POVERTY ASSESSMENT AT HOUSEHOLD LEVEL USING A POVERTY COMPOSITE INDICATOR

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The present study mainly aims to construct a Poverty Composite Indicator (PCI) for the Romanian households using a non-arbitrary method to compile multiple categorical indicators into an aggregate measure that describes the numerous poverty faces. The composite indicator allows for households ordering according to their level of poverty, in order to identify the profile of poor households from Romania.

Key words: Poverty, Poverty Composite Indicator, Multiple Correspondence Analysis

1. Problem description

"A composite indicator (CI) is formed when individual indicators are compiled into a single index, on the basis of an underlying model of the multi-dimensional concept that is being measured". It "measures multi-dimensional concepts (e.g. competitiveness, e-trade or environmental quality) which cannot be captured by a single indicator". (OECD, 2004)

The problem to solve here is to define a unique numerical indicator C as a composite of the K primary categorical indicators of poverty I_k, computable for each elementary population unit U_i (household), and significant as generating a complete ordering of the population U of households according to their level of poverty (Asselin, 2002, p. 3). Thus, a composite indicator of poverty C takes the value $C_i(I_{ik}, k=1,K)$ for a given elementary population unit (household) U_i.

The literature about composite indicators construction identifies basically two trends: the first is the approach based on the concept of entropy, while the second one refers to the concept of inertia. In the entropy approach, multidimensionality is seen as coming from a sequence of unidimensional distributions; in the inertia approach, multidimensionality consists simply in a finite set of simultaneous distributions on a given population. (Asselin, 2002, p. 4)

In the context of this study, the construction of the Poverty Composite Indicator (PCI) is based on the inertia approach which aims to define a composite indicator for each given population unit, using multidimensional analytical techniques. Among these tools, the most suitable to this case study is Multiple Correspondence Analysis (MCA), as it is the adequate non-arbitrary tool for the computation of a composite indicator, based on categorical (qualitative) indicators. A complete discussion on this approach could be found in the paper of Louis-Marie Asselin, *Pauvreté multidimensionnelle*, (2002).

For a given household, the value of the PCI corresponds to the mean of standardized scores on the first factorial axis and it is calculated as a linear combination of binary indicators describing poverty with weights resulting from MCA as indicated by the following formula:

$$Ci = \frac{\sum_{k=1}^{K}\sum_{j_k=1}^{J_k} W_{j_k}^{k} I_{i,j_k}^{k}}{K}$$, where: K = number of categorical indicators; J_k = number of categories for indicator k; $W_{j_k}^{k}$ = the weight (normalized first axis score) of category j_k; I_{i,j_k}^{k} = the binary variable 0/1 taking the value 1 when the unit i has the category j_k. (Asselin, 2002, pp. 22,30)

2. Preliminary analysis of data set

The data used in the study are drawn from the POB (Public Opinion Barometer) survey conducted in 2003 by The Gallup Organization Romania.

Table 1. The first set of 41 variables describing poverty

Means of subsistence	Infrastructure
Could your household afford buying or producing the daily necessary bread?	Which type of water supply do you have in your house?
Could your household afford a meal with meat or fish at least once a week?	How do you procure warm water for your household?
Could your household afford buying new clothes and not second hand ones?	Is your house connected to electricity?
	Is your house connected to sewerage?
Health	Is your house connected to gas?
How satisfied are you of your health?	Which type of heating does your house have?
Could your household afford buying necessary medicines?	Does your house have a toilet (WC)?
	Does your house have a bathroom, shower?
Have you appealed to a doctor for consultation, treatment or surgery intervention in the last 5 years?	Does your house have a kitchen?
	Distance to the closest town
	Living conditions
Education and access to information and communication	How many rooms for living (apart from bathroom, kitchen and hall) do you have?
Do you have a fixed phone in your household?	Which is the total surface (square meters) of the rooms (apart from bathroom, kitchen and hall) your household occupies?
Do you have a mobile phone (including from your job) in your household?	
Do you have a black & white TV in your household?	Type of the house
	Zone where the house is located
Do you have a color TV in your household?	**Elements of comfort – Do you have a … in your household?**
Do you have cable TV in your household?	
Do you have a video player in your household?	refrigerator
Do you have a computer in your household?	freezer
Do you have access to internet in your household?	non-automatic washing machine
	automatic washing machine
How often are you reading news-papers?	car
How often are you listening to radio?	**Possibilities/sources, alternative to income, to satisfy consumption**
How often are you watching TV?	
How often are you reading books?	Does your household own or use a garden for green stuffs, vineyard, corn, trees etc.?
Do you know how to use a computer?	
Last graduated school	Do you own or use any agricultural field?

