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# SENSITIVITY OF THE INDEX OF ECONOMIC WELL-BEING TO DIFFERENT MEASURES OF POVERTY: LICO VS LIM

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# Sensitivity of the Index of Economic Well-being to Different Measures of Poverty: LICO vs LIM

## Abstract

This paper uses an exercise similar to comparative statics to show that the growth rate of the Index of Economic Well-being (IEWB) for 1981-2009 was much greater when poverty was measured using Statistics Canada's Low Income Cut-Offs (LICOs) than it was when poverty was measured using Statistics Canada's Low Income Measures (LIMs). The LICO, an absolute definition of poverty, also exhibited greater cyclical variation than the LIM, a relative definition of poverty. The IEWB appears to reflect these trends. Real income growth was determined to be a key factor in explaining these trends because absolute poverty lines remain fixed while relative poverty lines shift in response to changes in real income. This paper concludes that there is a significant change in the growth of the IEWB between measures, although not as large as it would be in the absence of linear scaling methodology. Consequently, the use of the LIM instead of the LICO places a downward bias on economic well-being growth in Canada. The choice of the 'appropriate poverty measure' therefore has significant consequences for the discussion of economic well-being.

# Sensitivity of the Index of Economic Well-being to Different Measures of Poverty: LICO vs LIM

## Table of Contents

# List of Charts

# List of Tables

# Sensitivity of the Index of Economic Well-being to Different Measures of Poverty: LICO vs LIM

## Executive Summary

The Index of Economic Well-being (IEWB) is a composite index that captures four facets of well-being: consumption, wealth, equality, and economic security. Estimates of the IEWB for Canada and its provinces exist for 1981 through 2010. This paper uses these estimates up to 2009, the last year for which poverty data was available during the last update. Poverty measures affect the IEWB through equality and economic security. Poverty intensity (the product of the poverty rate and the poverty gap ratio) for the overall population contributes to the equality sub-index. Poverty intensity for the elderly population and poverty intensity for female lone-parent-headed households both contribute to the economic security sub-index. The two major options available for examining Canadian poverty are the Low Income Cut-Off (LICO), an 'absolute' measure of poverty, and the Low Income Measure (LIM), a 'relative' measure of poverty. This paper examines the differences between the poverty measures, including how they affect the IEWB. The key findings of this paper are:

- For the overall population, the LICO produced lower poverty rates than the LIM, whereas the LICO had a slightly larger poverty gap than the LIM. In Canada in 2009, the LIM gave an overall poverty rate of 13.3 per cent whereas the LICO overall poverty rate was 9.6 per cent. The estimates for the poverty gap ratio were 0.31 and 0.34, respectively (Statistics Canada, Table 202-0802).

- These measures, and the data for female lone-parent-headed households and the elderly, affect the estimates for the equality and economic security components of the IEWB through changes in poverty intensity under the two measures and through differences in the implicit weights of these changes applied through linear scaling.

- The overall poverty rate was the most significant effect in the difference between IEWB trends under the LICO and the LIM. The overall poverty rate increased 10.8 per cent under the LIM and decreased 17.2 per cent under the LICO.

- The choice of poverty measure makes a significant difference in analyzing trends in economic well-being across time. The IEWB measured using the LIM understates the growth of economic well-being in Canada compared to the IEWB measured using the LICO, but not as much as it would in the absence of linear scaling, as linear scaling has an offsetting effect.

- This effect might be explained by the real growth of national income from 1981 to 2009 – which removes people from absolute poverty, but not relative poverty, due to rising median income. The choice of poverty measure therefore has significant consequences for the policy discussion concerning economic well-being.

# Sensitivity of the IEWB to Different Measures of Poverty: LICO vs LIM

The aim of this paper is to explore how trends in the Index of Economic Well-being (IEWB) change when subjected to different measures of poverty. Specifically, this paper will examine the differences between the IEWB estimated using the Low Income Cut-Off (LICO) and using the Low Income Measure (LIM) as the poverty threshold. This analysis uses the recently updated database for the IEWB in Canada and its provinces (Osberg and Sharpe, 2011b)[1] and decomposes the differences in the long-run trend of the IEWB caused by changing the poverty indicators from LIM-based to LICO-based. The paper details the manipulations applied to poverty indicators in the order of calculation within the IEWB: the differences in the values of the poverty indicators (Section II), combined with implicit weights produced by linear scaling (Section III), explain differences in the IEWB's components caused by the change in poverty measure (Section IV). These differences in its components aggregate to final differences in the IEWB.

In total, four sections comprise this paper. The first section provides background information on the IEWB, defines the terms of the discussion, specifically the LIM and LICO, and provides motivation for this paper. The next section discusses differences in the estimates of overall, elderly, and female lone-parent poverty implied by these two poverty thresholds. The third section discusses the implications of linear scaling and its consequences for comparing the IEWB under different poverty measures. The final section applies these differences to the IEWB across time in an exercise similar to comparative statics.

## I. Introduction

### a. Motivation

Different perspectives exist concerning the appropriate measure for poverty. These differing measures have alternate implications for public policy and for monetary progress in economic well-being. In particular, the choice of the 'appropriate' poverty measure has consequences for the IEWB due to its inclusion of poverty indicators. Previous releases of IEWB results have used both relative measures of poverty and absolute measures of poverty. For example, whereas Osberg and Sharpe (2009a) used Statistics Canada's Low Income Cut-Off (LICO), which is an absolute measure of poverty, the Osberg and Sharpe (2011a) update of the IEWB for Canada and the provinces used Statistics Canada's Low Income Measure (LIM), a relative measure of poverty. Indeed, Osberg and Sharpe (2011a) note:

> …we previously opted to use the LICO approach for several reasons. First, the LICOs are the most common poverty measures used in the literature on Canada. Second, Statistics Canada produces official estimates of the poverty rate and gap based on location- and family size-specific LICOs; this level of precision would be difficult to achieve using the LIM approach, and in any case, we think it is better to use Statistics Canada's official data whenever possible in the interest of transparency. Recently, reliable LIM-based poverty

[1] This database, used for Osberg and Sharpe (2011a), is available on the CSLS website at http://www.csls.ca/iwb/prov.asp. Note that this database has estimates for 1981 through 2010. The data for 2010 were estimated using extrapolations of 5-year trends in poverty and other incomplete series. For this reason, this paper uses the data only up to 2009.

> data became available from Statistics Canada. As such, the numbers reported in the this report are based on the LIM in order to match the methodology of the international comparisons (Footnote 25, p. 37).

Furthermore, the methodology of the LIM is much simpler than that of the LICO, as the next section of this paper reveals. Notably, this change resulted in different trends in the IEWB, an observation that is important for the discussion of economic well-being in Canada. This paper discusses these key differences in IEWB trends and the next subsection of this paper defines these poverty measures in detail.

The most recent version of the IEWB for Canada and the provinces (Osberg and Sharpe, 2011a), released in September 2011, uses the LIM; however, this methodological change raises new questions concerning comparability. How did the trends in the IEWB for Canada and the provinces change when the poverty measure changed from LIM to LICO? What were the mechanisms behind this change? The answer to these questions has important consequences for the discussion concerning economic well-being in Canada. This paper explores the answers to these new questions by exploring these definitions of poverty, their relationship with the IEWB, and using a method similar to comparative statics.

## b. Definitions of Poverty

As discussed in the previous subsection, the IEWB has used both the Low Income Measure (LIM) and the Low-Income Cut-Off (LICO) in updates of the IEWB for Canada and the provinces. In the most recent update of the IEWB for Canada and the provinces, the poverty measures used were LIMs produced by Statistics Canada. This section briefly describes both the LIMs and LICOs produced by Statistics Canada, along with methodological changes recently implemented by Statistics Canada.

### *i. Low Income Measures*

The poverty line defined by the LIM is one-half of median income after adjusting for family size. According to Statistics Canada (2010: p. 10), the old equivalence scale used in the calculation of the LIM was: a value of one assigned to the oldest family member, a value of 0.4 assigned to the next oldest family member and all other adults,[2] and a value of 0.3 assigned to all children. This equivalence scale resulted in various different poverty lines due to the multitude of possible family sizes and compositions. In the 2010 release of income data (Statistics Canada 2010), Statistics Canada revised the methodology used in the construction of national low-income measures. These changes involved shifts from the use of economic families to households, from a median based on families to a median based on individuals, and to an equivalence scale based on the square root of family size, according to the recommendations of Murphy, Zhang, and Dionne (2010: pp. 13-14).

### *ii. Low Income Cut-Offs*

The LICO is an income threshold based on consumption patterns from the 1992 Family Expenditures Survey. This line occurs where a family spends "20 percentage points more than the average family on food, shelter, and clothing," (Statistics Canada, 2010: 7). “To produce the low

[2] Adults in this instance are defined as people aged 16 and above.

income cutoffs a regression line is fitted to the relationship between each family's income and its spending on basics," and in order to estimate this line appropriately, different LICOs are established for differing community populations and family sizes (Cotton: 1).

Although some argue that the definition above may imply a relative concept for the LICO, the LICO has become more of an 'absolute' measure of poverty as time has passed. Following James Foster on absolute poverty, we define absolute poverty as a "poverty line…typically calibrated in some initial period using, say, food-budget studies, and it is then carried forth from year to year," (1998: 336). The LICO satisfies this definition of 'absolute' poverty and we therefore consider it an absolute measure of poverty.

These two measures of low income, one relative (LIM) and one absolute (LICO), capture different aspects of poverty, and therefore have different implications for the IEWB. Consider a society where from year x to year x+1, the income of every citizen doubles. The LIM measures the relative position of individuals in society. Therefore, the poverty rate measured by the LIM would remain unchanged, as the distribution of income would be unchanged. On the other hand, the LICO measures the fraction of families that find themselves below an absolute threshold of socially acceptable income levels. Therefore, the poverty rate measured by the LICO would likely decrease markedly, as all individuals who earned at least half the poverty threshold would now earn more than this unchanged threshold. In this regard, the IEWB measures two different situations under the different measures.

### c. About the Index of Economic Well-being

Lars Osberg of Dalhousie University and Andrew Sharpe of the Centre for the Study of Living Standards developed the IEWB to measure trends in economic well-being. Over the past fifteen years, the two researchers published numerous updates and reports of the IEWB, expanding the IEWB to selected OECD countries in 2002 (Osberg and Sharpe, 2002). The IEWB is composed of four sub-indices: consumption, wealth, equality, and security. Each of these sub-indices is composed of a number of variables. Poverty variables are present in both the equality and security sub-indices of the IEWB. The equality sub-index is composed of the overall poverty rate and the Gini coefficient. The security sub-index is composed of the security from the risk of poverty in old age and the security from the risk of single parent poverty, as well as the security from the risk of illness and the security from the risk of unemployment.

The IEWB includes a poverty rate and a poverty gap for each of the overall population, the elderly (aged 65 or more), and individuals who are part of female single parent-headed households (henceforth these populations will be referred to as the three 'poverty groups'). For the calculation of indices of the relative risk of poverty, the pertinent variables in the IEWB are those of 'poverty intensity.' The IEWB defines poverty intensity as the product of the poverty rate, poverty gap, and a constant. For the overall population and the elderly, the IEWB uses the constant 1.89, whereas for single parents the IEWB replaces the constant with the divorce rate[3] (Osberg and Sharpe, 2011b).

