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by

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A MULTIDIMENSIONAL APPROACH TO THE MEASUREMENT OF POVERTY[1]

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Abstract

By using fuzzy set theory a cross country multidimensional analysis of poverty is performed on the basis of ECHP data. A set of composite indicators is contructed in order to analyse different dimensions of poverty. For each indicator is calculated an unidimensional poverty ratio, thus allowing a comparison among countries and indicators on the dimensions of poverty. Finally, for each country a multidimensional poverty ratio is obtained.

1. Introduction

The theoretical debate on the measurement of poverty made in the last years substantial improvements, gradually moving from the traditional undimensional view of poverty to the new multidimensional concept of social exclusion (Hagenaars, 1986; Dagum, 1989; Sen, 1992). As frequently happens owing to a great theoretical development, a methodological adjustment is needed, but it is neither immediate nor automatic. That is the case of poverty analyses, where empirical researches still generally refers only to income or expenditure.

A multidimensional concept of poverty demands a multidisciplinary analysis and, unlike income or expenditure as the only variable considered in an unidimensional framework, the multidimensional approach introduces and analyzes a vector of variables and attributes retained as indicators of some form of exclusion, deprivation or poverty.

They can be represented by a **m**-order vector of attributes $\mathbf{X} = (\mathbf{X_1}, ..., \mathbf{X_j}, ..., \mathbf{X_m})$; the **m**-order vector of attributes considered in a multidimensional approach to the analysis and measurement of poverty includes economic, demographic, social, cultural and political attributes.

A highly efficient and rigorous method to perform a multidimensional analysis of poverty makes use of the fuzzy set theory (Dagum, Gambassi and Lemmi, 1992; Cheli and Lemmi, 1995; Dagum and Costa, 2002): it purports to arrive at a poverty index as a function of the **m** attributes included in **X**.

The aim of the paper is to construct a set of indicators for the multidimensional analysis of poverty and to apply these indicators to the European countries, evaluating and comparing the different dimensions of poverty.

2. Methodology

This section strongly relies on a previous paper of Dagum and Costa (2002) and briefly summarizes the basic concepts related to the multidimensional analysis of poverty in the framework of the fuzzy set theory.

In this framework we need to define some fundamental tools, such as:

(i)   the set **B** of poor households;

(ii)   the degree of membership to the set **B** of the **i**-th household;

(iii)   the poverty ratio of the **i**-th household; and

(iv)   the poverty ratio of the population.

Given a population **A** of **n** households, **A** = {**a₁**, **a₂**, **…**, **aₙ**}, the subset of *poor households* **B** includes any household $\mathbf{a_i} \in \mathbf{B}$ which presents some degree of poverty in at least one of the **m** attributes of **X**.

The *degree of membership* to the fuzzy set **B** of the **i**-th household (**i=1,...,n**) with respect to the **j**-th attribute (**j=1,...,m**) is defined as

$$\mu_B(X_j(a_i)) = x_{ij}, \qquad 0 \le x_{ij} \le 1$$

In particular:

(i) $x_{ij}=1$, iff the **i**-th household does not possess the **j**-th attribute;

(ii) $x_{ij}=0$ iff the **i**-th household possesses the **j**-th attribute; and

(iii) $0<x_{ij}<1$ iff the **i**-th household possesses the **j**-th attribute with an intensity belonging to the open interval (0,1).

The *poverty ratio of the i-th household* $\mu_B(a_i)$, *i.e.*, the degree of membership of the **i**-th household to the fuzzy set **B** is defined as the weighted average of **xᵢⱼ**,

$$\mu_B(a_i) = \sum_{j=1}^{m} x_{ij} w_j \left/ \sum_{j=1}^{m} w_j \right. ,$$

where **wⱼ** is the weight attached to the **j**-th attribute.

The poverty ratio $\mu_B(a_i)$ measures the degree of poverty of the **i**-the household as a weighting function of the **m** attributes. Hence, it measures the relative deprivation, degree of social exclusion, and insufficient capability of the **i**-th household to reach a living standard of the society to which it belongs.

The weight **wⱼ** attached to the **j**-th attribute stands for the intensity of deprivation of **Xⱼ**. It is an inverse function of the degree of deprivation of this attribute by the population of households. The smaller the number of households and the amount of their deprivation of **Xⱼ**, the greater the weight **wⱼ**.

A weight that fulfils the above property is proposed by Cerioli and Zani (1990) and can be represented with the following expression:

$$w_j = \log\left[n \left/ \sum_{i=1}^{n} x_{ij} n_i \right. \right] \ge 0,$$

with $\sum_{i=1}^{n} x_{ij}n_i > 0$ and where n_i is the weight attached to the **i**-th sample observation when the data are extracted from a sample survey.

The requirement that $\sum_{i=1}^{n} x_{ij}n_i > 0$ means that it is not considered an attribute X_j such that $x_{ij}=0$ for all **i**. This would be an irrelevant attribute and should be excluded because there is not any deprivation in X_j.