From this survey questionnaire a first subset of 41 indicators describing various dimensions of poverty was extracted. The selected indicators are mentioned in table 1 and refer to: means of subsistence; health; education and access to information and communication; infrastructure; living condition; elements of comfort; possibilities/sources, alternative to income, to satisfy consumption needs. Both the questionnaire and the data base in SPSS format are available on-line on www.osf.ro.

The first step in building the composite indicator is to explore data with a preliminary data reduction analysis as MCA in order to identify some structure in the large set of categorical indicators.

The MCA eigenvalues highlight the distinction of the first factorial axis as it explains 29.2% of the total inertia of the variables group, whereas the other axes show a much lower explanatory power (each with less than 10.1% of the inertia explained). This distinction of the first factorial axis underscores the particular phenomenon of poverty, as it opposes poor households to those less poverty affected. Therefore further analysis will mainly center on this axis which describes poverty.

It is necessary that all the selected indicators to have the property of First Axis Ordinal Consistency (FAOC) so that the MCA first factorial axis to effect an ordering of households in accordance with their level of welfare/poverty (Asselin, 2002, p. 19). This property means, in this case, that from left to right, for each indicator, poverty condition expressed by the indicator is improving. Graphical representations drawn to verify FAOC property revealed that 11 variables don't have the property. Seven of them were brought to FAOC by a simple recoding of their categories, while the other 4 were excluded from further analysis, as they were not ordinal in nature or they couldn't be brought to a form that would have allowed them to have FAOC property. The four excluded variables are: *Zone where the house is located*, *Type of the house*, *How often are you watching TV?* and *Which type of heating does your house have?*.

By ordering the discrimination measures (the variances of the factorial scores obtained by the set of categories associated to each indicator) in the first factorial axis I identified another 3 variables to be excluded from further analysis because of their much lower discriminatory power (under 0.01) comparing to the others: *How many rooms for living (apart from bathroom, kitchen and hall) do you have?*, *Do you have a non-automatic washing machine in your household?*, *Have you appealed to a doctor for consultation, treatment or surgery intervention in the last 5 years?*.

3. Construction of the Poverty Composite Indicator with a final MCA

A final MCA run on the 34 indicators retained for the construction of the composite indicator has resulted in a considerable increase in the explanatory power of the first axis, which has risen from 29.2% to 31.2%. Thus, the average discrimination measure of the remaining 34 indicators is higher and the first axis appears stronger. More than that, all the indicators respect now the FAOC property.