A change in the definition of poverty used in the calculation of the IEWB will therefore affect the results through two channels. First, changes in the overall poverty intensity will change

[3] Current legal marriages that ended in divorce in any given year, per cent.

the results of the equality sub-index. These changes are likely to have a large effect on the results of the equality sub-index, as poverty intensity was assigned an explicit weight of 75 per cent and Gini coefficients were assigned only 25 per cent. Second, changes in female lone-parent poverty intensity and elderly poverty intensity will result in changes to the security domain. The changes are likely to be less dramatic, as the risks are weighted based on the proportion of the population confronted with the risk. The weights for these vulnerable groups are therefore much lower than the weights assigned to the risks of unemployment and illness, where the majority of people are at risk.

In 2009, the total weight of poverty measures on the IEWB for Canada was, at most, 25.4 per cent. Overall poverty accounted for 18.75 per cent of the IEWB, while lone-parent poverty and elderly poverty accounted for 3.6 and 3.0 per cent of the IEWB, respectively. Table 1 summarizes the breakdown of these weights.

**Table 1: Weight of Poverty in the IEWB, Canada, 2009**

| | | |
|---|---|---|
| Index of Economic Well-Being (100 per cent) | Consumption (25 per cent) | |
| | Wealth (25 per cent) | |
| | Equality (25 per cent) | Gini Coefficient (6.25 per cent) |
| | | **Overall Poverty (18.75 per cent)** |
| | Security (25 per cent) | Risk Imposed by Unemployment (7.52 per cent) |
| | | Risk Imposed by Illness (10.83 per cent) |
| | | **Risk Imposed by Lone-Parent Poverty (3.61 per cent)[4]** |
| | | **Risk Imposed by Poverty in Old Age (3.04 per cent)** |
| **Sum of all poverty indicators: 25.4 per cent[5]** | | |

Source: Calculated from Osberg and Sharpe (2011b)

Poverty therefore has a substantial effect on the outcome of the IEWB. Indeed, the influence of the poverty measure in the IEWB is approximately equal to a sub-index of the IEWB.[6] Furthermore, it is clear that overall poverty, which comprises 73.8 per cent of the total weight assigned to all poverty indicators, is the most heavily weighted poverty group. Nevertheless, the following section analyzes all three poverty groups in order to gain a comprehensive understanding of LIM and LICO trends that affect the IEWB.

## II. Poverty Measure Trends

The variables in this paper are poverty measures (rates and gap ratios) calculated under both LIM and LICO. Statistic Canada Cansim tables 202-0802 and 202-0804 provide these measures unless otherwise noted. It is necessary to understand the variation of these poverty

[4] In reality, this indicator also includes the divorce rate in a multiplicative relationship. Due to the multiplicative nature of the relationship, the interactions between the variables are what truly matter; we are overestimating the effect of poverty if we assign all 3.61 per cent of this weight to poverty. Consequently, it may be more appropriate to assign the range 0-3.61 per cent.

[5] See Footnote 5. It may therefore be more appropriate to assign the range of 21.8-25.4 per cent.

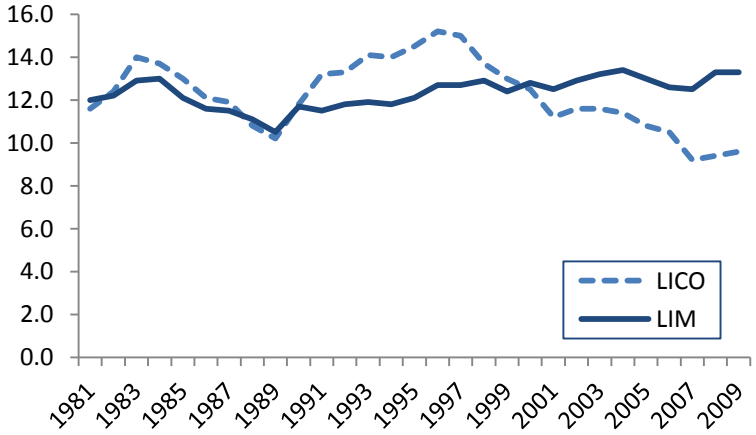
[6] This is true when the sub-indices are equally weighted, which is the scheme used in the evaluation of LIM and LICO.

measures across provinces and time in order to understand the effect a change from LIM to LICO might have on the IEWB. This section discusses these trends for Canada.[7]

### *i. Overall Poverty*

The after-tax overall (for all persons) poverty rate under the LICO follows the same downward trend as the overall poverty rate under the LIM until 1990, at which point the two measures diverge. Under the LIM, Canada has witnessed a slight overall increase in the poverty rate from 11.7 per cent in 1990 to 13.3 per cent in 2009 (Chart 1). Under the LICO, the poverty rate increased from 10.2 per cent in 1989 to a maximum of 15.2 per cent in 1996 and then declined to 9.6 per cent in 2009. In 1981, the LICO gives a poverty rate of 11.6 per cent and the LIM gives a poverty rate of 12.0 per cent. This translates into two very different stories of progress on the overall poverty rate in Canada. Indeed, if the LIM is used to measure poverty in Canada, we see a 10.8 per cent increase in the overall poverty rate in Canada over the 33-year period. On the other hand, if the LICO is used to measure poverty, a 17.2 per cent decrease in the poverty rate occurs.

**Chart 1: Overall After-Tax Poverty Rate, per cent, Canada, 1981-2009**




Source: CANSIM Table 2020802

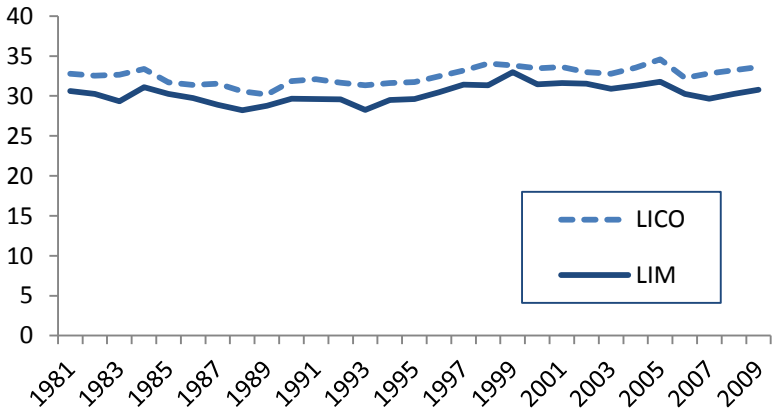
The average gap ratios for LICO and LIM measures follow similar trends, but the LICO gives a slightly larger gap ratio than does the LIM. In 1981, the poverty gap under the LIM was 0.31 and the poverty gap under the LICO was 0.33 (Chart 2). In 2009, the poverty gap under the LIM for Canada was 0.31, while the LICO poverty gap was 0.34. The poverty gap was therefore quite stable under both the LICO and the LIM, increasing only 0.5 per cent under the LIM and only 2.6 per cent under the LICO.

Rather than using the poverty rate or the poverty gap, the IEWB uses overall poverty intensity in the calculation of an index score for overall poverty. The IEWB defines poverty intensity as the product of the poverty rate, the poverty gap, and a constant (1.89). Due to the stability of the overall poverty gap under both the LICO and the LIM, the overall poverty intensity follows the same trend as the overall poverty rate. Under the LIM, overall poverty intensity was

[7] This paper limits the description of these trends to fluctuations relevant to the IEWB. For a more complete decomposition and description of poverty in Canada under different poverty measures, see Murphy, Zhang, and Dionne (2012). For a description of poverty trends in the provinces and their effects on the IEWB across the provinces, see Appendix III.

6.9 in 1981 and grew 11.4 per cent to 7.7 in 2009 (Table 2). Under the LICO, overall poverty intensity was 7.2 in 1981 and fell 15.1 per cent to 6.1 in 2009. The LICO therefore shows a decrease in poverty intensity whereas there was an increase in poverty intensity under the LIM. Given this indicator accounts for the vast majority of the poverty weight in the IEWB, the economic well-being of Canadians as measured by the IEWB will increase faster when using the LICO than when using the LIM.

**Chart 2: Overall After-Tax Average Poverty Gap Ratio, per cent, Canada, 1981-2009**



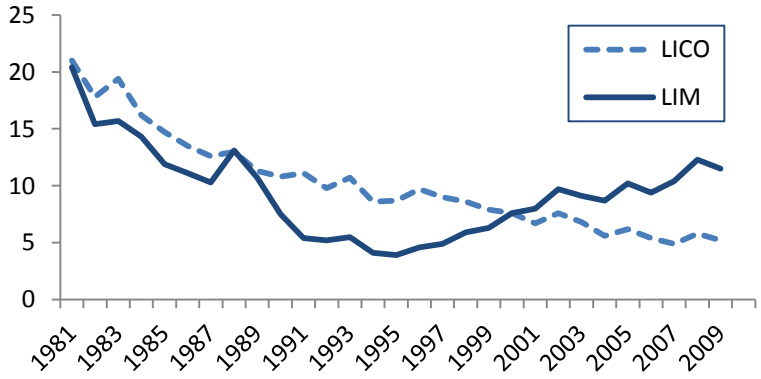

Source: CANSIM Table 2020802

Economic expansions and recessions are an important determinant of the trends of the poverty rates. During an economic expansion, average income rises. If all parts of the income distribution grow at the same rate, the LIM poverty rate should remain unchanged, since the same proportion of individuals would remain below the poverty line. On the other hand, the LICO poverty line would not shift due to an economic expansion, fewer individuals would be in poverty according to this line, and the poverty rate would fall. Therefore, we should expect the change of the LICO to exceed that of the LIM during recessions and booms. Similarly, if this is true, we expect the IEWB to respond more aggressively to economic expansion when based on the LICO. It appears that the LICO and LIM follow these expected patterns (Chart 1 and Appendix II).

### *ii. Elderly Poverty*

For Canada, the elderly poverty rate follows a sharp downward trend for both the LIM and the LICO until 1988, at which point the two measures begin to offer strikingly different results (Chart 3). At this point, the LICO continues to drop steadily to 5.2 per cent in 2009. On the other hand, the LIM falls at a faster rate until 1995, where it reaches a low of 3.9 per cent. The LIM then began to rise; by 2009, the LIM for the elderly reached 11.5 per cent. Overall, both measures showed enormous declines in the elderly poverty rate in Canada; the LIM decreased 43.6 per cent and the LICO decreased 75.2 per cent from 1981 through 2009. On the other hand, the LIM shows a recent reversal of this trend.

