalo, Cleveland, Detroit, and Pittsburgh between 1970 and 2006, and these cities also experienced a significant drop in average household incomes over the 36-year period.

The Canadian counterparts of rust belt cities are concentrated in Southern Ontario, including cities such as Hamilton, Windsor, and London, which historically transitioned from agriculture-oriented small towns to manufacturing cities and then deindustrialized after the mid-20th century as a result of plant closures (Hackworth 2016). Although there is evidence of urban decline in such Canadian rust belt cities, these cities did not witness pronounced urban decline (e.g., land abandonment, depopulation), which was seen in their U.S. counterparts (Eyles 2013; Hackworth 2016; High 2003). Reasons include the lack of racial segregation, geographic proximity to the financial/economic hub of Toronto, and less reliance on a single manufacturing industry (Hackworth 2016; High 2003).

Those looking at change in Canadian cities have tended to focus on neighborhoods in Canada's largest cities (Hulchanski 2010; Ley and Lynch 2012; Prouse et al. 2014; Walks 2013). In analyzing income change in Toronto between 1970 and 2005, for example, Hulchanski (2010) found that the city transformed into a "three-city" archetype, where sociospatial polarization of income characterized "three cities within a city." In the model, "city #1," the urban core, became a predominantly high-income area, with average individual incomes rapidly rising (Hulchanski 2010). In the outskirts of the city, neighborhood incomes had fallen substantially and were trending downward and were labeled "city #3." Between the outskirts and the core was "city #2," where incomes remained more or less in the middle and were not significantly trending upward or downward. The model has been applied to Vancouver and Montreal, both of which are larger cities (Ley and Lynch 2012; Rose and Twigge-Molece 2013). It has also been applied to Halifax (see Prouse et al. 2014) and a few other major centers, but the clear pattern found by Hulchanksi (2010) was not present across all cities. The model, moreover, has not been examined across other secondary Canadian cities or smaller regional cities.

The "rust belt" and "three cities" models also consider social and cultural changes that occur in urban areas. Rust belt studies generally show a pattern of increasing racialization in urban cores related to "white flight," population loss, and economic downturn. Looking at the case of Detroit, Farley et al. (2007) documented that white residents moved out of the urban core in the face of economic downturn. Studies of Cleveland, Milwaukee, Pittsburgh, and Youngstown also reveal "white flight" from the inner city, followed by the population decline of more affluent and middle-class black residents (Boardman and Field 2002; Deitrick 2015; Rhodes 2013). However, in Chicago, research has shown both black and white populations in the inner city declined simultaneously (Morenoff and Sampson 1997). Despite the complex demographic changes occurring in rust belt cities, population loss in the rust belt appears to be initiated by white, young to middle-aged residents fleeing the inner city neighborhoods around the period of deindustrialization (1970–1980) (Deitrick 2015; Morrison 2003).

The "three cities" model also sees a rapid change in the racial composition of the urban core, yet in the reverse direction. In Canada's largest population centers, white residents have come to dominate the inner city (Ley and Lynch 2012; Murdie 2008). This trend is partly explained by the geographies of immigration settlement. In 2006, new immigrants in Toronto were settling in the suburbs as opposed to the urban core, which is a shift from earlier periods (Murdie 2008). When the model was applied in Halifax, a secondary city, the pattern was less pronounced (Prouse et al. 2014).

Another set of factors examined in the "rust belt" and "three cities" models is physical infrastructure. In the "rust belt" model, research has found an increase in land abandonment and dilapidated houses as key features of the urban cores of rust belt cities (Deitrick 2015; Hackworth 2016; Hackworth and Nowakowski 2015; Linkon 2013). Despite signs of recovery and urban revitalization in recent decades, rust belt cities all experienced urban decay immediately after economic crisis (Hackworth and Nowakowski 2015). Analyses of the "rust belt" model in cities in Southern Ontario showed that the same urban decay of infrastructure did not occur in Canada (Eyles 2013; Hackworth 2016; High 2003). Moreover, in contrast to the "rust belt" model, the "three cities" model has the opposite pattern. The urban cores of Canada's largest cities experienced gentrification (Murdie and Teixeira 2011; Walks and Maaranen 2008). A case study on Toronto's Liberty Village (located in the urban core) showed that the closure of factories and industry in the 1960s created the opportunity for first- and second-wave gentrifications to initiate the redevelopment of factories into new urban communities (Wieditz 2007). In 1994, deregulation of land uses by the municipal government paved the way for local property owners and real estate developers to renovate and recycle the abandoned warehouses for new use. The bulk of such redevelopment is concentrated in the urban core and decline is largely seen in suburbs. Although this pattern is seen in Canada's largest cities, it is unclear whether and how this unfolds in secondary centers.

In this paper, we examine whether the U.S. "rust belt" or the Canadian "three cities" model can be applied to secondary Atlantic Canadian cities. We consider whether these explanations can help us describe change in Halifax, St. John's, Moncton, and Charlottetown. We broadly explore changes occurring in the four Atlantic Canadian cities following economic crisis in the 1990s. Three of the cities are the capitals of their respective province (Nova Scotia, Newfoundland and Labrador, and Prince Edward Island) and the fourth is an economic hub of its province (New Brunswick). Even so, each is classified as a secondary city by Statistics Canada (Statistics Canada 2016). In this regard, these cities are similar to the U.S. rust belt cities that are also classified as secondary. Also, the four Atlantic Canadian cities and U.S. rust belt cities all witnessed a major economic crisis roughly during the same time period.

We draw on the two models because they are prominently used in studying urban changes in North America. In assessing their applicability to smaller cities, our analysis offers insight into their generalizability. We do not expect either the "rust belt" or "three cities" model will perfectly fit with the urban changes that occurred in the four Atlantic Canadian cities. However, we are interested in investigating how the models can be used to help assess change in these cities. In the rest of the paper, we consider measures of economic, sociocultural, and structural/physical change to understand how the four secondary Canadian cities in the Atlantic region changed after the economic crisis of the 1990s.

## ECONOMIC COLLAPSE OF ATLANTIC CANADA

In the 1990s, Atlantic Canada was heavily impacted by the collapse of the commercial ground fisheries and a subsequent moratorium on harvesting groundfish (Baum 1999; Binkley 1996; Charles 1997; George and Reid 2005). The economic disruption caused by the moratorium led to a series of profound social, cultural, and demographic changes across the region. Although these wide-ranging changes affected the entire region, most research and policy initiatives on the postmoratorium era have focused on changes in rural or coastal communities (Binkley 1996, 2000; Corbett 2007; Wilson-Forsberg 2013). Few studies have examined the social, cultural, demographic, and physical changes impacting the region's urban areas following the crisis of the 1990s. Although there has been some research on Halifax, a limited amount has been done on other cities in the region (Gosse et al. 2016; Grant and Kronstal 2013; Grant et al. 2008; Grant et al. 2019; Prouse et al. 2014; Roth and Grant 2015).

For these reasons, we examine changes in Halifax and compare them to Moncton, St. John's, and Charlottetown, which are the largest cities of their respective provinces and are thus the major centers of the Atlantic region. Figure 1 plots where the four Atlantic Canadian cities are located in North America and also shows where other rust belt and three cities are located. As can be seen, like other rust belt cities, the four cities we examine are secondary and outside of the country's core economic hubs.

The cities are also chosen because they provide different contexts of change. Halifax is the most industrialized of the centers and has three major military bases; Moncton is a gateway city for transport and is bilingual (English and French); St. John's is being reshaped by the growing offshore oil industry in the wake of the fisheries collapse; and Charlottetown is the smallest of the cities and is capital to a largely agricultural-driven province. Although they are considered hub cities, within the broader Canadian context, they are seen as secondary centers (Statistics Canada 2016). As such, either the "rust belt" or "three cities" models of urban change could explain patterns in these cities. We are particularly interested in how extendable the models are to new analytic cases.

