

**EQUIVALENCE SCALES:
AN EMPIRICAL VALIDATION**

Working paper

Centre d'étude sur la pauvreté et l'exclusion

EQUIVALENCE SCALES: AN EMPIRICAL VALIDATION

Working paper

Writing and analysis

Guy Fréchet, Pierre Lanctôt, Alexandre Morin and Frédéric Savard

Centre d'étude sur la pauvreté et l'exclusion

September 2010

Table of contents

Table of contents	iii
List of tables	iv
Summary	v
1. Introduction	1
2. Equivalence scales	2
3. Modelling	8
4. Results	10
5. Conclusion	15
Bibliography	17

List of tables

Table 1 –	Equivalence scales	2
Table 2 –	Threshold simulation based on size of family and size of community of residence according to equivalence scales and the market basket measure (MBM) 2007, Québec	4
Table 3 –	Data used as the basis for Statistics Canada's 40/30 equivalence scale	6
Table 4 –	Differences between Statistics Canada's 40/30 equivalence scale and the square root method of household size	7
Table 5 –	Expenditure coefficients for the first, median and last quartile for a household composed of two adults and two children compared to an unattached person, Québec, average from 2005 to 2007	10
Table 6 –	Threshold simulation for households composed of unattached persons based on expenditure coefficients for households composed of two adults and two children, 2007, Québec	11
Table 7 –	Gap between thresholds for unattached persons recalculated using observed coefficients and market basket measure (MBM) thresholds (2007) for households composed of unattached persons, Québec	12
Table 8 –	Impact of using the 40/30 equivalence scale coefficient compared to the observed coefficient on the low income rate for the entire population based on the market basket measure (MBM) according to community size, Québec, 2006	13
Table 9 –	Expenditure coefficients for a two-adult household compared to those for a household composed of an unattached person, Québec, average for 2005 to 2007	14

Summary

The question of equivalence scales regularly arises when it comes time to measure low income or inequality. Intuitively, one may presume that consumption expenditures for a family of four are not four times higher than for an unattached person given the economies of scale (sharing of housing and food costs and other goods and services). It is therefore essential to take this element into account when comparing the living standards of members of these family units.

Our working paper offers an empirical validation that will make it possible to understand the implications of choosing one of the scales, in this case the Statistics Canada scale. Using the most recent data from Statistics Canada's *Survey of Household Spending* (SHS), we will attempt to ascertain by how many times the expenditures of a four-person household type are, in reality, higher than those for a household composed of an unattached person, or, conversely, by how many times the expenditures of a household composed of an unattached person are lower than those of a four-person household type, assuming an equivalent level of well being.

Given that the square root of household size, which differs only slightly from Statistics Canada's 40/30 scale, has recently been adopted by Statistics Canada for the low income measure (LIM) and the market basket measure (MBM), we enthusiastically recommend its future use. Adopting the square root should in fact help bring us closer to the norms of European countries and international organizations as regards equivalence scales.

1. Introduction*

In its brief to the minister entitled *Taking the Measure of Poverty: Proposed Indicators of Poverty, Inequality and Social Exclusion to Measure Progress in Québec*, the Centre d'étude sur la pauvreté et l'exclusion (CEPE) formulated numerous recommendations with respect to poverty indicators, inequality and exclusion. The fourth such recommendation concerns equivalence scales, which are tools that make it possible to adjust the various low income thresholds based on household size. These scales take into account economies of scale within a household and also presuppose a more or less equivalent level of well being. The recommendation reads as follows: "The Centre recommends using Statistics Canada's 40/30 equivalence scale to account for economies of scale" (CEPE, 2009, p. 33).

The question of equivalence scales regularly arises when it comes time to measure low income or inequality. Intuitively, one may presume that consumption expenditures for a family of four are not four times higher than for an unattached person given the economies of scale (sharing of housing and food costs and other goods and services). It is therefore essential to take this element into account when comparing the living standards of members of these family units (Nelson, 1993; Jean, 2001, p. 297-298; Betson, 2004).

Our working paper offers an empirical validation that will make it possible to understand the implications of choosing one of the scales, in this case the Statistics Canada scale. Using the most recent data from Statistics Canada's *Survey of Household Spending* (SHS), we will attempt to ascertain by how many times the expenditures of a four-person household type are, in reality, higher than those for a household composed of an unattached person, or, conversely, by how many times the expenditures of a household composed of an unattached person are lower than those of a four-person household type, assuming an equivalent level of well being.

*The authors would like to thank Dorothée Boccanfuso, Paul Bernard, Marco de Nicolini, Alain Noël and Normand Thibault for their judicious observations. They can in no way be held responsible for any errors or omissions in the text.

2. Equivalence scales

The following are a few of the existing scales (see Table 1):

- the Statistics Canada scale (or so-called 40/30 scale) (Statistics Canada, 2008);
- the square root of household size (Atkinson et al., 1995);
- the modified OECD scale (OECD, 2008);
- the Bernier and Lanctôt scale (Bernier and Lanctôt, 1996);
- the U.S. National Research Council scale (Citro and Michael, 1995);
- the Fuchs scale (JEAN, 2001, p. 297);
- the Oxford A scale (former OECD scale) (OECD, 2008); and
- the Oxford B scale (Atkinson et al., 1995).

