Relative Rankings of Communities in New Brunswick Using Community Well-Being Indicators from the Census

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Abstract: We examine a set of well-being measures for New Brunswick communities over a 15-year period (2001-2016). Using Canadian Census data at the subdivision level, we construct a community-level well-being index which includes the domains of income, education, housing, and employment. Our results show that communities in the top quartile of the well-being index tend to be in southern New Brunswick around the population centres of Moncton, Fredericton, and Saint John. In contrast, communities in the bottom quartile are in the eastern and northeastern parts of the province (e.g., the Acadian peninsula). Patterns for each domain are quite similar except for housing, where communities normally in the upper portion of the well-being distribution – around the population centres of Moncton, Fredericton, and Saint Andrews – tend to rank lower on this domain. Additionally, with respect to education, communities in the northern part of the province typically fare worse than those in southern New Brunswick, with some exceptions around Perth-Andover and Edmundston. Finally, we demonstrate that the distribution of these well-being indicators has remained remarkably stable over this 15-year period: communities at the top and at the bottom of the distribution have remained in these respective positions from 2001 to 2016.

JEL classification: I31, P25, R12

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1. Introduction

What is a community? How might the well-being of a community differ from the well-being of its individual members or the well-being of the province or state in which the community is located? This article investigates selected indicators of community well-being within New Brunswick over the first four census periods of the twenty-first century.

A person may be influenced by changes at many levels of interaction or analysis: individual, community, regional, provincial, federal, and global. While there are many studies of globalization and well-being (e.g., Helliwell 2002; Mukherjee and Krieckhaus 2012) and well-being at the national level or comparisons of the well-being of nations (e.g., Canadian Index of Wellbeing 2016; Helliwell et al. 2021; OECD 2020; Randall et al. 2019), to our knowledge this study is the only one of its kind with a focus on the economic well-being of communities in the province of New Brunswick.[2] As noted in the following section, Helliwell, Shiplett, and Barrington-Leigh (2019) explored life satisfaction across Canadian communities; however, economic well-being does not necessarily imply happiness or satisfaction. Hence, this paper may be viewed as an examination of community well-being that is complementary to Helliwell et al. (2019).[3]

One way to approach the idea of community is to ask people questions such as, "Where are you from?" or "Where did you go to school?" Connection to a place can be an important component of identity. A feeling of connection or belonging is a component of well-being. However, "community" is more than geography. A community is not just a small region. A community encompasses some aspect of cohesion that extends beyond geography. A community may be defined as a "group of people with diverse characteristics who are linked by social ties, share common perspectives, and engage in joint action in geographical locations or settings" (MacQueen et al. 2001, 1929). Bradshaw (2008) asserts that

> the essential characteristics of community are the social relations (solidarity or bonds) between people. Community so defined has historically shared boundaries with one's geography of residence (town, neighbourhood, city), but today the loss of place identity does not imply the loss of community, since solidarity among people no longer needs to be tied to a place. (6)

Since it is based purely on geography, our operating definition of community in this paper may not perfectly capture all the potential elements of community. Our operating definition of a community is based on geographic areas: census subdivisions from the Canadian Census. This approach is necessary since the data available to us is provided in this format; but this approach also reflects the consequences of choices of individuals and families to the extent that people have chosen to remain in, or move to, the communities located in specific census subdivisions.

[2] Hollett, May, and Giles (2008), along with May and Hollett (2008), note that another Atlantic Province, Newfoundland and Labrador, developed a system of accounts in order to assess community well-being; however, such accounts were not developed in New Brunswick.

[3] As a point of comparison, psychologists examining mental health have historically found that females tend to have higher levels of life satisfaction than males; however, males usually report lower levels of stress.

Measuring well-being at the community level allows for its study at an appropriate scale. In response to the question "Where are you from?" asked in New Brunswick, the answer might be the village of Alma or the town of Sackville. In contrast, residents of major centres often identify their place of residence as a neighbourhood: such as Kitsilano in Vancouver or "the Annex" in Toronto. The unit of analysis thus corresponds, in part, to lived experience.

Examining well-being at the community level reduces aggregation bias and can reveal local dispersion and inequality, at the cost of some missing data. Some data is missing because certain geographic units do not contain a large enough population to permit the release of detailed data by a statistical agency respectful of the confidentiality of an individual's information. Some data is missing because, where there is no specific measure for a community, we have not ascribed an average measure for a region to its subdivisions. With the community-level information we have, we can calculate measures of dispersion based on collections of communities. For example, we can construct measures of inequality within counties, which are administrative areas containing more than one community. This permits a comparison of levels of inequality at a finer level of analysis than the single administrative unit of the province.

The overall objective of this project is to present the results of a comparison of measures of community well-being over the 2001-2016 period in New Brunswick. We build on an earlier version of a community well-being (CWB) index that was developed to illuminate the geographical pattern of First Nations socioeconomic well-being.[4] Using measures from four cycles of the Canadian Census, we construct an index based on the four domains for which these measures are available: income, housing, education, and labour market profiles of the communities.

Most of the measures for our CWB index – such as unemployment rates, incomes, and educational attainment – are typically reported as averages at the provincial level. To tell a richer story and answer some questions obscured by a focus on the average, we investigate the variation around the mean in the province of New Brunswick. What is the range of well-being measures? How close to the provincial average are the communities in this province?

The values of economic indicators that are important to well-being are not randomly distributed across the landscape. The regional distribution of well-being can only be seen using measures more finely grained than the average provincial level. How are they distributed? How do these indicators change across time? More importantly, despite decades of policy intervention and regional development, are these measures stubbornly stable?

The CWB index allows for comparisons across several dimensions.[5] We compare regions of the province, such as north versus south. Additionally, we examine the essential issue of the stability of these measures over time.

[4] Armstrong (2001).

[5] We see future research opportunities in extending our understanding of well-being differences between Indigenous and non-Indigenous communities in New Brunswick. We also see research possibilities in drawing comparisons across international boundaries by looking to similar indicators for Maine in the US – especially given the recent work by Daley et al. (2018).

2. Literature Review

Broadly defined, well-being is a social construct regarding assessments of one's life – hence, an aggregation of micro-level evaluations can reflect community-level well-being. Di Tella and MacCulloch (2006) observe that well-being analyses have often been based on responses to a general question of how happy the respondent was at the time of survey – i.e., built upon a perception based on what people have to say – as opposed to the more traditional economist's approach of observing behaviour. Similarly, the Cantril Self-Anchoring Ladder illustrates a slightly more involved metric, capturing perception of well-being. Individuals are to mentally observe a 10-rung ladder such that 10 represents the best life an individual can imagine for themselves, while not being on a rung is suggestive of the worst life possible. The respondent is then asked to place themselves on this ladder given the way they feel at the time of survey.[6]

Using census tracts, subdivisions, and agglomerations, Helliwell et al. (2019) derived a set of over 1,200 similarly sized communities across Canada and determined their mean levels of life satisfaction based on the above metric. They find that levels of life satisfaction vary greatly across communities, even when examining those situated within the same city. Interestingly, the authors note that while higher income levels and lower unemployment rates are associated with higher degrees of life satisfaction within urban communities, the same is not true concerning rural neighbourhoods. However, in all cases, a sense of community matters, suggesting that more fulsome approaches to examining community well-being should include a measure of this factor, if possible.

While community-level life satisfaction scores may, at least partly, proxy for societal well-being, others have argued in favour of more comprehensive methods, including that proposed by Sen (1980), whereby social welfare requires that individuals have the *capability* to pursue their goals in life. Although the United Nations uses Sen's argument as a basis for their construction of the Human Development Index (HDI), a generally accepted capabilities metric has yet to be developed and widely adopted.