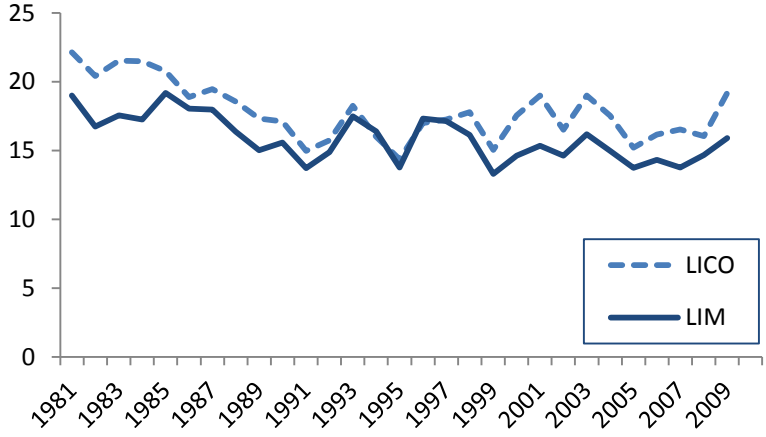
**Chart 3: Elderly after-Tax Poverty Rate, per cent, Canada, 1981-2009**




Note: Elderly refers to persons aged 65 and older.
Source: CANSIM Table 2020802

The poverty gap ratio for the elderly in Canada varies much less than its respective poverty rate, exhibting only a slight downward trend. In 1981, the poverty gap ratio for the elderly was 0.19 with the LIM and 0.22 with the LICO (Chart 4). Both measures decreased to 0.14 in 1995 but the LICO began to increase at a faster rate than the LIM. In 2009, the LIM elderly poverty gap ratio was 0.16 for Canada. This is 0.03 points lower than the poverty gap ratio of 0.19 given by the LICO for Canada in 2009. The poverty gap ratio for the elderly therefore decreased 16.2 per cent under the LIM and 13.3 per cent under the LICO.

**Chart 4: Elderly After-Tax Average Poverty Gap Ratio, per cent, Canada, 1981-2009**



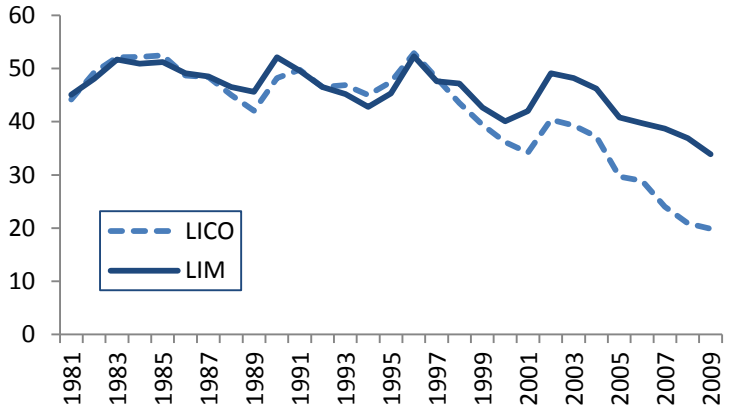

Note: Elder refers to persons aged 65 and older.
Source: CANSIM Table 2020802

As noted earlier, the indicator used in the IEWB is poverty intensity. Whereas for the overall population there was not much of a trend in the poverty gap, there was a downward trend in the poverty gap for the elderly. For this reason, the decrease in poverty intensity was larger than the decrease in the poverty rate for both the LICO and the LIM. Under the LIM, the elderly poverty intensity in 1981 was 7.3 and decreased 52.8 per cent to 3.5 in 2009 (Table 2). Under the LICO, the elderly poverty intensity in 1981 was 8.8 and decreased a staggering 78.5 per cent to 1.9 in 2010. It is therefore clear that the IEWB will register progress in economic security for this segment of the population under both the LICO and the LIM; however, the LICO shows greater improvement.

### *iii. Female Lone-Parent-Headed Household Poverty*

The female lone-parent-headed household after-tax poverty rate follows similar trends and exhibits almost no long-term change under both the LICO and the LIM until 1996, at which point the two measures begin to decrease, but at different rates (Chart 5). In 1981, the LIM gave a poverty rate of 45.1 per cent and the LICO gave a poverty rate of 44.2 per cent. By 1996, this had increased to 52.3 per cent under the LIM and 52.9 per cent under the LICO. In 2009, the poverty rate for this group in Canada was 33.9 per cent under the LIM and only 19.9 per cent under the LICO. Therefore, although the two measures followed similar increasing trends until 1996, there was an overall decrease of 24.8 per cent under the LIM and 55.0 per cent under the LICO from 1981 to 2009. In fact, although the LICO showed a much greater decline in the poverty rate for individuals in households with female lone-parent heads, both the LICO and the LIM show that Canada achieved its lowest female lone-parent household poverty rate in the previous 29 years in 2009.

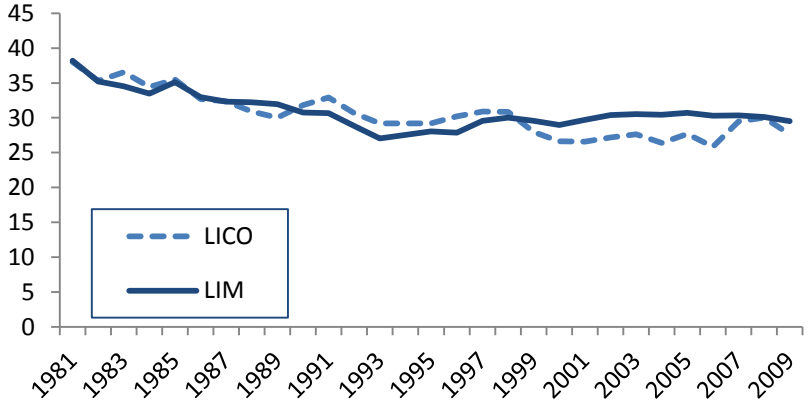
**Chart 5: Female Lone Parent After-Tax Poverty Rate, per cent, Canada, 1981-2009**




Source: CANSIM Table 2020804

The poverty gap ratio for female lone-parents in Canada also declined rather steadily over the twenty-nine year period. In 1981, the poverty gap ratio for single parents in Canada was 0.38 under both the LIM and the LICO (Chart 6). By 2009, this had decreased to 0.30 under the LIM and 0.28 under the LICO. This represents a decrease of 22.7 per cent under the LIM and 27.3 per cent under the LICO.

**Chart 6: Female Lone Parent After-Tax Average Poverty Gap Ratio per cent, Canada, 1981-2009**




Source: CANSIM Table 2020804

For people living in female lone-parent headed households, the relevant indicator is actually the product of the divorce rate, the poverty rate, and the poverty gap. Yet, in order to compare directly the advances in poverty for female lone-parent-headed households to those for the elderly and the overall population, define the poverty intensity the same way: the product of the poverty rate, the poverty gap, and the same constant (1.89). Under this definition, both the LICO and the LIM show great declines in poverty intensity for female lone-parent-headed households. Under the LIM, the poverty intensity was 32.6 in 1981 and decreased 41.9 per cent to 18.9 in 2009 (Table 2). Under the LICO, the poverty intensity for this group was 31.7 in 1981 and fell 67.3 per cent to 10.4 in 2009. Once more, the LICO shows a faster decrease in poverty intensity than does the LIM. This was true for all three poverty groups, and we therefore expect the IEWB to increase faster under the LICO than under the LIM.

### *iv. Aggregation of Poverty*

As noted previously, the indicator used to measure poverty in the IEWB is poverty intensity: the product of the poverty rate, the poverty gap, and a constant.[8] Table 2 presents a summary of the trends in these data. Note that for all three poverty groups, poverty intensity decreases faster under the LICO than under the LIM. Indeed, for overall poverty, poverty intensity actually increased under the LIM. The IEWB recognizes poverty intensity as a negative indicator. For this reason, the IEWB measured under the LICO must increase and must do so at a faster rate than the LIM; however, note that the trend in the IEWB for the LIM is not directly available from this as the effect of poverty on the IEWB is a weighted sum of these indicators.

**Table 2: Summary of Poverty Data used in the IEWB**

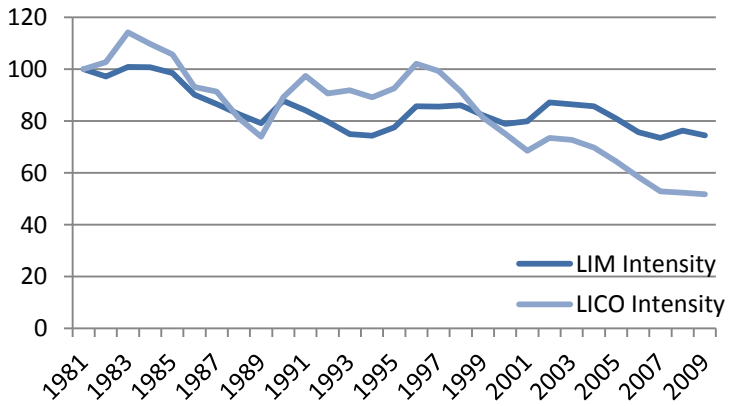
| | *Overall Poverty* | | | | | |
|---|---|---|---|---|---|---|
| | LIM | | | LICO | | |
| | Rate | Gap | Intensity | Rate | Gap | Intensity |
| 1981 | 12.0 | 0.306 | 6.9 | 11.6 | 0.328 | 7.2 |
| 2009 | 13.3 | 0.308 | 7.7 | 9.6 | 0.336 | 6.1 |
| Percentage Point Change | 1.3 | 0.002 | 0.8 | -2.0 | 0.009 | -1.1 |

[8] This poverty intensity index is constructed using the definition 1.89*rate*gap/100 for all three poverty groups, and is summed using the relative weights of poverty measures. 1981=100 was used to normalize the indices.

| | | | | | | |
|---|---|---|---|---|---|---|
| Per Cent Change | 10.8 | 0.5 | 11.4 | -17.2 | 2.6 | -15.1 |
| | *Elderly Poverty* | | | | | |
| | LIM | | | LICO | | |
| | Rate | Gap | Intensity | Rate | Gap | Intensity |
| 1981 | 20.4 | 0.190 | 7.3 | 21.0 | 0.221 | 8.8 |
| 2009 | 11.5 | 0.159 | 3.5 | 5.2 | 0.192 | 1.9 |
| Percentage Point Change | -8.9 | -0.031 | -3.9 | -15.8 | -0.030 | -6.9 |
| Per Cent Change | -43.6 | -16.2 | -52.8 | -75.2 | -13.3 | -78.5 |
| | *Lone-Parent-Headed Household Poverty* | | | | | |
| | LIM | | | LICO | | |
| | Rate | Gap | Intensity | Rate | Gap | Intensity |
| 1981 | 45.1 | 0.382 | 32.6 | 44.2 | 0.380 | 31.7 |
| 2009 | 33.9 | 0.295 | 18.9 | 19.9 | 0.276 | 10.4 |
| Percentage Point Change | -11.2 | -0.087 | -13.6 | -24.3 | -0.104 | -21.4 |
| Per Cent Change | -24.8 | -22.7 | -41.9 | -55.0 | -27.3 | -67.3 |

In order to visualize the aggregate effect of these poverty indicators on the IEWB, we therefore construct a 'Poverty Intensity Index.' In this index, we apply the weights the IEWB assigns to each at-risk-of-poverty indicator to the values given for poverty intensity. This method avoids the complications of linear scaling and the divorce rate and therefore does not wholly explain the effect of poverty on the IEWB. This paper therefore does not provide the growth rate of these indices and simply observes that aggregate poverty intensity measured under the LICO falls faster than when using the LIM (Chart 7). The IEWB should therefore grow faster when using the LICO than when using the LIM. Section IV confirms this initial prediction.

**Chart 7: Poverty Intensity Index, 1981=100**




Sources: CSLS Poverty Sensitivity Database, Table: 'Compare'

Further, note that the trends of convergence and divergence shown between these indices only approximate these respective trends for the overall IEWB (Chart 11). Although the divorce rate does not vary between poverty measures, the effect of linear scaling will be to amplify or to offset these trends. This index and its constituent poverty indicators, combined with an understanding of linear scaling, provide the complete picture of the adjustment of the IEWB to differing poverty measures.