Table 1 – Equivalence scales

Equivalence scales	Coefficients assigned to members of the family unit					Coefficient assigned to a two-parent family with two children
	1 st person	2 nd person	3 rd person	4 th person	5 th person	
Statistics Canada (40/30)	1 (older person)	0.4 (2 nd older person)	0.4 (16 years and older) 0.3 (less than 16 years old)	0.4 (16 years and older) 0.3 (less than 16 years old)	0.4 (16 years and older) 0.3 (less than 16 years old)	2
Square root of the household size	1	0.41	0.32	0.27	0.24	2
Modified OECD	1	0.5 (14 years and older) 0.3 (less than 14 years old)	0.5 (14 years and older) 0.3 (less than 14 years old)	0.5 (14 years and older) 0.3 (less than 14 years old)	0.5 (14 years and older) 0.3 (less than 14 years old)	2.1
Bernier and Lanctôt	1	0.4	0.5 (first child)	0.3	0.3	2.2
U.S. National Research Council	(number of adults + 0.7 X number of children) ⁶⁵					2.2
Fuchs	1	0.8	0.4	0.3	0.3	2.5
Oxford A (former OECD scale)	1	0.7	0.5	0.5	0.5	2.7
Oxford B	1	0.8	0.6 (5-16 years old) 0.5 (less than 5 years old)	0.6 (5-16 years old) 0.5 (less than 5 years old)	0.6 (5-16 years old) 0.5 (less than 5 years old)	2.8 - 3

Which scale to choose is an important methodological question since the use of one or another scale may cause the thresholds used to calculate low income rates to vary considerably. The reference measure for monitoring situations of poverty recommended in the CEPE (2009) brief is the market basket measure (MBM) (HRSDC, 2009).

As a first step, an attempt could be made to find out the expenditure level of a larger household and to divide these expenditures by the coefficient indicated for an unattached person. In the table, the coefficient assigned to a two-person family with two children would become a divisor.

With the market basket measure, the basket is only assessed for a “typical” family composed of two adults and two children under 16 years of age (a 13-year-old boy and a 9-year-old girl). We will therefore confine ourselves here to four-person households, especially since the number of cases decreases quickly for households composed of more than four persons. As it happens, it is possible for us to discover by how many times the expenditures of a one-person household are lower than for a four-person household type. As such, the result of the market basket measure for four persons will have to be divided by the coefficient that makes it possible to obtain the equivalent for an unattached person.

Lastly, following the same logic, but this time in the opposite direction, it may be possible to discover whether the coefficient that applies to two persons compared to one unattached person, by way of an intermediary validation and according to various scales, actually corresponds to reality. In this way, we will attempt to see how much it costs for two persons (a second adult or a child of 16 years of age or older in a one-parent family) compared to an unattached person.

Statistics Canada’s 40/30 scale, recommended by CEPE, provides a coefficient of 2 for the family type targeted by the basket assessment. Statistics Canada in fact assigns a weight of 1 to the first adult of a four-person family, a weight of 0.4 to the second, and to two children, a weight of 0.3 each, resulting in a coefficient of 2 ($= 1 + 0.4 + 0.3 + 0.3$) for the family unit (so-called 40/30 scale). Conversely, a value of 1 is assigned to an unattached person, i.e. 50% of the estimated amount for a family of four. As mentioned in CEPE’S brief (p. 35) “one might ask if a single individual can manage to live a decent life on half the amount required by the ‘typical’ family.”

What would the result have been with one of the other scales? For instance, based on the same thresholds for the two-adult, two-child household type that the 2007 market basket measure provides us, the thresholds for an unattached person in the Montréal census metropolitan area can vary from \$9,159 to \$13,280, according to the Oxford B scale in the first case and to Statistics Canada’s 40/30 scale or the square root in the second (Table 2).

Table 2 – **Threshold simulation based on size of family and size of community of residence according to equivalence scales and the market basket measure (MBM) 2007, Québec**