Fleurbaey (2009) provides a contextual overview of measuring community well-being, considering the ill-conceived notion that GDP is a suitable proxy for happiness. He argues that while synthetic measures using objective economic metrics (such as those included in HDI or used in this article) may not necessarily capture the entire essence of well-being, the advantage of a focus on common economic metrics is enhanced simplicity of data collection and ease of implementation. More recently, Jorgenson (2018) makes a compelling case for measures of well-being that extend "beyond the GDP" to include issues such as education, leisure, and inequality.[7]

The above literature suggests well-being is a multi-faceted concept such that any one variable would be unsuitable as a proxy for this social construct. This is perhaps best illustrated by the OECD Better Life Index, which consists of 11 domains: income, employment, education,

[6] While these methods capture perceptions of well-being, other metrics of well-being use only more objective measures. For instance, Stevenson and Wolfers (2006) proxied for lack of happiness, a correlate of well-being, by examining suicide rates.
[7] Examples of other measures constructed for similar purposes include the Canadian Index of Well-Being (CIW), the Genuine Progress Index (GPI) Atlantic, the Newfoundland and Labrador Community Accounts, OECD's Better Life Index (BLI), Helliwell et al. (2019), the Index of Economic Well-Being (IEWB) from the Centre for the Study of Living Standards (CSLS), and the Human Development Index (HDI) of the United Nations Development Programme (UNDP).

housing, health, safety, life satisfaction, community, civic engagement, environment, and work-life balance.[8] Additionally, the magnitude of impact of each domain matters in developing an index, and while the default settings on the OECD Better Life Index weight each domain equally, users of the data may see the results of applying varying weights based on their own interpretations of well-being. The OECD index includes objective components, discussed above, and a set of subjective variables, such as the feeling of safety when walking alone at night.

While we anticipate that future studies of well-being in New Brunswick communities will include both objective variables and subjective indicators, given current data availability, we present only results for the first four domains in this study of community well-being. Hence, we focus on a synthetic measure of economic well-being that extends "beyond the GDP" to include the domains of income and wealth, housing, education, and labour activity.

By comparison, the Centre for Study of Living Standards developed an index of economic well-being (IEWB) based on four domains (consumption, wealth, inequality, and insecurity), each of which encompass a set of objective components. Like the Better Life Index, the IEWB allows users to apply various weighting schemes based on subjective views of importance. At present, the 24 individual components that comprise this index are not comprehensively available at the census division level in New Brunswick. Therefore, while this index serves as an excellent point of comparison across countries (see Osberg and Sharpe 2002), we are unable to replicate this index at our chosen sub-provincial level at the present time. As more data becomes available for analysis, subsequent studies may compare the IEWB with our index, which consists of four similar, yet distinct, domains of economic well-being.

Within an economics framework, perhaps the most common correlate of well-being is income. Clark (2018) suggests that "it is by now almost universally accepted that individuals who are observed to have higher levels of income in cross-section data also report having higher levels of subjective well-being" (247). Kahneman and Deaton (2010) provide a specific example of the positive association between income and the Cantril Ladder.

Although Layard, Clark, and Senik (2012) find that GDP per capita is a major determinant of well-being, explaining as much as 65 percent of the variation in cross-country Cantril Ladder results, Easterlin (1974) presents us with a paradox in that longitudinal results fail to capture this association, with happiness scores tending to be stagnant across time and national income values tending to exponentially increase. Both Di Tella, Haisken-De New, and MacCulloch (2010) and De Neve et al. (2018) shed some light on the Easterlin Paradox, respectively finding that well-being over time adapts to income gains, and recessions are more damaging to well-being than expansions are improving well-being. Notably, this latter finding is in line with the microeconomic perspective of prospect theory (see Kahneman and Tversky 1979). The distribution of income is also relevant: Alesina, Di Tella, and MacCulloch (2004) find that individuals in both the US and Europe tend to report higher levels of happiness when there is less income inequality.[9]

[8] For additional insight on this index, see Durand (2015).
[9] This result tends to be stronger in Europe than in the US, which may be partly explained by the fact that Americans tend to have less awareness regarding the extent of inequality in their country (Osberg and Smeeding 2006).

While the above work focuses on the flow variable, income, there is evidence that an individual's stock of wealth also contributes to their well-being. Although many often think of income and wealth as being highly associated, Wolff and Zacharias (2009) note they are far from perfectly correlated. A distinction between income and wealth is also found in Headey and Wooden (2004), who find that wealth contributes as much to well-being as income, perhaps reflecting the importance of an economic security buffer. Moreover, Diaz-Serrano (2009) finds that home ownership is associated with increased life satisfaction, while Helliwell et al. (2019) note that regions with high proportions of financial housing stress are less likely to be among the happiest communities.

Housing quality also matters, as shown by Cattaneo et al. (2009): large-scale improvements to homes with dirt floors in Mexico not only improved child health but also improved life satisfaction among adults. Galiani et al. (2017) find that general infrastructure upgrades in Latin America improve well-being, and Devoto et al. (2012) similarly observe that improving home access to water in Morocco increases household well-being. Housing quality improvements do not only impact those living within these homes.

It is also widely accepted that there is a negative correlation between unemployment and well-being (Green 2011; Grün, Hauser, and Rhein 2010; Winkelmann and Winkelmann 1998). Helliwell and Huang (2014) note that among the unemployed, the non-pecuniary costs of job loss are about five times greater than that experienced from the loss of income. Additionally, Clark, Georgellis, and Sanfey (2001), along with Knabe and Rätzel (2011), note that this relationship is not only contemporaneous but also that past incidents of unemployment impact current levels of well-being, suggesting a "scarring" effect. Watson and Osberg (2018) extend this work to find that significant loss of well-being is likely to occur prior to the actual event of job loss, with job insecurity being associated with a larger increase in distress, relative to the rise in distress given the onset of unemployment.

For the domain of education, Oreopoulos and Salvanes (2011) observe that continuing in school until a later age is associated with a higher level of well-being. Moreover, Chen (2012) suggests that while income is an important mediator when examining the link between education and well-being, non-pecuniary elements of education, such as the development of social networks and increased diversity of experiences, have more impact. However, Powdthavee, Lekfuangfu, and Wooden (2015) note that that once health and income are accounted for, education is no longer predictive of higher well-being. In a review of the literature pertaining to the economics of happiness, Clark (2018) acknowledges these mixed findings, suggesting that more education may shape preferences regarding the ideal life.

3. Data and Methods

McHardy and O'Sullivan (2004) developed a community well-being index to measure and compare socioeconomic well-being among First Nations, Inuit, and non-Indigenous communities in Canada. This is a composite index, built from four domains – income, housing, education, and labour activity – where well-being in each domain is measured using one or more indicators (Government of Canada, 2019). The well-being index in our analysis is constructed using a

methodology similar to that of McHardy and O'Sullivan (2004) and Armstrong (2001), with some modifications.

For several reasons, we chose to construct our own version of the index. First, the earlier index was intended for use in comparing First Nations communities with other communities and not as a general measure of well-being. Second, we have some methodological concerns about the construction of the earlier index.[10] Finally, we aim, now and in the future, to improve the comprehensiveness of our index by expanding the set of indicators and domains within our well-being index, and so our metric requires additional flexibility.[11]

For this analysis, we construct a community well-being (CWB) index using Canadian Census data from the 2001-2016 period. The areas covered by communities are each defined as a census subdivision, which is "the general term for municipalities (as determined by provincial/territorial legislation) or areas treated as municipal equivalents for statistical purposes (e.g., Indian reserves, Indian settlements and unorganized territories)" (Government of Canada, 2018).

3.1 Domains and Indicators

The CWB index focuses on four domains: income and wealth, housing, labour activity, and education. The indicators for each domain are explained below.

3.1.1 Income and Wealth

The income domain is composed of following indicators:

i) Median household income
ii) Average dwelling values
iii) Share of dwellings that are owned
iv) Prevalence of low income[12]

These indicators are chosen to measure economic affluence, or its absence, by measuring the levels of income, wealth, and poverty in these communities.

[10] For example, in constructing the income component, McHardy and O'Sullivan (2004) report that "outliers whose extreme values skewed the distribution were reduced or increased to $40,000 or $2,000 respectively" (7). For defining the range of income per capita, McHardy and O'Sullivan (2004) use theoretical minimum and maximum values derived from actual values without specifying the derivation function or its theoretical underpinning, rather than using actual range for each census year. From the format of their equation (see McHardy and O'Sullivan 2004, 7), we conclude the derivation is truncation to a range between $2,000 and $40,000.

[11] In constructing their index, McHardy and O'Sullivan (2004) replaced the unidimensional indicators proposed by Armstrong (2001) with multi-faceted ones. We pursue a similar goal and improve the comprehensiveness of the overall well-being measure by expanding the set of indicators in our index relative to that of the earlier index.