The weight w_j is zero when $\sum_{i=1}^{n} x_{ij}n_i = n$, *i.e.*, when the **j**-th attribute is not possessed by any of the **n** households, hence, $x_{ij}=1$, $i=1,...,n$.

Finally, the *poverty ratio of the population* μ_B is simply obtained as a weighted average of the poverty ratio of the **i**-th household $\mu_B(a_i)$

$$\mu_B = \sum_{i=1}^{n} \mu_B(a_i)n_i \Big/ \sum_{i=1}^{n} n_i .$$

In addition to the multidimensional poverty ratio of the **i**-th household $\mu_B(a_i)$ and of the population μ_B, the fuzzy set framework also allows to simply obtain an unidimensional poverty ratio for each of the **j** attributes considered.

While the multidimensional poverty ratio for the **i**-th household $\mu_B(a_i)$ is the weighted average of x_{ij}, with weight w_j, the unidimensional poverty ratio for the **j**-th indicator is the weighted average of x_{ij}, with weight n_i:

$$\mu_B(X_j) = \sum_{i=1}^{n} x_{ij}n_i \Big/ \sum_{i=1}^{n} n_i .$$

In this way it also possible to obtain the multidimensional poverty ratio of the population μ_B as the weighted average of $\mu_B(X_j)$, with weight w_j:

$$\mu_B = \sum_{i=1}^{n} \mu_B(a_i)n_i \Big/ \sum_{i=1}^{n} n_i = \sum_{j=1}^{m} \mu_B(X_j)w_j \Big/ \sum_{j=1}^{m} w_j .$$

By resorting to a simple example it is possible to clearly illustrate the above definitions.
Table 1 reports the degrees of membership x_{ij} to the set **B** of a sample of 10 households (rows) with respect to 5 attributes (columns); in order to simplify the example, the x_{ij} assume only 0 and 1 values, and it is not considered the presence of sample weights n_i.

Analyzing Table 1 by columns it is possible to observe how the first attribute is not possessed by any of the ten household, $x_{11} = x_{21} = x_{31} = \ldots = x_{101} = 1$, and the corresponding weight, w_1, is equal to 0, indicating that X_1 does not contain useful information about the degree of poverty of the analyzed households. From the other side, the fifth attribute is possessed only by one household and the corresponding weight, w_5, is the greatest weight, indicating the strong social exclusion perceived by the only household possessing X_5.

Furthermore, analyzing Table 1 by rows, it is possible to observe how the greatest poverty ratio is attached to the household which does not possess any of the 5 attributes, $\mu_B(a_1) = 1$, while the lowest poverty ratio refers to the household which possesses only the first attribute, $\mu_B(a_{10}) = 0$.

Table 1

Example of fuzzy set multidimensional analysis of poverty

Attribute Household	1	2	3	4	5	$\mu_B(a_i)$
1	1	1	1	1	1	1.00
2	1	0	0	1	0	0.21
3	1	0	1	0	0	0.08
4	1	1	0	0	0	0.16
5	1	1	1	0	0	0.25
6	1	0	1	1	0	0.30
7	1	1	1	1	0	0.46
8	1	0	1	0	0	0.08
9	1	1	1	0	0	0.25
10	1	0	0	0	0	0.00
$A_j = \sum_{i=1}^{10} x_{ij}$	10	5	7	4	1.00	
$w_j = \log(10/A_j)$	0	0.30	0.15	0.40	1.00	
$\mu_B(X_j)$	1.00	0.50	0.70	0.40	0.10	

From the multidimensional poverty ratio of the **i**-th household $\mu_B(a_i)$, **i** = 1, ..., 10, and from the unidimensional poverty ratio of the **j**-th attribute $\mu_B(X_j)$, **j** = 1, ..., 5, it is straightforward to calculate the multidimensional poverty ratio of the population μ_B:

$$\mu_B = \sum_{i=1}^{10} \mu_B(a_i) \Big/ 10 = (1 + 0.21 + 0.08 + ... + 0)/10 = 0.28$$

$$\mu_B = \sum_{j=1}^{m} \mu_B(X_j)w_j \Big/ \sum_{j=1}^{m} w_j = (1*0 + 0.5*0.3 + ... + 0.1*1)/(0 + 0.3 + ... + 1) = 0.28.$$

3. Data

The data used in this study are from the European Community Household Panel (ECHP), a multidimensional survey on 15 European countries[3] performed every year since 1994. While the main focus of the ECHP is on income and labour market characteristics, it includes also relevant information about demographic characteristics, housing, health, education and training. The key feature of the ECHP is the standardisation and the harmonisation of both its methodology and its data, thus providing comparable information either across countries and across time. For more detailed information on the ECHP see the Eurostat documentation, as some more specialistic paper (Nicoletti and Peracchi, 2002; Peracchi, 2002).

