Voting with their Feet: Jobs versus Amenities

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March 22, 2006

Abstract: The determinants of rural and urban community population change over the period 1991-2001 are investigated at a very fine level of disaggregation for Canada. The study examines the influence of local amenities, economic factors, and agglomeration economies on population growth for age cohorts starting from the very young to the elderly. Motivated by the objective of assessing the overall jobs-versus-people question in economic development, the emphasis is on estimating the relative contribution of groupings of variables in explaining the variations in population change, rather than the contribution of individual variables. Results indicate that rural and urban populations are influenced to differing degrees by amenity, economic, and urban scale groupings of variables, and there are variations among age cohorts in both urban and rural areas. While economic variables are the most influential in population change for all rural cohorts, their contribution somewhat diminishes with age. In urban areas, amenity and economic variable groupings have approximately equal importance across all cohorts. For the key young adult cohort, the economic grouping is clearly the most influential in rural areas, while it is a close second to amenities in urban areas.

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Acknowledgements: This study has benefited from the resources of the Canada Rural Economy Research Lab (C-RERL) at the University of Saskatchewan. We greatly appreciate the help of Mike St. Louis of the C-RERL with the geo-referencing of many variables used in this study. Special thanks are also due to Ray Bollman of Statistics Canada for providing us with the data of the Census of Population used in this study. However, the views expressed here only represent the authors and do not reflect those of Statistics Canada or the University of Saskatchewan.

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1. Introduction

Understanding the causes of community-level population change is not only of interest to academics, but also has profound implications for social wellbeing and public policy design. North American communities have had widely varying and persistent growth and decline experiences. Hinterland rural communities, especially those tied to the primary sector, are persistently losing residents, most notably in the young labor force age groups (Rothwell et al., 2002). Without a critical mass of population, some rural communities enter a vicious cycle of decline, as illustrated by trends in the rural Great Plains and Atlantic Canada (e.g., Mwansa and Bollman, 2005). Conversely, many large urban centers, outlying suburbs, and exurban communities are experiencing rapid growth (Glaeser and Kahn, 2003). The resulting urban sprawl can strain infrastructure, denigrate green space, infringe on farmland, and create congestion, all of which can adversely affect quality of life. Thus, a better understanding of the underlying influences on community growth would inform both rural and urban economic development planning, as well as land use and environmental concerns.

Explanations for community population growth and decline can be seen as part of the "jobs" versus "people" debate: do regions grow because firms are creating jobs and the people follow, or do people move to a region for quality of life reasons and the jobs follow (Partridge and Rickman, 2003a; forthcoming). The most obvious causal factor of population change is the local community's economic strength, which often relates to whether the region has a mix of industries that are faring well nationally (Partridge and Rickman, 1996; Simon, 2004). For example, agriculture-reliant communities have generally struggled for decades. Other theories stress the role of agglomeration economies consistent with higher firm productivity and the provision of the highest order urban amenities such as upscale shopping, cultural and recreational venues (Krugman, 1991; Glaeser et al., 2001; Rosenthal and Strange, 2001). Akin to endogenous growth theories, still other hypotheses stress the role of local concentrations of human capital in increasing local productivity, inducing long periods of population growth (Romer, 1994; Simon and Nardinelli, 2002).

More recent theories stress the roles of social capital/cohesion and amenities in explaining the relative success of many North American communities. Reduced transactions costs in tightly knit communities where "everyone knows everyone," along with a rising demand for a clean environment, beautiful vistas, and abundant recreation opportunities can play a significant role in rural communities (Kilkenny et al., 1999; Turcotte, 2005; McGranahan, 1999; Deller et al., 2001; Henry, 2002; McGranahan and Beale, 2002). When broadly defining rural amenities to include not just climate but also rural recreation and beautiful landscape, rural U.S. communities endowed with these amenities have fared much better than others, many experiencing significant population gains. Fundamental theoretical issues relating to how we measure changes in social welfare, and the definition and measurement of natural, man-made, and cultural amenities have not been fully delineated (Deller et al., 2006; Power, 2006).[1]

Despite advances in our understanding of the roles of amenities, economic factors and social capital in community-level population movements over the last 15 years for the U.S., there remain significant gaps in our knowledge. First, we know very little about the *relative* importance of the key categories—economic factors and amenities—in determining population growth. Second, critical to policy design, does the underlying data generating process differ between rural and urban areas? Third, besides life cycle effects, what are the underlying reasons for different age-cohort rural/urban migration patterns. One would expect the underlying causes of the large net *out*-migrations of young adults and seniors from rural areas to be different from explanations for net-*in* migration of 25-69 year olds (Rothwell et al., 2002; McGranahan and Gibbs, 2005).[2] Finally, despite a growing community-level U.S. literature, Canadian population movement studies have focused on aggregate provincial- or urban-level geographies, rather than representing the range of urban and rural communities.[3] Because U.S. and Canadian settlement patterns differ significantly, Canada is a good test of the extent to which established U.S. patterns generalize to other countries.

This study examines 1991-2001 population change for about 2,400 Canadian communities. Unlike the previous literature, that generally aimed at discovering which individual variables were statistically

[1]Marcoullier et al. (2004) argue that income distribution may be another measure of socioeconomic well being.
[2]While there have been numerous studies by age-cohort and baby-boom/non-baby boom, as well as studies correlating migration patterns across business cycle phases, most of this research is descriptive rather than fully examining the underlying causes of different regional migration patterns by cohort groups (Plane, 1992; Pandit, 1997; Nelson et al., 2004). Though the existing research has been very useful in providing a "big picture" view of migration patterns, it is less useful for community development policymaking, a void this study is trying to fill.
[3]Studies of Canadian population movements include: Shaw (1986) where the focus is on the changing determinants of inter-metropolitan movements (17 cities); Anderson and Papageorgiou (1992) offer a descriptive overview of the population changes for Canadian CMAs, and the aggregate non-CMA parts of the provinces; Hou and Beaujot (1995) examine population movements at the regional level—Ontario versus Atlantic Canada.

significant (e.g., climate or education), the relative importance of broader "groupings" of causes (economic, amenities, etc.) is explicitly addressed for total population growth, a number of age groups, and for urban and rural typologies. In addition, the econometric analysis uses an extensive database that links economic, natural amenity, and social capital variables, many of which are quite novel, especially for Canada. This methodology extends the literature both by sorting out the role of broad groups of variables (differentiated by age group), and by offering guidelines for policymakers.

Among the key findings, economic factors are clearly the most influential for rural population growth, though this influence declines for the elderly. Urban population growth, relative to rural, is more strongly linked to amenities across age cohorts, with amenities assuming equal or greater importance compared with economic factors. The relatively weak attraction of amenities across all rural age cohorts including seniors runs counter to findings from the rural U.S.

The next section presents a theoretical approach to modelling population flows, followed by a section describing the empirical implementation. Section four reports the empirical findings and describes the public policy implications. The final section provides a summary and conclusion.

2. Modelling Population Migration

Numerous studies have documented the role of local economic and non-economic site-specific attributes in community population growth. The theoretical argument for including amenities and quality of life factors is based on utility maximization.[4] Initial research in this field dates back to seminal studies by Getz and Huang (1978), Graves and Linneman (1979), Graves (1980), Roback (1982), and Porell (1982). These studies, primarily of U.S. urban migration, determined that climate is a significant factor in explaining population change. However, Greenwood and Hunt (1989) challenged the early amenity literature's conclusions, showing that local economic opportunity variables have a greater effect on migration than do climate variables. More recent work emphasizes a more detailed and precise definition of amenity variables (Deller et al., 2006; Power, 2006).

There is a heightened interest in examining the role of amenities and quality of life in determining population movements, especially for the economic development planning of small urban centers and rural areas interested in attracting and retaining population. For example, Deller et al. (2001) and Kim et

[4]Closely related to our approach is a structural household and firm location approach based on labor supply and demand that jointly determines wages and employment (Partridge and Rickman, 2003b).

al. (2005) explored the willingness of U.S. households to relocate for location-specific rural amenities. Their major contribution was to show that a far-ranging list of amenities, such as access to recreation opportunities, can influence migration. Rappaport (2004a, 2004b), in an investigation of the effects of weather on the location choice of U.S. residents using county-level data, concluded that local population growth is highly correlated with warmer winters and temperate summers. Glaeser et al. (2001) and Glaeser and Shapiro (2003) examined the role of amenities in population change among American cities. They found that urban amenities and climate are critical, along with the initial stock of human capital. The unique characteristics of amenity-led growth, the multi-disciplinary bi-directional relationship between amenities and growth, and its potential distributional effects are explored in Green et al. (2006).

Consistent with endogenous growth models that stress institutional reasons for different growth outcomes, a recent literature has stressed social capital as a key determinant (Knack and Keefer, 1997; Knack and Zak, 2001; Guiso et al., 2004). Social capital potentially facilitates economic growth through promoting trust and civic engagement, thus reducing the need for stricter contracts and legal enforcement mechanisms (Kilkenny et al., 1999). Using U.S. county data, Rupasingha et al. (2002) found that a greater number of per-capita social organizations is positively related to per-capita income growth.

Most of the amenity and social capital literature has used U.S. data. Evidence from Canada is fragmentary because prior Canadian migration studies have not explicitly focused on amenities and social capital. An exception is Day (1992), who considered average temperatures, and the level of public spending in the health, education, and social service sectors as determinants of inter-provincial migration. Government expenditures can be viewed as a combination of quality-of-life enhancing household amenities and productivity-enhancing firm amenities. Day found temperatures to be highly significant, as well as all types of public expenditures. Yet, her study is limited for our purposes because the analysis was at the provincial level, and the results are less useful in examining sub-provincial problems.[5] Other Canada-based migration papers such as Courchene (1970), Dickie and Gerking (1998), Day and Winer (2001), and Newbold (1996) do not consider amenities or social capital, though some acknowledge their theoretical importance.

[5]Shearmur and Polèse (2004) examined employment and population growth rate differentials using census division data between 1971 and 2001. Census divisions are generally composed of about 10 census consolidated subdivisions (CCSs), which are our units of analysis. However, their model is not comparable to our model because it has no measures of amenities and social capital and they considered much larger geographical units.