[12] The prevalence of low income is not measured consistently in each census wave. In 2001, prevalence of low income is based on before-tax household income. In 2006, it is based on before-tax family income. In 2011 and 2016, it is based on after-tax family income.

3.1.2 Housing

The following indicators are chosen to assess the quantity and quality of housing in the province:

i) Number of habitable dwellings that do not require major repairs per capita
ii) Percentage of households for which occupancy exceeds the average number of bedrooms in the community[13]
iii) Percentage of households[14] that spend more than 30 percent of their income on shelter costs

3.1.3 Education

To measure differing levels of education attainment across communities, the following indicators are included:

i) Percentage of population with less than a high school diploma
ii) Percentage of population with a bachelor's degree or more

In comparing values of these indictors from 2001 to subsequent years, note that the population targeted by the education questions in the census changes over time.[15]

3.1.4 Labour Activity

To determine various aspects of labour activity across communities, the following indicators are chosen:

i) Labour force participation rate
ii) Unemployment rate
iii) Share of employment income of total income

3.2 Construction of the Index

Similar to most indices of well-being, such as the OECD Better Life Index,[16] each indicator is normalized prior to the calculation of the index. Normalization of positive indicators that have a direct relationship with community well-being is conducted using the following formula:

$$Indicator_{ij} = \frac{Value\ for\ community\ i - minimum\ community\ value}{maximum\ community\ value - minimum\ community\ value}$$

[13] Ideally, we would have liked to incorporate a direct household crowding measure in our analysis. However, this measure is only available for the 2016 Census. To make the index as consistent as possible across the census years, we construct the household crowding measure in our index by calculating the proportion of private households for which the number of persons in the household exceeds the average number of bedrooms per residential unit in that community.
[14] This indicator includes both landlords and tenants in a community.
[15] In 2001, the sample includes individuals that are 20 years and older. In 2006 and onwards, the population target includes individuals 15 years and older, although it is possible to select individuals 20 years and older in these census years. For 2006 and onwards, our education variables include those who are 15 years and older.
[16] http://www.oecdbetterlifeindex.org/

where $Indicator_{ij}$ measures the normalized value of indicator *j* for community *i* in a given year.

Normalization of negative indicators that have an inverse relationship with community well-being is conducted using the formula below:

$$Indicator_{ij} = 1 - \frac{Value\ for\ community\ i - minimum\ community\ value}{maximum\ community\ value - minimum\ community\ value}$$

where $Indicator_{ij}$ measures the normalized value of indicator *j* for community *i* in a given year.

This approach results in normalized indicators for a domain that are unit-free and range from zero to one. This facilitates construction of the index in a sub-domain using indicators that may initially have different units of measurement (e.g., median household income measured in dollars versus prevalence of low income measured in percentage points).

The index for each domain is then constructed by taking the arithmetic average of the normalized indicators in that domain, and the CWB index is constructed by taking the arithmetic average of the domain indices. Consequently, the resulting indices for each domain and the overall well-being index range from zero to one. This approach gives an equal weight to each indicator when calculating the index for a given domain, and similarly an equal weight to the index for each domain in calculating the well-being index. This approach has the advantage of simplicity for calculation purposes, but it also has limitations, which are discussed below.

The indices resulting from this approach provide a relative measure of well-being, defined by the best and the worst performances of communities for a given indicator. A community with an index score of zero has the lowest value for an indicator relative to all the other communities in the province; however, it would not necessarily indicate that the level of the indicator is intrinsically poor. We repeat this ranking exercise for each census year separately, so the range for each indicator is determined by the corresponding values in a given year.

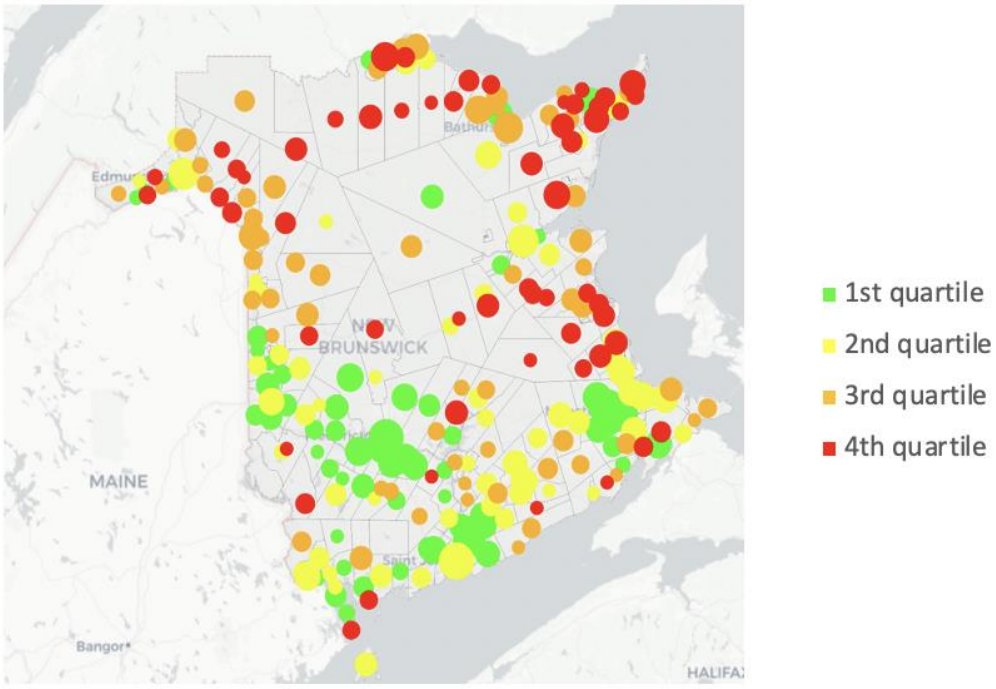
4. Results

4.1 Community Well-Being in New Brunswick

Figure 1 depicts the quartile rankings of communities based on their CWB scores in 2016.[17] There are systematic geographical differences in the overall well-being of communities in New Brunswick. Communities in the top quartile of the well-being index tend to be in southern New Brunswick around population centres such as Moncton, Fredericton, and Saint John. In contrast, communities in the bottom quartile of the well-being index are commonly found in the northern and eastern parts of the province, such as the Acadian peninsula.

[17] In recognition of the Tri-Council Policy Statement (Chapter 9), which emphasizes dialogue between researchers and Indigenous communities, we have chosen to omit First Nations communities from our analysis and anticipate future research, within the boundaries of an ethical space, examining such differences in well-being.

FIGURE 1. CWB Quartile Rankings (2016)



Quartile rankings of communities in individual domains of well-being in 2016 are depicted in Figure 2. The geographic patterns in individual domains are similar to the patterns for the CWB index in Figure 1, with some key differences.

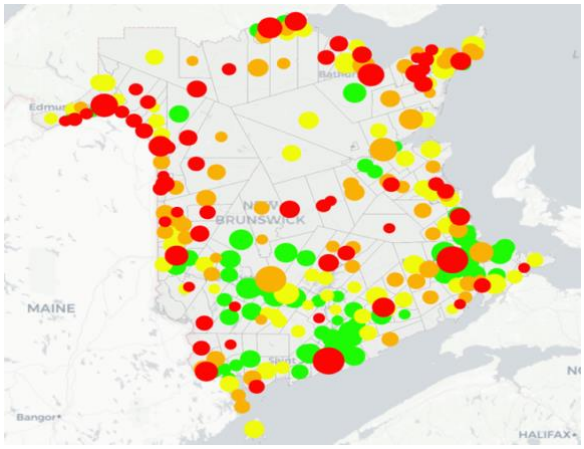
Looking at the income domain,[18] we can see that communities near the western New Brunswick border are ranked at the bottom with a few exceptions, such as small pockets around Woodstock, Edmundston, and Saint Andrews.

Moreover, population centres like Saint John, Fredericton, and Moncton are ranked at the bottom of the income distribution, whereas communities surrounding these centres, such as Rothesay, Quispamsis, and New Maryland, are in the top quartile. This may be because wealthier individuals prefer settling outside the urban centres.