According to discrimination measures, variables that have contributed the most to the construction of the first axis were: *Does your house have a bathroom, shower?* (0.710), *Does your house have a toilet (WC)?* (0.703), *Is your house connected to sewerage?* (0.703), *Which type of water supply do you have in your house?* (0.699). Variables that contributed the least to the formation of the first axis were: *Is your house connected to electricity?* (0.022) and *Which is the total surface (square meters) of the rooms (apart from bathroom, kitchen and hall) your household occupies?* (0.051).
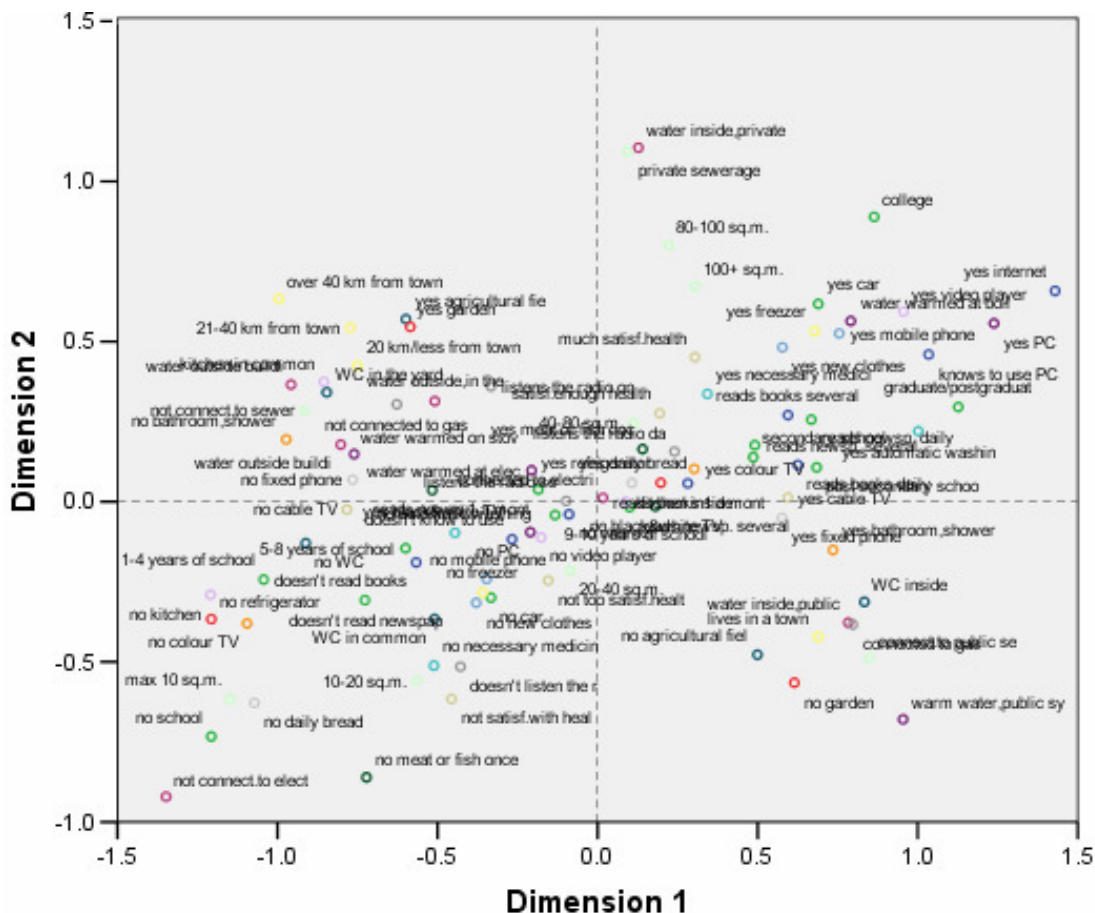
Figure 1. Joint Plot of Category Points

Source: Output obtained with SPSS using POB 2003 data

Figure 1 presents the joint plot of category points corresponding to modalities' scores on the first 2 axis. Modalities with positive scores increase welfare, while those with negative scores reduce it. The largest positive scores are observed to be associated with goods and comfort elements whose ownership is limited to a certain number of well-to-do households. This situation refers to possessing a computer, having access to Internet, possessing an automatic washing machine, having access to basic utilities (drinking water, heating, sewerage) inside the house. At the same time, positive high scores are specific to a very high level of education (graduate or postgraduate studies). Larger negative scores are on the first axis lesser the households possess such goods and their access to education and information is limited. This is the case of households that lack refrigerator, color TV, cable TV or phone, that live far away from a town, in very small spaces, which are not connected to basic utilities (electricity, sewerage, drinking water), and that lack minimum conditions of comfort (toilet, bathroom/shower, kitchen inside the house). In addition, low scores are specific to not or less educated persons, that have low access to information and that can't afford the minimum nutritional necessary in nourishment.