Theoretical Model

We develop a theoretical model to explain individuals' location decisions amongst various communities. Following Roback (1982) and Beeson and Eberts (1989), utility maximization is the central behavioural criterion. Individuals are hypothesized to weigh both the pecuniary and non-pecuniary benefits of moving against the associated costs of remaining in their current location. We assume that:

1. Individuals maximize utility (U). Expected utility values are defined for every location i to which a representative individual can possibly migrate (or stay), such that i = 1, 2, 3,…n.

2. Individuals can rank any two locations using the location's expected utility-generating value, and these preference rankings are transitive.

3. Individuals derive utility from two location-specific attributes – favorable local economic conditions (e) and amenities, broadly defined (a), given a set of control variables (z).

Potential migrants compare the expected utility of residing in different communities (U_1, $U_2 \ldots U_n$) with the utility at their current location (U_0) net of the pecuniary and nonpecuniary costs of migrating (m_i). The migration decision is shown in equation 1 as:

$$M = U_i(e_i, a_i, z_i, m_i) - U_0(e_0, a_0, z_0) \quad (1)$$

If M>0, utility maximizing individuals will migrate to community i; if M<0, individuals stay in their original location. The migration decision outlined in equation 1 is repeated for n communities. In making a migration decision and choosing their preferred location, individuals are essentially 'voting with their feet,' revealing their preference rankings for different locations. In reality, we are representing migration decisions of the most mobile portion of the population. Heterogeneous preferences suggest that, for example, particular individuals may have greater non pecuniary moving costs (sense of place) ensuring that not all households would relocate to a community with seemingly favorable attributes for a 'representative' individual.

Revealed preference through migration decisions allows us to rank communities based on their expected utility-generating attributes. Due to data constraints, we are unable to measure the actions of specific individuals or households in terms of their location decisions. However, we can examine the characteristics of the community, and whether it is experiencing net gains or losses in population. We assume that the average levels of local factors (such as employment, income, and amenities) constitute a representative-agent household's access to these characteristics. Yet, one reason for exploring different age cohorts and a rural-urban breakdown is to recognize that there are heterogeneous preferences that are reflected by households self-sorting to different communities (Tiebout, 1956).

3. An Empirical Model of Population Change

The principal source of data in this study is the 1991 and 2001 Censuses of Population. The geographic area includes all provinces but excludes Northern territories. Census consolidated subdivisions (CCSs) form the unit of observation, representing communities.[6] Additional data sources, described in Appendix Table 1, include Statistics Canada, the Canadian Institute for Health Information, Canadian Centre for Justice Statistics, Natural Resource Canada, and Environment Canada.

Population change by CCS is measured over the period 1991-2001. The 10-year time period is considered long enough to represent long-run population movements, and to avoid contamination by short-term idiosyncratic changes (especially in small communities). It is also lengthy enough to help ensure that the (1991) explanatory variables are predetermined, avoiding endogeneity bias in the estimated coefficients.[7] Population change is considered the proper metric in assessing the often offsetting effects of economics and quality of life in residential location decisions. Thus, by examining how people vote with their feet, we can assess the relative importance of the various migration determinants.

Several measures of population change using artificial cohorts are examined to estimate differential impacts across age groups. Thus, we create a "young" age cohort, 5-19 years old in 1991 and then "age" this cohort 10 years by considering the age cohort between 15 and 29 years old in 2001. Age-specific deaths (D) over the 1991-2001 period are added to the 2001 population, ensuring that deaths are not counted as out-migration. The log difference between the 2001 and 1991 population figures yield the approximate percent change in population for the "young" cohort. A similar process is used to calculate

[6]A foundation of Canadian statistical units is the census subdivision (CSD), which is usually an incorporated urban or rural town or municipality (du Plessis et al., 2002). CSDs often do not form a functional economic unit. For example in the Prairies, a town or village forms a CSD, while the surrounding rural municipality forms another CSD. Statistics Canada merges the two into a (more functional) census consolidated subdivision (CCS).

[7]To create an endogeneity problem, it is not enough for past migration to affect the explanatory variables. It is also necessary for the residual term to be correlated with the beginning-of-the-period explanatory variables. This is less likely when there are no key omitted variables that are correlated with (1) past events, (2) the initial values of the explanatory variables, and (3) the residual term. Our use of a fully specified model greatly mitigates this possibility. Endogeneity is also less likely when the dependent variable is measured over long periods as in this case. For example, endogeneity could imply that economic actors are making pre-1991 migration decisions based on what they believe will happen to 1991-2001 population change, which is a lengthy spell for a potential migrant to consider. For these and other reasons, this type of specification has been quite popular in examining city and regional growth dynamics (e.g., Glaeser et al., 1995; Rappaport, 2004b; Simon, 2004; Simon and Nardinelli, 2002).

population change for: "young adults" 20-34 years olds; "adults" 35-49 years olds; "early retirees" 50-59 year-olds; and an "elderly" 60+ years olds, all as of 1991. Finally, we calculate the mortality-adjusted total population change between 1991 and 2001. The calculation of the total population and age cohort groups with a given annual age-specific mortality rate (AMR) are as follows:

$$\text{Popchg\_total} = \log(\text{pop}_{2001} + D) - \log(\text{pop}_{1991}), \quad (2)$$

$$\text{Popchg\_AGE} = \log(\text{pop}_{AGE+10,\ 2001} + D_{AGE}) - \log(\text{pop}_{AGE,\ 1991}), \quad (3)$$

$$D_{AGE} = POP_{AGE,\ 1991}{*}AMR_{AGE} + ESTPOP_{AGE,\ 1992}{*}AMR_{AGE} + \ldots + ESTPOP_{AGE,\ 2000}{*}AMR_{AGE} \quad (4)$$

AGE denotes the five age-specific population cohorts measured in 1991 and D is estimated deaths.[8] For comparison, the correlation of overall 1991-2001 population change and our mortality adjusted population change is 0.96 in the rural sample and 0.99 in our urban sample (which are defined below).

A set of amenity and economic variables is constructed, along with control variables including agglomeration, demographic, human capital, geographic, and social capital. In selecting our explanatory variables, we stay close to the U.S. literature (e.g., Deller et al., 2001; Rupasingha et al, 2002; Glaeser and Shapiro, 2003), although differences in data availability between the U.S. and Canada limited some choices. To the extent possible, the variables correspond to the initial period (1991) for each CCS. Migration decisions are affected not only by the level of amenity and economic factors in a given community (CCS), but by the opportunities available in surrounding locations. Thus, a number of distance weighted variables for surrounding CCSs are created to account for the underlying spatial dependence that may exist between proximate communities, though we also consider more direct spatial econometric approaches, as described below.

We divide the data into two parts: an "urban" set composed of CCSs located in Census Agglomerations (CAs) and Census Metropolitan Areas (CMAs) and the rural and small town (RST)

[8]Net migration would be an alternative dependent variable, but out-migration estimates are not available in census data at such a fine level aggregation used here, though it is available at the provincial, census division, and metropolitan area levels. Mortality rates are taken from Duchesne et al. (1999). Non-census year populations (ESTPOP) are calculated by subtracting expected mortalities occurring in previous years to ensure that people that are already expected to have died in past periods are not multiplied by the mortality rate a second time. A caveat is that mortality data at the CCS level are not available, so national mortality rates are used to estimate expected CCS mortality. In examining the accuracy of our estimates, when aggregating our mortality-adjusted CCS data to the provincial level after subtracting out those who were less than 10 years old in 2001 (so as not to confound births and migrants), the correlation between provincial net domestic migration and the aggregated CCS population change is over 0.8. Generally, Partridge and Rickman (2003a) show that population and migration are highly correlated, which is why many migration studies use population change.

group comprising CCSs outside of CAs and CMAs.[9] The RST (rural and small town) subset contains 1,893 CCSs; the urban (CA/CMA) group 509 CCSs. Approximately 200 RST observations are omitted due to suppressed census data, mostly CCSs with less than 250 residents. The basic model representation for the *i*th CCS is presented below; the specific variables are described in Appendix Table 1:

$$\%popchg_{1991\text{-}2001,\,i} = \beta_0 + \boldsymbol{\beta_1}{*}\mathbf{amenity}_{1991,\,i} + \boldsymbol{\beta_2}{*}\mathbf{econ}_{1991,\,i} + \boldsymbol{\beta_3}{*}\mathbf{agglom}_{1991,\,i} + \boldsymbol{\beta_4}{*}\mathbf{demog}_{1991,\,i} + \boldsymbol{\beta_5}{*}\mathbf{geog}_{1991,\,i} + \boldsymbol{\beta_6}{*}\mathbf{human}_{1991,\,i} + \boldsymbol{\beta_7}{*}\mathbf{social}_{1991,\,i} + \varepsilon_i \quad (5)$$

The **amenity** vector contains 8 natural and 10 modern amenity variables. The natural amenities include percent of CCS covered by forest; adjacency of the CCS to a coastline, one of the Great Lakes and/or whether it contains open water; 5 climate variables; and the standard deviation of CCS elevation to represent the degree of variation in terrain topography. Generally, our choice of natural amenity variables corresponds to past analysis such as Clark and Hunter (1992) and McGranahan (1999) and McGranahan and Gibbs (2005).[10] Modern amenities (or disamenities) include violent crime rates; property crime rates; and distances to 9 government/private services, a proxy for their accessibility.[11] Some of the amenity variables act as positive attractive forces (e.g., forest cover; proximity to lakes, rivers, or seas; proximity to hospitals; etc.), while others generally act as negative or repulsive forces (e.g., high crime rates, high humidity etc.). Because some act as a positive force to some age-cohorts, while being negative for others, clear *a priori* hypothesized effects on population change cannot always be determined.

