The Canadian Rural Revitalization Foundation

Seven Reports on the Identification of Rural Indicators for Rural Communities

6. Regional Disparity

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Introduction

The term disparity refers to differences in rank, conditions or excellence (Merriam-Webster, 1995). When this term is applied to the socio-economic conditions of regions or territories, the term disparity can be used to describe the "variations in wealth, and socio-economic conditions and opportunities among units of observation (Alasia, 2002). In order to properly measure these variations between regions, geographic concentration indexes are most often used. These indexes are intended to measure the extent to which a small area of national territory accounts for a large proportion of a certain economic phenomenon (Spieza, 2002). Thus, a high concentration index would suggest a high degree of disparity (a few places hold most of the resources), whereas a low index denotes a low degree of disparity (resources are spread out among many places).

There has been a growing discontent with the magnitude of the differences in income and employment opportunity which exist between various regions in the same country: "In the less developed nations especially there is often a widening gap between the growth of a few industrialized urban centres and the stagnation of rural areas, and if not redressed the disparity that results can be a potent cause of political unrest. Though likely to be less extreme, regional differences in prosperity within advanced industrial are also a source of concern (and) Canada is no exception" (Brewis, 1969).

Disparities in income and employment opportunity within Canada have long been one of the important issues for Canadian policymakers. Much attention has been placed on areas where high rates of disparities exist and governments have been increasing efforts to reduce it. Upon identification of regions with high levels of disparity, policymakers may want to consider, or even reconsider, public programs directed at enhancing the performances in these regions (Alasia, 2002). Throughout history, the government has passed special legislation and taken steps to close the inequalities between regions. For instance, a special Area Development Agency (ADA) established in 1963 was designed to assist in the economic development of slow growth areas of the country. The Atlantic Provinces were also given further assistance through the strengthening of the Atlantic Development Board (Brewis, 1969). Even today, 'transfer payments' are annually made to the poorer regions of Canada from the federal government.

Definition of Regional Disparity

Regional disparity is quite evident in all parts of Canada and this trend continues to grow in many areas. How do we define regional disparity, and more importantly, how do we control it? Unfortunately, the issues involved in regional disparity cannot be defined in the narrow sense. Political, sociological, economical and administrative considerations lie at the root of development programs. The need for close collaboration is nowhere more obvious than in problems concerning regional development.

Upon review of existing literature, three key characteristics of regional disparity have emerged:

- First, disparities are linked to the natural conditions and physical characteristics of the region.
- Second, disparities are indicative of an unequal development of production potential.
- Lastly, disparities highlight the great differences in income and living standards from one region to another.

Among the many variables that contribute to regional differences in income and growth, the following have been singled out for discussion: capital formation, the labour force and education, industrial mix and regional exports. There seems to be a high degree of interdependence between these variables. The presence of rich natural resources will encourage investment; investment will influence the industrial mix and levels of employment, and thereby incomes.

Capital Formation (Capital Expenditures per capita) plays a prominent role in most theories of growth and the fact that it is higher in some parts of the country than in others leads one to expect significant regional differences in output. However, it is the technological change embodied in it rather than simply its magnitude that is regarded as significant. Other things being equal, provinces experiencing a lower level of capital expenditures per capita than others over a period of years are also likely to experience lower levels of output and income (Brewis, 1969). On the other hand, capital expenditures are an influence of government policy generally geared towards lower income regions and regions which have less educated and less skilled workers.

Spatial differences in the quality and skills of the labour force also contribute to interregional differences in employment and income. There has been a notable shift to more skilled occupations, accompanied by a great increase in the employment of women. There has been a shift from occupations with low educational requirements to ones with high ones. This trend is a factor in existing spatial disparities in income and employment. The shift away from employment in primary occupations raises the issue of the industrial mix.

The growth of a region reflects the fortunes of the individual industries within its borders. The industrial mix in an area affects not just the level of incomes, but also the distribution and stability of incomes, the growth of the population, and land use. The concentration of production in particular fields of activity that are subject to sharp fluctuations in demand and technological change lead to a higher degree of economic instability. The fact that different regions are competing against each other may hurt one region at the expense of the other, leaving a disparity between the regional exports.

Measurements of regional disparity have also been conducted comparing gross national product (GNP) per capita using the Gini Index of Inequality (Gylfason, 1999). When applied to incomes, the Gini coefficient measures the degree of disparity in an income distribution. A Lorenz curve plots the cumulative percentages of total income received against the cumulative number of recipients, starting with the poorest individual or household. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. A value of 0 represents perfect equality whereas a value of 100 represents perfect inequality.

In brief, a great deal of the literature deals with international analyses of regional disparity. Generally, researchers have utilized four principle measurements of geographic concentration:

1. Concentration Ratio
   This measurement simply takes the ratio between the economic or production weight of a region and its geographic weight (Spieza, 2002). The economic weight of a region has been measured in terms of production or gross domestic production (GDP), income or employment. This measurement is best suited for international comparisons of regional disparity.