4. Describing poverty affected households through their socio-demographical characteristics

Table 2 shows PCI values corresponding to the modalities of a few illustrative socio-demographical characteristics of the households involved in this study. Analysis of the relationship between PCI and these characteristics allowed me to identify the poverty profile of Romanian households:

Table 2. PCI values for the categories of illustrative variables

AREA		GENDER	
urban	0.689	masculine	0.014
rural	-0.789	feminine	-0.011
LOCALITY SIZE		**HOUSEHOLD SIZE**	
city, over 200.000 inhabitants	0.866	1 person	-0.301
big town, 100-200.000 inhabitants	0.815	2 persons	-0.069
small town, 30-100.000 inhabitants	0.611	3 persons	0.347
very small town, under 30.000 inhabitants	0.056	4 persons	0.180
		5 persons	-0.188
village center of a commune	-0.702	6 persons	-0.272
village	-0.946	7 persons	-0.798
AGE		8 persons	-1.251
18-24 years	0.307	9 persons	-0.637
25-34 years	0.091	10 persons	-0.987
35-44 years	0.142	11 persons	-1.500
45-54 years	0.185	12 persons	-1.694
55-64 years	-0.172	13 persons	-1.784
65+ years	-0.420	14 persons	-1.571
NATIONALITY		**MARITAL STATUS**	
Romanian	0.005	married	0.015
Magyar	0.270	living together but not married	-0.207
Rom	-1.073	divorced	0.211
German	0.576	separated	0.221
Other	-0.317	never married	0.262
RELIGION		widowed	-0.450
orthodox	-0.015	**TYPE OF THE HOUSE**	
Romano catholic	0.151	individual house	-0.547
protestant	0.190	building with multiple dwellings	0.028
Greek catholic	-0.127	villa (2-4 apartments)	1.046
neo-protestant	-0.082	block of flats with comfort 1 or 2	0.956
without religion	0.159	block of flats with comfort 3,4 or ex hostel	0.388
other	0.150		
TYPE OF THE ACCESS ROAD TO DWELLING – for rural areas		improvised shelter	-1.597
		ZONE WHERE THE HOUSE IS LOCATED	
asphalted	-0.564	central area	0.132

886

| paved | -0.721 | suburbs | -0.158 |
| of earth | -1.023 | other area than central or suburbs | 0.177 |

Source: Results obtained with SPSS using POB 2003 data

- The poorest households live in rural areas. As for the locality size, PCI values rise with the number of inhabitants and with proximity to a town.
- In rural areas, the quality of access roads to dwelling is a factor of great influence on the level of poverty. Thus, PCI values for the households that have a road made of earth passing in front of their houses is twice smaller than for those that benefit of an asphalted access road to their house.
- According to their location, the most poverty affected households can be found in the regions North East and South West (figure 2).
- Poorest persons are met in localities suburbs and usually live in improvised shelters. A significant negative value of the indicator is also obtained for the households that live in individual houses, these being specific, ordinarily, to rural areas. People with the highest living standard live in blocks of flats with comfort 1 or 2 or in villas with at most 4 apartments.
- Overall, households managed by a man have a higher living standard than those managed by a woman.
- Looking at the age, the poorest persons are those from 55-64 years and 65 years and over age groups. These age groups also obtained the only negative values of the indicator (-0.172 and -0.420).
- In can be noticed a generalized spreading of poverty among gypsies. At the opposite position, there are German or Magyar households which enjoy the highest living standard.
- In accordance with the results obtained for nationality, the most well-to-do households are those that embrace protestant or Romano-catholic religions. Given the great spreading of orthodox religion among Romanians, PCI values for people of Romanian nationality and for those of orthodox religion are much closed (0.005 and -0.015). The most poverty affected are Greek Catholic and neo-protestant households.
- Poverty level rises significantly for the households with more than 5 members. A high level of poverty is noticed also for single persons.
- PCI values for the marital status of the household head shows that widowed persons are the most affected, together with those who live together without being married.
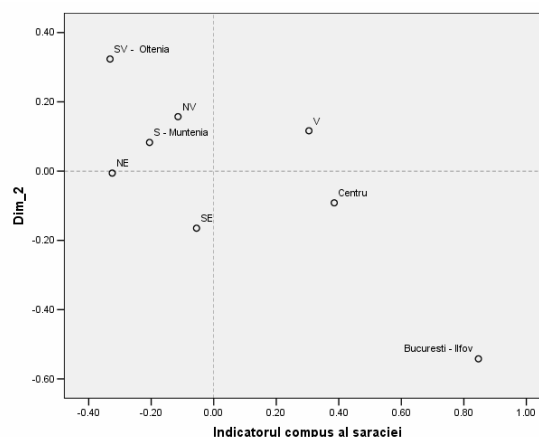
Figure 2. Relationship between PCI and region

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