Number of persons in the family unit	Rural regions	Urban regions				
		Fewer than 20 000 inhabitants	30 000 - 99 999 inhabitants	100 000 - 499 999 inhabitants	Québec CMA	Montréal CMA
40/30 Scale						
1 person	12 931	12 982	12 142	12 246	12 905	13 280
2 people	18 103	18 175	16 998	17 144	18 067	18 592
3 people*	21 982	22 069	20 641	20 818	21 939	22 576
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	29 740	29 859	27 925	28 166	29 682	30 544
6 people****	33 619	33 753	31 568	31 840	33 553	34 528
7 people*****	37 498	37 648	35 210	35 513	37 425	38 512
Square root						
1 person	12 931	12 982	12 142	12 246	12 905	13 280
2 people	18 286	18 359	17 171	17 318	18 250	18 781
3 people*	22 396	22 485	21 030	21 211	22 352	23 002
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	28 913	29 029	27 149	27 383	28 856	29 695
6 people****	31 673	31 799	29 740	29 996	31 611	32 529
7 people*****	34 211	34 347	32 123	32 400	34 143	35 136
OCDE 50/30 (modified)						
1 person	12 315	12 364	11 563	11 663	12 290	12 648
2 people	18 472	18 546	17 345	17 494	18 436	18 971
3 people*	22 167	22 255	20 814	20 993	22 123	22 766
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	29 555	29 673	27 752	27 991	29 497	30 354
6 people****	33 250	33 382	31 221	31 490	33 184	34 149
7 people*****	36 944	37 091	34 690	34 989	36 871	37 943
Bernier & Lanctôt						
1 person	11 755	11 802	11 038	11 133	11 732	12 073
2 people	16 457	16 523	15 453	15 586	16 425	16 902
3 people*	22 335	22 423	20 972	21 152	22 290	22 938
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	29 388	29 505	27 594	27 832	29 330	30 182
6 people****	36 441	36 586	34 217	34 511	36 369	37 425
7 people*****	39 967	40 126	37 528	37 851	39 888	41 047

Family with at least

*one child under 16 years of age

**two children under 16 years of age

***three children under 16 years of age

****four children under 16 years of age

*****five children under 16 years of age

Number of persons in the family unit	Rural regions	Urban regions				
		Fewer than 20 000 inhabitants	30 000 - 99 999 inhabitants	100 000 - 499 999 inhabitants	Québec CMA	Montréal CMA
CNR-US						
1 person	11 755	11 802	11 038	11 133	11 732	12 073
2 people	18 808	18 883	17 660	17 812	18 771	19 316
3 people*	22 335	22 423	20 972	21 152	22 290	22 938
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	29 388	29 505	27 594	27 832	29 330	30 182
6 people****	32 914	33 045	30 906	31 172	32 849	33 804
7 people*****	35 265	35 405	33 113	33 398	35 195	36 218
Oxford A 70/50 (former OCDE scale)						
1 person	9 578	9 616	8 994	9 071	9 559	9 837
2 people	16 283	16 348	15 289	15 421	16 251	16 723
3 people*	21 072	21 156	19 786	19 956	21 030	21 641
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	30 650	30 772	28 780	29 028	30 590	31 479
6 people****	35 439	35 580	33 277	33 563	35 369	36 397
7 people*****	40 228	40 388	37 774	38 099	40 149	41 316
Oxford B 80/60/50						
1 person	8 918	8 953	8 373	8 446	8 900	9 159
2 people	16 052	16 116	15 072	15 202	16 020	16 486
3 people*	21 402	21 487	20 096	20 269	21 360	21 981
4 people**	25 861	25 964	24 283	24 492	25 810	26 560
5 people***	31 212	31 336	29 307	29 559	31 150	32 055
6 people****	36 562	36 708	34 331	34 627	36 490	37 550
7 people*****	41 913	42 080	39 355	39 694	41 830	43 046

Source: CEPE compilation based on HRSDC data (2009).

Family with at least

*one child under 16 years of age

**two children under 16 years of age

***three children under 16 years of age

****four children under 16 years of age

*****five children under 16 years of age

The same data for four-person households is used in every case, and these data correspond to the data of the 2007 market basket measure for all of Québec (HRSDC, 2009), which serves as the reference measure here. The differences between the various scales therefore appear for all other household sizes.

Statistics Canada's 40/30 equivalence scale is based on three elements (Wolfson and Evans, 1989) (Table 3):

- Low income cut-offs (LICO) after income taxes for 1969 and 1978;
- Average last resort financial assistance benefits in Québec (non-specified years; probably the decade of the 1970s or of the 1980s); and
- Budgetary directives of the Dispensaire diététique de Montréal and of the Metro Toronto Social Planning Council (non-specified years; probably the decade of the 1970s or of the 1980s).

Table 3 – Data used as the basis for Statistics Canada's 40/30 equivalence scale

	Coefficients assigned to members of the family unit			
	2 nd person	3 rd person	4 th person	5 th person
Low income cut-offs (LICO) after income taxes¹				
1969	0.5	0.4	0.4	0.3
1978	0.3	0.4	0.3	0.3
Average last resort financial assistance (Québec)				
Unattached persons or couples (with or without children)	0.5	0.3	0.2	0.2
Single-parent families	0.5	0.3	0.2	0.2
Dispensaire diététique de Montréal				
Unattached persons or couples (with or without children)	0.3	0.3	0.3	0.3
Single-parent families	0.2	0.4	0.2	0.3
Metro Toronto Social Planning Council				
Unattached persons or couples (with or without children)	0.4	0.3	0.3	0.2
Single-parent families	0.4	0.3	0.2	0.3
Average coefficients selected	0.4	0.3	0.3	0.3

1. Average thresholds for various community sizes with population distribution taken into account.

Constructed in this way, the 40/30 scale is based on observations dating back three or more decades, and the low income thresholds considered are calculated on a before-income-tax basis; they therefore do not allow for the redistribution of wealth carried out through a tax system to be included in the calculations or for the income actually available for purchasing goods and services to be taken into account. Lastly, this scale is indirectly based on choices that are partially political, rather than scientific, since it takes last resort financial assistance benefits into account.