## DATA AND METHODS

### DATA

We analyze the 1996 and 2006 Census microdata files of four Atlantic Canadian cities: Halifax, St. John's, Moncton, and Charlottetown. Based on the individual-level data, we construct neighborhood-level data for each city to examine the multiple dimensions of changes of each neighborhood from 1996 to 2006. For Halifax, St. John's, and Moncton, we use census tracts (CTs) as the unit of analysis, which represents a geographic area with a population ranging from approximately 2,500 to 8,000 for census metropolitan areas (CMAs). Our choice of CTs as neighborhood is consistent with a number of urban studies on Canadian cities (e.g., Hulchanski 2010; Skaburskis 2012). For Charlottetown, we use census subdivisions (CSDs) instead as the unit of analysis. The city is classified as a census agglomeration (CA), not a CMA, and CTs for this city are thus unavailable. We created a dataset of a total of 131 neighborhoods across the four cities, containing information on their economic, sociocultural, and physical characteristics in 1996 and 2006.

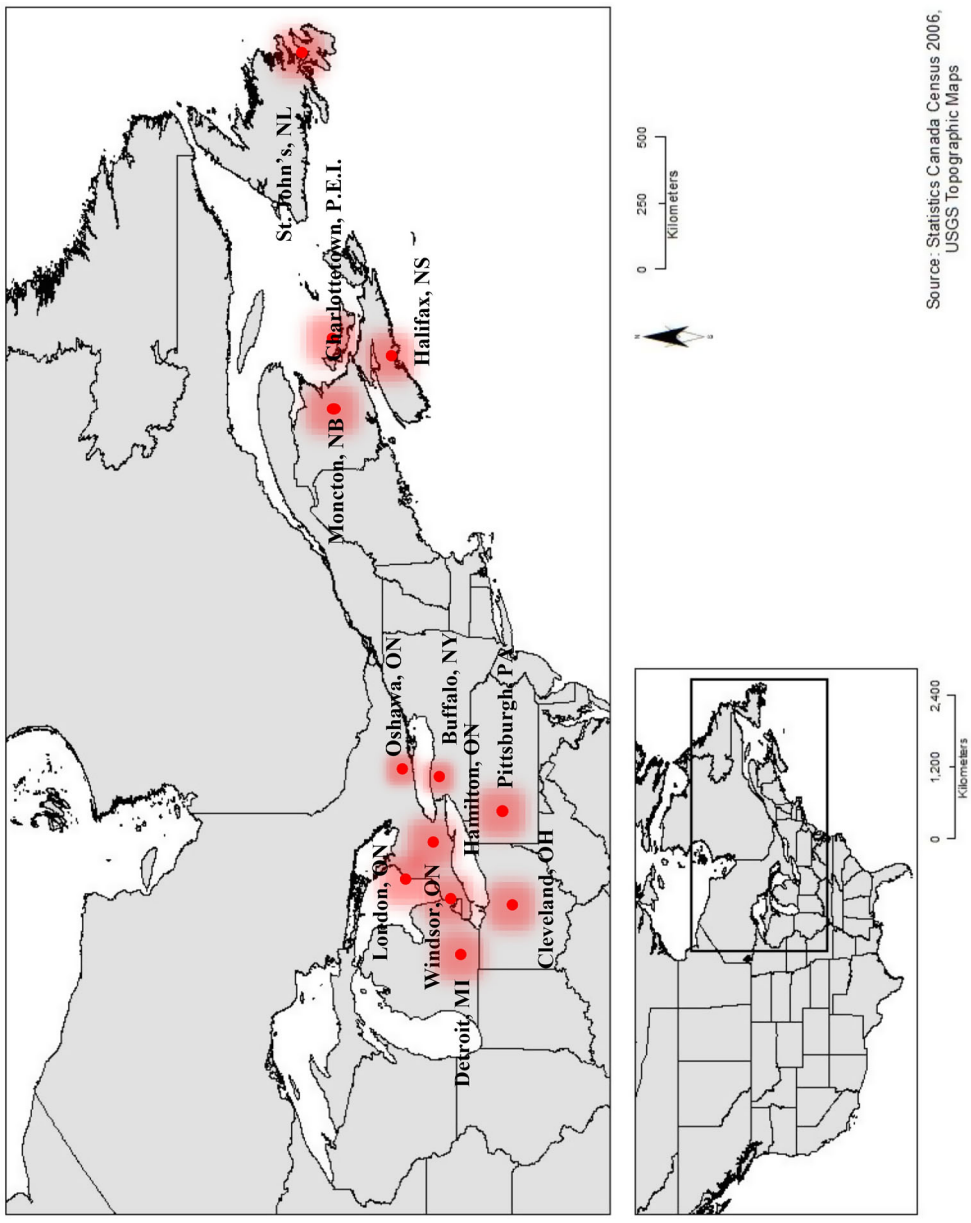


**FIG. 1.** Location of US/Canadian Rust Belt cities and the four Atlantic Canadian cities. [Color figure can be viewed at wileyonlinelibrary.com]

To analyze multiple dimensions of change in a holistic way, we create an index of change to assess overall neighborhood changes of Atlantic Canadian cities from 1996 to 2006. The index considers three key dimensions of change—economic, sociocultural, and physical—identified in the "rust belt" and "three cities" literatures. For each dimension, four measures (variables) are selected to ensure a balanced number of measures in each dimension and to avoid skewing the index. The economic dimension includes four measures: the percentage of lone parent families, the unemployment rate, the mean annual individual incomes, and the percentage of low-income households (spending more than 30 percent of the household income on housing) in each neighborhood. The sociocultural dimension is composed of the percentage of immigrants, the percentage of racial minorities (visible minorities), the percentage of university degree holders, and the percentage of residents aged 65 and older. The physical dimension consists of the percentage of occupied private dwellings that are apartments, that are rented, that are single occupancy, and the percentage of buildings that require major repairs.

To construct the index of change, we standardize the absolute value of raw change between 1996 and 2006 for each measure by calculating a *z*-score. Using the *z*-score, we first identify the CTs (or CSDs for Charlottetown) that changed significantly on a given measure within each city. We define a CT whose *z*-score is above 2.0 or below −2.0 as having changed significantly (from the mean value at an approximate *p*-value of 0.05). For example, in Moncton, CT5 has a *z*-score of −2.54 for changes in the percentage of lone parent families between 1996 and 2006, a value that is statistically significant, indicating that it is different from Moncton's mean change in the share of lone parent families. Similarly, the Halifax CT300 is assigned a standardized score 5.28 for the lone parent family measure, indicating that the change in the percentage of lone parent families between 1996 and 2006 is statistically significant.

Next, we sum the *z*-scores (in absolute values) of all the 12 composite measures of change for each neighborhood (CT or CSD) and divide the summed amount by 12, which we define as the overall change index score. We use absolute index values to gauge the magnitude, rather than direction, of change.

In addition to the index of overall change detailed above, we also create three subindexes of change as dependent variables, along the three composite dimensions: economic, sociocultural, and physical. Each subindex is constructed using the same steps as the index of overall change, but we use four relevant measures of each dimension only. For example, the economic change index is composed of its four relevant measures: the percentage of lone parent families, the unemployment rate, the mean annual individual incomes, and the percentage of low-income households in each neighborhood.