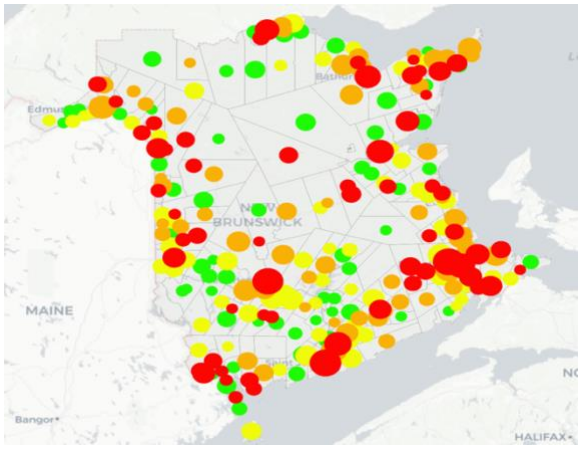
For the housing domain, population centres and the surrounding communities in southern New Brunswick perform at the bottom of the distribution.

[18] In response to an observation from an anonymous referee, we conducted some robustness checks for this variable. Median before-tax household income was (1) replaced with the after-tax version, and then (2) the income measure was divided by the average household size in the community. These modifications had no significant impact on the distribution of well-being scores.

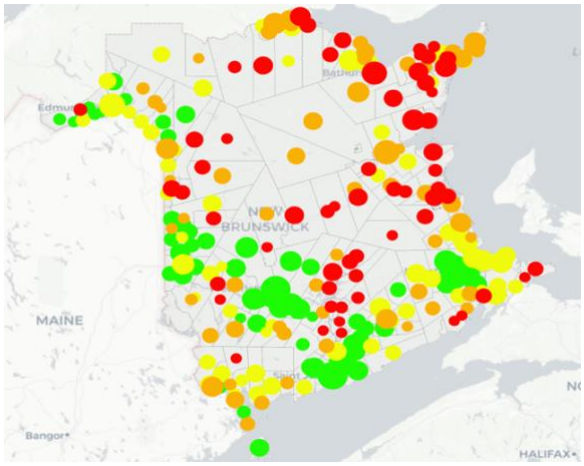
FIGURE 2. Quartile Rankings[19] (2016): Individual Domains



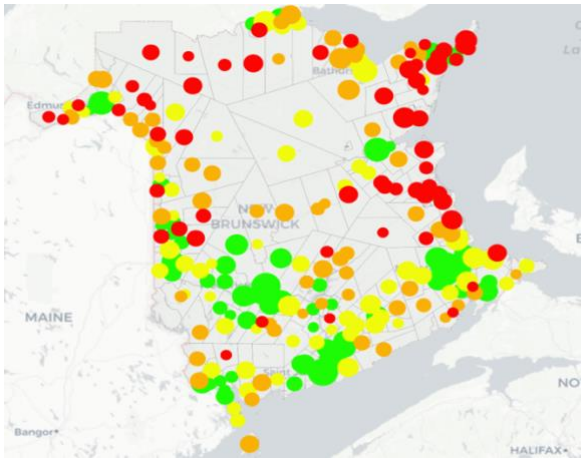
(a) Income



(b) Housing



(c) Labour

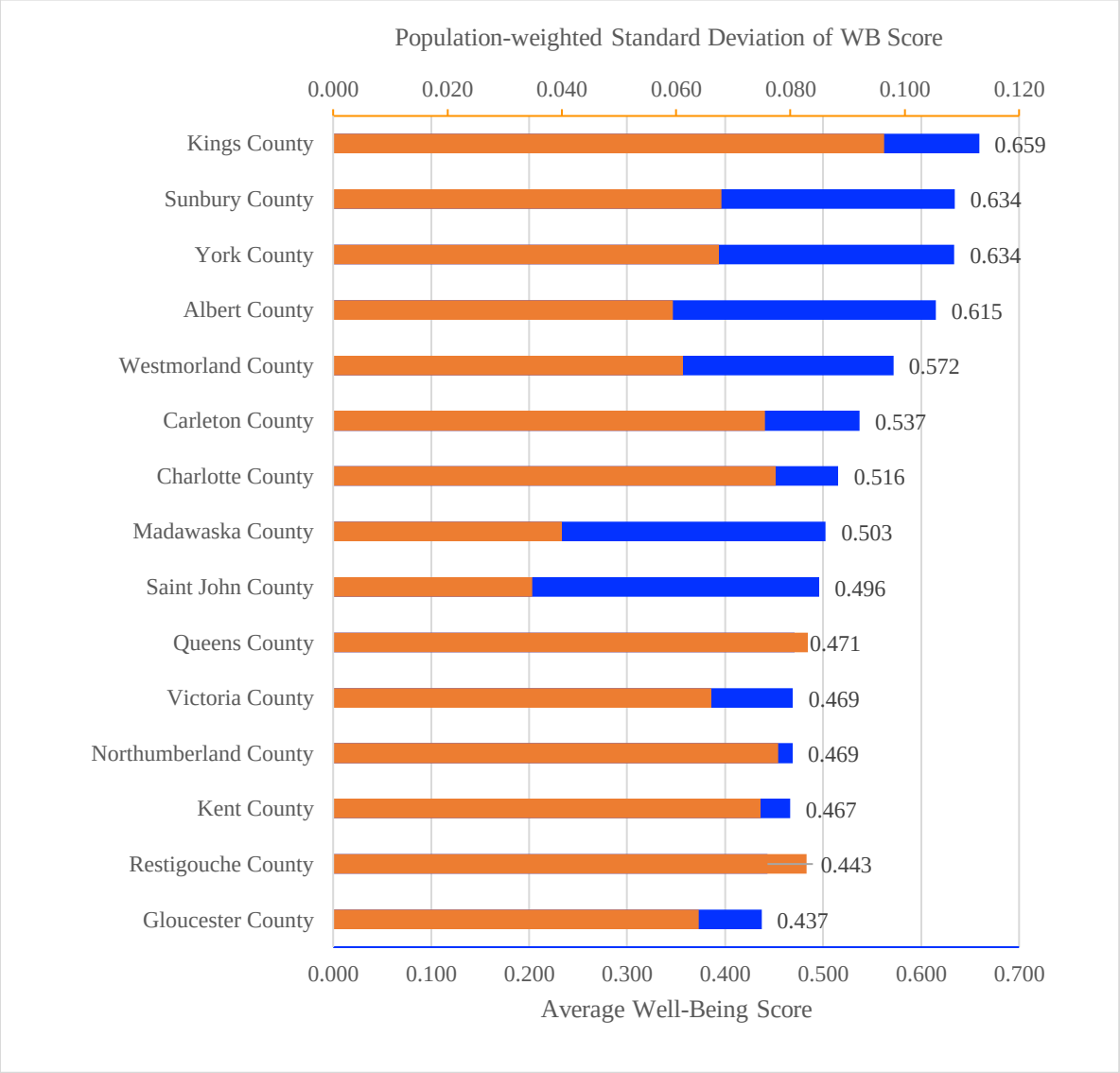


(d) Education

Figure 3 depicts the distribution of overall well-being by county in 2016. The figure has two axes. The primary axis, shown at the bottom in blue font, captures the county-level CWB score, which is calculated by taking a weighted average[20] of CWB scores in that particular area. The secondary axis, shown at the top in orange font, presents the weighted standard deviation of the CWB score based on community dispersion of CWB scores in that county.

[19] The colour legend in Figure 2 is the same as Figure 1, where green denotes the 1st quartile, etc.
[20] Community populations are used as weights for calculating the weighted average of the well-being in a given county.