The **econ** vector includes 11 variables shown in Appendix Table 1. The employment rate, income, and industry mix employment growth variables and their distance-weighted counterparts are designed to measure economic pull factors, as well as spill-over or spread effects.[12] The Herfindahl index measures

[9]CMAs and CAs are formed by one or more adjacent CCSs centered on a large urban core. The population of the urban core must be at least 10,000 to form a CA and at least 100,000 to form a CMA. To be included in the CMA or CA, other adjacent municipalities must have a high degree of integration with the central urban area, as measured by commuting flows (Statistics Canada, 2004). Communities are classified as rural if they do not geographically overlap part of a CA or CMA. Any community not tightly linked to a city of 10,000+ people is classified as rural.
[10]For example, McGranahan (1999) and McGranahan and Gibbs (2005) account for average January sunshine, January temperature, July humidity and temperate summer. Our climate variables described in the Appendix place a greater weight on the variation in Canadian winters (i.e., summer temperatures do not greatly vary across Canada).
[11]We tried numerous other amenity and social capital variables, but the selected grouping had by far the largest explanatory power (see Ferguson, 2005 for details of the multiple measures that were considered). Nevertheless, this does not rule out the possibility that more detailed measures could be constructed such as a precise measure of natural wonders. We also had to be careful in selecting the “modern” amenity variables so as to avoid endogeneity (see footnote 16). Note that the distance variables will likely have differing interpretations in the rural and urban samples. For example, distance to the nearest religious institution would be more meaningful in a sparsely settled region, where in an urban region, this distance is likely close to zero, producing less variation across the sample.
[12]It should be noted that the employment measures could be obtained only by place of *residence* of the employed, as opposed to place of *work*. This should be taken into account in interpreting the individual economic variables such as the employment rate coefficient. If the latter been available, it seems likely that more of the individual economic

the diversity of industry mix – i.e., lower values represent diversity and higher values represent industry concentration (lack of diversity). Because a larger Herfindahl index implies less diverse job opportunities, it should be inversely related to net-migration. Percent employed in agriculture and in other-primary sectors accounts for local dependence on slow growth industries (in terms of jobs). Finally, the non-farm self-employment share tests whether home-grown entrepreneurship and capital attract population.

The **demog** vector includes 4 variables – percent of young (5-19 years) population, percent of old (60+ years) population, percent immigrated 10 years before 1991, and percent aboriginal. The **geog** vector includes 4 dummy variables representing Atlantic, Northern, Ontario and Quebec regions to reflect region-specific differences (Western Canada is the excluded region).

The **human** vector refers to the community's 'human capital endowment.' Three such variables are specified—percent of 25-54 population with post-secondary certificate, with university degree, and without a high school diploma. A more educated workforce is expected to attract more, and idea-oriented, jobs/businesses (Simon and Nardinelli, 2002). In contrast, a higher percentage without a high school diploma is expected to be negatively associated with population change, though it may also signal low wages and a relatively immobile population.

The **social** vector, a proxy for 'social capital endowment' of the community, is represented by four variables. These are distance to the nearest religious institution, percent home ownership, percent eligible voters who voted, and number of voluntary organizations per 100,000 people measured at the census division (CD) level. Of these, Guiso et al. (2004) contend that electoral participation is the best measure of social capital. Social capital models suggest that the distance variable (as an inverse proxy of accessibility) is expected to be negatively associated with population change while the other three variables are expected to be positively associated.

The **agglom** vector refers to the set of variables designed to capture the agglomeration effects, broadly defined. Three variables are included—total initial (1991) population in each CCS, a distance weighted measure of 1991 population in the surrounding CCSs, and distance to the centroid of the nearest Census Agglomeration (CA) or Census Metropolitan area (CMA) (defined in footnote 9). The first variable represents the size or scale of the community itself, and the other two measure proximity to

coefficients would have been stronger and followed more closely to *a priori* expectations.

larger cities (Partridge et al., forthcoming b).

Model Estimation

The three broad groupings of the empirical models include the amenity (and social capital) variable model (Model 1), the full specification with all of the control variables (Model 2), and the spatial-error model for the full specification (Model 3). With the exception of the spatial error model, most specifications are estimated by weighted least squares (WLS) for the rural and urban groups, with their error terms adjusted for spatial clustering (described below). The dependent variable is mortality-adjusted population change, for the total and the five age cohorts separately.

In reporting the results, we emphasize the WLS models with only the amenity (and social capital) variables (to approximate an upper-bound estimate of their influence), as well as the fully-specified WLS models. All cohort models have the same explanatory variables except that two (distances to college and university) are dropped for the adult cohort model and three (distances to school, college, and university) are omitted for the early retiree and elderly cohort models (and distance to long-term care facilities is added). All models are *weighted* by the initial population (1991) to ensure that we are capturing migration tendencies of the typical urban and rural Canadian.[13]

To account for potential autocorrelation or regional clustering in the residuals across CCS observations, two approaches are taken. First we report robust t-statistics that adjust for spatial clustering of the error terms within a CA/CMA in the urban sample or within a census division in the RST sample. Second, we consider a spatial error model (SEM) to adjust for potential spatial autocorrelation in the errors (Anselin, 1988). Becoming our third broad empirical category, the specific SEM we estimate is:

$$\mathbf{y} = \mathbf{X}\boldsymbol{\beta} + \mathbf{u} \qquad (6a)$$

$$\mathbf{u} = \rho\mathbf{W}\mathbf{u} + \boldsymbol{\varepsilon}, \quad \boldsymbol{\varepsilon} \sim \mathrm{N}(0, \sigma^2\mathbf{I}) \qquad (6b)$$

where, $\mathbf{y}$ is a (n x 1) vector of the dependent variable (n being the number of observations in the sample), $\mathbf{X}$ is a (n x k) matrix of the k explanatory variables described above, $\boldsymbol{\beta}$ is a (k x 1) vector of parameters, $\mathbf{u}$

[13]Note that because there are CCSs with population as small as 250 people and others with a population over 1 million, weighting is necessary. Statistics Canada's practice of randomly rounding to the nearest 5 may create measurement error bias in less-populated CCSs, further arguing for weighting by population. Idiosyncratic changes among a few people in less populated CCSs would add additional noise to the unweighted estimates. The actual weights are normalized to sum to the number of observations, so that total sum of squares for the dependent variable is approximately the same as in the unweighted case (which applies when the square of the dependent variables is not significantly different between less and more populated observations, as in our case). The key difference with the unweighted case is the estimated variable coefficients and the adjusted R^2 are calculated giving more weight to the more populated CCSs to better reflect aggregate population change in rural and urban Canada.

is a (n x 1) vector of residuals, ρ is a scalar parameter representing the spatial autocorrelation among residuals, **W** is a (n x n) spatial-weight matrix or neighborhood matrix, and **ε** is a vector of white noise errors. **W** is in row-standardized form of a distance-based weight matrix created using the inverse of the squared distances, which means that spillovers from more distant CCSs receive less weight. A bandwidth of 880 kilometres is used as a cut-off, i.e., CCSs inside this bandwidth retained the weight equal to the value of inverse squared distance; CCSs outside that bandwidth received a value of zero as their weight.

The empirical results are presented with the primary goal of showing how bundles of local factors impact community population growth for different age cohorts (e.g., economic vs. amenity, etc.). Our emphasis will be on deriving the relative contributions of the specific explanatory variable groupings. We use a form of variance decomposition in which we first report the adjusted R^2 statistic when only a specific variable grouping is included in the model (e.g., amenities). This is the "high" bound of the variance explained by that group. The "low" bound estimate is the change in the adjusted R^2 statistic when the target variable grouping is incrementally added to the regression equation that already includes *all* of the other variable groupings. Note that while variance decomposition approaches generally rely on an unadjusted R^2, we use an adjusted R^2 statistic because some groups have more variables than others.[14]

We also provide a "middle" estimate of the key variable-grouping impacts by taking an average of all possible combinations of the change in the adjusted R^2 when that group is added as the first group, the second, etc., all the way through to being added as the sixth or final variable grouping. In each model, this requires estimating 63 regressions for each category (e.g., weather). With total population and 5 age cohorts, 378 (63 x 6) regressions are estimated for each grouping in the urban sample and another 378 regressions for each grouping in the rural sample. We believe this method of deriving a middle estimate for each category's contribution is a novel and practical approach to assess the influence of broad groups.

Since variables within particular groupings tend to be collinear (e.g., climate measures), a key advantage of our variance-decomposition approach is that problems of within-group multicollinearity are less consequential. Further, our primary interest is in overall explanatory power of variable groups and not in the value of a particular coefficient, which may be clouded by collinearity problems.

An alternative approach is to use factor analysis or principal components (PC) of variable groups as

[14]Adding any variable to a regression model will increase the unadjusted R^2 by at least an infinitesimal amount. The adjusted R^2 statistic only increases when an incremental variable has a t-statistic greater than 1.0.

a way to easily summarize each category of variables into one measure (Henry et al., 1997; English et al., 2000; Deller et al., 2001). This approach is quite useful in investigating whether a variable grouping is statistically significant. It is less useful in determining its share of variation, or in ascertaining which, if any, of the component variables are statistically significant. Moreover, as described by Judge et al. (1985, pp. 909-912), despite gains in reducing multicollinearity, using a PC approach to select one summary group measure also has the disadvantage of producing biased results because some of variation in the variable grouping is omitted (akin to omitted variable bias). Because the PC approach does not have better sampling properties than least squares models, they advise that it is "not a good strategy in general." Thus, while no approach is perfect, we believe our variance decomposition approach serves our purposes well, and advances this literature.

4. Empirical Results

Table 1 shows grouped adjusted R^2 results from various regressions, first for the total rural and total urban population, and then for urban and rural age-cohorts. Table 2 contains the results of urban and rural regressions for each of the 3 model types; Tables 3 and 4 present the age-cohort results for urban and rural areas. Again, most of the emphasis will be placed on the two WLS models—one that includes only the amenity variables and one with the full specification—with some attention on the third model (the spatial error model using the full specification).

General Trends – Total Population Growth

Table 1 (Panel A) provides the low, mid, and high bound estimates of each variable grouping for the total population change regressions. Generally, the mid estimate tends to fall a little closer to the lower bound, though the rankings are virtually identical across the three estimates. In interpreting these results, note that we included the social capital variables with the amenities category, treating social capital as a form of amenity.

Overall, economic factors account for the largest proportion of the variation in population change in both rural and urban models, explaining between 8 and 42 percent of the rural variation, and between 5 and 56 percent of the urban model's variation. Amenities are more important than agglomeration in urban areas, with amenities explaining between 6 and 50 percent of the variation in population growth, with a mid-range estimate of about 22 percent.[15] In rural communities, agglomeration is estimated to be the second-most influential variable grouping, explaining between 3 and 27 percent of the variation in population growth, with a mid-range estimate of about 11 percent. The agglomeration results are particularly interesting as the regional/urban literature almost universally stresses agglomeration's role in *urban* settings. Yet, rural agglomeration factors such as population thresholds and critical mass to sustain community vitality actually appear more important than urban agglomeration (Stabler and Olfert, 2002).