Using the change index (the overall and three subindexes), we analyze changes in Atlantic Canadian cities in three steps. First, we focus on each composite measure of change and discuss which neighborhood changed significantly on which measure. Second, we map the results for each city and visually assess whether or not the urban changes (economic, sociocultural, physical/ structural, and overall) have any notable sociospatial patterns as well as to see which model, if any, it fits. To this end, we rank the scores of the index of change and three subindexes of change into quintiles for all the CTs (or CSDs and quartiles for Charlottetown) of the four Atlantic Canadian cities to identify the most changed CTs/CSDs in each city between 1996 and 2006. Because of the small number of CSDs in Charlottetown, we use quartiles in place of quintiles in that city.

Third, we conduct ordinary least square (OLS) regression to estimate which measures of change are associated with the greater change (the overall and three dimensions of change) in the four Atlantic Canadian cities altogether. We regress the dependent variable (the change index) on two sets of independent variables. The first set consists of the composite neighborhood measures in 1996. This allows us to see which neighborhood characteristics in 1996 (right after the economic crisis) contribute to the greater neighborhood change in the next decade. The second set of independent variables is the differences in the values of composite measures between 1996 and 2006 (in raw values). This helps us determine which measures of neighborhood change from 1996 to 2006 were contributing to the greater neighborhood change. Our regression analysis makes a novel contribution to the "rust belt" literature, given that the majority of works are case studies, focusing on just one city, and a comparative perspective across multiple cities is limited. It also extends the application of the "three cities" model to new cases.

## RESULTS

### WHICH NEIGHBORHOODS SIGNIFICANTLY CHANGED, AND IN WHICH WAY?

First, we focus on composite measures of change and discuss which neighborhoods changed significantly between 1996 and 2006 within a city. Table 1 suggests that right after the economic crisis, changes were happening across the four Atlantic Canadian cities, as the distribution of Xs is dispersed fairly evenly. In a number of neighborhoods, changes were happening across two dimensions. For example, CT7 in St. John's underwent a significant change in the percentages of university degree holders (the sociocultural dimension) and apartments and renters/tenants (the physical/structural dimension) between 1996 and 2006. Interestingly, a CT (or a CSD for Charlottetown) experiencing significant changes in all of the three dimensions is rare. An exception is CT4.01 in Halifax, where changes in the percentages of lone parent families (the economic dimension), visible minority (the sociocultural dimension), and single occupancy homes (the physical/structural dimension) from 1996 to 2006 were statistically different from the mean change scores of the city.

Next, we examine whether change was concentrated in the urban core of Halifax, St John's, Moncton, and Charlottetown and then assess whether it reflects the "rust belt" or "three cities" model of change. We address these questions by mapping urban change for each city across three dimensions (economic, sociocultural, and physical/structural) by plotting our change index scores. Figures 2–4 show the top quintile neighborhoods of economic, sociocultural, and physical/structural change, respectively, in the darkest gray, representing the areas that experienced the most change relative to other areas in the city between 1996 and 2006. Likewise, Figure 5 shows the top quintile neighborhoods of overall change in the darkest gray. These maps offer a visual representation of change both *within* and *across* the four Atlantic Canadian cities and help us examine whether these secondary cities are going through major changes in their urban cores, as did the U.S. rust belt cities.

In defining where an urban core is, we adopt a hybrid version of Statistics Canada's definition of the urban core and our own perception of the urban core based on our lived experience in Atlantic Canadian cities. The first, second, and fourth authors have

**TABLE 1.** List of Census Tracts (Census Subdivisions for Charlottetown) Whose Compositional Measure Changed Significantly Different from the Means, 1996–2006

| | Economic | | | | Sociocultural | | | | Physical/Structural | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTs | % Lone Parent | % Low-Income Household | Unemployment Rates | Mean Individual Income | % 65 and Older | % Immigrants | % Visible Minority | % University Degrees | % Apartments | % Renters | % Major Repairs | % Single Occupancy |
| Halifax | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | X | | | | | | | | |
| 4.01 | X | | | | | | X | | | | | X |
| 4.02 | | | | | | X | | X | | | | |
| 5 | | | | X | | | | | | | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | X | | X | | | | X |
| 8 | | | | | X | | | | | | | |
| 9 | | | | | | X | | | | | | |
| 10 | | | | | | | | | | | | |
| 11 | | | | | | | | | | | | |
| 12 | | | | | | | | X | | | | |
| 13 | | | | | X | | | | | | | |
| 14 | | | | | | | | | | | | |
| 15 | | | X | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 17 | | | X | | | | | | | | | |
| 18 | | | | | X | | | | | | | |
| 19 | | | | | | | | | | | | |
| 20 | | | | | | | | | | X | X | |
| 21 | | | | | | | | | | | | |
| 22 | | | | | | | | X | | | | |
| 23 | | | | | | | | | | | X | |

(*Continued*)

**TABLE 1.** Continued

| | Economic | | | | Sociocultural | | | | Physical/Structural | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTs | % Lone Parent | % Low-Income Household | Unemployment Rates | Mean Individual Income | % 65 and Older | % Immigrants | % Visible Minority | % University Degrees | % Apartments | % Renters | % Major Repairs | % Single Occupancy |
| 24 | | | | | | | | | | | | |
| 25.01 | | | X | | | | | | | | | |
| 25.02 | | | | | | | | | | X | | |
| 25.03 | | | | | | | | | | | | |
| 26 | | | | | | | | | | X | | |
| 27 | | | | | | X | X | | | | | |
| 100 | | | | | | | | | | | | |
| 101 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 103 | | | | | | | | | | | | |
| 104 | | | | | | | | | | | | |
| 105 | | | | | X | | | | | X | | |
| 106 | | | | | | | | | | | | |
| 107 | | | | | | | | | | | | |
| 108 | | | | X | | | | | | | | |
| 109 | | | | | | | | | | | | |
| 110 | | | X | | | | X | | | | | |
| 111 | | | | | | | | | | | | |
| 112 | | | | | | | | | X | X | | X |
| 113 | X | X | | | | | | | X | | X | |
| 114 | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | |
| 120 | | | | | | | | | | | | |
| 121 | | | | | | | | | | | | |
| 122 | | | | | | | | | | | | |
| 122 | | | | | | | | | | | | |
| 123 | | | | | | | | | | | | |

(*Continued*)

**TABLE 1.** Continued

| | Economic | | | | Sociocultural | | | | Physical/Structural | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTs | % Lone Parent | % Low-Income Household | Unemployment Rates | Mean Individual Income | % 65 and Older | % Immigrants | % Visible Minority | % University Degrees | % Apartments | % Renters | % Major Repairs | % Single Occupancy |
| 123 | | | | | | | | | | | | |
| 123 | | | | | | | | | | | | |
| 130 | | X | | | | | | | | | | |
| 130 | | | | | | | | | | | | |
| 131 | | | | | | | | | | | | |
| 131 | | | | | | | | | | | | |
| 131 | | | | | | | | | | | | |
| 131 | | | | | | | | | | | | |
| 131.1 | | | | | | | | | | | | |
| 132 | | | | | | | | | | | | |
| 140 | | | | | | | | | | | | |
| 141 | | | | | | | | | | | | |
| 143 | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | |
| 150 | | | | | | | | | | | | |
| 151 | | | | | | | | | | | | |
| 152 | | | | | | | | | | | | |
| St. John's | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | X | | | |
| 3.01 | | | | | | | | | | | | |
| 3.02 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5.01 | | | | | | | | | | | X | |
| 5.02 | | | | | | | | | | X | | |
| 6 | | | | | | | | | | | | |
| 7 | | | | | | | | X | X | X | | |
| 8 | | | | | | | | | | | | |
| 9 | | | X | X | | X | | | | | | |
| 10 | X | | | | | | | | | | | X |