Statistics Canada recently decided to apply a recommendation of the Canberra Group (2001) to the effect that the square root of household size be adopted for current and future use, this being the scale used most notably in the *Luxembourg Income Study*. Also the agency recently decided to use this scale in the future with the low income measure (LIM), which will henceforth be calculated in accordance with the standards of European countries and international organizations, especially so as to facilitate international comparisons (Murphy et al., 2010). Statistics Canada also recently adopted it with the market basket measure (MBM) so as to standardize methods of calculation (Statistics Canada, 2010).¹ The differences are in fact minor for small-sized households, but become more accentuated as household size increases (Table 4).

1. In the case of low income cut-offs (LICOs), it is a known fact that there is no pre-established equivalence scale; instead the scale is implicit and included in the calculations carried out to establish these LICOs for families of different sizes.

Table 4 – **Differences between Statistics Canada's 40/30 equivalence scale and the square root method of household size**

Number of persons in the family unit	40/30 scale	Square root
1	1,00	1,00
2	1,40	1,41
3	1,70	1,73
4	2,00	2,00
5	2,30	2,24
6	2,60	2,45
7	2,90	2,65

On the whole, these two scales, which presume minimum economies of scale resulting from resource sharing, are more favourable for unattached persons.

The “modified” OECD scale, itself very widespread, has been used in Europe for a great many years and has more recently been selected by the European Union in connection with the Laeken indicators. It replaced the McClement scale, which has been reviewed and corrected over the years. Nevertheless, a recent critical analysis asserted that it underestimated the needs of unattached persons of working age and those of families with children in Great Britain (Bradshaw et al., 2008).

As for the Bernier and Lanctôt scale (1996) and the Fuchs scale (Jean, 2001), they exist in theory but it would seem that they have not been used by statistics agencies. The U.S. National Research Council (Citro and Michael, 1995) uses its own scale, the same one used by some researchers, including Sarlo (2008) in Canada.

Lastly, the former OECD scale, also known as the Oxford scale (which we have called Oxford A), along with another Oxford scale (called Oxford B), both presume maximum economies of scale resulting from resource sharing.

A more exhaustive review of the literature would provide examples of questionings of one or another of the scales, which arguably under- or over-estimate low income for one category or another. Whatever the case may be, concerning the choice of scale, the question to be asked is the following: Among economy of scale indicators, which one best represents the real expenditures of one-person households based on the data for two adults and two children provided by the market basket measure? Do they spend two times less, as both Statistics Canada's 40/30 scale and the square root of household size indicate? Or do they spend up to three times less, as is the case if we rely on the Oxford B scale? And what are the implications of the choice that is made?

3. Modelling

In the following exercise, we attempt to estimate the expenditure level of an unattached person for the various elements making up the market basket measure, i.e. **food, clothing and footwear, housing, transportation, and other expenditures**. For this exercise, we followed the market basket measure methodology as faithfully as possible (HRSDC, 2003; HRSDC, 2009) so as to obtain an empirical validation of the scale used. The question is whether or not this corresponds to what is actually observed in the households.

Based on data for Québec from the *Survey of Household Spending* (SHS) and the methodology described by Human Resources and Skills Development Canada (HRSDC, 2009), we calculated the coefficients applicable to expenditures for households composed of two adults and two children for 2005, 2006 and 2007. Next, using the coefficient average for these three years, we estimated the market basket measure thresholds for unattached persons.²

○ Food

The food coefficient is the median expenditure ratio for “store-bought foods” (hence without counting restaurant meals) for four-person households (two adults and two children) divided by the median expenditure for unattached persons.³

○ Clothing and footwear

According to the SHS, total clothing expenditures served as an approximation for the “clothing and footwear” element of the market basket measure (MBM). The coefficient for the “clothing and footwear” element is therefore the median clothing expenditure ratio for four persons (two adults and two children) divided by the expenditure median for one adult for the same expenditure item.

○ Housing

The housing coefficient is the median expenditure ratio for four-person households (two adults and two children) for rent payments for two or three bedroom rental accommodations divided by the median expenditure for unattached persons for rent payments for one bedroom rental accommodations. The variable used is the total monthly rent payment (rent + water + electricity + fuel). The household occupied the rental accommodation for 12 months, without any rent reduction. In addition, the rental unit did not require any major repairs.

○ Transportation

For this expenditure item, we selected the amounts allowed by the HRSDC for a four-person household (two adults and two children). For unattached persons living in rural regions and in urban regions with fewer than 30,000 inhabitants, the coefficient is equal to

2. Using the coefficient average, we are able to obtain a more precise estimate given the small sample size for certain variables.