A comparison of the relative importance of economic and amenity variables reveals a consistent pattern (Panel A, Table 1). Though second to economic factors in absolute importance, amenities play a relatively more important role in urban (compared with rural) population growth. In contrast with U.S. findings (e.g., Fuguitt and Beale, 1996; McGranahan and Gibbs, 2005; McGranahan and Beale, 2002; Nelson, 2002), Canada's rural population growth is highly dependent on economic factors (relative to amenities). This is consistent with the importance of relatively small, isolated resource-based communities in rural Canada, where it is often a single employer that shapes the growth of the community. Comparable U.S. towns may have more scope for affecting population growth through enhancing amenities. Besides differences in tastes, one reason may be greater average U.S. income levels, in conjunction with high income elasticities for amenities. Overall, these results indicate that quality of life (people) driven growth is relatively more consequential in urban than rural Canada.

Regarding the detailed total population change results in Table 2, the first three models are estimated for rural, with specifications 4 to 6 for urban CCSs. Specifications 1 and 4 include only amenities as explanatory variables (for rural and urban respectively), while specifications 2 and 5 include the entire set of explanatory variables. Specifications 3 and 6 show the results of the spatial error model. A comparison of the adjusted R^2 values of specifications 1 (0.23) and 2 (0.56) indicates that in the case of rural communities, the parsimonious model with only amenities accounts for less than half of the explanatory power of the full model where all the other control variables are included. However, if one examines the adjusted R^2 of the urban models 4 (0.50) and 5 (0.66), the initial explanatory power of amenities alone is

[15]One surprising pattern was the lack of significance of the presence of any water on population growth. Yet, we experimented with alternative measures such as separate indicators for adjacency to ocean, adjacency to a large lake (e.g., Superior or Winnipeg), and the presence of small lakes in the CCS, without effect. We also interacted these indicators with January temperature to account for some bodies of water being very cold (e.g., Hudson Bay), but again without effect. Finally, the percentage of the CCS covered by water was also insignificant.

much higher, while the extra explanatory power of the added non-amenity variables is much smaller.

An examination of the individual coefficients in the fully-specified models 2 and 5 (Table 2) reveals several interesting results, though we caution about the possible impact of multicollinearity. First, natural amenities such as weather and the presence of forests and water do not have a strong effect on population change for either rural or urban areas, with the presence of mountains and July humidity being exceptions in urban areas. These results are at variance with previous findings from U.S. data, which indicate that weather is very important in explaining population growth. A likely explanation is that technological changes such as air conditioning induced widespread Sunbelt migration in the U.S., while Canadians have always lived predominantly in their "Deep South" along the U.S. border.

Modern (dis)amenities such as crime and distance to hospitals and police stations are often more significant in the amenity-only parsimonious models 1 and 4. Yet in the case of rural areas, once economic, agglomeration, and other control variables are added to the fully-specified model (specification 2), amenities take on much less importance. Amenities appear to retain their significance in explaining urban population growth when other control variables are included. For example, it is notable that reduced distance to large hospitals is beneficial in the fully-specified base urban model in column 5.[16] Moreover, again unlike U.S. studies, the social capital measures are mostly insignificant.

In the fully-specified models in columns 2 and 5, a number of economic variables appear to play a large role in population change, though mostly differently between rural and urban areas. In rural areas, the Herfindahl index is negative and highly significant showing that local industry diversification enhances local population growth, perhaps through better labor-force matching and reducing unemployment risk in smaller labor markets. In both urban and rural areas, the percentage of self-employed (non-farm) individuals is positively related to population growth, suggesting that fostering entrepreneurship may be an effective development strategy. The positive highly significant employment rate variable underscores the importance of economic conditions in urban population change.

In terms of agglomeration, rural CCSs benefit from close proximity to large population centers. The

[16]It is possible that there is a persistence in the growth process where in anticipation of *future* growth, private and public actors opened new modern amenity facilities. Though such factors are likely minimal for major facilities such as large hospitals or universities that are more historically predetermined, it could play a role for others such as ski facilities and schools. This could negatively bias their corresponding distance variable coefficients, though our use of a ten-year window should mitigate this concern. In fact, given that most of the possibly suspect modern amenity *facility* distance variables are insignificant, this further suggests that this concern is relatively minor.

positive coefficients on weighted nearby population size (POP_91_SURR) and the negative coefficient on the distance to the nearest city clearly indicate that communities with close access to urban centers had higher 1991-2001 growth, *ceteris paribus*. In neither rural nor urban communities, does higher initial population result in greater subsequent population growth. This implies that congestion and agglomeration effects offset one another in Canada's cities. However, the negative and significant CMA_DISTANCE variable indicates that close proximity to the urban core remains important for community growth even within a CA/CMA. Thus, after accounting for other control variables, the underlying urban congestion and disamenity effects do not appear to be causing Canada's urban centers to deconcentrate to same extent as in the U.S.

Comparison to Principal Component (PC) Approach

To explore how our approach would compare to the PC technique, we tested the PC technique following English et al. (2000), and Deller et al. (2001) on the set of amenity variables. The PC of the 22 amenity variables explained 27.7% and 26.9% within-group cumulative variance in the rural and urban samples respectively. Serving as the upper-bound estimate, when used as the only variable in the total population change equation, the "amenity" PC only explained approximately 5% and 0% of the rural and urban variation compared to the corresponding upper bound estimates of 23.3% and 49.7% when using our upper-bound approach (from Panel A, Table 1). The corresponding lower bound estimate for the amenity PC in the rural and urban samples was only 0.23% and –0.08%.

The PC approach would have suggested that our amenity measures explain virtually none of the variation in population change. This would be an understatement as our base least squares regression approach, by definition, uses *all* of the variation of the amenity variables (not just the PC's variation). Thus, because of poor explanatory power in our sample, the PC approach appears inadequate for our purpose, though future research could determine when this technique could be most successful.

Spatial Econometrics Model

The results of the spatial econometrics models are shown as specifications 3 and 6 of Table 2. If there is spatial dependence in the residuals, it is often induced by omitted variables reflecting attributes of the neighboring communities that in turn produce shocks that cross CCS boundaries. Thus, not accounting for the omitted neighboring variables means that the WLS coefficients likely would be biased and inconsistent. The spatial autocorrelation coefficient (located near the end of the table) is highly significant for both the rural and urban areas. The spatial model results in somewhat reduced significance of the other coefficients, though their values are relatively stable. Thus, because the coefficients are similar to the WLS estimates, we infer that any spatial autocorrelation is more of a nuisance variety that is an artifact of spatial heterogeneity, rather than a process of shocks caused by omitted neighboring characteristics that spill over and bias the coefficients (and create inefficiency in the estimates).[17]

Regression Results by Age Cohorts – Urban Communities

The age-cohort disaggregation of the importance (in terms of adjusted R^2) of the broad variable groups for urban communities is shown in Panel B of Table 1. The results reveal that amenities and economic factors make similar contributions to the variation in population change across cohorts, while agglomeration and other groupings play smaller roles. For urban youth, amenities explain between 4 and 69 percent of population growth, with a mid estimate of 21 percent, while economic factors explain 3 to 67 percent, with a mid estimate of 20 percent. This relative importance of these two variable groupings applies to young adults and adults as well. It is notable that agglomeration variables are the most influential for the youngest cohort, suggesting younger urbanites place more value on urban scale and adjacency to large population centers. One pattern consistent with the U.S. is the importance of initial levels of human capital in explaining subsequent urban population growth, especially in attracting youth.

Table 3 shows the detailed results of the base model urban cohort regressions. Assessing the importance of explanatory variables for specific age groups tests whether the total population results mask idiosyncrasies of component age groups. Unlike the rural regressions, the Herfindahl index is not significant in explaining urban population growth, suggesting that greater industry concentration does not undermine urban labor market matching.

Two age cohorts—young adults and early retirees—are sensitive to a number of amenity variables,

[17]This alternative spatial dependence arises when there is slight spatial heterogeneity in the parameters. For instance, the determinants of population growth in New Brunswick and Manitoba differ modestly. Similarly, there is usually a positive spatial correlation in the explanatory variables (e.g., New Brunswick has less farming than Manitoba). This causes a positive correlation between the residuals (e.g., the model may consistently under (over) predict population growth in New Brunswick (Manitoba)). But this is due more to a slight misspecification from data pooling rather than shocks spilling over to nearby CCSs. All CCSs are pooled to obtain the average national effect and improve efficiency, but assuming a uniform effect can produce a slight loss of information if there is spatial heterogeneity. Standard spatial autocorrelation tests will be unable to identify whether the spatial autocorrelation in the residuals is due to spatial heterogeneity in both the specification and explanatory variables; omitted nearby-CCS variables; or a process of shocks spilling over to nearby CCSs (McMillen, 2003, 2004).

including the presence of hills or mountains, precipitation, and July humidity. The latter also exerts a negative influence for other age cohorts with the exception of the elderly. Violent crime is a disamenity, negatively affecting urban population growth for all cohorts except the elderly. Two “disamenities”—distances to large hospitals and physicians—exert a negative influence on the elderly cohort, with the former also negatively affecting young adult and early retiree cohorts.

As was the case for total population change, the urban population size variables either have a negative or no effect across urban age cohorts. The coefficient for the distance to the urban core (CMA_DISTANCE) is negative and statistically significant for the young, young adult, and adult cohorts, implying that communities further away from the urban core are at a disadvantage with respect to population growth for these cohorts, *ceteris paribus*. Access to unmeasured central-city amenities and employment opportunities could be responsible for this result.

Among the economic variables, population growth in the young age cohort is positively affected by the employment rate and negatively by the prominence of agriculture. This pattern is not unlike that for the young adult cohort where, in addition, the proportion of self-employment exerts a positive influence. Multicollinearity likely masks the positive influence of some of the individual economic variables that is more clearly evident when the economic variables are represented in total as a group in Table 1.

Regression Results by Age Cohort – Rural Communities

The age-cohort disaggregation of the importance (in terms of adjusted R^2) of the broad variable groups for rural communities is shown in Panel C of Table 1. The results indicate that for all cohorts, economic factors play a larger role than either amenities or agglomeration in influencing population growth. The importance of the economic-variable grouping (relative to amenities) is lowest for the elderly age cohort and highest for the adult cohort. Agglomeration and amenities, though less important than economic factors, appear to have the greatest *relative* influence on the young adult and elderly rural cohorts. This implies that while it is most important for rural communities to have strong economies if they wish to attract population, it is also important to provide a superior quality of life for particular age cohorts, while also attracting a critical population mass. Nonetheless, quality of life does not seem to have the same influence as it does in U.S. rural migration patterns—even for seniors.