(*Continued*)

**TABLE 1.** Continued

| | Economic | | | | Sociocultural | | | | Physical/Structural | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTs | % Lone Parent | % Low-Income Household | Unemployment Rates | Mean Individual Income | % 65 and Older | % Immigrants | % Visible Minority | % University Degrees | % Apartments | % Renters | % Major Repairs | % Single Occupancy |
| 11 | | | | | | | | | | X | | |
| 12 | X | | | | | | | | | | | |
| 13 | | | | X | | | | | | | | |
| 14 | | | X | | | | X | | | | | |
| 15.02 | | | | | | | | | | | | |
| 15.03 | | | | | | | | | | | | |
| 16 | | | | | | | | | | | | |
| 100 | | | | | X | | | | | | | |
| 110 | | | | | | | | | | | | |
| 172 | | | | | | | | | | | | |
| 172 | | | | | | | | | | | | |
| 300 | | X | | | | | | | | | | |
| 301 | | | | | | | | | | | | |
| 301 | | | | | | | | | | | | |
| 302 | | | | | | | | | | | | |
| Moncton | | | | | | | | | | | | |
| 1 | | | | | X | | | | | | | |
| 2 | | | | X | | X | | | | | | |
| 3.01 | | | | | | | | | | | | X |
| 3.02 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | X | | | | | | | | | | | |
| 6 | | | X | | | | | | | | | |
| 7 | | | | | | | | | | | | |
| 8 | | | | | | | | | | | | |
| 9 | | | | | | | | | | | | |
| 10.01 | | X | | | | | | | X | | X | |
| 10.02 | | | | | | | | | | | | |

(*Continued*)

**TABLE 1.** Continued

| | Economic | | | | Sociocultural | | | | Physical/Structural | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CTs | % Lone Parent | % Low-Income Household | Unemployment Rates | Mean Individual Income | % 65 and Older | % Immigrants | % Visible Minority | % University Degrees | % Apartments | % Renters | % Major Repairs | % Single Occupancy |
| 11 | | X | | | | | X | | | | | |
| 12 | | | | | | | | | | | | |
| 13 | | | | | | | | | | | | |
| 16.02 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 102 | | | | | | | | | | | | |
| 110 | | | X | | | | | | | | | |
| Charlottetown (CSDs) | | | | | | | | | | | | |
| 02014 | | | | | | | | | | | | |
| 02026 | | | | | | | | | | | | |
| 02028 | | | | | | | | | | | | |
| 02033 | | | | X | | | | | | | X | |
| 02037 | | | | | | | | | | | | |
| 02040 | | | | | | | | | | | | |
| 02048 | | | | | | | | | | | | X |
| 02049 | | | | | | | | | | | | |
| 02050 | X | | X | | | | X | | | | | |
| 02052 | | | | | | | | | | | | |
| 02054 | | | | | | | | | | | | |
| 02056 | | | | | | | | X | | | | X |
| 02065 | | | | | | X | | | | | | |
| 02070 | | | X | | | | | | X | | | |
| 02075 | | | | | | | | | | | | |
| 02080 | | | | | | | | | | | | |
| 02085 | | | | | | | | | | | | |

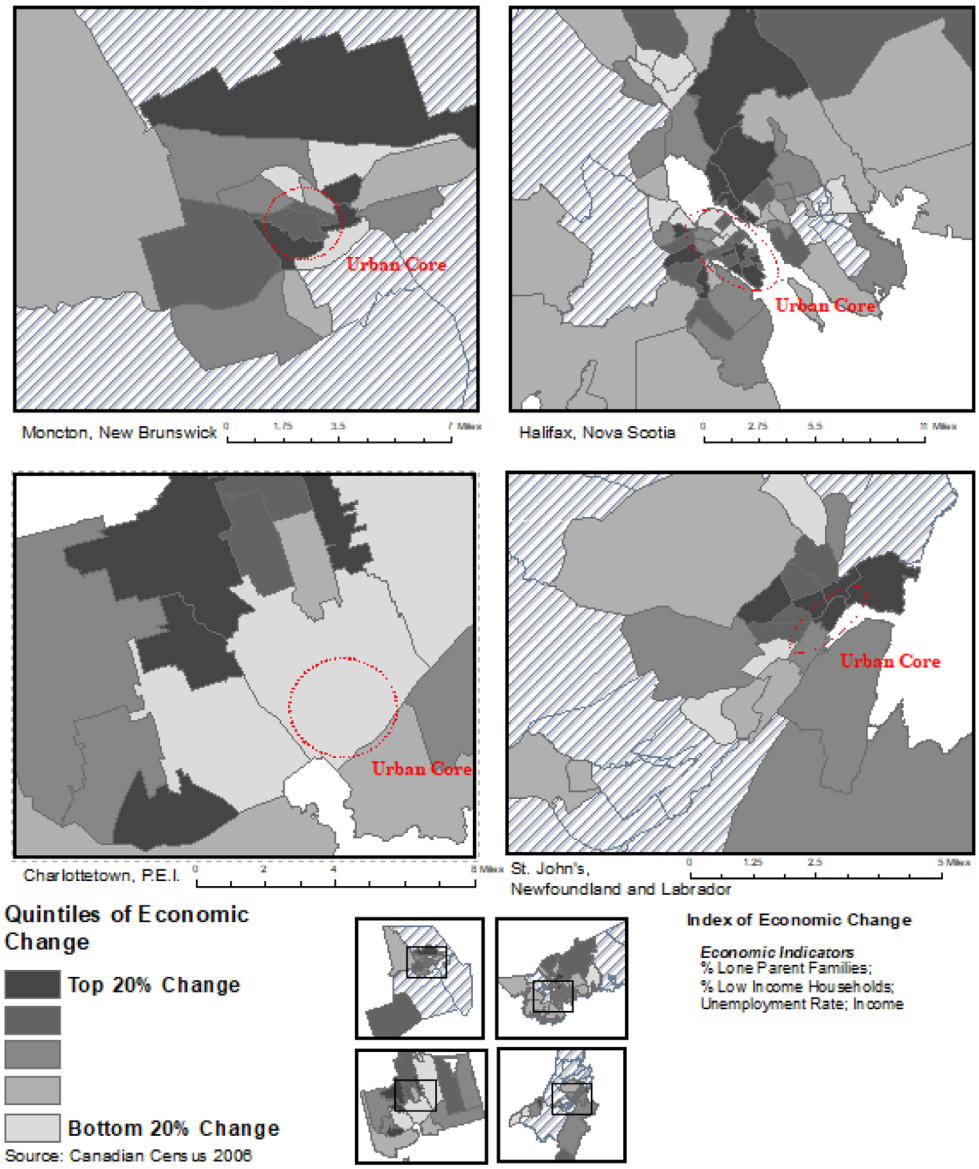


**FIG. 2.** Census tracts and subdivisions in quintiles (or quartiles for Charlottetown) of relative economic change, 1996–2006. [Color figure can be viewed at wileyonlinelibrary.com]

lived or are currently living in St. John's and Halifax. As part of a larger research project on the perceptions of changes in Atlantic Canadian cities, the second author also leads a team of student research assistants, some of whom have lived in Charlottetown and Moncton. These individuals have contributed to the construction of a hybrid version of urban cores that are smaller than Statistics Canada's classification of urban cores shown in CT reference maps but better reflect lay and common understanding of the "cores" of the four Atlantic Canadian cities.