## III. Linear Scaling and the Valuation of Changes in Poverty

Although changes in absolute poverty gaps and rates when moving from LIM to LICO are responsible for movement in the IEWB, the linear scaling methodology used for poverty intensity measures in the IEWB is responsible for adjustment of this movement. For poverty intensity, we define the linear scaling equation uniquely for each poverty indicator: [9]

$$I_{pt} = \frac{max - x}{max - min}$$

where $I_{pt}$ is the index value for a particular province in a particular year. The maximum used in the scaling of IEWB is ten per cent of the range larger than the observed maximum. The minimum is ten per cent of the range smaller than the observed minimum. Therefore, estimates produced for the poverty intensity indicator for any given year will change only when the relative position of the observed value within the range changes. For this reason, the same poverty intensity produces different estimates for different measures. Extending this consequence to the eventual aggregation of the IEWB, the long term trend for the IEWB under the LIM and the LICO will differ only if the trends in these relative positions differ. The previous section detailed the trends in the relative position of poverty intensity under both the LICO and the LIM. The following section applies these differences, detailing how the trends of the IEWB differ when the poverty measure is changed from the LIM to the LICO.

Furthermore, the response of the IEWB to absolute fluctuations in poverty intensity is different for LIM and LICO poverty intensity due to the relativism of the linear scaling methodology. If the observed range is larger for one measure, the adjusted range used for scaling will also be larger for that measure, resulting in a smaller rate of change in the IEWB per change in poverty intensity. Indeed, from the linear scaling equation we obtain the slope:

$$slope = -\frac{1}{max - min}$$

Changing the maximum or the minimum therefore results in different rates of change or different 'implicit weights' on poverty measure improvement. Due to the differing ranges across poverty measures and across poverty groups, this creates different tradeoffs between the different poverty groups and measures in any given year and across time. Conceptually, this produces two different valuations on a policy outcome. For example, the IEWB under the LIM does not value changes in the overall poverty intensity as much as the IEWB under the LICO. The converse is true for single parent poverty and elderly poverty (Table 3). See Appendix I for a more complete breakdown of the implicit weights produced by linear scaling.

**Table 3: Effect of the Increase of Poverty Intensity by One Equivalent Unit**

| Index | LIM | LICO |
|---|---|---|

[9] This is the equation when an increase in the value, x, represents a deterioration of well-being in the geographical unit being observed. In the case of poverty intensity (defined as the product of the poverty rate and the poverty gap), this is always the case. The definition where an increase in the value of x represents an improvement in well-being is:

$$I_{pt} = \frac{x - min}{max - min}$$

| | | |
|---|---|---|
| Overall Poverty | -8.19 | -9.68 |
| Elderly Poverty | -8.48 | -6.28 |
| Female Lone-Parent Poverty[10] | -0.03 | -0.03 |

Source: CSLS Poverty Sensitivity Database, Table: 'Scaling'

From the above equation, a larger range in observed poverty intensity results in a smaller slope and therefore a smaller implicit weight on that poverty group. Using the equation for poverty intensity, the implicit weight of a one-unit increase in poverty intensity can be broken down into implicit weights for a one-unit increase in the poverty rate or a one-unit increase in the poverty gap ratio.[11] Due to the multiplicative relationship, larger differences in poverty intensity are the result of larger absolute changes in, or larger initial values of, rates and gap ratios. Therefore, consider only equivalent unit increases[12] in pre-scaled poverty intensity on the indices of each poverty group under the different poverty measures. Comparing the two measures, note that the ratio of the equations for equivalent changes in between LICO and LIM is equal to one, as all the variables are constant. Therefore, the ratio of an increase of poverty rates or gap ratios by one equivalent unit will be equal to the ratio of increases of poverty intensity by one unit. Therefore, equivalent decreases in the poverty rate or poverty gap under LIM are valued at 85 per cent, 128 per cent, or 135 per cent of LICO equivalent decreases of the same magnitude for overall poverty, female lone-parent poverty, and elderly poverty, respectively. To determine the effect of this methodology on the trend in the IEWB under the two measures, this paper applies this adjustment to absolute changes in the poverty measure by using the LICO range on LIM poverty data and vice-versa.

## IV. Effect of Poverty on Long-Run IEWB Trends

Overall poverty intensity affects the IEWB through the equality sub-index, while single parent-headed household poverty intensity and elderly poverty intensity affect the IEWB through the security sub-index. Over time, the IEWB has increased under both the LICO and the LIM; however, this growth has occurred at different rates across time and poverty measures. Under the different measures, differing absolute changes in poverty levels and differing responses of the IEWB to absolute poverty changes resulted in IEWB scores that converged across time. At different moments in time, any given poverty group might have a positive or a negative effect

[10] The poverty intensity for this index is defined as: poverty intensity=poverty rate*divorce rate*poverty gap. For this reason, the implicit weights for female lone-parent poverty appear much different than the implicit weights of the poverty groups. Note that these are the implicit weights in terms of the index for each individual poverty group and that the relative valuations for the IEWB are yet to be determined.

[11] Where i represents poverty intensity, r represents poverty rate, and g represents poverty gap:

$$\Delta i = r_1 \Delta g + g_1 \Delta r + \Delta r \Delta g$$

For an increase in the poverty rate or the poverty gap for overall poverty and elderly poverty:

$$\frac{\partial i}{\partial r} = \frac{1.89}{100} g \text{ and } \frac{\partial i}{\partial g} = \frac{1.89}{100} r$$

For an increase in the poverty rate or the poverty gap for female lone-parent poverty:

$$\frac{\partial i}{\partial r} = g(divorce\ rate) \text{ and } \frac{\partial i}{\partial g} = r(divorce\ rate)$$

Multiplying by the effect of a one-unit increase in the poverty intensity on the respective index establishes an implicit weight of the effect of an increase in the poverty rate or the poverty gap for each province.

[12] Here, define an equivalent unit increase or decrease: an increase or decrease in some poverty measure from the same initial value by the same magnitude.

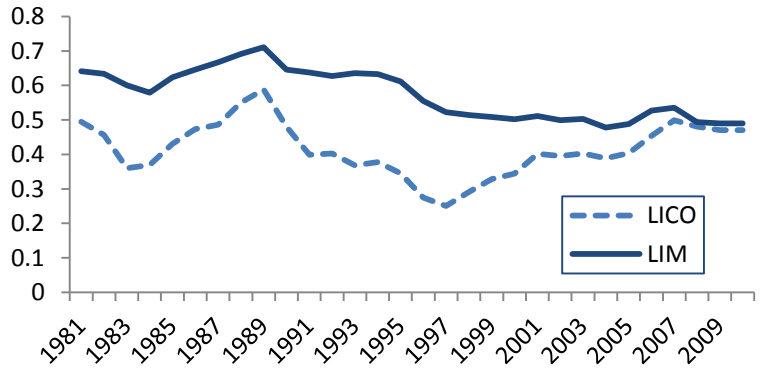
upon the IEWB score when shifting from LICO to LIM. This section analyzes the aggregate effect of these differences over time with a focus on the overall change from 1981 to 2009.[13]

## a. Canada

The overall poverty rate affects the IEWB through its effect on the equality sub-index. Therefore, the trends seen in the different measures of the poverty intensity for the total population will translate directly into trends in the index of equality, given that the index of the Gini coefficient remains unchanged. In general, the equality domain appears to be a very significant source of difference in the estimates of the IEWB before 2005.

For Canada, the equality sub-index calculated using the LIM and the equality sub-index calculated using the LICO converged over time due to a decreasing index under the LIM. In 1981, the equality index under the LICO was 0.495 – much lower than the equality index, at 0.642, under the LIM. In 2009, the equality sub-index was 0.490 under the LIM and 0.471 under the LICO (Chart 8 and Table 4). While the equality index therefore also decreased under the LICO, it therefore did so only 4.9 per cent. On the other hand, the equality index under the LIM fell 23.6 per cent from 1981 to 2009. As noted earlier, there was only a slight increase in LIM rates but a great decrease in LICO rates over 1981-2009. Over the same period, overall poverty gap trends were similar for both measures. The closure of this gap is therefore primarily due to the decrease in estimated total population poverty under the LICO.[14]

**Chart 8: Equality Sub-Index, Canada, 1981-2010**




Sources: CSLS IEWB Database for Canada and the Provinces and

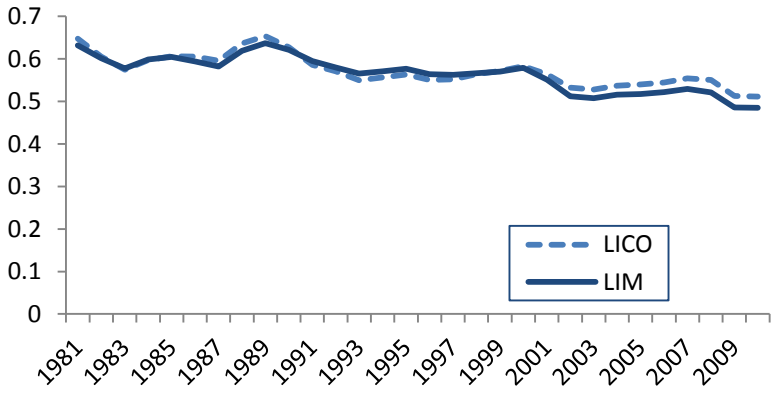
At the same time, Chart 9 shows that the differences in economic security trends across time appear to be rather insignificant. The trends before 2000 are very little similar, falling only slightly. In 1981, the security index was 0.632 under the LIM and 0.648 under the LICO (Table 4). By 2009, the security index had dropped to 0.486 under the LIM and 0.514 under the LICO.

[13] In this and all subsequent sections, Osberg and Sharpe (2011a) is the source for LIM data for the IEWB estimates and all its sub-estimates. LICO data are determined using this database and Statistics Canada (Table 202-0802, Table 202-0804) data. The CSLS 'Poverty Sensitivity' database contains these manipulations. Further, this new database includes the comparisons between LIM and LICO and all the analyses performed. All comparisons and analyses draw from the three sources mentioned and Statistics Canada (Table 384-0013).

[14] Note that the value of the equality sub-index has not improved under the LICO. This has occurred due to the increase of the Gini Index; however, the gap between the LIM and LICO measures narrowed due to the great improvement of LICO measures.

Therefore, the LIM fell 23.1 per cent and the LIM fell 20.7 per cent. Although both indices dropped, the overall similarity in the security domain for Canada under both measures suggests that both measures of poverty for female lone-parents and the elderly represent approximately the same relative trend, only at different absolute levels. Consequently, the long-run trend shows that differences in overall poverty are much more important than differences in economic security in determining differences in IEWB trends.

