Academia to Application

Working Paper No. 6

Informetrica Limited

August 2009

Richard Shillington

Michelle Lasota

Mike McCracken: Reviewer

Informetrica Limited

Table of Contents

Working Papers provide a succinct discussion of specific issues that arise throughout the analytical process of poverty measurement. The Metcalf Foundation has funded the overall project.

The research was assisted immensely by the comments and suggestions of a sounding board (Nate Laurie, Brian Murphy, Bob Rainer, Sheila Regehr, Katharine Scott, Sherri Torjman and Armine Yalnizyan). Regardless, the opinions expressed are those of Informetrica Limited staff preparing the papers.

Academia to Application

1 Objectives

There is a difference between academic research on poverty and the application of low-income measures used for policy analysis.

International and provincial governments, and organizations such as the United Nations and the World Bank have recognized that the measurement of poverty (or low income) in a society requires more than one indicator. Recent developments regarding how one measures poverty in society has expanded from simply measuring one's income or consumption to include factors like, but not exclusive to, social inclusion, education, and health.

These measures were developed in order to capture, in part, Amartya Sen's proposed properties (or axioms) of poverty indexes. Over time, these axioms have been developed, as well as how poverty is quantified or gauged. From the Rio Group's "Compendium of best practices in poverty measurement", there are two major stages in the process of poverty measurement. The first being the identification of who is "poor" and who is "non-poor", the second is "the aggregation of poverty into a single measure".[1] This concept has expanded since Amartya Sen's 1976 paper and has lead to methodological changes with the development of poverty indexes such as the poverty gap.

The following sections will state the axioms of poverty, from two different sources, the Rio Group's interpretation, as well as Professor Lars Osberg's interpretation. Measures that have been developed to include consideration of these axioms will also be mentioned, both theoretical and those newly developed. Finally, the application of these axioms to the most commonly used low-income measures in Canada, such as the Low-Income Cut-Off (LICO), the Low-income Measure (LIM), and the Market Basket Measure (MBM), will be outlined.

[1] Rio Group (2006): *Compendium of Best Practices in Poverty Measurement*, United Nations Statistics Division, Expert Group on Poverty Statistics; United Nations; 2006, P. 95 <http://www.ibge.gov.br/poverty/pdf/rio_group_compendium.pdf> Accessed 23 Sep 2008.

2 Axioms for the Measurement of Poverty

There are four axioms for the measurement of poverty summarized by the Rio Group as follows:[2]

> ***Focal axiom****: The poverty measure should disregard information relating to the income of the non-poor.*
>
> ***Monotonicity axiom****: A poverty measure should increase when the income of a poor person diminishes. This means that there should be a correlation between the index and the distance of the poor to the poverty line.*
>
> ***Transfer axiom****: A transfer of income from any given person to a less poor person should increase the poverty index. This axiom means that the poverty measure should reflect how incomes are distributed among the poor.*
>
> ***Subgroup monotonicity****: If a given population subgroup's poverty measure increases, and everything else remains constant, then the poverty measure for the whole population should increase.*

Professor Osberg summarizes literature regarding the axioms for poverty measures as:[3]

> ***Axiom 1*** *(Focus Axiom) The poverty index should be independent of non-poor population.*
>
> ***Axiom 2*** *(Weak monotonicity axiom for income) A reduction in a poor person's income, holding other incomes constant, must increase the poverty index.*
>
> ***Axiom 3*** *(Impartiality axiom for income) The poverty index may be defined over ordered income profiles without loss of generality.*
>
> ***Axiom 4*** *(Weak transfer axiom for income) An increase in the poverty index occurs if the poorer of two individuals involved in an upward transfer of income is poor and if the set of the poor people does not change.*
>
> ***Axiom 4A*** *(Strong upward transfer axiom for income) An increase in the poverty index occurs if the poorer of two individuals involved in an upward transfer of income is poor.*
>
> ***Axiom 5*** *(Continuity axiom for income) The poverty index varies continuously with incomes.*
>
> ***Axiom 6*** *(Replication invariance axiom for income) The poverty index does not change if it is computed based on an income distribution that is generated by the k-fold replication of an original income distribution.*

Measures that have been developed to directly capture these axioms include the Sen-Shorrocks-Thon (SST) Index, and the Foster Greer Thorbecke (FGT) measure. The SST index is a weighted

---

[2] Ibid, P. 95.

[3] Osberg, L (2007): "The Evolution of Poverty Measurement - with special reference to Canada" February 2007 <http://myweb.dal.ca/osberg/classification/research/working%20papers/The%20Evolution%20of%20Poverty%20Measurement/PaperFebruary9The%20Evolution%20of%20Poverty.pdf > Accessed 19 Nov 2008, P. 15.

sum of the poverty gap ratios of the poor, and is indexed so that it has a value from 0 to 1 (0 = no poor people, as defined by the poverty line). The FGT measure combines the incidence of poverty (headcount ratio), the poverty gap and a measure of inequality.

A poverty gap ratio assumes a poverty line (some level of observable income) for an economy is defined. Then, all persons (or some measure of household/family) in that economy are compared against that level of income. Those persons with income below the line are then defined as "poor". The income of those deemed to be "poor" is then compared against the poverty line, capturing the "poverty gap". The difference of the poverty line and the income of those who are "poor" is taken, and divided by the poverty line this captures the per cent of income below the poverty line, per person.