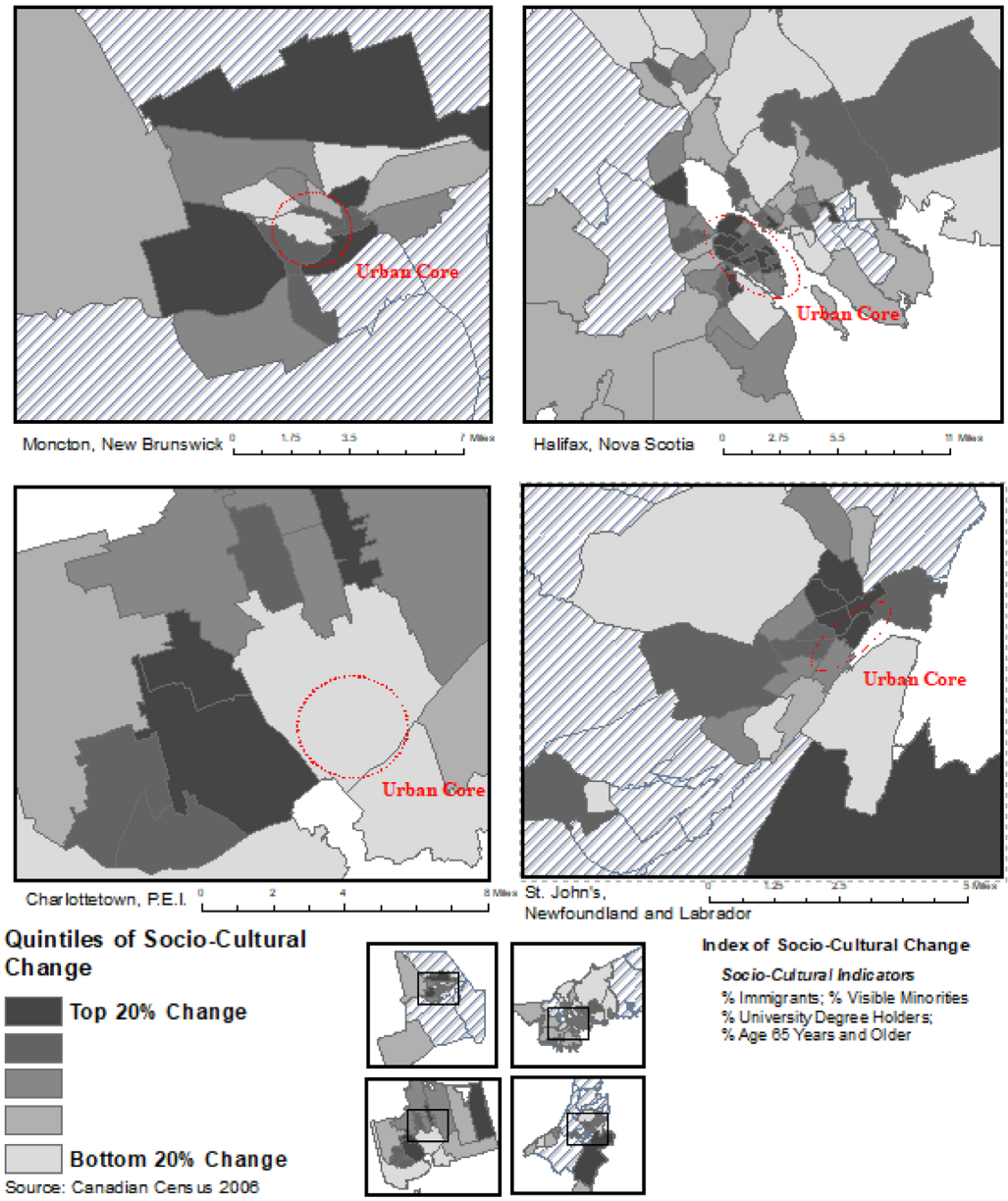


**FIG. 3.** Census tracts and subdivisions in quintiles (or quartiles for Charlottetown) of relative sociocultural change, 1996–2006. [Color figure can be viewed at wileyonlinelibrary.com]

## ECONOMIC CHANGE

Figure 2 shows that in Moncton, three of the four neighborhoods that changed most economically are adjacent to the urban core. CT10.01, just northeast of the urban core, witnessed the most economic change between 1996 and 2006, along with CT6 (located

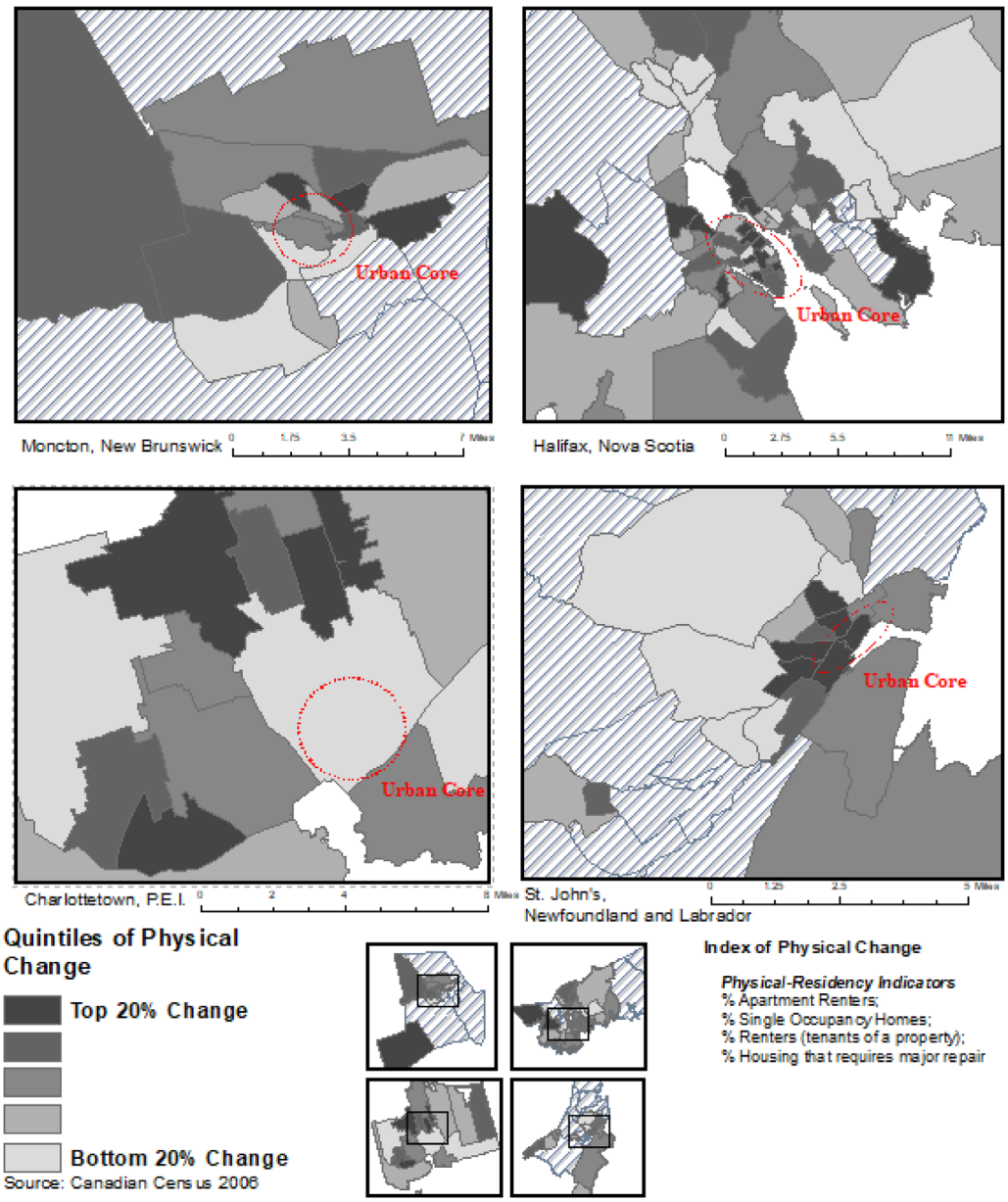


**FIG. 4.** Census tracts and subdivisions in quintiles (or quartiles for Charlottetown) of relative physical/structural change, 1996–2006. [Color figure can be viewed at wileyonlinelibrary.com]

east of the urban core) and CT2 (located south of the urban core). Thus, economic change in Moncton from 1996 to 2006 did not follow either the "rust belt" or "three cities" model that indicates a significant economic change in the urban core.