1. In this case, it is considered that the need for a car and the related costs are the same, regardless of household size.

For urban centres with a public transit system, the “transportation” element of the basket for an unattached person is made up of the annual cost of a monthly public transit pass and \$16 for one return trip by taxi per month.

- **Other expenditures**

HRSDC has published the articles from the *Survey of the Household Spending* (SHS) that have served to calculate other expenditures. The authors provided an estimate for other expenditures using a multiplier representing expenditures for this category as a proportion of average expenditures for food, clothing, and footwear for the reference family of the second decile (HRSDC, 2009, p. 69). Based on a moving average over three years (2005 to 2007), the ratio was set at 73.1%. Thus, for each community and each community size, the total expenditure figure, for food, clothing, and footwear in 2007 was multiplied by 0.731 in order to calculate the total sum of other expenditures.

Based on the SHS, we calculated expenditures for these articles for households with one to four members (two adults and two children). To do so, we used the list of articles making up this grouping (HRSDC, 2009, Appendix F, p. 77). The coefficient for the other expenditures is the median expenditure ratio for four-person households (two adults and two children) for these articles divided by the median expenditure for unattached persons for the same articles.

Once all the coefficients were estimated, we applied them to the 2007 low income thresholds for the reference family established by HRSDC for various elements that are included in the market basket measure (MBM).

4. Results

Referring to the *Survey of Household Spending* (SHS), we looked at the cost of living in each of the first, median and last expenditure quartiles. The observations were collated for each expenditure item of the market basket measure. The coefficients obtained (average for the years 2005 to 2007), expressing the household expenditure ratio for two adults and two children divided by the expenditures for unattached persons, are as follows (Table 5):

Table 5 – **Expenditure coefficients for the first, median and last quartile for a household composed of two adults and two children compared to an unattached person, Québec, average from 2005 to 2007**

	First quartile	Median	Last quartile
Food	3.46	3.09	2.77
Clothing	6.52	4.65	3.76
Housing	1.37	1.26	1.23
Transportation	*	*	*
Other	4.24	3.27	2.53

* variable

Generally speaking, the portion of the budget used for essential needs, including food, decreases as living standards improve. The classical law, put forth by Engel in the 19th century, proposes that as a family's standard of living improves, the proportion of the budget spent on food decreases.

At the median level, food expenditures are **3.09** times higher than for unattached persons. As an illustration, food expenditures established in the market basket measure for four-person households are located between the first quartile level and the median level.

According to the market basket measure, expenditures for clothing and footwear would be **4.65** times higher at the median for a family of two adults and two children than for an unattached adult. This is plausible since what we have here is a personal expenditure, and with growing children, clothing and footwear are needed more often.

For housing, the coefficient is **1.26**, which is once again plausible since housing provides the most significant economy of scale as a result of the sharing of resources.

For transportation, the coefficient varies according to the urban centres in question and the estimated cost of public transit. We estimated that the cost was the same in rural regions and in towns with fewer than 30,000 inhabitants, but different when there is access to public transit. The rules of the market basket measure concerning taxis were also included in the calculation.

For other expenditures, the coefficient at the median is **3.27**.

The thresholds obtained for unattached persons and the resulting equivalence scales (ratio of four-person households to unattached person households) are presented in the following table.

Table 6 – **Threshold simulation for households composed of unattached persons based on expenditure coefficients for households composed of two adults and two children, 2007, Québec**

	Food	Clothing	Housing	Transportation	Other expenditures	Total	Ratio of four-person households/ unattached person households
Observed coefficient	3,09	4,65	1,26	variable	3,27		
Four-person households							
Rural regions	7 248	1 976	6 201	3 691	6 745	25 861	1,92
Urban regions							
Fewer than 30 000 inhabitants	7 248	1 976	6 304	3 691	6 745	25 964	1,92
30 000 to 99 999 inhabitants	7 248	1 976	6 851	1 463	6 745	24 283	2,19
100 000 to 499 999 inhabitants	7 248	1 976	6 790	1 733	6 745	24 492	2,19
Québec CMA	7 304	1 976	7 901	1 843	6 786	25 810	2,12
Montréal CMA	7 405	1 976	8 509	1 810	6 860	26 560	2,10
Unattached person households							
Rural regions	2 346	425	4 921	3 691	2 063	13 446	
Urban regions							
Fewer than 30 000 inhabitants	2 346	425	5 003	3 691	2 063	13 527	
30 000 to 99 999 inhabitants	2 346	425	5 437	828	2 063	11 098	
100 000 to 499 999 inhabitants	2 346	425	5 389	963	2 063	11 185	
Québec CMA	2 364	425	6 271	1 018	2 075	12 152	
Montréal CMA	2 396	425	6 753	1 001	2 098	12 673	

1. Transportation: In rural settings and in urban regions with fewer than 30,000 inhabitants, the same for 1 person as for 4; elsewhere, the cost for 4 persons (\$16 X 12 months)/2 (taxi for the adults) plus \$16 X 12 months.