FIGURE 3. CWB by County (2016)



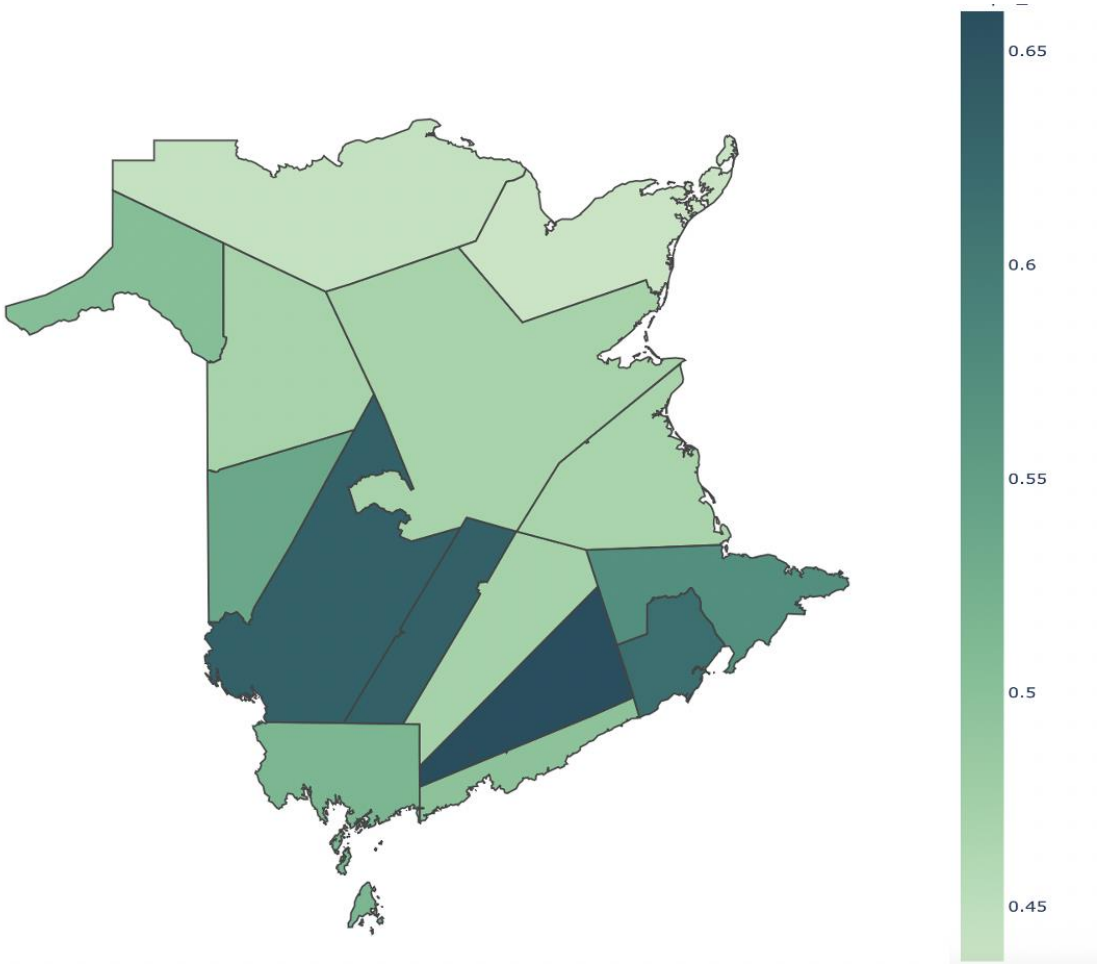
Looking at the county aggregation, we can see that counties with the highest overall well-being scores are located in the southern part of the province, and counties with the lowest overall-being scores are clustered along the northern and eastern parts of the province.

Aggregation of the overall well-being scores at the county level allows us to gain insight into the degree of inequality in well-being among the counties as well. Looking at the orange bars, we can see that the magnitude of the dispersion seems to be higher in the counties at the bottom of the overall well-being distribution. The differences in the degree of inequality becomes even more pronounced if they are evaluated in a relative manner.

In Figure 4, the map of overall well-being for the counties of New Brunswick in 2016 is depicted. This figure confirms our previous findings by illustrating a well-being gradient that

declines as we move from the southwest to the northeast of the province, where Kings County is ranked at the top and Gloucester County is ranked at the bottom.

FIGURE 4. Map of Overall Well-Being by County in New Brunswick (2016)



4.2 Sensitivity to Alternative Weighting Schemes

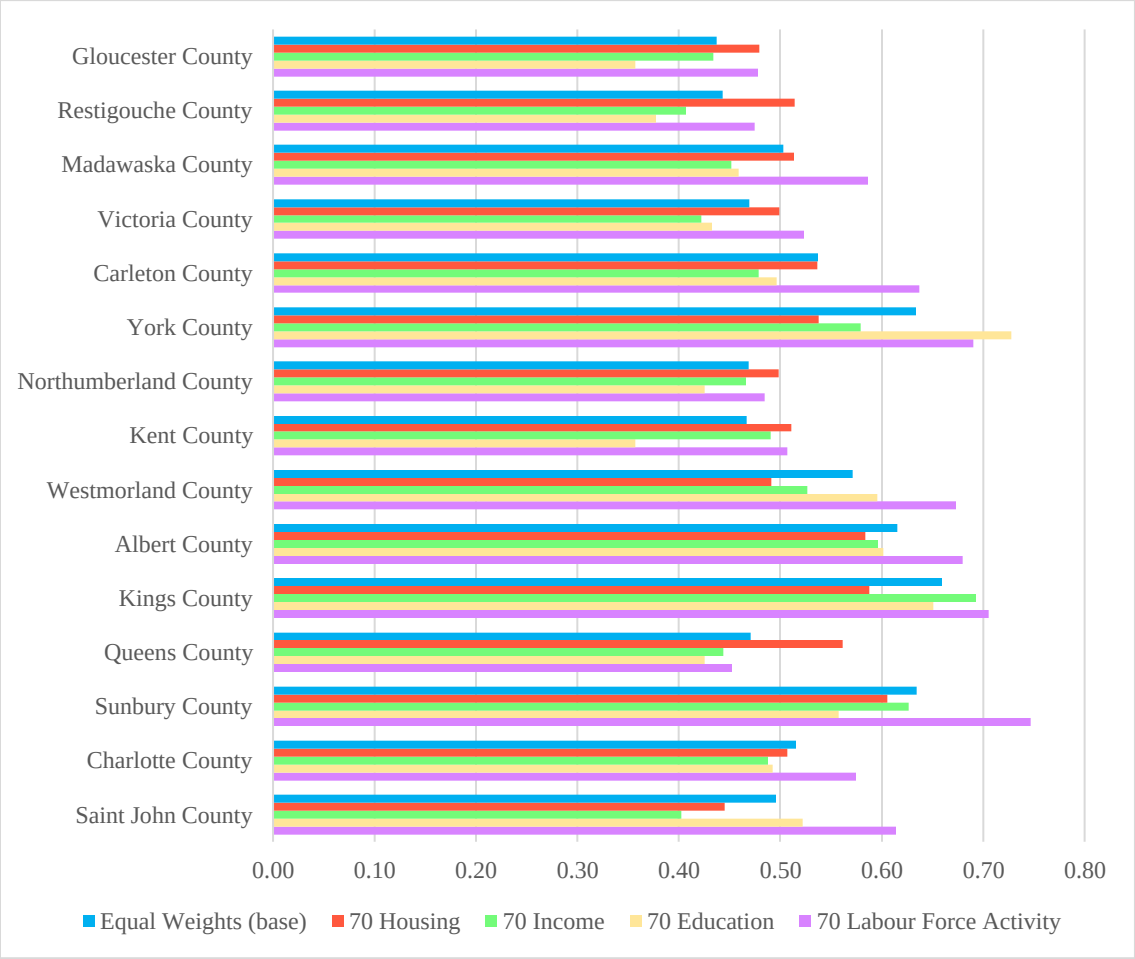
The CWB index values discussed above are composite scores, calculated using equally weighted domains (income, housing, labour, and education) of community well-being, as explained in Section 3. Because the performance of the communities in each domain may be heterogenous, the overall well-being scores, and the implied rankings, may be subject to change if we were to adopt alternate weighting schemes, placing more weight on one or more of the domains and less on others.

To test the sensitivity of our results, we consider two alternative scenarios using differing weights. In the first instance, for each domain, we inspect a case where that domain gets a larger weight (70 percent) while the remaining domains receive a smaller weight (10 percent each). The second scenario depicts an extreme case where each domain is given a 100 percent weight and

the remaining domains are disregarded (a weight of zero). Consequently, we end up with nine cases: four in each scenario plus the base scenario with each domain being equally weighted. For brevity, we present the county-based aggregate overall well-being scores for the base case and first scenario in Figure 5.