In Halifax, some of the most economically changed CTs are in the urban core (the Halifax Peninsula). The CTs that underwent the most economic change are also in the

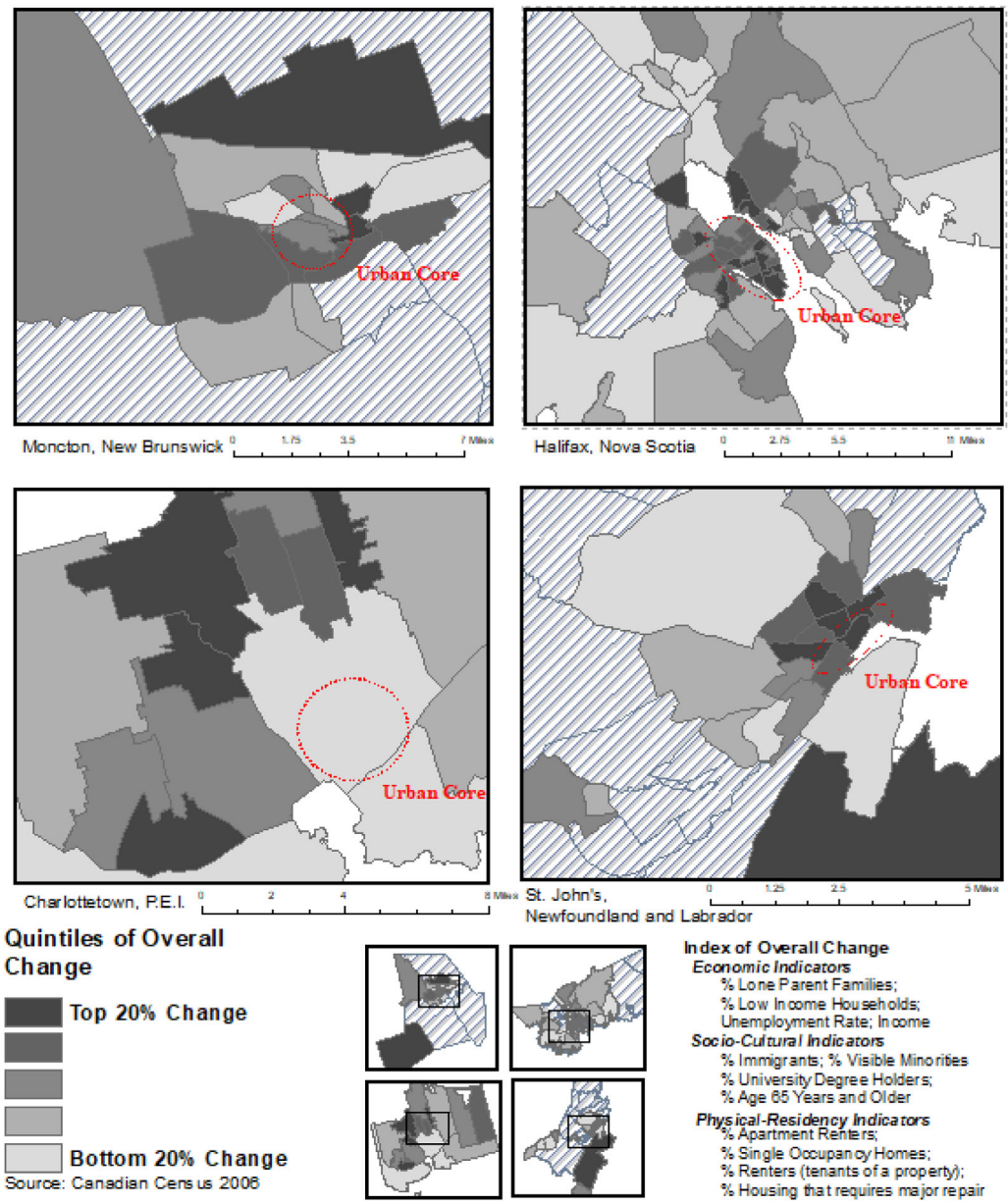


**FIG. 5.** Census tracts and subdivisions in quintiles (or quartiles for Charlottetown) of relative overall change, 1996–2006. [Color figure can be viewed at wileyonlinelibrary.com]

surrounding areas of the urban core, near the Halifax Harbour. Furthermore, the remaining CTs that experienced the most economic change are clustered near the eastern shore of the city and situated in the outskirts, the more rural areas of the city.

Similar to Halifax, in St. John's, the most economic change is happening in the urban core in its east end (CT7). However, the majority of the most economically changed

neighborhoods are in the areas adjacent to the urban core (CTs 8, 9, 10, and 12). Four of the six most changed CTs comprise this pattern of clustering near the urban core. Another most changed CT (300) departs from this pattern; it is located southwest of the urban core, in the outskirts of the city.

The economic subindex scores for Charlottetown are presented in quartiles and the neighborhoods are represented by CSDs because of its small scale. We find that the geographic patterns of economic changes in Charlottetown are similar to those of Moncton; the most changes are occurring in areas adjacent to the urban core (near the island's harbor area on either side of the city's boundaries) and in the outskirts of the city.

## SOCIOCULTURAL CHANGE

In Figure 3, we report the neighborhoods that changed most socioculturally across the four cities. In Moncton, the pattern of sociocultural change appears to be consistent with its economic change; changes were happening in neighborhoods adjacent to the urban core. Two of the CTs that experienced the most economic change also underwent the most sociocultural change (CTs 10.01 and 11) between 1996 and 2006.

The patterns of sociocultural change in Halifax are similar but slightly different from its patterns of economic change. While many of the most socioculturally changed CTs can be found in the urban core (the Halifax Peninsula) like the most economically changed CTs, the former are concentrated in the northern and middle parts of the core. This departs from the most economic change, which was happening in the southern end and the middle of the peninsula. Moreover, other most economically changed CTs are in the north of the urban core across the Halifax Harbour with no clustering.

Similar to Halifax, part of St. John's urban core went through the most sociocultural change (CT7). Similar to the most economic change, its adjacent CTs (north of CT7) also changed most socioculturally. The most changed neighborhood also can be found in the outskirts (suburbs), the south end of St. John's. Patterns of sociocultural change in Charlottetown were similar to Moncton's. The neighborhoods that changed most socioculturally between 1996 and 2006 were surrounding the urban core, a pattern consistent with the economic change.

## PHYSICAL/STRUCTURAL CHANGE

Figure 4 displays which neighborhoods underwent the most physical/structural changes across the four cities. In Moncton, three of the four most changed CTs were located in Greater Moncton. CTs 9 and 10.01 were situated just north of the urban core, while CT13 was found in the southeastern part of Greater Moncton. The remaining most physically/structurally changed CT was located in the southwest end of the city, far away from the urban core.