The headcount ratio is the incidence of poverty, as defined within an economy. In Canada, it is referred to as the per cent of those with income below a measure of low income, such as the LICO, LIM, and the MBM.

The Rio Group's Report said the following about poverty head counts: "The headcount index satisfies the focus axiom and is additively decomposable. It provides a very limited view of poverty, however since it offers no information on 'how poor the poor are' (monotonicity axiom) and it does not consider distributional aspects of the poor population (transfer axiom)."

As for poverty gaps the Rio Group said: "The poverty gap index satisfies the focal and monotonicity axioms and is additively decomposable, but it does not comply with the transfer axiom."

Additional poverty measures take into consideration both the incidence and depth of poverty and are in-fact measures of inequality. The Gini coefficient is the best known of these but only policy experts would be familiar with this measure. Even many poverty advocates would have only a limited understanding of how a Gini is calculated or used.

Examples, of these broader inequality measures include the SST and FGT which take into account (or have a component within it) a monetary-based poverty line. They also incorporate the incomes of those living below the poverty line.

The Rio Group reports that "… of the currently available indices only the FGT-family indices or some renormalization methods … satisfy subgroup monotonicity."

Similar components within both the SST and FGT measures include the incidence of poverty and the poverty gap. These two measures, or type of measures (there has been further development with both measures) make an attempt to satisfy the axioms. Published results with the MBM include the incidence, poverty line and poverty gap. These items are not captured within a single measure, but are captured as three separate applications of the MBM.

There has also been acknowledgement; through the development of deprivation indicators, life expectancy, and education attainment indicators, that poverty is a wider concept than just lack of income (or consumption). In Canada, both Ontario and Nova Scotia's proposed measures to

gauge their progress of their anti-poverty strategy (soon to be legislation) include indicators that are not limited to income.[4] Ontario is applying 8 indicators that include education, income, birth weights and deprivation. Nova Scotia will be applying a Genuine Progress Index, which includes numerous quality of life items, income and non-market items. Both provinces' separate combination of measures to be used to gauge progress is not aggregated into one index.

The United Nations Development Programme's (UNDP) HDI is a composite measure that combines life expectancy, education and income. However, the income measure within the HDI is based solely on GDP-per-capita, which is then indexed for international comparability. Inequality within an economy, depth of poverty, and other aspects of a poverty measure are not captured by the HDI. It is primarily a development index for cross-national comparisons. It does, however, aggregate several items into one measure.

[4] See Working Paper 10 "Measurement and Policy" for a basic explanation, or see Ontario's strategy at: www.growingstronger.ca/english/pdf/Ontario's_Poverty_Report_EN.pdf; and Nova Scotia's Poverty Reduction Working Group's recommendations at: http://www.gov.ns.ca/coms/specials/poverty/documents/Poverty_Reduction_Working_Group_Report.pdf.

3 Axioms and Canadian Low-Income Measures

The application of the Axioms to Canadian measures of poverty, using both the Rio Group's interpretation, and Osberg's interpretation is below:

The Canadian measures, LICO, LIM and MBM, differ in how an income threshold and is determined. From there the method for calculating the poverty rate and poverty gap are the same.

As indicated above by the Rio Group the poverty rate satisfies the focus axiom and is additively decomposable but fails the monotonicity and transfer axioms while the poverty gap satisfies the focus and monotonicity axioms but also fails the transfer axiom.

4 References

Giles, Philip (2004): "Low income measurement in Canada". Statistics Canada research paper, Cat. No. 75F0002MIE — No. 011, December 2004 <http://www.statcan.ca/english/research/75F0002MIE/75F0002MIE2004011.pdf> Accessed 4 Nov 2008

Government of Nova Scotia (2008): "Poverty Reduction Strategy", *Press release*, Department of Community Services, 26 June 2008 <http://www.gov.ns.ca/coms/specials/poverty/Reportnewsrelease.html> Accessed 28 Nov 2008

Government of Ontario (2008): *Breaking the Cycle: Ontario's poverty reduction strategy*, 2008 <http://www.growingstronger.ca/english/pdf/Ontario's_Poverty_Report_EN.pdf> Accessed 16 Dec 2008

Human Resources and Social Development Canada (2006): "Low Income in Canada: 2000-2002 Using the Market Basket Measure - June 2006" <http://www.hrsdc.gc.ca/en/cs/sp/sdc/pkrf/publications/research/2002-000662/page04.shtml> Accessed 4 Nov 2008

Osberg, Lars (2007): "The Evolution of Poverty Measurement - with special reference to Canada" February 2007 <http://myweb.dal.ca/osberg/classification/research/working%20papers/The%20Evolution%20of%20Poverty%20Measurement/PaperFebruary9The%20Evolution%20of%20Poverty.pdf > Accessed 19 Nov 2008

Rio Group (2006): *Compendium of Best Practices in Poverty Measurement* United Nations Statistics Division, Expert Group on Poverty Statistics; United Nations; 2006 <http://www.ibge.gov.br/poverty/pdf/rio_group_compendium.pdf> Accessed 23 Sep 2008

Statistics Canada (2001): "Census Low Income Cut-Offs definition" <http://www12.statcan.ca/english/census01/Products/Reference/dict/fam021.htm> Accessed 4 Nov 2008