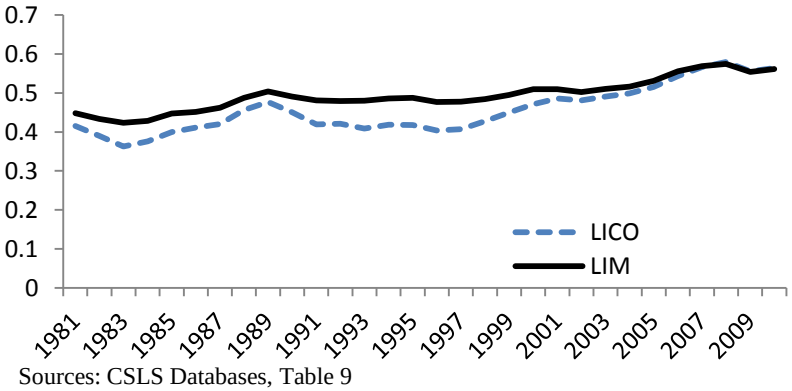
**Chart 9: Security Sub-Index, Canada, 1981-2010**




Sources: CSLS Databases, Table 8

Clearly, the improvement of the LICO in overall poverty is much more significant than the improvement of the LICO in elderly poverty and single parent-headed household poverty. This is due to the weights assigned to each variable.[15] The weight placed on overall poverty, especially after adjusting for implicit weights (Appendix I), is much larger than the combined weight placed on single parent-headed household poverty and elderly poverty.

**Chart 10: Overall Index of Economic Well-being, Canada, 1981-2010**



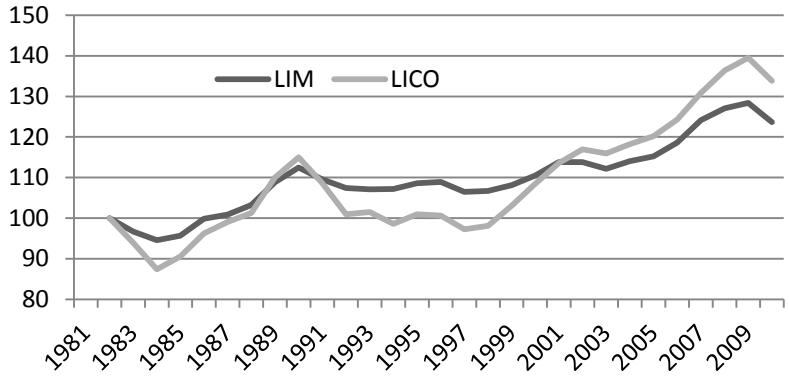

Sources: CSLS Databases, Table 9

This difference between using the LICO and the LIM is clear when looking at Canada's historical IEWB trends (Chart 10). Historically, Canada obtained a higher IEWB score using the LIM instead of the LICO. In 1981, the IEWB was 0.448 under the LIM and 0.415 under the LICO (Table 4). Recently, the two measures have resulted in similar scores – in 2009, the IEWB was

[15] See Appendix I: For Canada in 2009, overall poverty changes were valued at 951.58 per cent of elderly poverty and 4,134.07 per cent of female lone-parent poverty under the LICO measure. Although the implicit weight placed on economic security was lower in the past due to increasing divorce rates, the sheer magnitude of the difference in valuation indicates that differences in the growth rate moving from the LICO to the LIM is largely explained by the relative improvement of the LICO under the overall poverty rate

0.554 under the LIM and 0.556 under the LICO. This was due to dramatically different growth rates for Canada's IEWB estimate under the two different measures. Indeed, the growth of the IEWB under the LIM was 23.6 per cent, much lower than the growth of the LICO IEWB at 33.9 per cent. In other words, from 1981 to 2009, the LIM estimates grew at an average annual rate of 0.76 per cent per year while the LICO estimates grew at a considerably larger pace of 1.05 per cent per year. Chart 11 depicts this trend.

**Chart 11: Index of Economic Well-being, 1981-2009 (1981=100)**




Sources: Calculated from CSLS Databases, Table 9

This result reiterates the difference in relative and absolute poverty measures. In the early 1980s, during a recession, the LICO (the absolute measure) estimate fell considerably more than the LIM (the relative measure) estimate (Chart 11). This occurs again in the early 1990s during another recession. From 2008-2009 we see the reemergence of this trend as the world entered the most recent financial crisis. During periods of sustained real economic growth such as the late 1980s, late 1990s, and mid 2000s, the LICO estimates grow considerably more than the LIM estimates. During these periods, individuals earned higher real income and more people therefore moved above an absolute poverty line such as the LICO. For this reason, IEWB estimates rise considerably. On the other hand, as real income rises, the poverty line under the LIM, based on median income, shifts upward. Therefore, fewer people move out of poverty defined by the LIM. On the other hand, this effect is not as significant for the overall IEWB as it was for the poverty rates, as different implicit weights on poverty groups produced by linear scaling and different absolute changes in poverty measures alter fluctuations in these variables and because poverty measures only account for a portion of the IEWB.

**Table 4: Different Estimates of Economic Well-being, 1981-2009**

| | *Effect on the IEWB* | | | | | |
|---|---|---|---|---|---|---|
| | **LIM** | | | **LICO** | | |
| | Equality | Economic Security | IEWB | Equality | Economic Security | IEWB |
| 1981 | 0.642 | 0.632 | 0.448 | 0.495 | 0.648 | 0.415 |
| 2009 | 0.490 | 0.486 | 0.554 | 0.471 | 0.514 | 0.556 |
| Percentage Point Change | -0.152 | -0.146 | 0.106 | -0.024 | -0.134 | 0.141 |
| Per Cent Change | -23.6 | -23.1 | 23.6 | -4.9 | -20.7 | 33.9 |

Within this growth, the contribution of poverty to the IEWB fluctuates each year, as levels of all variables and the weights within the economic security domain fluctuate. Using the weights of indicators in the IEWB, this paper calculates the total contribution of poverty indicators to the IEWB estimate. Table 5 lists the levels for 1981 and 2009. Note that the overall contribution of poverty decreased under the LIM and increased under the LICO. The well-being as measured by LICO therefore grew at a rate exceeding well-being as measured by non-poverty indicators whereas the converse is true for well-being as measured by LIM.

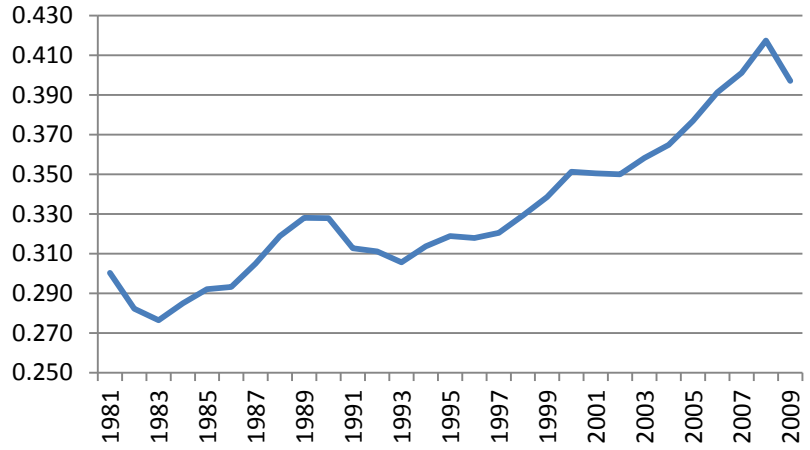
**Table 5: Contribution of Poverty to Index of Economic Well-being (per cent of total IEWB Score)**

| | LIM | LICO |
|---|---|---|
| 1981 | 32.1 | 27.0 |
| 2009 | 27.3 | 27.9 |

Source: CSLS Poverty Sensitivity Database, Table: 'Poverty Effect'

Well-being as measured by non-poverty indicators is simple to calculate from Osberg and Sharpe (2011b): simply apply zero weight to all poverty indicators within each domain and sum to obtain an index value that ignores the contribution of poverty. Call this index the 'Zero-poverty IEWB.' The selection of a poverty measure clearly does not affect non-poverty indicators. For this reason, the Zero-poverty IEWB is independent of LIM and LICO and was equal to 0.300 in 1981 and 0.397 in 2009. Therefore, non-poverty variables caused an increase of 0.097 in the IEWB, growing at a rate of 1.00 per cent per year. Chart 12 displays this trend.

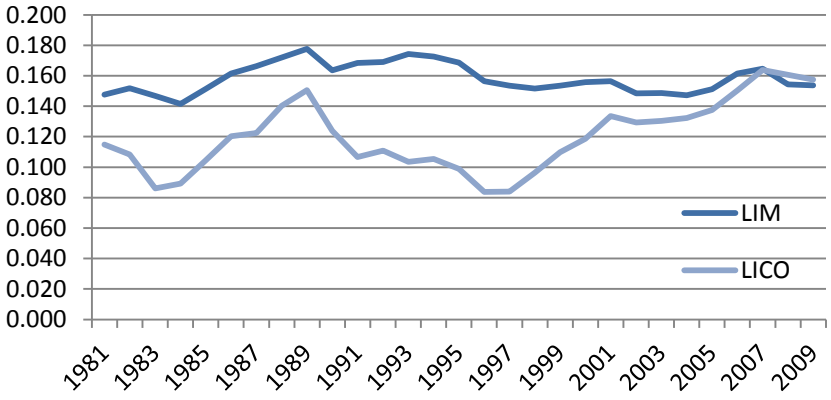
**Chart 12: Zero-Poverty Index of Economic Well-being, 1981-2009**




Source: CSLS Poverty Sensitivity Database, Table: '0-Pov Index'

To capture only the effect of poverty data, this paper controls for variation in the divorce rate. Using the data for female lone-parent poverty under constant divorce rates,[16] the IEWB increased 0.103 from 0.448 in 1981 to 0.551 in 2009 under the LIM. Under the same circumstances, the LICO-based IEWB increased 0.139 from 0.415 in 1981 to 0.555 in 2009.[17] Subtracting the Zero-poverty IEWB, we achieve a 'poverty residual' that is indicative of the effect of each poverty measure. Call these the LIM-only IEWB and the LICO-only IEWB. Chart 13 and Table 6 display these trends. The increase in the LIM-only IEWB is 0.006 (4.1 per cent) and the increase in the LICO-only is 0.043 (37.1 per cent). Therefore, the LIM accounts for 5.8 per cent of the total change in the LIM-based IEWB and the LICO accounts for 30.2 per cent of the total change in the LICO-based IEWB (between 1981 and 2009). Therefore, poverty indicators are a positive influence on IEWB growth under both measures, the LIM is a relatively small component of IEWB growth whereas the LICO would be a relatively large component of IEWB growth. This is due to the increase in the LIM poverty rate for the overall population. As explained earlier, the fact that the LICO is an absolute measure of poverty whereas the LIM is a relative measure of poverty helps explains this result.

**Chart 13: Contribution of Poverty to the Index of Economic Well-being, Constant Divorce Rate, 1981-2009**




Sources: CSLS Poverty Sensitivity Database, Tables: 'LIM', 'LICO'

[16] We do not wish to measure the effect of divorce rates on the growth of the IEWB.
[17] This corresponds to growth rates of 0.740 and 1.039 per cent per year, respectively.