In Halifax, the most physical/structural changes were spread out from west to east of the city. Similar to the economic and sociocultural change, some of the most physically/structurally changed CTs can be found in the Halifax Peninsula, vertically from the north to the south of the peninsula. The most physical changes were also happening in the surrounding areas of the urban core and in the outskirts of the city.

Results for St. John's reveal a somewhat different pattern of physical/structural change from that of Moncton and Halifax. The most physical/ structural change was happening within the east urban core (CT7), as well as its surrounding CTs. The most physical/structural changes in St. John's were occurring in somewhat similar ways as its economic and sociocultural changes in neighborhoods tightly clustered around the urban core. Finally, the most physical/structural change in Charlottetown was occurring in many of the CSDs that experienced the most economic change, in the outskirts of the city, north of the urban core.

### OVERALL CHANGE

In Figure 5, we map the results from the overall change index across the three dimensions (economic, sociocultural, and physical/structural) in quintiles (or quartiles for Charlottetown) for each city. In Moncton, the greatest overall change was taking place in many of the neighborhoods experiencing the most economic change. Considering that three of the most changed CTs (overall) are located adjacent to the urban core, we find little evidence that neighborhood change in Moncton follows the "rust belt" or "three cities" models. With the exception of CT6 (which is very close to the urban core), the most changed neighborhoods in Moncton typically follow the pattern seen across the three subindexes, and the results do not fit with either the "rust belt" or "three cities" model.

The overall change in Halifax reveals somewhat similar patterns observed in its sociocultural change. The most changed CTs (overall) are clustered in the south end of the urban core (the Halifax Peninsula) in CTs 3, 4.01, 4.02, and 5. Some other most changed CTs in the Halifax urban core are in the middle of the peninsula (CTs 7, 12, and 13). Other CTs that experienced the most overall change outside the urban core are scattered but in surrounding areas of the core and the Halifax Harbour (CTs 25.01, 27, 110, 112, and 113).

The St. John's neighborhoods that changed most overall include the urban core (CT7) and the surrounding northern areas of the urban core (CTs 5.02, 9, 10, and 13). Many of the neighborhoods that underwent the most economic and physical/structural changes are in the top quintile of the overall change index as well.

In Charlottetown, the most overall change was taking place in similar ways as Moncton. The neighborhoods experiencing the most overall change in Charlottetown were primarily in areas adjacent to the urban core on the outer boundaries of the island.

## WHICH NEIGHBORHOOD CHARACTERISTICS CONTRIBUTED TO OVERALL CHANGE?

So far, we have analyzed urban changes in the four Atlantic Canadian cities separately and examined whether they were happening in urban cores as seen in the U.S. rust belt cities and Canada's largest three cities. We find that the CTs (or CSDs) that underwent significant changes in Moncton and Charlottetown are not in the urban core but in their adjacent areas or in the outskirts of the city. This departs from the urban change patterns identified in the U.S. "rust belt" or Canadian "three cities" models, in which the urban cores were changing the most. By contrast, the urban cores of Halifax and St. John's were

**TABLE 2.** OLS Regression Models Predicting the Economic, Sociocultural, Physical, and Overall Change, with 1996 Neighborhood Characteristics Used as Independent Variables ($N = 131$)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Economic Index | | Sociocultural Index | | Physical Index | | Overall Change | |
| | Coef. | *p* | Coef. | *p* | Coef. | *p* | Coef. | *p* |
| *1996 characteristics* | | | | | | | | |
| Economic measures | | | | | | | | |
| % lone parents | 0.017 | 0.004 | | | | | 0.000 | 0.976 |
| unemployment rate | 0.014 | 0.193 | | | | | 0.012 | 0.095 |
| Individual income (in $1,000) | 0.032 | 0.000 | | | | | 0.012 | 0.304 |
| % low income household | −0.012 | 0.001 | | | | | −0.009 | 0.000 |
| Socio-cultural measures | | | | | | | | |
| % immigrants | | | 0.003 | 0.808 | | | 0.015 | 0.148 |
| % visible minority | | | 0.009 | 0.159 | | | −0.002 | 0.765 |
| % university degree holders | | | 0.009 | 0.041 | | | 0.002 | 0.740 |
| % aged 65 and older | | | 0.012 | 0.018 | | | −0.007 | 0.198 |
| Physical measures | | | | | | | | |
| % apartment renters | | | | | −0.011 | 0.004 | −0.008 | 0.001 |
| % single occupancy homes | | | | | 0.008 | 0.351 | 0.013 | 0.082 |
| % renters/tenants | | | | | 0.012 | 0.000 | 0.009 | 0.000 |
| % dwelling requiring major repair | | | | 0.008 | 0.422 | 0.011 | 0.094 | |
| Intercept | 0.218 | 0.290 | 0.384 | 0.000 | 0.455 | 0.000 | 0.393 | 0.037 |
| R-squared | 0.153 | | 0.224 | | 0.158 | | 0.378 | |

Source: Statistics Canada, 1996 and 2006 Censuses of Population.

changing most (economically, socioculturally, physically, and overall), consistent with the "rust belt" or "three cities" models. Moreover, the changes in the four Atlantic Canadian cities were also taking place in the outskirts of the cities. In St. John's, suburbs were changing the most, whereas Charlottetown and Halifax were witnessing the most overall changes in rural parts of the city. These results suggest that urban changes in the face of economic crisis in these four secondary cities cannot be straightforwardly characterized by the U.S. "rust belt" or Canadian "three cities" models. Their patterns of change look more like "hot spots" with the most change taking place both in the outskirts of the city and the areas adjacent to the urban core.

We explore this further with OLS regression analyses, regressing the neighborhood change index (economic, sociocultural, physical, and overall) on composite measures of change. In Table 2, we explore which composite neighborhood characteristics in 1996 were contributing to greater neighborhood changes from 1996 to 2006 in the four Atlantic Canadian cities. In identifying the contributing composite measures, we consider statistical significance (*p*-value) of the coefficient, although we do not strictly use $p = 0.05$ as the threshold of our identification (Wasserstein and Lazar 2016).

In Model 1, we examine which four composite measures of economic characteristics of a neighborhood (the percentages of lone parent families and low-income households, unemployment rates, and mean annual individual incomes) in 1996 were contributing to the economic change in the next decade. The results show that three composite measures, the percentages of lone parent families and low-income households and mean individual incomes in 1996, are significantly contributing to economic changes ($p < 0.05$). An increase in lone parent families in a neighborhood in 1996 is associated with an increase in the economic change index score in the subsequent 10 years, while a rise in the percentage of low-income households is associated with a decrease in the economic change index. Moreover, a neighborhood whose mean individual income in 1996 was higher than another was expected to change more economically between 1996 and 2006 ($b = 0.032$). The results suggest that both economically advantaged (i.e., higher income neighborhoods) and disadvantaged neighborhoods (i.e., higher percentage of lone parent families) in 1996 were contributing to greater economic changes in the next 10 years.

Model 2 displays the results of an OLS regression model predicting the sociocultural change using its four composite measures: percentages of residents aged 65 and older, immigrants, visible minority, and university degree holders in 1996. Two measures, the percentages of university degree holders and those aged 65 and older, are contributing to the sociocultural change ($p < 0.05$). An increase in higher educated and older residents is associated with sociocultural change. Meanwhile, diversity-related indicators (the percentages of immigrants and visible minority) have no significant influence on the sociocultural change in 1996–2006 ($p > 0.05$).