The expenditure ratio for the four-person households divided by the expenditures for unattached persons varies between 1.92 and 2.19 depending on community size, with the average being 2.07. A first observation needs to be made at this time: the rough estimate of the coefficient being sought is closer to 2.1 than to 3 (the highest scale), which confers a certain validity to such scales as Statistics Canada's 40/30 scale (2), the square root method (2), and even the modified OECD method (2.1) used by the European Union. The Bernier and Lanctôt scale (2.2) and the U.S. National Research Council method (2.2) are relatively accurate as well. The other scales are rather less so, but it is very plausible that the differences between countries are taken into account by the different scales.

The comparison between Statistics Canada's implicit equivalence scale for low income cut-offs and that of the United States led Phipps and Garner (1994) to conclude that there was no significant statistical difference between low income rates as measured by these two scales.

For his part, Chen (2008, p. 16) compared Statistics Canada's low income cut-offs equivalence scales, the square root scale, and the OECD modified scale and reached the same conclusion, i.e. that there is no significant statistical difference between the three scales. Using the stochastic dominance approach, he concluded that "[i]n comparing with the base-case results ... low-income rankings are virtually insensitive to the choice of equivalence scale" (p. 19).

Sarlo (2008, p. 7), for his part, compared the square root scale and the U.S. National Research Council scale and noted a few minor differences between them.

Phipps and Garner (1994, p. 12) also envisioned the possibility that a single coefficient applies across a given area but that there are differences between its various regions, which, if true, could result in a certain bias. The results of our exercise lead us to believe that a single coefficient, such as 2, will lead to a slight bias, i.e. the rate in rural regions

and in urban regions with fewer than 30,000 inhabitants will be underestimated, while it will be overestimated for medium-sized and large cities. Nonetheless, the fact that no author has observed any statistical differences among low income rates with the scales using the coefficient 2 or 2.1 should also apply to the observed scope of the scales across our area, i.e. regional differences should not have too many consequences.

Table 7 – Gap between thresholds for unattached persons recalculated using observed coefficients and market basket measure (MBM) thresholds (2007) for households composed of unattached persons, Québec

	Thresholds (MBM) for 2 adults and 2 children	Equivalence scale coefficient	Thresholds (MBM) for unattached persons (a)	Observed coefficient	Recalculated thresholds (MBM) for unattached persons (b)	Gap (b-a)	Gap in %
Rural regions	25 861	2	12 931	1,92	13 446	515	4,0
Urban regions							
Fewer than 30 000 inhabitants	25 964	2	12 982	1,92	13 527	545	4,2
30 000 to 99 999 inhabitants	24 283	2	12 142	2,19	11 098	-1 043	-8,6
100 000 to 499 999 inhabitants	24 492	2	12 246	2,19	11 185	-1 061	-8,7
Québec CMA	25 810	2	12 905	2,12	12 152	-753	-5,8
Montréal CMA	26 560	2	13 280	2,10	12 673	-607	-4,6

The thresholds as recalculated on this basis are a few hundred dollars higher for unattached persons from rural zones and from urban zones with fewer than 30,000 inhabitants, essentially due to the need for a car as recognized by the market basic measure methodology. The thresholds recalculated on this basis for unattached persons from urban zones with more than 30,000 inhabitants are a thousand dollars lower, while they are a few hundred dollars lower in the Québec and Montréal CMAs.

While the impact on the thresholds may seem substantial, i.e. a gap of up to -8.7%, the situation is totally different as regards the impact on rates for the population as a whole, which is completely negligible, i.e. approximately 0.1% in total (Table 8). It may be observed that the gap between low income rates according to the market basket measure as calculated using the 40/30 scale coefficient and the rate calculated using the observed coefficient does not exceed 0.3% for the various community sizes. This result is therefore in line with the conclusions of the aforementioned studies, i.e. that the equivalence scale that is applied has very little influence on low income rates.

Table 8 – **Impact of using the 40/30 equivalence scale coefficient compared to the observed coefficient on the low income rate for the entire population based on the market basket measure (MBM) according to community size, Québec, 2006**

	Low income rate calculated using the 40/30 scale coefficient	Low income rate calculated using the observed coefficient	Gap in percentage points
Rural regions	8,7	9,0	-0,3
Urban regions			
Fewer than 30 000 inhabitants	12,1	12,2	-0,1
30 000 to 99 999 inhabitants	7,1	6,9	0,2
100 000 to 499 999 inhabitants	10,8	10,5	0,3
500 000 inhabitants and more	9,2	9,1	0,2
Total	9,4	9,3	0,1

Source: CEPE compilation based on data from the 2006 Survey of Labour and Income Dynamics (SLID).

We also attempted to estimate the expenditure level for a two-adult household compared to the level for an unattached person.³ We wanted to find out whether the expenditures of a two-adult household are in fact 1.4 times higher than those for an unattached person, as is the case with Statistics Canada's 40/30 scale and the square root scale.