Table 4 shows the detailed results of the rural cohort regressions. In terms of the specific economic coefficients, more industry diversity in rural communities appears key in attracting younger working age cohorts, as shown by the negative HERF_INDEX coefficient. This effect declines for older cohorts, suggesting that diverse employment opportunities are more important for those earlier in their work life.

The young age cohort is strongly and positively influenced by the employment ratio and the proportion of self-employment, with strong negative influences from the prominence of agriculture and other primary sectors. In fact, the negative effect of primary production sectors, and the positive effect of self-employment, is evident for most age cohorts. In terms of urban scale or agglomeration economies, all (except the elderly) cohorts are positively affected by larger nearby CCS populations (indicated by positive and significant coefficients for the POP_91_SURR variable). This supports the idea that nearby urban centers are the engines of growth for successful rural communities (Partridge et al., forthcoming b), which is further reinforced by the negative and significant influence of distance to the nearest urban center (CMA_DISTANCE) for the young adult and adult age cohorts.[18]

Regarding specific amenities, the results suggest that rural Canadian seniors do not gravitate *en masse* towards places with warmer temperatures as found in U.S. studies (Rappaport, 2004a). The youngest and oldest cohorts are also the most influenced by disamenities. Significant disamenities for the young cohort are violent crime rates and distance from police. For the elderly cohort, violent crime is a deterrent in their location decisions, while access to hospitals and physicians exerts a positive influence.

As indicated above for urban communities, one caveat in interpreting our research, and other research, should be noted. Individual coefficients in the detailed regressions are likely affected by multicollinearity, and for that reason, are less central to our analysis. For this reason, Table 1's results, based on broad variable groups (economic, amenities, etc.), are the most reliable for broad inferences.

5. Conclusion

This paper examines 1991-2001 Canadian community population growth (urban and rural communities separately) for total population, as well as for five age cohorts using a number of econometric models. We develop an innovative approach to gauge the relative contribution of variable groupings (amenities, economic factors, and agglomeration economies) for different population segments. This extends the literature by defining the relative *shares* of population growth attributable to amenities

[18] Several of the distance variables may be correlated, which could affect the individual variable results, but not the variance decomposition results.

and other factors, thus identifying the broad policy alternatives to be considered. The study also extends the literature because there have been few studies that examine Canadian migration patterns at the community level, especially those considering amenities and social capital. Furthermore, unlike much of the literature, population is separated into distinct age cohorts ranging from youth to elderly.

The results reveal that variable groupings have different effects for rural and urban communities. For example, in urban CCSs, amenities and economic factors appear to be about equally important, while in rural CCSs, economics clearly dominates. Moreover, the age groups respond differently to combinations of amenities, economic factors, and urban scale. For example, agglomeration factors were more important for the urban young and rural young adults. In rural communities, economic variables explained the highest proportion of variation except for the elderly population, where economic factors and amenities were roughly equivalent. Overall, the U.S. pattern of amenity driven migration appears less applicable to Canada. The spatial distribution of the Canadian population, along a thin east-west line along the U.S. border, results in relatively little scope for movement towards warmer climate. Further the presence of francophone Quebec and the extensive Canadian Shield impose a geographic barrier to mobility. Finally, as already noted, the greater U.S. standard of living in conjunction with high income elasticities for amenities imply a larger scope for amenity-based migration. The Canada-U.S. differences invite additional investigation of the applicability of the well-established U.S. findings to other settings.

Policy implications of this research suggest that a targeted approach for population attraction and retention is appropriate. Given the broad groupings of variables of primary interest here—economic, amenity, and agglomeration—the results imply that for rural communities, especially those concerned with retaining/attracting rural youth, supporting/facilitating economic activity would have the greatest payoff. This paramount importance of economic factors applies to all rural age cohorts. Yet, in some cases, especially in remote communities, improving quality of life may be more attainable than stimulating economic growth; and our results suggest that this could have positive results when targeted at certain cohorts. Yet, for hinterland rural communities dependent on agricultural and other primary bases, the negative influence of this dependence underlines the importance of stimulating a more diversified economic base. The specific means for enhancing a community's economy will often vary from one community to the next. For the rural elderly, amenities are virtually equal in importance to economic factors. As this age cohort swells with the aging of the baby boomers, enhancing amenities will become increasingly important for rural communities aiming to attract/retain population.

The importance of surrounding regional population scale or size and proximity to urban centers is clearly a part of the reality facing rural communities. Access to the benefits afforded by size and scale of larger nearby communities as a way of retaining local population may be promoted by improving rural-urban links, focussing on regional, rather than community strategies, i.e., regional policies for development, zoning, and infrastructure with governance structures reflecting these realities.

In an urban setting, a more balanced approach between job creation and quality of life policies holds more promise than in rural areas. Further, urban centers likely have greater capacity to successfully conduct both quality of life and economic development initiatives (at the risk of oversimplifying the difference between the two policies). For urban quality of life, access to large hospitals and lower violent crime rates are good examples of community attributes that may be influenced by policy direction. Regarding the former, these results support community efforts to build healthcare clusters. Finally, in communities disadvantaged by the absence of the climatic and landscape variables that positively influence population, these limitations must be recognized and alternatives investigated.

Future research is required to test the robustness of these findings for additional measures of amenities, such as cultural amenities, especially in terms of potential differential effects in rural and urban areas. Applications for rural economic and land use planning as well as environmental protection depend on additional refinements in the empirical investigation of the role of amenity and economic factors. Further, how the income elasticity for amenities influences population migration merits more international investigation. While our primary focus was the relative importance of amenities, economic characteristics, and agglomeration economies, a high priority should be placed on enhancing human capital, especially in chronically lagging regions and areas of persistent poverty.

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Table 1: Adjusted R^2 Contributions of Variable Groups for Total Population and Age Cohorts

Panel A - Total Population Change

	Rural			Urban		
Variable Grouping	Low	Mid	High	Low	Mid	High
Amenities	0.020	0.085	0.233	0.063	0.218	0.497
Economic	0.083	0.204	0.423	0.054	0.242	0.557
Agglomeration	0.029	0.111	0.268	0.004	0.035	0.137
Human capital	0.002	n.a.	0.124	0.000	n.a.	0.091
Demographic	0.022	n.a.	0.176	0.020	n.a.	0.247
Regional	0.005	n.a.	0.125	0.003	n.a.	0.118

Panel B - Urban Communities by Age Cohort

	Youth		Young Adult		Adult		Early Retiree		Elderly	
Variable Grouping	Low	High	Low	High	Low	High	Low	High	Low	High
Amenities	0.041	0.692	0.082	0.683	0.057	0.448	0.067	0.365	0.052	0.276
[Mid]	[0.213]		[0.305]		[0.205]		[0.179]		[0.126]	
Economic	0.025	0.673	0.043	0.672	0.061	0.405	0.063	0.384	0.056	0.293
[Mid]	[0.198]		[0.279]		[0.188]		[0.187]		[0.152]	
Agglomeration	0.003	0.419	0.005	0.160	0.009	0.136	0.012	0.144	-0.002	0.097
[Mid]	[0.093]		[0.050]		[0.041]		[0.049]		[0.030]	
Human capital	0.007	0.485	0.001	0.127	0.001	0.065	-0.001	0.103	0.020	0.033
Demographic	0.015	0.645	0.010	0.274	0.014	0.150	0.054	0.253	0.088	0.134
Regional	0.011	0.062	0.000	0.067	0.010	0.110	0.003	0.098	0.018	0.101

Panel C - Rural Communities by Age Cohort

	Youth		Young Adult		Adult		Early Retiree		Elderly	
Variable Grouping	Low	High	Low	High	Low	High	Low	High	Low	High
Amenities	0.033	0.219	0.025	0.239	0.013	0.144	0.009	0.139	0.029	0.135
[Mid]	[0.094]		[0.083]		[0.052]		[0.051]		[0.068]	
Economic	0.074	0.342	0.050	0.317	0.042	0.305	0.043	0.243	0.047	0.135
[Mid]	[0.171]		[0.137]		[0.15]		[0.135]		[0.082]	
Agglomeration	0.012	0.114	0.018	0.247	0.015	0.131	0.011	0.105	0.019	0.113
[Mid]	[0.043]		[0.092]		[0.052]		[0.042]		[0.052]	
Human capital	0.002	0.142	0.001	0.088	0.005	0.043	0.003	0.023	0.006	0.060
Demographic	0.057	0.253	0.016	0.090	0.098	0.279	0.106	0.228	0.007	0.065
Regional	0.007	0.051	0.012	0.173	0.001	0.077	0.001	0.060	0.008	0.032

The adjusted R^2 values provided in panels A, B, and C correspond to regression results for the complete models presented in Tables 2, 3, and 4 (not the spatial econometric models). These values can be interpreted as the percentage of variation in the dependent variable (population change) explained by each of the variable groupings. The "High" values correspond to regressions where the variable group in question is the only group of variables in the model. The "Low" values are additional adjusted R^2 when a variable group is added to complete the full model. The “Middle” values (square brackets) correspond to the average incremental contribution of each group of variables when a group is estimated alone, added as a second group, third group, and so on up to the sixth group to complete the full model. The mid estimates are not reported for the human capital, demographic, and regional categories for the sake of brevity.