The New Brunswick counties shown in Figure 5 are ranked in an ascending order based on the overall well-being scores for the base case (equal weights) illustrated by the blue bar. Overall well-being scores under alternative weighting schemes are presented in the following order: housing (red), income (green), education (yellow) and labour (purple).

FIGURE 5. Overall Well-Being by New Brunswick Counties – Alternate Weights (2016)



Overall, the relative rankings of counties under the base scenario seem to be stable under alternate weighting schemes. This is not surprising, given the close relationship between income, education, and labour activity in each community.

The housing domain seems to be unique in that placing more weight towards housing appears to have the most impact on the relative rankings of counties in comparison to the base scenario. For example, Queens County is ranked near the bottom (10th out of 15 counties) under the base case, whereas it is ranked 4th if the housing dimension is given a larger weight.

TABLE 1. Change in Quartile Rankings Under Alternate Weights (2016)

	70* Hou	70* Inc	70* Edu	70* LFA	100* Hou	100* Inc	100* Edu	100* LFA
No Change	48.8	69.2	67.9	65.4	29.6	59.6	56.3	54.6
One Step (+/-)	40.0	30.0	27.5	31.7	44.6	34.2	35.4	35.0

Note: Hou = Housing; Inc = Income; Edu = Education; LFA = Labour Force Activity

Another way of looking at the sensitivity of our results involves examining the stability of the quartile rankings. Table 1 shows the share of communities whose quartile ranking either remained the same or changed by one step in either direction in each alternate weighting scheme relative to the base scenario.

When increasing the weighting of one domain to 0.70, the share of communities whose ranking remained the same ranges from 49 percent to 69 percent depending on which domain is given the larger weight. Again, the housing domain seems to be uniquely different, with more than half of the communities changing their rank when housing is more heavily weighted. The results for the other three domains are similar in size, with 65 percent to 70 percent of the communities remaining at the same point in the ranking as the weighting changes.

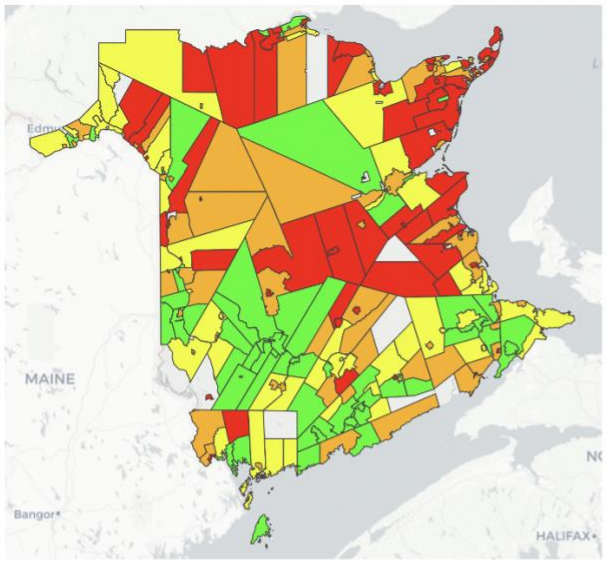
4.3 Change of Well-Being across Time

In addition to identifying geographical patterns in New Brunswick CWB scores for 2016, we may also ask, to what degree do these geographical well-being differences change over time? To answer this question, we also calculate CWB scores of New Brunswick communities for the 2001, 2006, and 2011 Censuses using data from 245, 244, and 169 census subdivisions respectively. The quartile rankings of these communities for each census year during this period are illustrated in Figure 6.

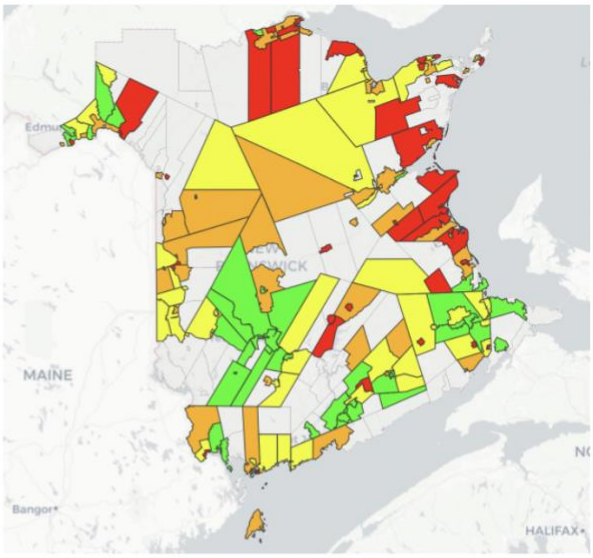
Our results suggest that the geographical patterns in overall community well-being scores in New Brunswick have not changed significantly over this period.[21] In particular, communities in the top well-being quartile are consistently clustered around the south/southwestern part of the province, whereas communities in the bottom quartile are clustered around the north/northeastern part of the province.

[21] There are many communities whose well-being scores could not be calculated for 2011 due to the disruptions related to the Census long form. Although the map for 2011, compared to other years, includes more sections with no ranking (which are not coloured) due to data problems, the overall geographic pattern is like other years.

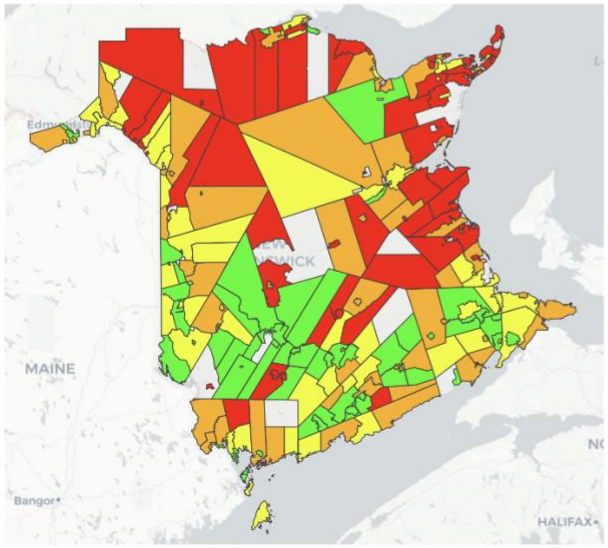
FIGURE 6. Quartile Rankings[22] Across Time



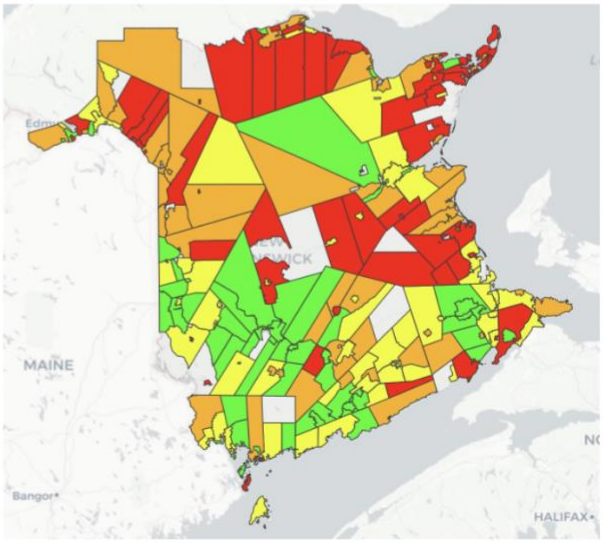
(a) 2016



(b) 2011



(c) 2006



(d) 2001

What is the probability that a community in 2016 is in the same quartile as in 2001? Table 2 presents a transition matrix which suggests a strong degree of "stickiness" – i.e., a lack of relative mobility in well-being. For instance, of the lowest quartile communities in 2001, about two-thirds remain in the lowest quartile in 2016. Among those who transitioned upward, the overwhelming majority only shifted to the second quartile with less than 2 percent moving to the top. At the other end of the spectrum, about 65 percent of top quartile communities in 2001 were also in the top quartile in 2016, with 24 percent transitioning to the third quartile and less than 2

[22] The colour legend in Figure 6, which is omitted from the figure for spacing reasons, is the same as in Figure 1, where green denotes the 1st quartile, yellow denotes the 2nd quartile, etc.

percent falling to the lowest quartile. Thus, there is a general persistence to the ranking of relative well-being among communities.