2. Locational Gini Coefficient
   This measurement is simply a modification of the Gini inequality index where individuals are replaced by regions and weights are determined by regional shares in total population or employment (Krugman, 1991; Spieza, 2002). This method is widely used but Gini coefficients have also been criticized for confusing inequality and concentration when they, in fact, two distinct concepts (Arbia, 1989; Spieza, 2002; Wolfson, 1997).

3. Herfindahl Geographic Concentration index
   Developed by Ellison and Glaeser (1997), this measurement is a slight reformulation of the original Herfindahl index. The Herfindahl index has been called the one true measure of geographic concentration (Spieza, 2002). This index takes into account the regional differences in size. The formula appears as follows:

   $$EG = \sum_{i=1}^{N} (y_i - a_i)^2$$

   Where y_i is the production, income, or employment proportion of region *I* and N stands for the number of regions being compared; and a_i is the area of region *i* as a proportion of the country area. If the production share of each region equals its relative area, then there is no concentration and EG equals 0 indicating no regional disparity.

The EG index is the sum of all *N* squares for the entire nation. It indicates the extent to which there is employment disparity among these *N* regions. Note that each of these squares would be a decimal number or a fraction, and the EG index is also most likely to be a decimal or fractional number. Thus, to apply this formula to calculate the proportion of regional disparity that is contributed to the total by each region, the ratio of the square $(y_i - a_i)^2$ to EG is used. The formula would appear as follows: $(y_i - a_i)^2$ / EG.

4. Adjusted Geographic Concentration index (AGC)
This measurement essentially transforms the Herfindahl index in order to take into account intra and international differences in the size of regions. This index is best suited for international comparisons of geographic concentration. The formula appears as follows:

$$AGC = GC / GC^{MAX}$$

where $CG^{MAX} = \sum_{i \neq \min} a_i + 1 - a_{\min} = 1 + 1 - 2a_{\min} = 2(1 - a_{\min})$ is the maximum value of the CG index, reached when all production, income, or employment is concentrated in the region with the smallest area, and $a_{\min}$ is the relative area of the smallest region (Krugman, 1991; Spieza, 2002).

Indicator Development

Based on the literature review, we have determined that the Herfindahl Geographic Concentration index, developed by Ellison and Glaeser, is the best way to measure regional disparity. This index was found to be the most sensitive measure when it comes to the level of aggregation of regional data. This feature is a result of the fact that the "differences between production share and relative area of each region are squared" (Spieza, 2002). We have chosen employment share as the best indicator of production for the region. GDP data at the regional level is not available to us for this analysis and income data is often problematic with misrepresentation and missing data found in many smaller areas. In addition, the rate of employment will often account for large portion of the differences between incomes between regions (Brewis, 1969).

In order to generate this index, we first have to determine the appropriate area and employment shares of each CSD[1] in Canada. To determine the area share, the total land area (in square kilometres) for each CSD was divided by the total land area (in square kilometres) for all CSDs in Canada. To calculate the employment share, the total labour force (all classes of workers 15 years of age

[1] A census subdivision (CSD) is the general term for municipalities (as determined by provincial legislation) or an area treated as municipal equivalents for statistical purposes (Statistics Canada, 2004). Geographic boundaries are based on 2001 Statistics Canada census definitions. CSDs with populations of less than 250 people have been excluded from this analysis since the values become unreliable due to confidentiality transformations.

and older, male and female) of each CSD was divided by the total labour force of all CSDs in Canada.

In order to measure regional disparity, each CSD's area share (in square kilometres) of the country is subtracted from the CSD's total employment share and then squared. The statistical procedure of squaring the differences between the employment share and the relative area share of each CSD, makes all these values positive.

To summarize, the formula to measure the overall degree of regional disparity in Canada is as follows:

EG of Canada = SUM (CSD total employment share – CSD total area share)^2

In order to calculate the proportion of total regional disparity contributed by each CSD we use the following formula:

CSD contribution to Regional Disparity = (CSD total employment share – CSD area share)^2/EG of Canada

The following example will illustrate how this measure of regional disparity is calculated:

If we had 5 regions or CSDs in Canada, with the following employment shares and area shares:

	1	2	3	4	5	Total
y	0.3	0.2	0.1	0.3	0.1	1.00
a	0.4	0.2	0.1	0.1	0.2	1.00

then, the overall regional disparity index (EG) for these five regions would be:

EG = $(.3-.4)^2 + (.2-.2)^2 + (.1-.1)^2 + (.3-.1)^2 + (.1-.2)^2$ = .01 + 0 + 0 + .04 + .01 = **.06**
To compute the disparity contribution of region 1, we calculate the ratio: $(.3-.4)^2$ / .06 = .01/.06 = .1667
To compute the disparity contribution of region 2: $(.2-.2)^2$ / .06 = 0 / .06 = .0000
To compute the disparity contribution of region 3: $(.1-.1)^2$ / .06 = 0 / .06 = .0000
To compute the disparity contribution of region 4: $(.3-.1)^2$ / .06 = .04 / .06 = .6667
To compute the disparity contribution of region 5: $(.1-.2)^2$ / .06 = .01 / .06 = .1667