Table 2: Percentage Change in Total Population Regressions, Rural and Urban, Various Models

	Rural			Urban		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Variable Name	Amenities	Add All	Spatial	Amenities	Add All	Spatial
INTERCEPT	-1.95	-13.7**	-10.9**	8.65***	10.3	10.8
	(-0.45)	(-2.49)	(-2.25)	(2.71)	(0.77)	(1.04)
COVER_FOREST	-0.0007	0.005	0.004	-0.015*	-0.007	-0.002
	(-0.13)	(0.96)	(0.94)	(-1.67)	(-0.83)	(-0.25)
D_ANYWATER	0.289	-0.359	0.458**	-0.729	0.236	-0.241
	(0.64)	(-1.01)	(2.01)	(-0.76)	(0.35)	(-0.43)
ELEV_STD_DEV	0.005	0.0001	0.001	0.0009	0.008***	-0.0008
	(1.6)	(0.06)	(0.54)	(0.24)	(2.82)	(-0.21)
WEATH_AVE_PRECIP	-0.001	-0.001*	-0.001*	-0.00008	0.001	-0.00007
	(-1.32)	(-1.82)	(-1.71)	(-0.07)	(1.57)	(-0.07)
WEATH_AVE_SNOW	-0.002	0.001	0.0006	-0.008	0.002	0.001
	(-0.56)	(0.53)	(0.31)	(-1.49)	(0.35)	(0.24)
WEATH_JAN_SUNSHINE	0.0226	0.0114	0.001	0.0148	0.0187	0.0193
	(1.29)	(0.97)	(0.14)	(0.68)	(0.92)	(1.02)
WEATH_JAN_TEMP	0.0733	-0.108	-0.187***	0.278***	0.0663	0.106
	(0.81)	(-1.43)	(-2.84)	(2.65)	(0.79)	(0.97)
WEATH_JULYHUMID	0.0103	0.002	-0.002	-0.108***	-0.0577***	-0.0351
	(0.47)	(0.11)	(-0.13)	(-3.29)	(-2.83)	(-1.48)
CRIME_PROPERTY_RATE	0.001***	0.0001	0.0001	0.0003	0.0002	0.0003
	(5.27)	(0.93)	(0.54)	(1.33)	(0.77)	(1.37)
CRIME_VIOLENT_RATE	-0.003***	0.0003	-0.0003	-0.003***	-0.002***	-0.001
	(-4.54)	(0.43)	(-0.51)	(-3.44)	(-2.76)	(-1.42)
DIST_SMALL ACUTE HOSP	0.0106	0.017*	-0.006	0.109***	0.109***	0.0613**
	(0.82)	(1.71)	(-0.81)	(3.34)	(3.04)	(2.28)
DIST_LARGE HOSPITAL	-0.0123**	-0.002	-0.002	0.001	-0.0189***	-0.017**
	(-2.51)	(-0.62)	(-0.59)	(0.16)	(-2.63)	(-2.47)
DIST_COLLEGE	0.004	0.004	-0.003	0.0132	0.0208**	0.009
	(0.45)	(0.82)	(-0.65)	(1.07)	(2.02)	(0.91)
DIST_PHYSICIAN	-0.00915	-0.003	-0.001	-0.0241	0.0165	0.0121
	(-0.66)	(-0.28)	(-0.15)	(-0.4)	(0.4)	(0.43)
DIST_POLICE	-0.0353**	-0.0151	-0.0129	-0.0713**	-0.0658**	-0.0212
	(-2.47)	(-1.56)	(-1.49)	(-2.25)	(-2.15)	(-0.8)
DIST_SCHOOL	0.0267	-0.0101	-0.005	0.009	0.0441	0.0614*
	(1.05)	(-0.58)	(-0.35)	(0.19)	(1.46)	(1.68)
DIST_SKI	-0.005	0.001	0.001	-0.0388***	0.0003	-0.008
	(-0.66)	(0.28)	(0.25)	(-4.45)	(0.04)	(-0.96)
DIST_UNIV	-0.005	0.0005	0.001	-0.001	0.005	0.004
	(-1.05)	(0.14)	(0.46)	(-0.19)	(0.86)	(0.68)
POP_91		0.00005	0.00004		-0.0000003	-0.000003
		(1.34)	(1.31)		(-0.22)	(-1.39)
POP_91_SURR		0.00008***	0.00008***		-0.000004	-0.000005
		(4.63)	(4.13)		(-0.61)	(-0.61)
CMA_DISTANCE		-0.011**	-0.008*		-0.0257**	-0.004
		(-2.35)	(-1.81)		(-2.06)	(-0.4)

EMPLOYMENT		0.007	0.007		0.304***	0.027
		(0.21)	(0.45)		(3.12)	(0.49)
EMPLOYMENT_SURR		0.131*	0.188***		-0.205	-0.0181
		(1.9)	(3.17)		(-1.54)	(-0.16)
HERF_INDEX		-11.2***	-10.2***		-15.1	-19.5***
		(-3.17)	(-5.16)		(-1.36)	(-2.84)
INCOME		-0.00001	0.00007		0.00003	-0.00001
		(-0.14)	(1.43)		(0.06)	(-0.08)
INCOME_SURR		0.0003	0.00004		0.0008**	0.0005
		(1.11)	(0.18)		(2.1)	(1.53)
INDMIX_EMPGROWTH		-0.119	-0.181		-1.29*	-0.565
		(-0.6)	(-1.64)		(-1.75)	(-1.43)
INDMIX_SURR		0.424*	0.431**		-0.231	0.138
		(1.87)	(2.32)		(-0.56)	(0.39)
PER_BEL_MEDIAN		0.004	0.004		-0.005	-0.0544*
		(0.31)	(0.52)		(-0.06)	(-1.85)
PER_EMPLOY_AGRIC		-0.0778*	-0.0702***		-0.35**	-0.171*
		(-1.91)	(-2.99)		(-2.42)	(-1.89)
PER_PRIMARY		-0.188***	-0.0984***		0.0102	-0.0853
		(-5.95)	(-4.17)		(0.09)	(-1.12)
PER_SELFEMPLOY		0.202***	0.0489**		0.486***	0.176**
		(5.04)	(2.43)		(3.04)	(2.27)
DIST_RELIG	0.0584***	0.0172*	0.0174**	-0.005	-0.0819**	-0.0856**
	(3.28)	(1.85)	(2.21)	(-0.11)	(-2.55)	(-2.15)
PER_OWN_HOME	0.007	0.002	0.0006	0.167***	-0.0114	0.0277*
	(1.28)	(0.28)	(0.11)	(4.55)	(-0.48)	(1.68)
PERCAP_VOL	-1.3*	-0.494	0.0129	-3.5**	-1.92	-1.14
	(-1.95)	(-0.97)	(0.03)	(-1.99)	(-1.24)	(-1.03)
PERVOTE_EV	0.0622	0.0392	0.0293	0.0156	-0.0006	0.0423
	(1.36)	(1.3)	(1.09)	(0.65)	(-0.01)	(0.85)
Human Capital Group		X	X		X	X
Demographic Group		X	X		X	X
Regional Dummy Group		X	X		X	X
Spatial Autocorrelation Coefficient			0.721***			0.364***
			(17.17)			(5.40)
Adjusted R^2	0.233	0.556	0.472	0.497	0.660	0.440
N	1893	1893	1893	509	509	509

Regressions are weighted by the 1991 initial CCS population. Due to concerns about outliers and Statistics Canada data suppression, the territories and CCSs with missing data or a population of less than 250 are excluded from this regression. Robust t-statistics are reported in parentheses. They are adjusted for regional clustering of the error terms by census division in the RST sample and by CA/CMA in the urban sample. *, **, and *** denote significance at 10%, 5%, and 1% levels respectively.

Note: To compare with the WLS R^2, a similar R^2 measure for the spatial error model is also calculated by simply squaring the correlation coefficient between observed and predicted values of the dependent variable.

Table 3: Percentage Change in Urban Population Regressions, by Age Cohort

Variable Name	Young	Young Adult	Adult	Early Retire	Elderly
INTERCEPT	76.6***	-20.0	12.4	-22.7**	-11.0
	(2.63)	(-1.27)	(1.11)	(1.96)	(-0.95)
COVER_FOREST	0.0007	-0.0183**	-0.003	-0.012*	-0.008
	(0.05)	(-2.08)	(-0.38)	(-1.66)	(-1.27)
D_ANYWATER	0.659	-0.915	0.533	0.861*	0.0642
	(0.73)	(-0.76)	(0.99)	(1.73)	(0.14)
ELEV_STD_DEV	-0.006	0.012***	0.004	0.009***	0.005**
	(-1.3)	(3.47)	(1.41)	(3.0)	(2.55)
WEATH_AVE_PRECIP	0.0006	0.004***	0.0006	0.001**	0.0007
	(0.44)	(3.68)	(0.76)	(2.05)	(1.3)
WEATH_AVE_SNOW	-0.003	0.004	0.006	0.004	-0.003
	(-0.33)	(0.51)	(1.39)	(0.67)	(-0.93)
WEATH_JAN_SUNSHINE	0.01	0.0578**	-0.005	0.002	-0.006
	(0.31)	(2.27)	(-0.3)	(0.14)	(-0.49)
WEATH_JAN_TEMP	0.125	0.107	0.0778	0.146**	-0.0103
	(0.84)	(1.14)	(0.98)	(2.01)	(-0.15)
WEATH_JULYHUMID	-0.0577*	-0.094***	-0.0564***	-0.0279**	-0.002
	(-1.68)	(-3.94)	(-3.58)	(-1.98)	(-0.15)
CRIME_PROPERTY_RATE	-0.0001	0.0003	0.00004	-0.0001	-0.00005
	(-0.36)	(0.97)	(0.28)	(-0.77)	(-0.39)
CRIME_VIOLENT_RATE	-0.002*	-0.003***	-0.002***	-0.002**	-0.0002
	(-1.72)	(-2.77)	(-2.76)	(-2.55)	(-0.41)
DIST_SMALL ACUTE HOSP	0.138***	0.152***	0.0816***	0.0393	-0.007
	(2.82)	(3.71)	(2.72)	(0.84)	(-0.27)
DIST_LARGE HOSPISTAL	-0.005	-0.0385***	-0.00953	-0.0134***	-0.00944**
	(-0.39)	(-4.92)	(-1.57)	(-2.6)	(-2.52)
DIST_COLLEGE	-0.00936	0.0313*			
	(-0.66)	(1.89)			
DIST_PHYSICIAN	-0.0355	0.0925*	0.008	0.0175	-0.0948**
	(-0.64)	(1.69)	(0.2)	(0.45)	(-2.12)
DIST_POLICE	-0.0866*	-0.0899**	-0.0256	-0.0123	0.0225
	(-1.8)	(-2.5)	(-1.14)	(-0.53)	(1.2)
DIST_SCHOOL	-0.007	0.0682*	0.0411		
	(-0.13)	(1.85)	(1.55)		
DIST_SKI	0.0124	0.002	-0.003	-0.0106*	-0.005
	(1.08)	(0.18)	(-0.81)	(-1.81)	(-0.97)
DIST_UNIV	0.0124	0.015**			
	(1.26)	(2.04)			
DIST_LTERM				-0.0118	0.008
				(-0.35)	(0.33)
DIST_RELIG	-0.0118	-0.1**	-0.0763***	-0.0705***	-0.0498**
	(-0.26)	(-2.14)	(-2.86)	(-2.61)	(-2.15)
PER_OWN_HOME	-0.304***	0.207***	-0.0249	-0.0529**	-0.101***
	(-5.77)	(4.74)	(-1.25)	(-2.25)	(-4.67)
PERCAP_VOL	-5.41**	-1.09	-1.68	-2.05	1.13