Model 3 shows the results of an OLS regression model predicting the physical/structural change using its four composite measures: the percentages of occupied private dwellings that are apartments, that are rented, that are single occupancy, and the percentage of buildings that require major repairs. Two of the measures, the percentages of apartments and renters/tenants, are found to influence the physical change index ($p < 0.05$). An increase in renters/tenants leads to a rise in physical change, whereas an increase in the percentage of apartments is negatively associated with physical/structural change. In other words, a neighborhood that had a lower share of apartments and a greater share of renters/tenants in 1996 was estimated to undergo greater physical/structural changes in the subsequent 10 years.

In Model 4, we estimate the overall change index using all the 12 composite measures (based on the 1996 values) as the independent variables. Among the three dimensions (economic, sociocultural, and physical/structural) constituting the overall neighborhood change, measures of the physical/structural dimension contributed to the overall change more than the other two. The percentages of apartments and renters/tenants were associated with the overall change index scores as in Model 3. An increase in apartments in 1996 is associated with a decline in the overall change index, whereas the percentage of renters/tenants is positively associated with overall neighborhood change. This is similar to the Model 3 results where only economic measures are included.

Moreover, the percentage of low-income households in 1996 is negatively associated with the overall change index. In summary, Model 4 suggests that physical/structural characteristics of a neighborhood in 1996 are making a more notable contribution to the overall urban change between 1996 and 2006. Neighborhoods with a lower share of apartments and a higher share of renters/tenants, as well as a lower share of poorer households in 1996, were estimated to change more in 1996–2006.

**TABLE 3.** OLS Regression Models Predicting the Economic, Sociocultural, Physical, and Overall Change, with Changes in Neighborhood Characteristics from 1996 to 2006 Used as Independent Variables ($N = 131$)

| | Model 1 | | Model 2 | | Model 3 | | Model 4 | |
|---|---|---|---|---|---|---|---|---|
| | Economic Index | | Sociocultural Index | | Physical Index | | Overall Change | |
| | Coef. | *p* | Coef. | *p* | Coef. | *p* | Coef. | *p* |
| *Changes from 1996 to 2006* | | | | | | | | |
| *Economic measures* | | | | | | | | |
| % lone parents | 0.004 | 0.624 | | | | | −0.005 | 0.457 |
| Unemployment rate | −0.011 | 0.325 | | | | | 0.006 | 0.496 |
| Individual income (in $1,000) | 0.028 | 0.003 | | | | | 0.015 | 0.042 |
| % low-income household | 0.007 | 0.012 | | | | | 0.006 | 0.003 |
| *Sociocultural measures* | | | | | | | | |
| % immigrants | | | 0.003 | 0.845 | | | 0.010 | 0.410 |
| % visible minority | | | −0.002 | 0.901 | | | −0.012 | 0.233 |
| % university degree holders | | | 0.007 | 0.461 | | | 0.001 | 0.916 |
| % aged 65 and older | | | 0.005 | 0.278 | | | 0.002 | 0.643 |
| *Physical measures* | | | | | | | | |
| % apartments | | | | | 0.019 | 0.001 | 0.014 | 0.001 |
| % single occupancy homes | | | | | 0.008 | 0.612 | 0.003 | 0.758 |
| % renters/tenants | | | | | −0.019 | 0.016 | −0.007 | 0.224 |
| % dwelling requiring major repair | | | | 0.019 | 0.063 | 0.010 | 0.162 | |
| Intercept | 0.459 | 0.000 | 0.691 | 0.000 | 0.625 | 0.000 | 0.579 | 0.000 |
| *R*-squared | 0.118 | | 0.012 | | 0.126 | | 0.231 | |

Source: Statistics Canada, 1996 and 2006 Censuses of Population.

In Table 3, we continue OLS regression on the neighborhood change index but use changes in composite neighborhood characteristics from 1996 to 2006 as the independent variables. We aim to determine which indicators of change were contributing to the greater economic, sociocultural, physical/structural, and overall changes between 1996 and 2006. Model 1 shows that the increase in the mean individual incomes and the percentage of low-income households from 1996 to 2006 were contributing to the greater economic changes during this period. This suggests that both economic growth (i.e., the rise in mean individual incomes) and decline (i.e., the rise in the percentage of low-income households) were contributing to the greater economic changes, indicative of growing inequality between richer and poorer neighborhoods after the economic crisis in the early 1990s.

Model 2 shows that none of the four composite measures of sociocultural change (changes in the percentages of older, immigrant, visible minority, and highly educated residents between 1996 and 2006) was significantly associated with the sociocultural change index ($p > 0.05$). It may be that sociocultural (especially percentages of immigrants and visible minority) changes after the economic crisis in the 1990s were minimal

in Atlantic Canadian cities (except for Halifax, see Table 1), and this linear model may not adequately fit the pattern of such change.

Model 3 assesses which composite measures of physical change from 1996 to 2006 were contributing to greater physical/structural change. An increase in the percentages of apartments is making a notable contribution to greater physical/structural change. By contrast, a decrease in the percentage of renters is contributing to physical/structural change ($b = -0.019$). Furthermore, an increase in the percentage of dwelling requiring major repair was also contributing to physical/structural change, although caution is necessary to interpret the coefficient ($p = 0.063$).

When all the 12 composite measures (changes in values from 1996 to 2006) are included in an OLS regression model, a select number of composite measures from economic and physical/structural dimensions are found to contribute to the overall change. In the economic dimension, a greater increase in mean individual incomes and low-income household rates are contributing to the overall change. In the physical/structural dimension, a greater increase in the percentage of apartments is associated with greater overall change.

In summary, the OLS regression analysis shows that in the face of economic crisis, change in the four Atlantic Canadian cities was associated with economic and physical/structural characteristics of neighborhoods more than sociocultural characteristics. The rise in poverty in some neighborhoods and the rise in high income residents may be happening simultaneously, suggesting growing inequality.

## CONCLUSION

Our results show that complex patterns of urban change can be observed in the four mid-sized Atlantic Canadian cities that we analyzed. In Halifax and St. John's, change was happening in the urban core, consistent with the U.S. "rust belt" and Canadian "three cities" models. However, changes were also happening in areas adjacent to the urban core in these two cities, as well as in Moncton and Charlottetown. Furthermore, outskirts of the city were also undergoing the most change. This arguably suggests a deviation from the U.S. "rust belt" or Canadian "three cities" models. Rather, Atlantic Canadian cities witnessed significant changes across all regions of the city, in the cores, suburbs, and even rural parts of the city. These changes can be characterized by a "hot spot" model, rather than the U.S. "rust belt" or Canadian "three cities" models.

The OLS regression analysis suggests various neighborhood characteristics of the four secondary Atlantic Canadian cities in 1996 (right after the economic crisis), and changing neighborhood characteristics in the subsequent decade did not equally contribute to changes within the cities. Some neighborhood characteristics in 1996 contributed to the greater urban changes more than others. Also, several aspects of changes in neighborhoods between 1996 and 2006, such as the rise in low-income household rates, rising mean individual incomes, or rising share of apartments, contributed to overall change more than others.

We thus conclude that the "rust belt" or "three cities" models do not fit with the change that occurred in the four cities under analysis. Instead, we find that changes were occurring not only in urban cores but across all parts of the cities. The image of neighborhood change emerging from our results is one of "hot spots" of urban renewal and

suburban/rural development. Changes happened in a more haphazard way. The hot spot model we uncovered is a hybrid version of the U.S. "rust belt" and Canadian "three cities" models.

Our study lends support to an argument that conceptual models that are based on the characteristics of the larger metropoles do not help explain the reality of smaller cities. City size matters and alternative models should be developed to better understand how smaller cities are reacting to or coping with economic restructuring.

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