TABLE 2. Transition Matrix: 2001-2016

		2016			
	Quartiles	**1**	**2**	**3**	**4**
2001	**1**	**0.6721**	0.2131	0.0984	0.0164
	2	0.2069	**0.4138**	0.2759	0.1034
	3	0.0678	0.2542	**0.4237**	0.2542
	4	0.0185	0.0926	0.2407	**0.6481**

To further assess whether community well-being scores statistically changed over time, we conduct the Wilcoxon matched-pairs signed-ranks test (Wilcoxon 1945) to ascertain whether the quartile rankings changed significantly between the 2001 and 2016 Censuses.[23] The null hypothesis is that both distributions are the same and the p-value of the associated (two-sided) test-statistic is 0.476, suggesting that we cannot reject the null hypothesis at conventional levels of significance.[24] We also test whether community economic inequality increased during the 2001 and 2016 period using the Levene's (1960) test. P-values of the Levene's robust statistic are in excess of 30 percent, implying that community economic inequality has not significantly increased during this period.

TABLE 3. Random-Effects Ordered Logistic Regression

Variable	**Coefficients**	**Z-score**	**P-value**	**95% Confidence Interval**	
Year 2001	0.091	0.460	0.646	-0.298	0.480
	(0.198)				
Year 2011	0.418	1.850	0.064	-0.024	0.861
	(0.226)				
Year 2016	0.092	0.460	0.644	-0.299	0.484
	(0.200)				
Number of observations = 898				Number of groups = 255	

Notes: Standard errors are in parentheses.

In addition, we run a random-effects ordered logistic regression where the quartile rankings of communities in each year are regressed against dummy variables for each census year. Results of this regression are presented in Table 3. The individual census year coefficients are statistically insignificant both individually and collectively at the 5 percent level of significance.

Combining the visual, descriptive, and inferential evidence, we conclude that the relative

[23] Since this test requires matched pairs, communities whose well-being scores were only observed in one census year (13 communities in 2001 and 8 communities in 2016) had to be excluded from this test. Consequently, the test was conducted using the quartile rankings of 232 communities that were observed in both census years.

[24] We also conducted the Wilcoxon matched-pairs signed test, which tests the null hypothesis that the median of the differences is zero without making further distributional assumptions. The p-value was 0.57, which supports the notion that the distribution of quartile rankings in 2001 are not significantly different from those in 2016.

distribution of overall well-being scores for New Brunswick communities has not significantly changed from 2001 to 2016. Communities with a strong relative performance in 2001 continued to have a high ranking in 2016 (and vice versa).

Although it is outside the scope of this paper, this finding may have potential implications for intra-provincial migration patterns in New Brunswick. Changes in the rankings of communities' economic well-being may well have occurred prior to our sample period, during the period of urbanization between 1951 and 2001, when workers and their families moved away from farms and away from communities associated with forestry operations.[25] Moreover, communities in the parts of the province associated with persistently lower well-being status may experience outmigration or face difficulty in benefitting from provincial immigration policies, which may compound the existing discrepancy over time.

TABLE 4. Age Structure in the Community by Overall Well-Being Quartile

	Overall Well-Being Quartiles			
Age Demographics	**First**	**Second**	**Third**	**Fourth**
Median Age	45.8	48.9	50.1	51.8
Share of Population that is 14 Years or Younger	15.7	14.1	13.0	11.9
Share of Population that is 65 Years or Older	18.4	21.8	23.3	25.3
Share of Population that is 85 Years or Older	1.66	2.10	2.49	3.12

Table 4 presents the median age as well as average shares of the population that are 14 years or younger, 65 years or older, and 85 years or older for each overall well-being quartile. On average, communities in the first quartile are relatively younger, having a larger share of young people and a smaller share of elderly people, relative to the communities in the bottom quartile. In fact, in all instances, the change is monotonic across quartiles. The p-value of the F-test obtained from a one-way ANOVA test confirms that the differences in the means of the age demographics between overall well-being quartiles are statistically significant.

5. Conclusions

A key finding of this study is the stability of community rankings within New Brunswick.[26] Among other things, this result implies that policy changes intended or expected to change the well-being distribution undertaken during this period have had little impact. Some of the events might have been expected to cause upward movements, and some downward, but in general the pattern of relative ranking remained stable throughout the period. Further research is needed to uncover why the changes we identified have not significantly shifted the distribution of well-being.

There is remarkable statistical persistence in the rankings. Consider that the opposite result would see each community with an equal probability of being at any point in the ranking from

[25] We thank an anonymous referee for this observation.
[26] We are currently constructing CWB indices for communities in neighbouring provinces in Atlantic Canada to investigate whether these patterns also hold for these jurisdictions.

year-to-year.[27] The transition matrix for the communities of New Brunswick shows little movement and suggests little prospect for movement in the absence of some drastic and persistent change in circumstance.[28] This result implies that the starting point is key to understanding the current situation. History matters.

References

Alesina, Alberto, Rafael Di Tella, and Robert MacCulloch. 2004. "Inequality and Happiness: Are Europeans and Americans Different?" *Journal of Public Economics* 88 (9-10): 2009-2042.

Armstrong, Robin P. 2001. "The Geographical Patterns of Socio-Economic Well-Being of First Nations Communities in Canada." Working Paper No. 46, Agriculture and Rural Working Paper Series, Agriculture Division, Statistics Canada.

Bradshaw, Ted K. 2008. "The Post-Place Community: Contributions to the Debate about the Definition of Community." *Community Development: Journal of the Community Development Society* 39 (1): 5-16.

Canadian Index of Wellbeing. 2016. *How are Canadians Really Doing? The 2016 CIW National Report*. Waterloo, ON: Canadian Index of Wellbeing and University of Waterloo.

Cattaneo, Matias D., Sebastian Galiani, Paul J. Gertler, Sebastian Martinez, and Rocio Titiunik. 2009. "Housing, Health, and Happiness." *American Economic Journal: Economic Policy* 1 (1): 75-105.

Chen, Wan-chi. 2012. "How Education Enhances Happiness: Comparison of Mediating Factors in Four East Asian Countries." *Social Indicators Research* 106: 117-131.

Clark, Andrew E. 2018. "Four Decades of the Economics of Happiness: Where Next?" *Review of Income and Wealth* 64 (2): 245-269.

Clark, Andrew E., Yannis Georgellis, and Peter Sanfey. 2001. "Scarring: The Psychological Impact of Past Unemployment." *Economica* 68: 221-241.

Daley, Angela, Andrew Crawley, Muntasir Rahman, Jake Demosthenes, and Erin Lyons. 2018. "How Well is Maine Doing? Comparing Well-Being across Maine Counties." *Maine Policy Review* 27 (2): 30-37. https://digitalcommons.library.umaine.edu/mpr/vol27/iss2/4

[27] This is not to say that absolute levels of well-being remained virtually unchanged among communities; only their relative position. A within-community examination of changes in level of well-being must also consider Equal Opportunity fiscal transfers, public spending, and migration patterns (as an example of the latter, see Emery et al. 2019).

[28] Indeed, Wilbur (2008) notes that disparities between the provincial north and south have been present since the 1960s, and while industrial development sought to improve economic well-being in the north, a series of pulp and saw mill closures during the 2000s reinforced this relative discrepancy.

De Neve, Jan-Emmanuel, George Ward, Femke De Keulenaer, Bert Van Landeghem, Georgios Kavetsos, and Michael I. Norton. 2018. "The Asymmetric Experience of Positive and Negative Economic Growth: Global Evidence Using Subjective Well-Being Data." *Review of Economics and Statistics* 100 (2): 362-375.

Devoto, Florencia, Esther Duflo, Pascaline Dupas, William Parienté, and Vincent Pons. 2012. "Happiness on Tap: Piped Water Adoption in Urban Morocco." *American Economic Journal: Economic Policy* 4 (4): 68-99.

Di Tella, Rafael, and Robert MacCulloch. 2006. "Some Uses of Happiness Data in Economics." *Journal of Economic Perspectives* 20 (1): 25-46.

Di Tella, Rafael, John Haisken-De New, and Robert MacCulloch. 2010. "Happiness Adaptation to Income and to Status in an Individual Panel." *Journal of Economic Behavior & Organization* 76: 834-852.