	(-2.11)	(-0.58)	(-1.2)	(-1.49)	(1.36)
PERVOTE_EV	-0.008	-0.0297	0.0237	-0.03	0.0191
	(-0.09)	(-0.56)	(0.52)	(-1.02)	(0.83)
POP_91	-0.000002	0.000002	-0.0000008	-0.000004***	-0.00000005
	(-0.72)	(1.39)	(-0.53)	(-3.36)	(-0.05)
POP_91_SURR	-0.00001	0.00001	-0.000008	-0.00001***	-0.000004
	(-1.10)	(1.46)	(-1.49)	(-3.32)	(-1.02)
CMA_DISTANCE	-0.0411**	-0.035**	-0.0225*	0.023	-0.002
	(-2.57)	(-2.08)	(-1.69)	(1.33)	(-0.12)
EMPLOYMENT	0.38***	0.249*	0.0558	0.169**	0.121*
	(2.64)	(1.93)	(0.74)	(2.35)	(1.72)
EMPLOYMENT_SURR	-0.125	-0.417**	-0.0606	-0.114	-0.0996
	(-0.62)	(-2.54)	(-0.60)	(-1.25)	(-1.14)
HERF_INDEX	-7.88	-15.5	-7.12	7.86	-0.973
	(-0.41)	(-1.25)	(-0.72)	(0.95)	(-0.12)
INCOME	-0.00005	0.0004	-0.0003	-0.0006	-0.0003
	(-0.08)	(0.67)	(-0.85)	(-1.59)	(-1.1)
INCOME_SURR	0.001**	0.001**	0.0005*	0.0004	0.0004
	(2.4)	(2.27)	(1.79)	(1.29)	(1.11)
INDMIX_EMPGROWTH	-1.93**	-1.0	-1.17***	-0.146	0.859***
	(-2.19)	(-0.75)	(-2.69)	(-0.27)	(2.83)
INDMIX_SURR	-0.621	-0.0917	-0.0399	0.149	-0.243
	(-1.13)	(-0.17)	(-0.12)	(0.49)	(-0.99)
PER_BEL_MEDIAN	0.261**	-0.002	-0.13	0.0145	-0.0766
	(1.99)	(-0.02)	(-1.51)	(0.22)	(-1.19)
PER_EMPLOY_AGRIC	-0.563**	-0.098	-0.218*	-0.183*	-0.0943
	(-2.42)	(-0.4)	(-1.7)	(-1.76)	(-1.14)
PER_PRIMARY	-0.0554	-0.064	0.143	0.0204	-0.184***
	(-0.33)	(-0.37)	(1.41)	(0.19)	(-2.61)
PER_SELFEMPLOY	0.346	0.85***	0.583***	0.812***	0.442*
	(1.40)	(3.88)	(3.74)	(4.94)	(1.89)
Human Capital Group	X	X	X	X	X
Demographic Group	X	X	X	X	X
Regional Dummy Group	X	X	X	X	X
Adjusted R^2	0.832	0.792	0.560	0.600	0.491
N	509	509	509	509	509

Regressions are weighted by the 1991 initial CCS population. Due to concerns about outliers and Statistics Canada data suppression, the territories and CCSs with missing data or a population of less than 250 are excluded from this regression. Robust t-statistics are reported in parentheses. They are adjusted for regional clustering of the error terms by CA/CMA.

*, **, and *** denote significance at 10%, 5%, and 1% levels respectively.

Table 4: Percentage Change in Rural Population Regressions, by Age Cohort

Variable Name	Young	Young Adult	Adult	Early Retire	Elderly
INTERCEPT	-9.2	-35.5***	-0.076	-29.1***	14.7***
	(-0.74)	(-4.30)	(-0.01)	(-3.29)	(2.86)
COVER_FOREST	0.0108	0.005	0.0156***	0.0004	-0.008**
	(1.4)	(0.63)	(3.6)	(0.07)	(-2.07)
D_ANYWATER	-0.737	-0.906	0.0005	0.93*	-0.007
	(-1.42)	(-1.58)	(0.01)	(1.89)	(-0.03)
ELEV_STD_DEV	0.001	0.002	-0.002	-0.002	-0.0009
	(0.26)	(0.65)	(-0.92)	(-0.81)	(-0.49)
WEATH_AVE_PRECIP	-0.003*	-0.0007	-0.001**	-0.002**	-0.001
	(-1.92)	(-0.70)	(-2.17)	(-2.44)	(-1.58)
WEATH_AVE_SNOW	0.003	0.002	0.001	0.004	0.001
	(0.69)	(0.58)	(0.65)	(1.32)	(0.95)
WEATH_JAN_SUNSHINE	-0.004	0.0464***	-0.005	-0.004	0.003
	(-0.2)	(2.74)	(-0.52)	(-0.29)	(0.46)
WEATH_JAN_TEMP	-0.108	-0.104	-0.0435	0.0539	0.0561
	(-0.87)	(-0.89)	(-0.7)	(0.61)	(0.99)
WEATH_JULYHUMID	0.0178	-0.008	-0.002	0.0157	0.004
	(0.67)	(-0.37)	(-0.15)	(0.9)	(0.3)
CRIME_PROPERTY_RATE	0.002***	-0.0005	-0.0005**	0.0002	0.0002
	(2.96)	(-1.03)	(-2.57)	(0.68)	(1.12)
CRIME_VIOLENT_RATE	-0.002*	0.001	0.0007	-0.0009	-0.002***
	(-1.86)	(1.63)	(1.24)	(-1.13)	(-3.89)
DIST_SMALL ACUTE HOSP	0.0248*	0.0184	0.00905	-0.0005	-0.0149**
	(1.66)	(1.34)	(1.03)	(-0.05)	(-2.38)
DIST_LARGE HOSPISTAL	0.002	0.0003	-0.004	-0.009*	-0.007**
	(0.43)	(0.04)	(-1.12)	(-1.81)	(-2.16)
DIST_COLLEGE	0.0149*	-0.008			
	(1.68)	(-1.32)			
DIST_PHYSICIAN	0.001	0.009	0.005	0.0129	-0.0132*
	(0.11)	(0.54)	(0.49)	(1.05)	(-1.80)
DIST_POLICE	-0.0399***	-0.008	0.003	-0.005	-0.001
	(-2.61)	(-0.62)	(0.31)	(-0.42)	(-0.14)
DIST_SCHOOL	-0.0235	0.007	0.002		
	(-0.98)	(0.28)	(0.14)		
DIST_SKI	0.0005	-0.005	-0.002	-0.00971*	0.008**
	(0.07)	(-0.62)	(-0.6)	(-1.69)	(2.08)
DIST_UNIV	-0.005	0.003			
	(-0.99)	(0.64)			
DIST_LTERM				-0.0004	-0.0003
				(-0.06)	(-0.06)
POP_91	0.00006	0.00002	-0.00003	0.00002	0.0001***
	(1.09)	(0.41)	(-1.10)	(0.73)	(4.61)
POP_91_SURR	0.00008**	0.0001***	0.00007***	0.00008***	0.0000004
	(2.28)	(5.20)	(6.62)	(6.67)	(0.05)

CMA_DISTANCE	-0.007	-0.0163**	-0.009*	-0.006	-0.005
	(-0.98)	(-2.16)	(-1.77)	(-0.64)	(-1.27)
EMPLOYMENT	0.146***	-0.0227	-0.0998***	-0.0415	-0.0106
	(2.75)	(-0.46)	(-2.95)	(-1.01)	(-0.44)
EMPLOYMENT_SURR	0.437***	-0.0369	0.0587	-0.006	0.0759
	(3.15)	(-0.36)	(0.94)	(-0.06)	(1.42)
HERF_INDEX	-13.4*	-11.8**	-9.28**	2.65	-5.81*
	(-1.68)	(-2.34)	(-2.18)	(0.49)	(-1.68)
INCOME	0.00002	0.00003	-0.00001	-0.0003*	0.00005
	(0.09)	(0.18)	(-0.13)	(-1.70)	(0.67)
INCOME_SURR	-0.0007	0.001***	0.0004	0.0002	-0.0004**
	(-1.55)	(2.73)	(1.53)	(0.49)	(-2.27)
INDMIX_EMPGROWTH	0.0474	-0.0269	-0.661***	-0.673**	0.163
	(0.13)	(-0.09)	(-3.21)	(-2.04)	(0.69)
INDMIX_SURR	0.223	0.487	0.469**	0.601**	-0.0748
	(0.50)	(1.51)	(2.33)	(2.06)	(-0.46)
PER_BEL_MEDIAN	0.0479	-0.0407*	-0.0197*	-0.0577**	0.0472***
	(1.24)	(-1.65)	(-1.69)	(-2.17)	(3.96)
PER_EMPLOY_AGRIC	-0.153**	-0.001	-0.103***	-0.256***	-0.0488
	(-1.96)	(-0.02)	(-2.63)	(-3.98)	(-1.13)
PER_PRIMARY	-0.314***	-0.218***	-0.0564*	-0.0871	-0.0789**
	(-4.91)	(-4.03)	(-1.75)	(-1.21)	(-2.48)
PER_SELFEMPLOY	0.0967	0.258***	0.221***	0.274***	0.0489
	(1.47)	(4.06)	(4.94)	(3.67)	(1.56)
DIST_RELIG	0.0219	0.0249*	0.0125	0.006	-0.006
	(1.57)	(1.95)	(1.5)	(0.55)	(-0.64)
PER_OWN_HOME	-0.0172	0.0146	0.006	0.035*	-0.0112
	(-0.52)	(0.76)	(1.07)	(1.73)	(-1.42)
PERCAP_VOL	0.469	-1.98***	0.144	0.614	0.81**
	(0.44)	(-2.81)	(0.31)	(0.96)	(2.26)
PERVOTE_EV	0.0802*	0.0621	0.0315	0.039	0.004
	(1.72)	(1.23)	(1.00)	(0.91)	(0.19)
Human Capital	X	X	X	X	X
Demographic	X	X	X	X	X
Regional Dummy	X	X	X	X	X
Adjusted R^2	0.494	0.425	0.464	0.420	0.268
N	1893	1893	1893	1893	1893

Regressions are weighted by the 1991 initial CCS population. Due to concerns about outliers and Statistics Canada data suppression, the territories and CCSs with missing data or a population of less than 250 are excluded from this regression. Robust t-statistics are reported in parentheses. They are adjusted for regional clustering of the error terms by census division.