Unfortunately, we were unable to use a methodology identical to the one used for households composed of two adults and two children due to an absence of information concerning the various elements making up the market basket measure thresholds as defined by HRSDC. It should also be added that the existing definitions of equivalence scales consider a child of 16 years or older as the second adult in a single-parent household, and that we have only been able to take into consideration persons 18 years of age or older due to the groupings established in the *Survey of Household Spending* (SHS), (5 to 17 years old, 18 years or older).

We therefore only considered a second adult or a second person 18 years of age or older in a single-parent household, and we estimated the cost of these elements (food, clothing, housing, transportation, and other expenditures) for a two-adult household and for a one-person household based on information provided by the SHS for 2005, 2006, and 2007. Next we were able to calculate the average ratios for the same expenditure items during these three years for these two types of households, without being able to follow the reasoning to its logical conclusions and faithfully reproduce the information contained in tables 6 and 7. The results thus obtained provide a rough estimate of the coefficient rather than the coefficient itself. The following table presents the results of estimated coefficients for these various expenditure items.

3. We were unable to extend the analysis to a larger number of households (a household composed of two adults and three children for example) given the small number of cases observed in the Survey of Household Spending.

Table 9 – **Expenditure coefficients for a two-adult household compared to those for a household composed of an unattached person, Québec, average for 2005 to 2007**

	Average
Food	1,81
Clothing	1,91
Housing	1,09
Transportation	2,06
Other expenditures	1,68
Total	1,53

For two-adult households compared to a single-person household, costs are on average 53% higher. In the first quartile, transportation expenditures are multiplied by a factor of more than 5, which no doubt reflects the fact that means of transportation whose costs cannot be shared (public transit, bicycle, motorcycle, etc.) are exchanged for car expenditures. For housing, the expenditure level is 29% higher since housing provides the most significant economy of scale resulting from the sharing of resources. With the Statistics Canada scale or the square root scale, the recognized expenditure level is only 40% higher for all budgetary items for the second person. Our observations lead us instead to believe that expenditures for the second adult are slightly more than 50% of an unattached adult's, with the caveat that we were only able to carry out this validation with persons aged 18 years and older.

5. Conclusion

From 2005 to 2007, in Québec, the coefficient varied from 1.92 to 2.19, depending on the characteristics being considered, i.e. 2.07 on average, such that a coefficient of 2 seems relatively accurate. The results of our observations therefore enable us to obtain an empirical validation for an equivalence scale. Statistics Canada's 40/30 scale is, in our opinion, a valid standard of living indicator, even if certain biases could be corrected with the adoption of a different scale.

As such, using the 40/30 scale coefficient results in our underestimating the low income rates in cases where the observed coefficient is less than 2, while they are overestimated in cases where it is greater than 2.

With the same coefficient, low income is slightly underestimated for rural regions and overestimated for middle-sized and large cities. The choice of a scale associated with a coefficient of 2.1, such as the OECD modified scale, would likely lead to fewer significant biases in this regard, but some would remain nevertheless, although not for the same sub-groups.

Moreover, for a second adult or a second person aged 16 or over in the household, the 40/30 scale coefficient recognizes expenditures amounting to only 40% of those for an unattached person. The same applies with the square root scale, i.e. costs for the second person are slightly underestimated since our results instead suggest additional expenditures of slightly over 50%. Choosing a scale associated with a coefficient of 2.1, for instance the OECD modified scale, would make it possible to correct this bias.

Assuming that there will be a review of the scale on a periodic basis, updating this exercise will enable us to see whether or not the biases of the measure become too significant. These biases exist as things stand now, but in our view they are not a major cause for concern even though choosing a scale associated with a coefficient of 2.1, such as the modified OECD scale, would make it possible to correct them.

While enabling a minimal correction, using this scale would lead to a rupture in the chronological series and a lesser capacity for comparison with other Canadian provinces. On the other hand, it would facilitate comparisons with European countries.

Lastly, we should recall that scales with coefficients of 2 or 2.1 do not produce significant differences between low income rates. The same would apply for the observed scope of the coefficients across our territory, the consequences of which would be negligible.

Moreover, Statistics Canada recently adopted the square root of household size as the low income measure (LIM), a wise decision that will facilitate international comparisons. The agency also recently adopted the same scale with the market basket measure (MBM), especially so as to standardize methods of calculation (Statistics Canada, 2010). Since Statistics Canada's 40/30 scale and the square root of household size scale differ only slightly, the two scales seem to us to represent valid standard of living indicators.

Given that the square root of household size, which differs only slightly from the 40/30 scale, has just been adopted by Statistics Canada for the low income measure (LIM) and

market basket measure (MBM), we enthusiastically endorse it for future use. Adopting the square root should in fact help us move closer to the norms of European countries and international organizations as regards equivalence scales.