As illustrated in the example above, region 4 makes the greatest contribution to the overall regional disparity, followed by regions 1 and 2. This means region 4 has contributed about 67 % of the regional disparity for the entire country, while regions 1 and 2 each contribute about 17 %. Even though this region is one of the smallest regions in terms of geographic area (only 0.1 or 10%), it enjoys 30% or 0.3 employment share. Thus, its contribution to overall regional disparity was found to be the highest.

For the Canadian case, we examined 4039 CSDs in 1996 and 4014 CSDs in 2001 with populations of greater than 250 people. This produced an overall Herfindahl Geographic Concentration index total of .043 for 1996 and .045 for 2001. These statistics provide us with our overall index of regional disparity.

Contributions of CSDs to the Regional Disparity Indicator

Each CSDs contribution to the overall regional disparity was calculated and the results were multiplied by 100 for each of the years. This was done in order to reduce the number of zeroes in the results since each CSD makes such a small contribution to the overall index for Canada. The average contributions of CSDs to the regional disparity index for Canada appear in Table 1:

Table 1:
Average CSD Percent Contribution to Regional Disparity

Regional Disparity	N	Minimum	Maximum	Mean (%)	Std. Dev.
1996	4039	0.0000	21.5097	0.0248	0.5312
2001	4014	0.0000	23.2232	0.0249	0.5579

As we see in Table 1, on average, CSDs contribute about .024% to the overall level of regional disparity in both 1996 and 2001. This level of regional disparity has changed very little over the 5-year period.

The next table presents a breakdown of the CSD contribution to regional disparity index by urban-rural type of CSD[2]:

Table 2:
Average CSD Percent Contribution to Regional Disparity by Urban-Rural Status

Urban area/Rural area type of CSD	1996	2001
Urban core	0.0361	0.0848
Urban fringe	0.0012	0.0013
Rural fringe, in CMA/CA	0.0001	0.0004
Urban, outside CMA/CA	0.0001	0.0001
Rural, outside CMA/CA	0.0270	0.0259
Total	0.0218	0.0251

The table above indicates that urban core regions contribute most to Canadian regional disparity and the contribution is growing. Urban core areas contributed .036% in 1996 and that number rose in 2001 to .084%. This is most likely due to the fact that they have such a large proportion of the labour force in a relatively

[2] Urban core, urban fringe and rural fringe distinguish between central and peripheral urban and rural areas within or outside of a census metropolitan area (CMA) or census agglomeration (CA) (Statistics Canada, 2004).

small area. Rural areas outside CMA/CA regions also contribute a relatively large proportion to disparity, but in their case it is due to the fact that they are large areas with a very small proportion of the labour force. Urban areas outside of census metropolitan areas contributed the least to overall regional disparity.

The following table presents the average levels of contribution to regional disparity at the CSD level by province:

Table 3:
Average CSD Percent Contribution to Regional Disparity by Province

Province	1996	2001
Newfoundland	0.0064	0.0072
PEI	0.0000	0.0000
Nova Scotia	0.0038	0.0036
New Brunswick	0.0002	0.0001
Quebec	0.0094	0.0100
Ontario	0.0870	0.0903
Manitoba	0.0308	0.0093
Saskatchewan	0.0125	0.0138
Alberta	0.0161	0.0178
BC	0.0132	0.0137
Yukon	1.6551	1.6593
Northwest	0.0000	0.0000
Nunavut	0.0000	0.0000
Total	0.0248	0.0249

As we can see in this table, the Yukon Territory contributes the most to the overall regional disparity in Canada. Ontario made the next highest contribution, most likely due to its high levels of labour force participation in relatively small CSDs. The province of PEI, Canada's smallest province, made the smallest contribution to regional disparity among the ten provinces indicating a relatively even balance of space and labour force participation.

Future Research

This approach to regional disparities takes the all of Canada as its point of reference and considers the extent to which each CSD contributes to an overall measure of regional disparity. Future work needs to be done in which other spatial units are taken as the point of reference: provinces, regions, and CSDs themselves. Using a similar approach, it would be possible to calculate Herfindahl indexes for each of these units – focusing on the extent to which variation occurs within them.

Future studies might also examine a wider variety of characteristics to more adequately reflect other aspects of regional disparity. This set of indicators could better "capture the multiplicity and complexity of the underlying spatial

processes" (Alasia, 2002). For instance, one might want to include income and GDP along with employment in a more comprehensive set of indicators to measure regional disparity. Extending the analysis to characteristics such as family structure, ethnicity, or housing would provide insights on the changing social nature of Canadian society.

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