Diaz-Serrano, Luis. 2009. "Disentangling the Housing Satisfaction Puzzle: Does Homeownership Really Matter?" *Journal of Economic Psychology* 30 (5): 745-755.

Durand, Martine. 2015. "The OECD Better Life Initiative: *How's Life?* and the Measurement of Well-Being." *The Review of Income and Wealth* 61 (1): 4-17.

Easterlin, Richard A. 1974. "Does Economic Growth Improve the Human Lot?" In *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz*, edited by Paul A. David and Melvin W. Reder, 89-125. Palo Alto: Stanford University Press.

Emery, J. C. Herbert, Li Wang, and Bethany Daigle. 2019. *The Impact of Official Bilingualism on the Geographic Mobility of New Brunswickers: Evidence from 2001 to 2016.* Fredericton, NB: New Brunswick Institute for Research, Data and Training.

Fleurbaey, Marc. 2009. "Beyond GDP: The Quest for a Measure of Social Welfare." *Journal of Economic Literature* 47 (4): 1029-1075.

Galiani, Sebastián, Paul J. Gertler, Raimundo Undurraga, Ryan Cooper, Sebastián Martínez, and Adam Ross. 2017. "Shelter from the Storm: Upgrading Housing Infrastructure in Latin American Slums." *Journal of Urban Economics* 98: 187-213.

Government of Canada. 2018. *Census Subdivision 2016.* https://open.canada.ca/data/en/dataset/90db78e2-eda2-4b2c-ae2e-a474187f2bf8

Government of Canada. 2019. *National Overview of the Community Well-Being Index, 1981 to 2016*. https://www.sac-isc.gc.ca/eng/1419864229405/1557324163264

Green, Francis. 2011. "Unpacking the Misery Multiplier: How Employability Modifies the Impacts of Unemployment and Job Insecurity on Life Satisfaction and Mental Health." *Journal of Health Economics* 30: 265-276.

Grün, Carola, Wolfgang Hauser, and Thomas Rhein. 2010. "Is Any Job Better than No Job? Life Satisfaction and Re-Employment." *Journal of Labor Research* 31: 285-306.

Headey, Bruce, and Mark Wooden. 2004. "The Effects of Wealth and Income on Subjective Well-Being and Ill-Being." *Economic Record* 80 (s1): 524-533.

Helliwell, John F. 2002. *Globalization and Well-Being*. Vancouver, BC: UBC Press.

Helliwell, John F., and Haifang Huang. 2014. "New Measures of the Costs of Unemployment: Evidence from the Subjective Well-Being of 3.3 Million Americans." *Economic Inquiry* 52 (4): 1485-1502.

Helliwell, John F., Hugh Shiplett, and Christopher P. Barrington-Leigh. 2019. "How Happy are Your Neighbours? Variation in Life Satisfaction among 1200 Canadian Neighbourhoods and Communities." *PLoS ONE* 14 (1): 1-24.

Helliwell, John F., Richard Layard, Jeffery D. Sachs, Jan-Emmanuel De Neve, Lara B. Aknin, and Shun Wang, eds. 2021. *World Happiness Report 2021*. New York: Sustainable Development Solutions Network.

Hollett, Alton, Doug May, and Cory Giles. 2008. "The Newfoundland and Labrador System of Community Accounts." In *Statistics, Knowledge and Policy 2007: Measuring and Fostering the Progress of Societies*, 481-492. Paris: OECD.

Jorgenson, Dale W. 2018. "Production and Welfare: Progress in Economic Measurement." *Journal of Economic Literature* 56 (3): 867-919.

Kahneman, Daniel, and Amos Tversky. 1979. "Prospect Theory: An Analysis of Decision under Risk." *Econometrica* 47 (2): 263-291.

Kahneman, Daniel, and Angus Deaton. 2010. "High Income Improves Evaluation of Life but not Emotional Well-Being." *PNAS: Proceedings of the National Academy of Science of the United States of America* 107 (38): 16489-16493.

Knabe, Andreas, and Steffen Rätzel. 2011. "Scarring or Scaring? The Psychological Impact of Past Unemployment and Future Unemployment Risk." *Economica* 78 (310): 283-293.

Layard, Richard, Andrew Clark, and Claudia Senik. 2012. "The Causes of Happiness and Misery." In *World Happiness Report*, edited by John Helliwell, Richard Layard, and Jeffrey Sachs, 58-89. New York: Columbia Earth Institute.

Levene, H. 1960. “Robust Tests for Equality of Variances.” In *Contributions to Probability and Statistics: Essays in Honor of Harold Hotelling*, edited by Ingram Olkin, Sudhist G. Ghurye, Wassily Hoeffding, William. G. Madow, and Henry B. Mann, 278-292. Menlo Park, CA: Stanford University Press.

MacQueen, Kathleen M., Eleanor McLellan, David S. Metzger, Susan Kegeles, Ronald P. Strauss, Roseanne Scotti, Lynn Blanchard, and Robert T. Trotter II. 2001. “What is Community? An Evidence-Based Definition for Participatory Public Health.” *American Journal of Public Health* 91 (12): 1929-1938. https://ajph.aphapublications.org/doi/full/10.2105/AJPH.91.12.1929

May, D., and Alton Hollett. 2008. “The System of Community Accounts: An Application to Newfoundland and Labrador.” In *The Proceedings of the 30th General Conference of The International Association for Research in Income and Wealth*. Portoroz, Slovenia, 24-30 August.

McHardy, Mindy, and Erin O’Sullivan. 2004. *First Nations Community Well-Being in Canada: The Community Well-Being Index (CWB), 2001*. Strategic Research and Analysis Directorate, Indian and Northern Affairs Canada. http://publications.gc.ca/collections/Collection/R2-344-2001E.pdf

Mukherjee, Nisha, and Jonathan Krieckhaus. 2012. “Globalization and Human Well-Being.” *International Political Science Review* 33 (2): 150-170.

OECD. 2020. *How’s Life? 2020: Measuring Well-Being*. Paris: OECD Publishing.

Oreopoulos, Philip, and Kjell G. Salvanes. 2011. “Priceless: The Nonpecuniary Benefits of Schooling.” *Journal of Economic Perspectives* 25 (1): 159-184.

Osberg, Lars, and Andrew Sharpe. 2002. “An Index of Economic Well-Being for Selected OECD Countries.” *Review of Income and Wealth* 48 (3): 291-316.

Osberg, Lars, and Timothy Smeeding. 2006. “‘Fair’ Inequality? Attitudes toward Pay Differentials: The United States in Comparative Perspective.” *American Sociological Review* 71 (3): 450-473.

Powdthavee, Nattavudh, Warn N. Lekfuangfu, and Mark Wooden. 2015. “What's the Good of Education on our Overall Quality of Life? A Simultaneous Equation Model of Education and Life Satisfaction for Australia.” *Journal of Behavioral and Experimental Economics* 54: 10-21.

Randall, Chris, Abbie Cochrane, Rhian Jones, and Silvia Manclossi. 2019. *Measuring National Well-Being in the UK: International Comparisons, 2019*. UK: Office for National Statistics. https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/measuringnationalwellbeing/internationalcomparisons2019

Sen, Amartya. 1980. “Equality of What?" In *The Tanner Lectures on Human Values* 1, edited by Sterling McMurrin, 195-220.

Stevenson, Betsey, and Justin Wolfers. 2006. “Bargaining in the Shadow of the Law: Divorce Laws and Family Distress.” *The Quarterly Journal of Economics* 121 (1): 267-288.

Watson, Barry, and Lars Osberg. 2018. “Job Insecurity and Mental Health in Canada.” *Applied Economics* 50 (38): 4137-4152.

Wilbur, R. 2008. *New Brunswick: An Annual Review, 1960-2006.* Fredericton: Atlantic Canada Portal and Electronic Text Centre.

Wilcoxon, Frank. 1945. “Individual Comparisons by Ranking Methods.” *Biometrics Bulletin* 1 (6): 80-83.

Winkelmann, Liliana, and Rainer Winkelmann. 1998. “Why are the Unemployed so Unhappy? Evidence from Panel Data.” *Economica* 65 (257): 1-15.

Wolff, Edward N., and Ajit Zacharias. 2009. “Household Wealth and the Measurement of Economic Well-Being in the United States.” *The Journal of Economic Inequality* 7: 83-115.