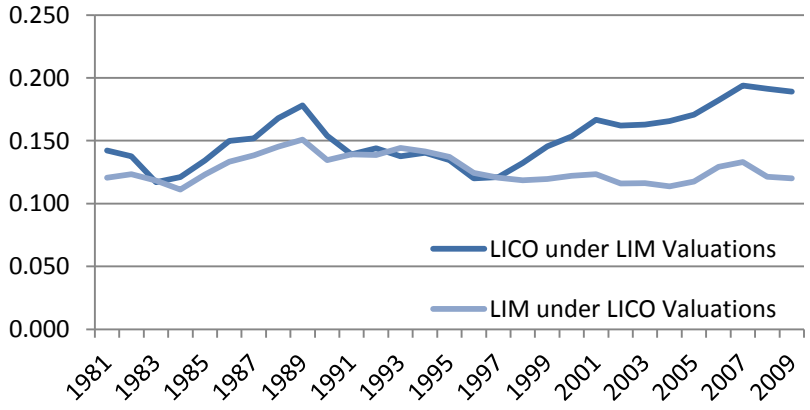
Due to the process of linear scaling, the relative, not absolute, position of poverty data points within its range determines the LIM-only and LICO-only IEWB. This exercise, therefore, although determining the contribution in IEWB growth of different poverty measures, therefore sheds no light on the 'pure' effect of poverty measure reduction – the absolute effect before linear scaling. Each poverty measure has a different range for each type of poverty and its two indicators. We therefore cannot simply remove the hurdle that is linear scaling and directly compare the two measures in the IEWB framework. Instead, we calculate the LICO-only IEWB using the implicit weights generated by LIM linear scaling and the LIM-only IEWB using the implicit weights generated by LICO linear scaling to estimate the significance of linear scaling in this comparative exercise. Call these indices the 'alternative valuation' indices. Chart 14 and Table 6 depict these trends.

**Table 6: Poverty-only and Alternative-Valuation IEWB**

| | *Poverty-Only IEWB* | | *Alternative-Valuation IEWB* | |
|---|---|---|---|---|
| | LIM | LICO | LIM with LICO Weights | LICO with LIM Weights |
| 1981 | 0.148 | 0.115 | 0.121 | 0.142 |
| 2009 | 0.154 | 0.158 | 0.120 | 0.189 |
| Percentage Point Change | 0.006 | 0.043 | 0.000 | 0.047 |
| Per Cent Change | 4.1 | 37.1 | -0.3 | 32.8 |

A change to LIM implicit weights resulted in an increase of the LICO-only change from 0.043 to 0.047 IEWB points (Table 6). Conversely, a change to LICO implicit weights resulted in a decrease of the LIM-only change from 0.006 to 0.000 IEWB points. Therefore, LICO implicit weights have a negative effect on growth, while LIM implicit weights have a positive effect on growth. Note that gap in alternative-valuation IEWB growth is larger than the gap in poverty-only IEWB growth. This proves that the process of linear scaling actually closes the growth gap and does not contribute to an amplified growth gap.

**Chart 14: Alternate Valuation Poverty-only Index of Economic Well-being, Constant Divorce Rate, 1981-2009**




Source: Calculated from CSLS Databases through the swapping of linear scaling parameters.

The effect of linear scaling is therefore approximately 11.1 per cent or 17.6 per cent of the overall difference in the change of poverty-only IEWB under the different measures (0.043-0.006), using LIM weights or LICO weights, respectively. Both effects were in the opposite direction of the overall change. Therefore, linear scaling is an offsetting factor in the divergence of IEWB growth rates. This strengthens the observation that the fundamental differences between poverty measures leads to differences in the growth rate of the IEWB, as the linear scaling methodology does not contribute to the observed divergence in growth rates seen in the IEWB under the different measures, but rather constricts it.

## V. Conclusion

Under the LIM, the IEWB for Canada grew at an annual rate of 0.76 per cent. Under the LICO, the IEWB grew at a more impressive rate of 1.05 per cent per year. The effect of linear scaling was determined to be offsetting in terms of IEWB growth divergence. The significant greater growth in the IEWB is therefore due entirely to greater decreases in LICO poverty intensity. In particular, an analysis of the contributing domains showed that the decrease in the LICO overall poverty rate was the main factor. In other words, the rise in real national income over 1981-2009 is largely responsible for the divergence in growth rates between the two IEWB measures because the LICO falls at a considerably faster pace than the LIM during periods of economic expansion. The upward long-term trend in economic performance has resulted in greater IEWB growth for the LICO than for the LIM. The IEWB measured under the LIM therefore understates growth in economic well-being compared to the IEWB measured under the LICO, but not to the extent that it would in the absence of linear scaling. The choice of what is the 'appropriate' poverty measure for Canadians therefore has very significant consequences for policies concerning economic well-being.

## VI. Appendix I: Implicit Weights of Poverty Groups under LIM or LICO

This appendix calculates estimates of the implicit weights of each poverty group within each poverty measure. Due to linear scaling, the explicit weights assigned to each poverty group in the summation of the IEWB do not accurately reflect the weight applied to equivalent changes in poverty intensity of different poverty groups. These calculated 'valuation ratios' estimate these implicit tradeoffs that the IEWB makes between the different poverty groups. Assuming a constant divorce rate and either constant poverty gap ratios or constant poverty rates, the ratio between the tradeoffs (slopes for the linear scaling function) for overall poverty or elderly poverty and female lone-parent poverty is the weight of an equivalent increase in one of these variables. Thus:

$$valuation\ ratio = \frac{1.89}{100(divorce\ rate)} \times \frac{i\ effect\ for\ elderly\ or\ overall\ poverty}{i\ effect\ for\ female\ lone-parent\ poverty}$$

for the ratio between female lone-parent poverty and elderly or overall poverty. Therefore, depending on the divorce rate, this will vary across provinces and time. On the other hand, the difference between elderly and overall poverty intensity change is constant; however, these must then be multiplied by the relative weights of each type of poverty in the IEWB for each province. Appendix Table 1 tabulates the results for 2009 for LIM and Appendix Table 2 tabulates the results for 2009 for LICO.

**Appendix Table 1: Implicit Weight Ratios for LIM, 2009**

| | Overall-Elderly (per cent) | Overall-Female Lone-Parent (per cent) | Elderly-Female Lone-Parent (per cent) |
|---|---|---|---|
| Canada | 595.80 | 2,724.32 | 457.25 |
| Newfoundland | 532.31 | 5,006.70 | 940.57 |
| Prince Edward Island | 567.50 | 2,880.62 | 507.60 |
| Nova Scotia | 549.37 | 3,149.54 | 573.30 |
| New Brunswick | 548.99 | 3,852.24 | 701.70 |
| Quebec | 568.50 | 3,182.26 | 559.77 |
| Ontario | 609.84 | 2,391.56 | 392.16 |
| Manitoba | 626.49 | 2,498.08 | 398.75 |
| Saskatchewan | 627.34 | 3,040.23 | 484.62 |
| Alberta | 651.52 | 2,480.00 | 380.65 |
| British Columbia | 576.38 | 2,855.39 | 495.40 |

Sources: CSLS Poverty Sensitivity Database, Tables: 'Scaling' and 'Divorce Rate'

The largest valuation ratios for overall to female lone-parent-headed household poverty and elderly to female lone-parent-headed household poverty occur where the divorce rate is smallest, as the effect of an increase in the poverty ratio or poverty gap for female lone-parents will result in less of an increase in the scaled poverty intensity. For this reason, Ontario, which has the highest divorce rate in the country at 0.980 (Osberg and Sharpe, 2011b), has the lowest

valuation ratios for overall-female lone-parent and elderly-female lone-parent under both LICO and LIM. In other words, changes in the poverty rate or poverty gaps for lone-mothers are valued most in Ontario. On the other hand, Newfoundland has the lowest divorce rate at 0.515 (Osberg and Sharpe, 2011b) has the highest valuation ratios under both measures of poverty for these tradeoffs. The highest valuation of the overall poverty rate over the elderly poverty rate occurs in Alberta in 651.52 per cent and the lowest valuation of the overall poverty rate over the elderly poverty rate occurs in Newfoundland at 532.31 per cent. This occurs due to the weighting of the risks in the economic security sub-index. Therefore, Alberta must have the lowest percentage of people at-risk-of-elderly-poverty compared to other target groups, while Newfoundland must have the highest.[18]

In Canada under the LIM, a change in the overall poverty rate or gap is valued at 595.80 per cent a change in the elderly poverty rate or gap, and 2,724.32 per cent a change in female lone-parent rates and gaps. Changes in the elderly poverty rate or gap are valued at 457.25 per cent of equal changes in the female lone-parent poverty rate or gap. Under the LICO, a change in the overall poverty rate or gap is valued at 951.58 per cent a change in the elderly poverty rate or gap and 4,134.07 per cent a change in female lone-parent rates and gaps. Changes in the elderly poverty rate or gap are valued at 434.44 per cent of changes in the female lone-parent poverty rate or gap. Therefore, overall poverty is always more important than either elderly or female lone-parent poverty in calculating the IEWB, but become less so under the LIM. This helps explain why the poverty-only IEWB under the LIM still increased under the LIM despite the increase in overall poverty intensity.

**Appendix Table 2: Implicit Weight Ratios for LICO, 2009**

| | Overall-Elderly (per cent) | Overall-Female Lone-Parent (per cent) | Elderly-Female Lone-Parent (per cent) |
|---|---|---|---|
| Canada | 951.6 | 4,134 | 434.4 |
| Newfoundland | 850.2 | 7,598 | 893.6 |
| Prince Edward Island | 906.4 | 4,371 | 482.3 |
| Nova Scotia | 877.4 | 4,779 | 544.70 |
| New Brunswick | 876.8 | 5,846 | 666.70 |
| Quebec | 908.0 | 4,829 | 531.84 |
| Ontario | 974.0 | 3,629 | 372.60 |
| Manitoba | 1,001 | 3,791 | 378.85 |
| Saskatchewan | 1,002 | 4,613 | 460.44 |
| Alberta | 1,041 | 3,763 | 361.66 |
| British Columbia | 920.6 | 4,333 | 470.69 |

Sources: CSLS Poverty Sensitivity Database, Tables: 'Scaling' and 'Divorce Rate'

Indeed, the LIM gives reduced valuation ratios, which increases the value of changes in elderly and female lone-parent poverty rate. This occurs because the spread of poverty intensity under the LIM for female lone-parents and the elderly is much less than under the LICO. The

[18] Osberg and Sharpe (2011b) define this group as citizens aged 45-64. Out of all the provinces, Newfoundland does in fact have the largest proportion in this age category at 32.14 per cent, while Alberta does in fact have the lowest at 26.06 per cent.

opposite is true of the elderly – female lone-parent tradeoff. Although improvements in the elderly rate are always valued more than improvements in female lone-parent poverty, the valuation of the elderly is larger under the LIM, indicating that the spread in poverty intensity for the elderly narrows more than the spread in poverty intensity for female lone-parents when moving away from the LICO.

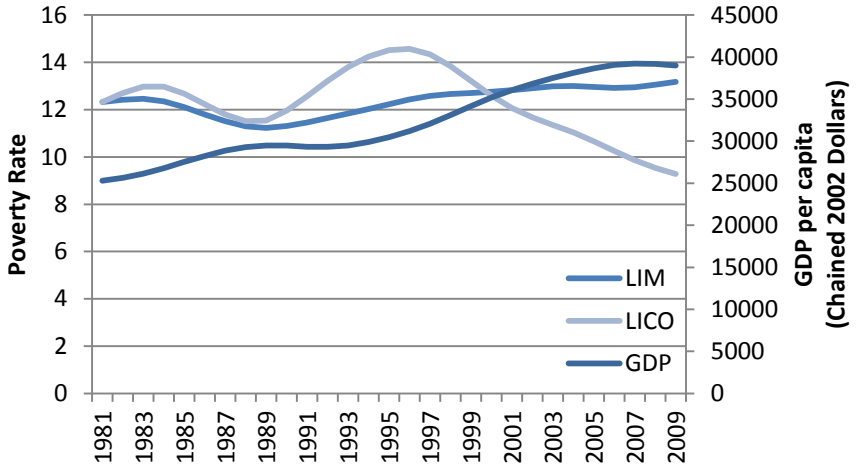
These results stem from the fact that, as mentioned in Section III, decreases in the poverty rate or poverty gap under LIM are valued at 85 per cent, 128 per cent, or 135 per cent of LICO decreases of the same magnitude for overall poverty, female lone-parent poverty, and elderly poverty, respectively. Given that the overall poverty rate is valued less and the special poverty rates are valued more, the valuation ratio must decrease under LIM.