Bibliography

- ATKINSON, Anthony B., Lee RAINWATER and Timothy M. SMEEDING (1995), "Income Distribution in OECD Countries: Evidence from the Luxembourg Income Study," *Social Policy Studies* 18, Paris. OECD, 164 p.
- BERNIER, Jean and Pierre LANCTÔT (1996), *Échelles d'équivalence*, Québec, ministère de la Sécurité du revenu, 38 p.
- BETSON, David M. (2004), *Poverty Equivalence Scales: Adjustment for Demographic Differences Across Families*, Department of Economics and Policy Studies, University of Notre Dame, 28 p.
http://www7.nationalacademies.org/cnstat/Poverty_Equivalence_Scales_Betson_Paper_PDF.pdf
- BRADSHAW, Jonathan, Sue MIDDLETON, Abigail DAVIS, Nina OLDFIELD, Noel SMITH, Linda CUSWORTH and Julie WILLIAMS (2008), *A minimum income standard for Britain, What people think*, Joseph Rowntree Foundation, York, 57 p.
<http://www.jrf.org.uk/sites/files/jrf/2226-income-poverty-standards.pdf>
- CENTRE D'ÉTUDE SUR LA PAUVRETÉ ET L'EXCLUSION (CEPE) (2009), *Taking the Measure of Poverty: Proposed Indicators of Poverty, Inequality and Social Exclusion to Measure Progress in Québec*, Québec, 80 p.
http://www.cepe.gouv.qc.ca/publications/pdf/Avis_CEPE.pdf
- CHEN, Wen-Hao (2008), *Comparing Low Income of Canada's Regions: A Stochastic Dominance Approach*, Ottawa, Statistics Canada, 75F0002M, 44 p.
<http://www.statcan.gc.ca/pub/75f0002m/75f0002m2008006-eng.pdf>
- CITRO, Constance F. and Robert T. MICHAEL (1995), *Measuring Poverty: A New Approach*, Washington, National Academy Press, 501 p.
<http://www.nap.edu/openbook.php?isbn=0309051282#>
- CANBERRA GROUP (2001), "Expert Group on Household Income Statistics: Final Report and Recommendations," Ottawa, 200 p.
<http://www.lisproject.org/links/canberra/finalreport.pdf>
- JEAN, Sylvie (2001), "Le revenu," *Portrait social du Québec: données et analyses*, Québec, Institut de la statistique du Québec, p. 291-316.
http://www.stat.gouv.qc.ca/publications/conditions/pdf/port_soc2001.pdf
- MURPHY, Brian, Xuelin ZHANG and Claude DIONNE (2010), "Revising Statistics Canada's Low Income Measure (LIM)," Statistics Canada, Income Statistics Division 75F0002M, 31 p.
<http://www.statcan.gc.ca/pub/75f0002m/75f0002m2010004-eng.htm>

- NELSON, Julie A. (1993), "Household Equivalence Scales: Theory versus Policy?", *Journal of Labor Economics*, 11, 3, p. 471-493.
<http://www.jstor.org/stable/2535082>
- ORGANIZATION OF ECONOMIC CO-OPERATION AND DEVELOPMENT (2008), *What Are Equivalence Scales?*, Paris, 2 p.
<http://www.oecd.org/dataoecd/61/52/35411111.pdf>
- PHIPPS, Shelley and Thesia GARNER (1994), "Are Equivalence Scales the Same for the United States and Canada?", *The Review of Income and Wealth*, 40, 1, p. 1-18.
- HUMAN RESOURCES AND SKILLS DEVELOPMENT CANADA (2009), *Low Income in Canada, 2000-2007, Using the Market Basket Measure*, Gatineau, Knowledge and Data Management Directorate, SP-909-07-09F, 79 p.
http://www.hrsdc.gc.ca/eng/publications_resources/research/categories/inclusion/2009/sp-909-07-09/page00.shtml
- HUMAN RESOURCES AND SOCIAL DEVELOPMENT CANADA (2003). *Understanding the 2000 Low Income Statistics Based on the Market Basket Measure*, Gatineau, Applied Research Branch, SP-569-03-03F, 66 p.
<http://www.hrsdc.gc.ca/eng/cs/sp/sdc/pkrf/publications/research/2003-000151/page00.shtml>
- SARLO, Chris (2008), *What is Poverty? Providing Clarity for Canada*, Fraser Institute, 27 p.
http://www.fraserinstitute.org/commerce.web/product_files/What_is_Poverty.pdf
- STATISTICS CANADA (2008), "Analytic Concepts, Family Size Adjustment (equivalence scale)," on-line publication.
<http://prod.library.utoronto.ca/datalib/codebooks/cstdsp/13f0022/2002/00002/noted ef/analytic.htm>
- STATISTICS CANADA (2010), *Low Income Lines, 2008-2009*, Ottawa, Statistics Canada, no 75F0002M, 005, 35 p.
<http://www.statcan.gc.ca/pub/75f0002m/75f0002m2010005-eng.pdf>
- WOLFSON, M. C. and J. M. EVANS (1989), *Statistics Canada's Low Income Cut-Offs: Methodological Concern and Possibilities*, Ottawa, Statistics Canada, discussion paper, 89 p.