*, **, and *** denote significance at 10%, 5%, and 1% levels respectively.

Appendix Table 1: Variable Description, Data Sources, and Weighted Descriptive Statistics[a]

Variable	Description	Source	Rural Wtd		Urban Wtd	
			Mean	Std Dev	Mean	Std Dev
Dependent Variables						
POPCHG_TOT	Percentage change in the total population accounting for mortality between 1991 and 2001	CoP, Auth	3.97	5.25	7.05	4.64
POPCHG_YOUTH	Percentage change in young people aged 5-19 in 1991 (born 1972-1986) accounting for mortality between 1991 and 2001	CoP, Auth	-10.49	8.86	5.28	9.97
POPCHG_YOUNG_ADULT	Percentage change in young adults aged 20-34 in 1991 (born 1957-1971) accounting for mortality between 1991 and 2001	CoP, Auth	2.68	8.09	2.38	7.87
POPCHG_ADULT	Percentage change in adults aged 35-49 in 1991 (born 1942-1956) accounting for mortality between 1991 and 2001	CoP, Auth	2.05	6.16	0.87	3.52
POPCHG_EARLY_RETIRE	Percentage change in early retirees aged 50-59 in 1991 (born 1932-1941) accounting for mortality between 1991 and 2001	CoP, Auth	6.54	8.27	3.52	4.07
POPCHG_ELDERLY	Percentage change in late retirees aged 60+ in 1991 (born before 1931) accounting for mortality between 1991 and 2001	CoP, Auth	7.31	4.32	9.16	2.84
Economic Indicators						
EMPLOYMENT	1991 employment rate for individuals age 15+	CoP	56.53	10.91	62.35	5.99
EMPLOYMENT_SURR	A distance-weighted measure of the employment rate in1991 in surrounding CCSs. Calculated by multiplying EMPLOYMENT by a spatial weight matrix (W)		57.61	9.08	62.66	5.78
HERF_INDEX	1991 Herfindahl Industry Concentration Index	CoP	0.18	0.05	0.18	0.02
INCOME	The 1991 average per-capita income of individuals 15+ in the CCS	CoP	17,916	3,332.2	22,887	3,127.1
INCOME_SURR	A distance-weighted measure of the average income in 1991 in surrounding CCSs. Calculated by multiplying INCOME by a spatial weight matrix (W)		17,909	2,543.7	21,488	2,758.6
INDMIX_EMPGROWTH	Industry mix employment growth, calculated by multiplying each industry's national employment growth (between 1991 and 2001) by the initial period (1991) industry employment shares in each CCS	CoP, Auth	12.15	2.60	14.69	0.97
INDMIX_SURR	A distance-weighted measure of employment growth between 1991 and 2001 in surrounding CCSs. Calculated by multiplying INDMIX_EMPGROW by a spatial weight matrix (W)	CoP, C-RERL	11.63	2.22	12.98	1.56
%_BEL_MEDIAN	The 1991 percentage of the households in each CCS that have an income below the national median level	CoP	48.82	15.12	37.37	10.09
% EMPLOY_AGRIC	The percentage of the CCS workforce that is employed in the agricultural sector, 1991	CoP	11.33	12.87	1.36	2.46
%_PRIMARY	The percentage of the CCS workforce that is employed in primary industry other than agriculture (natural resource extraction), 1991	CoP	3.43	5.32	1.12	2.83
%_SELFEMPLOY	The percentage of the workforce in each CCS that is self-employed, 1991	CoP	8.8	3.51	8.3	1.98
Human Capital						
% CERTIFICATE	Percentage of individuals 25-54 that have attained a post-secondary certificate or diploma, 1991	CoP	13.95	3.85	15.01	2.53
%_NO_HSGRAD	Percentage of individuals 25-54 that did not attain a high school diploma, 1991	CoP	28.95	5.73	23.24	4.86

%_UNIVERSITY	Percentage of individuals 25-54 that have attained a university degree, 1991	CoP	5.46	2.72	12.73	5.34
Demographic						
%_ABORIGINAL	The 1991 percentage of the population in the CCS that is aboriginal	CoP	5.71	11.68	3.0	3.85
%_IMMIG_10	Percentage of the population that has immigrated to Canada in the last 10 years, 1991	CoP	0.83	0.98	6.17	5.60
%_OLD	Percentage of the population aged 60+ in 1991	CoP	16.97	5.76	14.94	4.36
%_YOUNG	Percentage of the population aged 5-19 in 1991	CoP	30.82	4.69	27.07	4.55
Geographic Dummies						
D_ATLANTIC	Dummy variable; 1if the CCS is in either Newfoundland, P.E.I., Nova Scotia, or New Brunswick	StatsCan, Auth	0.19	0.39	0.06	0.23
D_NORTHERN	Dummy variable; 1 if the CCS is located in a remote northern region	StatsCan, Auth	0.05	0.22	0.01	0.11
D_ONTARIO	Dummy variable; 1 if the CCS is located in Ontario	StatsCan, Auth	0.23	0.42	0.41	0.49
D_QUEBEC	Dummy variable; 1 if the CCS is located in Quebec	StatsCan, Auth	0.27	0.44	0.25	0.43
Social Capital						
DIST_RELIG	Distance to the nearest religious institution (km)	DMTI, C-RERL	13.19	28.35	3.67	11.47
%_OWN_HOME	Percentage of Individuals living in an owned home	CoP	76.54	21.32	66.36	13.52
PERCAP_VOL	Number of volunteer organizations per 100,000 people, measured at the CD level	CBP, C-RERL	0.75	0.38	0.46	0.24
PERVOTE_EV	Percentage of eligible voters that voted in the 2000 federal election, measured at the Electoral District level	Ecan, C-RERL	62.33	5.03	55.03	12.99
Agglomeration						
POP_91	The total population of the CCS in 1991	CoP	7,942.2	7,430.4	344,014	470,247
POP_91_SURR	Computed as W *x* X where X is the initial-year CCS population and W is the spatial weight matrix defined in equation (6). The result is the distance-weighted average of the neighboring CCSs' population.		14,156	17,768	59,727	59,167
CMA_DISTANCE	Distance to the center of the nearest CMA or CA	C-RERL	71.4	71.03	20.62	34.04
Modern Amenities						
CRIME_PROPERTY_RATE	Property crime rate (number of property crimes per 100,000 people)	CCJS, StatsCan, Auth	3,735.1	1,308.9	5,637.8	1,847.1
CRIME_VIOLENT_RATE	Violent crime rate (number of violent crimes per 100,000 people)	CCJS, StatsCan, Auth	975	495.13	997.49	339.28
DIST_SMALL ACUTE HOSP	Distance (km) from the CCS centroid to the nearest acute care hospital	DMTI, C-RERL, Auth	23.51	27.78	8.32	24.09
DIST_LARGE HOSPITAL	Distance (km) from the CCS centroid to the nearest large (more than 200 beds) acute care hospital	DMTI, C-RERL, Auth	70.99	85.94	15.14	47.43
DIST_COLLEGE	Distance (km) from the CCS centroid to the nearest College	DMTI, C-RERL, Auth	53.94	63.24	11.82	33.16
DIST_PHYSICIAN	Distance (km) from the CCS centroid to the nearest CCS that possesses at least one physician	DMTI, C-RERL, Auth	7.26	18.21	0.29	2.42
DIST_POLICE	Distance (km) from the CCS centroid to the nearest police station	DMTI, C-RERL, Auth	21.39	23.10	7.09	19.45

DIST_SCHOOL	Distance (km) from the CCS centroid to the nearest elementary or high school	DMTI, C-RERL, Auth	11.18	17.97	2.97	8.06
DIST_SKI	Distance (km) from the CCS centroid to the nearest ski facility	DMTI, C-RERL, Auth	64.37	62.31	28.78	38.32
DIST_UNIV	Distance (km) from the CCS centroid to the nearest university	DMTI, C-RERL, Auth	108.32	108.79	30.18	62.75
Natural Amenities						
COVER_FOREST	% of the total geographic area of the CCS covered by forest	NRCan, C_RERL, Auth	57.25	45.31	23.87	40.75
D_ANYWATER	Dummy variable; 1 if the CCS is located adjacent to the coastline of an ocean or one of the great lakes OR if water area comprises >0 of the CCS land area	C-RERL, NRCan, Auth	0.75	0.43	0.92	0.27
ELEV_STD_DEV	Standard deviation of the elevation points located within the CCS - suggests variation in terrain - mountains, hills, etc.	NRCan, C-RERL	74.02	127.17	51.99	92.27
WEATH_AVE_PRECIP	Average annual precipitation (mm) (20+ year average)	EnvCan,C-RERL	940.02	368.84	945.43	345.55
WEATH_AVE_SNOW	Average annual snowfall (mm) (20+ year average)	EnvCan,C-RERL	212	104.39	159.02	74.39
WEATH_JAN_SUNSHINE	Average January sunshine (hours) (20+ year average)	EnvCan,C-RERL	86.67	21.01	90	17.72
WEATH_JAN_TEMP	Average January temperature (degrees Celsius) (20+ year average)	EnvCan,C-RERL	-10.66	4.90	-7.7	5.40
WEATH_JULYHUMID	Average July Humidity (20+ year average)	EnvCan,C-RERL	58.73	11.18	58.85	10.21
N			1893		509	

a. CoP: Census of population 1991; Auth: authors calculation, C-RERL: the Canada Rural Economy Research Lab, University of Saskatchewan; StatsCan: Statistics Canada; NRCan: Natural Resources Canada; EnvCan: Environment Canada; CCJS: Canadian Centre for Justice Statistics; CIHI: Canadian Institute for Health Information; DMTI: DMTI Spatial Inc.'s EPOI database; CBP: Canadian Business Patterns (Statistics Canada product); Ecan: Elections Canada.

Note: All variables are weighted by the 1991 CCS population