These results explain the effects of the trends across the different poverty groups when moving from the LICO to the LIM. Under the LIM, improvements in the elderly or female lone-parent poverty rates or gaps are more important than under the LICO. The reverse is true for overall poverty. Under both measures and across all provinces, changes in overall poverty are the most lucrative, followed by changes in elderly poverty, and then changes in female lone-parent poverty.

## VII. Appendix II: Hodrick-Prescott Filter Applied to Poverty Rates & Gross Domestic Product, Per Capita

In order to analyze the trends and deviations of LIM and LICO poverty rates compared to those of GDP per capita (chained 2002 dollars), a Hodrick-Prescott filter[19] was applied (Appendix Chart 1). From this chart, it is evident that the trend for LICO exceeds that of the LIM until 2000, after which the LIM trend exceeds that of the LICO due to the falling rate of the LICO. The LIM has been steadily increasing since 1989. Note that the correlation of the LIM trend with trend GDP is 0.73 whereas the correlation of the LICO trend with trend GDP is -0.61. Consequently, while real GDP per capita rise, the LICO therefore tends to fall and the LIM tends to rise. Therefore, fewer and fewer people remain below an absolute poverty line and more individuals are finding themselves below half-median income, possibly due to rising real income (the GDP trend is in fact steadily increasing). Notably, long-term policy changes might also affect the trends of poverty rates. The deviations of poverty rate from its trend might therefore be a more reliable source of information relating the poverty rate to changes in national income.

**Appendix Chart 1: Hodrick-Prescott Trends, 1981-2009**




Source: Calculated from Cansim Tables 2020802 & 3840013

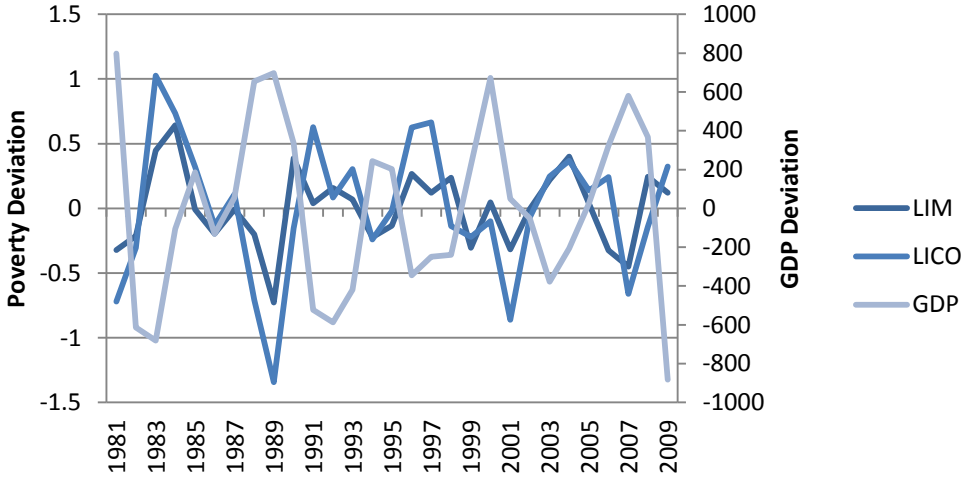
To capture the effect of business cycles on the performance of LIM and LICO rates, compare the deviations from the Hodrick-Prescott trend to those of real GDP per capita (Appendix Chart 2). Both LIM and LICO poverty rates respond to below trend GDP (recessions) by increasing above trend; the correlation coefficient of the deviations of both poverty rates with real GDP per capita is negative.[20] As well, the standard deviation of LICO is 0.52 per cent, whereas the standard deviation of LIM is 0.30 per cent. The LICO therefore responds to changes in real GDP 73.8 per cent more aggressively than the LIM. This supports the premise that the LICO will

[19]The Hodrick-Prescott (HP) filter removes deviations from a long-run trend, giving an easily analyzable smooth trend. For a description of the mechanics of the HP filter, please see the original paper by Hodrick and Prescott (1997). Ravn and Uhlig (2002: 375) recommend a smoothing coefficient of 6.25 for annual data. This analysis uses this value.

[20] The correlation coefficient of the LIM deviations with GDP deviations is -0.52 and the correlation coefficient of the LICO deviations with GDP deviations is -0.66.

fall more than the LIM during economic expansions and, consequently, that the IEWB will increase more during economic expansions if poverty is measured using the LICO.[21]

**Appendix Chart 2: Deviations from the Hodrick-Prescott Trend, 1981-2009**




Source: Calculated from Cansim Tables 2020802 & 3840013

[21] A complete analysis is beyond the scope of this paper and requires econometric analysis.

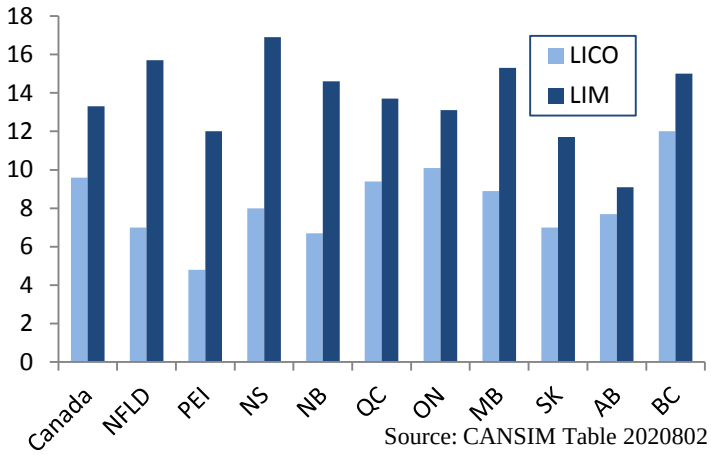
# VIII. Appendix III: Poverty and the IEWB: Across the Provinces

## a. Poverty Rates and Gaps: Across the Provinces

### *i. Overall Poverty*

The LICO and the LIM paint different pictures of which provinces perform the best and which perform the worst. Under the LICO, the province with the highest overall population poverty rate in 2009 was British Columbia – 12.0 per cent, while the province with the lowest poverty rate was Prince Edward Island – 4.8 per cent (Appendix Chart 3). On the other hand, the LIM depicts Nova Scotia as the worst performing province with 16.9 per cent and Alberta as the top province with a poverty rate of 9.1 per cent. The variation across provinces is therefore large under both measures; however, the LIM gave a higher level of poverty in every province than did the LICO because the LIM is a relative measure of poverty and the LICO is an absolute level of poverty. Therefore, although the vast majority of people might be meeting a sustainable level of income, the LIM will give a higher poverty rate.

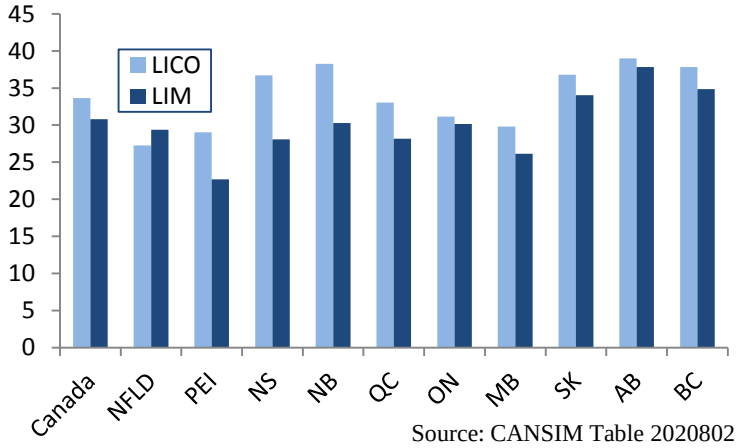
**Appendix Chart 3: Overall After-Tax Poverty Rate, per cent, Canada and the Provinces, 2009**




Source: CANSIM Table 2020802

The largest difference in poverty rates is in Nova Scotia, where the LIM gives a poverty rate that is 8.9 percentage points higher than the LICO (16.9 per cent compared to 8.0 per cent). The smallest difference in poverty rates is observed in Alberta, where the LIM is only 1.4 percentage points higher than the LICO (9.1 per cent compared to 7.7 per cent). If the IEWB had only one poverty component, overall poverty, we would therefore expect a smaller difference between the two IEWB measures in Alberta and a larger difference between the two IEWB measures in Nova Scotia; however, there are other poverty types and indicators.

**Appendix Chart 4: Overall After-Tax Average Poverty Gap Ratio, per cent, Canada and the Provinces, 2009**




Source: CANSIM Table 2020802

In general, the poverty gap ratio does not vary as much as the poverty rate within each province (Appendix Chart 4). Furthermore, the LICO poverty gap ratio was larger than the LIM poverty gap in every province except Newfoundland. According to the LIM, the largest poverty gap ratio belonged to Alberta at 0.38 points. Alberta also has the largest poverty gap ratio under the LICO at 0.39 points. The lowest poverty gap ratio under the LIM belonged to Prince Edward Island at 0.23 points, while the lowest poverty gap ratio under the LICO belonged to Newfoundland at 0.27 points. The largest difference in the measured poverty gap ratio occurred in Nova Scotia, where the LICO poverty gap was 0.09 higher than the LIM (0.37 compared to 0.28). The smallest difference in the poverty gap ratios occurred in Ontario, where the LICO poverty gap ratio was 0.01 per cent higher than the LIM (0.31 compared to 0.30). Alberta also had a very small change in poverty gap ratios, from 0.39 under the LICO to 0.38 under LIM. Therefore, the poverty gap ratio in Alberta was consistently high.

### *ii. Elderly Poverty*

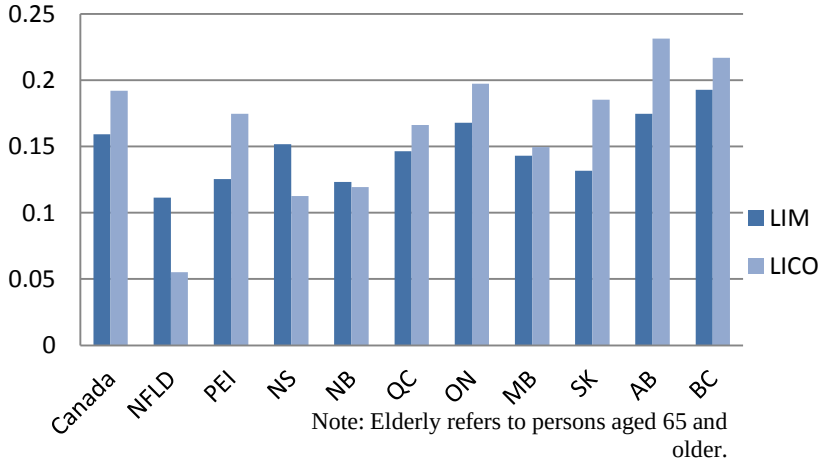
Across the provinces in 2009, the LIM consistently reports higher poverty rates than does the LICO (Appendix Chart 5). The largest poverty rates occur in Newfoundland at 21.1 per cent under the LIM and in Quebec at 7.7 per cent under the LICO. The lowest poverty rates occur in Alberta at 2.5 per cent under the LIM and Saskatchewan under the LICO at 1.2 per cent. The largest difference in elderly poverty rates is in Newfoundland, where the elderly LIM rate (21.1 per cent) is an astounding 19.4 percentage points higher than the elderly LICO rate (1.7 per cent). The smallest difference in elderly poverty rates is in Alberta, where the elderly poverty rate is consistently low. There, the LIM (at 2.5 per cent) is only 0.6 percentage points higher than the LICO (at 1.9 per cent). In all provinces in 2009, these rates are lower than the rates for female lone-parent families (Appendix Chart 7) and, in most provinces in 2009, lower than the overall poverty rate (Appendix Chart 3). It is therefore clear that the avoidance of elderly poverty is a policy priority in Canada and its provinces, regardless of the measure used to calculate poverty.

**Appendix Chart 5: Elderly After-Tax Poverty Rate, per cent, Canada and the Provinces, 2009**


Note: Elderly refers to persons aged 65 and older.
Source: CANSIM Table 2020802

Across the provinces, the lowest poverty gap ratio, under both measures, was found in Newfoundland (Appendix Chart 6). Under the LIM, Newfoundland had a poverty gap ratio of 0.11. Under the LICO, this ratio was reduced further to 0.06, an astoundingly low value that is based on data from 1997, the last year poverty gap ratios for the elderly under the LICO were available for Newfoundland. The largest poverty gap ratios for the elderly were found in British Columbia at 0.19 under the LIM and in Alberta at 0.23 under the LICO. The largest difference in poverty gap ratios was found in Alberta at 0.056 points. In Alberta, the LICO poverty gap ratio was larger than the the LIM gap. Newfoundland was close behind, due to the small poverty gap under the LICO, also at 0.056 points. There, the LIM poverty gap ratio exceeded the LICO gap ratio. The smallest difference in poverty gap ratios occurred in New Brunswick, where the poverty gap ratio under both measures was approximately 0.12. In general, these poverty gap ratios tend to be lower than poverty gap ratios for the overall population (Appendix Chart 4) and female lone-parents (Appendix Chart 8) – once more confirming that reduction in elderly poverty intensity is a strong policy initiative across Canada.

**Appendix Chart 6: Elderly After-Tax Average Poverty Gap Ratio, per cent, Canada and the Provinces, 2009**

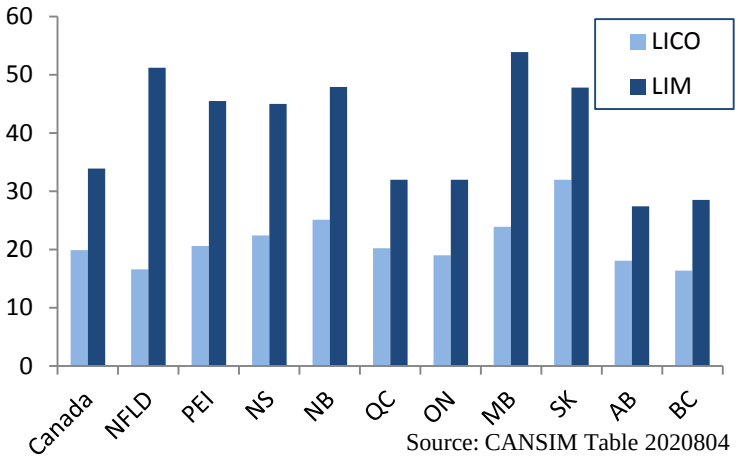



Note: Elderly refers to persons aged 65 and older.

### *iii. Female Lone-Parent-Headed Household Poverty*

Across the provinces, there is much variation across female lone-parent poverty rates (Appendix Chart 7). According to the LIM, the largest poverty rate for female lone-parents was 53.9 per cent in Manitoba, while the lowest poverty rate was in Alberta at 27.4 per cent. On the other hand, the largest LICO poverty rate for female lone-parents was 32.0 per cent in Saskatchewan, while the lowest poverty rate was 16.4 in British Columbia. In every province, the LIM again gave higher poverty rates than the LICO. The largest difference in these poverty rates occurred in Newfoundland, where the LIM poverty rate was 34.6 percentage points higher than the LICO (51.2 per cent compared to 16.6 per cent). The smallest difference in these poverty rates was also rather large and occurred in Alberta, where the LIM poverty rate was 9.3 percentage points higher than the LICO (27.4 per cent compared to 18.1 per cent). The difference in female lone-parent poverty rates across the provinces was therefore consistently high, which should, in the absence of scaling, lead to lower economic security for all provinces under the LIM.[22]

**Appendix Chart 7: Female Lone Parent After-Tax Poverty Rate, per cent, Canada and the Provinces, 2009**

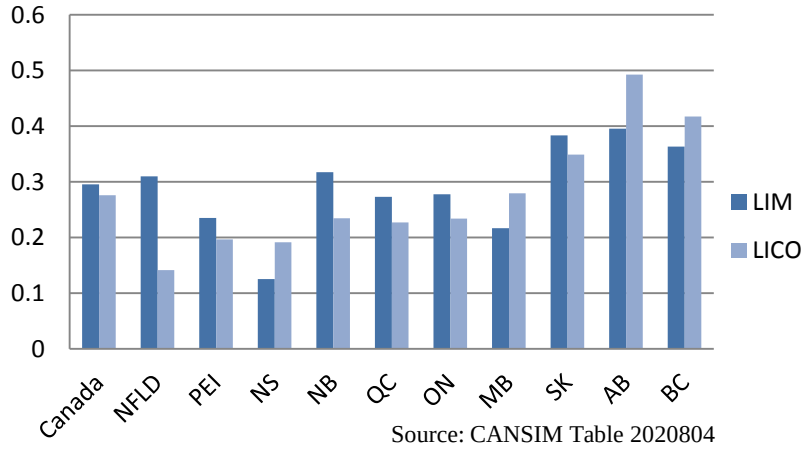



Source: CANSIM Table 2020804

Across the provinces, the poverty gap once again changed less than the poverty rate within each province (Appendix Chart 7). In fact, both the LICO and the LIM show that Alberta had the largest poverty gap ratio for female lone-parents at 0.40 and 0.49 points, respectively. The lowest poverty gap ratio differs across measures. Although the LIM shows that Manitoba had the lowest poverty gap ratio at 0.22 points, the LICO gives Newfoundland the lowest poverty gap ratio at 0.14 points. Similar to the poverty rate for female lone-parents, the difference in poverty gap ratios was largest in Newfoundland. In Newfoundland, the poverty gap under the LIM was 0.31, which is 0.17 points higher than the poverty gap ratio of 0.14 under the LICO. Meanwhile, Saskatchewan had a poverty gap ratio of 0.38 under the LIM and 0.35 under the LICO, a difference of only 0.03 points – the smallest across the provinces.

[22] This is true if and only if the change in poverty intensity outweighs the change in the valuation of the poverty group, discussed in detail in Appendix I.

**Appendix Chart 8: Female Lone Parent After-Tax Average Poverty Gap Ratio, per cent, Canada and the Provinces, 2009**

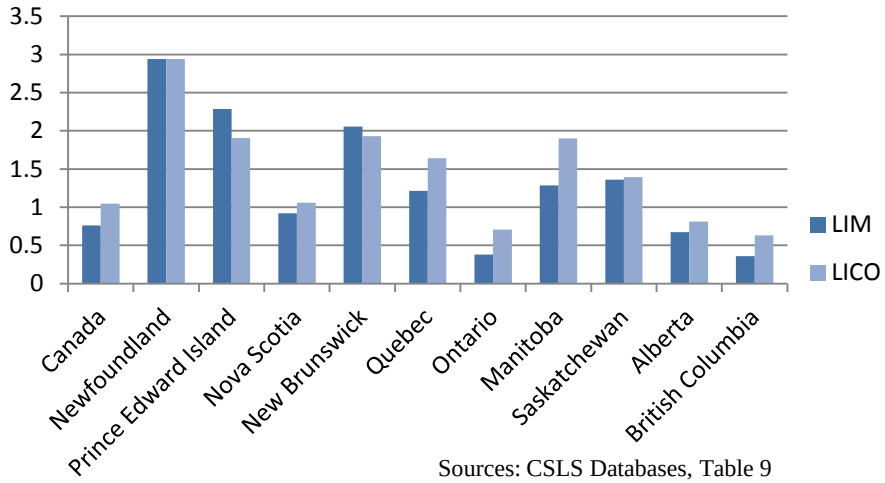



Source: CANSIM Table 2020804

## b. Effect on the IEWB

Across the provinces, very different results occurred for the growth of IEWB estimates; however, we note in Appendix Table 3 that the ordinal rankings of the growth rates of IEWB estimates are robust across measures. Under both the LICO and the LIM, Newfoundland experienced the fastest growth in the IEWB whereas British Columbia experienced the lowest growth in the IEWB. According to IEWB estimates based on the LIM, Newfoundland grew at an astounding rate of 2.94 per cent per year while British Columbia's IEWB estimates grew at a leisurely pace of 0.36 per cent per year (Appendix Chart 9). The estimates of the IEWB based on the LICO also give Newfoundland a growth rate of 2.94 per cent per year but raise British Columbia's growth rate to 0.63 per cent per year.

**Appendix Chart 9: Growth Rate of the Index of Economic Well-being, 1981-2009**




Sources: CSLS Databases, Table 9

Across provinces, therefore, we note little difference in the ordinal ranking of provincial performance (Appendix Table 3) but observe significant differences in growth in certain provinces. For example, the largest difference in growth rates occurred in Manitoba (Appendix Chart 9), where the LICO growth rate, at 1.90 per cent per year, was 0.62 percentage points greater than the LIM, at 1.28 per cent per year. In most instances, the provinces followed the

national trend – the growth rate under the LICO exceeded the growth rate under the LIM. Furthermore, the provinces use the same linear scaling range for each poverty indicator as Canada. Therefore, although it is not necessarily the case that the use of linear scaling offsets diverging growth rates, on (proportional) average it must be the case. Overall, there are large differences in poverty data across the provinces, but the ordinal rankings of the provinces are robust to the change in poverty measure only account for approximately one quarter of the IEWB.

**Appendix Table 3: Ordinal Rankings of the Growth Rate of the IEWB, 1981-2009**

| ***LIM*** | ***LICO*** |
|---|---|
| Newfoundland | Newfoundland |
| *Prince Edward Island* | *New Brunswick* |
| *New Brunswick* | *Prince Edward Island* |
| ***Saskatchewan*** | *Manitoba* |
| *Manitoba* | *Quebec* |
| *Quebec* | ***Saskatchewan*** |
| Nova Scotia | Nova Scotia |
| CANADA | CANADA |
| Alberta | Alberta |
| Ontario | Ontario |
| British Columbia | British Columbia |

Sources: CSLS Databases, Table 9

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