In the following are analysed the data of the 5th wave of the ECPH, related to survey year 1998[4].

The information provided by the ECHP allow to construct the following set of composite indicators on the basis of both household and individual data:

1. Household equivalent total net income, *i.e.*, total household income minus taxes and social contributions (HI100) divided by the corresponding value of the OECD equivalence scale[5] (HD004);

2. Household size (HD001) and dimension of the household residence (HA006);

3. Environmental (HA021) and crime (HA022) problem in the area of the household residence and tenure status (HA023);

4. Heating (HA012) and bath (HA009, HA010) facilities in the household residence;

5. Household type (economical typology, focused on persons aged 65 or more, HD006B) and main activity status of the reference person[6] (PE002);

6. Higher level of education completed by the reference person (PT022);

7. Principal activity performed by the reference person (PE006C, PE001A, PE002).

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[3] They are: Germany, Denmark, The Netherlands, Belgium, Luxembourg, France, United Kingdom, Ireland, Italy, Greece, Spain, Portugal, Austria, Finland, Sweden.

[4] In the 5th wave of the ECHP data related to Luxembourg and Finland are not available.

[5] According to the OECD equivalence scale, the number of adult equivalents in the household is defined as
1+0.7*(HD003-1)+0.5*(HD001-HD003)
where HD003 and HD001 are the number of adults (14 years or more) and the household size respectively.

All indicators but the 6th are composite, the first four are defined on the basis of household data, the 5th by mixing household and individual data, while the last two refer only to individual data; within brackets is indicated the ECHP code.

Notwithstanding the considerable efforts made to ensure to ECPH data completeness and harmonisation, the construction of the 7 previous composite indicators causes the loss of some observations. The main problems are related to national differences: for the Netherlands and France the level of education completed is observed only in very few cases, Germany lacks completely information about environmental and crime problems in the area of the household residence, Sweden is excluded from the analysis due the great number of missing cases in many variables. Furthermore also merging household and individual data lead to a reduction of the sample size.

Table 2

Missing cases by country and variable

Country Var.	D	DK	NL	B	F	UK	IRL	I	GR	SP	P	A
HG001	4	46	0	0	3	0	0	544	0	0	0	0
HD004	76	1	0	6	0	19	0	0	0	1	0	1
HD006b	73	26	182	64	18	0	0	14	0	5	62	0
HI100	6	7	45	26	16	38	21	82	40	58	50	9
HA006	103	3	0	25	273	106	17	5	0	4	1	0
HA021	-	5	0	7	1	15	25	0	0	2	0	6
HA022	-	3	2	1	0	14	3	0	0	1	0	1
HA023	0	0	0	2	0	0	0	0	4	0	0	2
HA009	33	1	1	0	4	0	9	0	0	0	0	5
HA010	13	0	0	5	0	0	0	0	0	0	0	1
HA012	35	0	0	5	5	1	7	0	0	0	0	1
MERGE	19	12	219	74	21	299	27	34	19	50	26	0
PT022	30	7	3	200	-	49	27	1	108	4	1	37
VALID CASES	5570	2401	4511	2461	5525	4455	2593	5891	4040	5360	4576	2897

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[6] The concept of reference person substitutes the notion of head of the household.

Table 2 shows the number of missing observations by the variables included in the construction of the 7 indicators X_j. Even if the construction of the 7 indicators leads to the loss of many observations, the valid cases are still a relevant number and represent a powerful data set for the cross country multidimensional analysis of poverty.

In order to define the degree of membership x_{ij} to the set **B** of the **i**-th household, **i = 1, 2, …, n**, with respect to the **j**-th indicator, **j = 1, 2, …, 7** it is possible to follow a three steps procedure.

First, for each indicator X_j it is necessary to build a table containing the possible simple or composite outcomes of X_j. Second, to each outcome it is associated a value, in the closed unit interval **[0,1]**, which represents, for the **j**-th indicator, the degree of membership to **B** corresponding to the given outcome. Third, for the **i**-th household, **i = 1, 2, …, n,** is observed the outcome with respect to the **j**-th indicator and it is assigned the corresponding degree of membership to **B**, which for the **i**-th household is x_{ij}.

Tables A.1 – A.7 in the Appendix report the degrees of membership assigned to the outcomes of the 7 indicators considered.

Only for Table A.1 it is necessary to add some explanation about the definition of the degrees of membership. First, total net household income, **y**, is transformed into total net equivalent household income, y^e, by using OECD equivalence scale. Second, are calculated the 5th and the 25th percentile of y^e, respectively $y^e_{0.05}$ and $y^e_{0.25}$. Third, the possible outcomes of X_1 are classified as: (i) $y^e < y^e_{0.05}$, (ii) for $y^e_{0.05} \leq y^e_i \leq y^e_{0.25}$ and (iii) $y^e > y^e_{0.25}$. Fourth, to the case (i) $y^e < y^e_{0.05}$ is assigned degree of membership to **B** equal to 1, to the case (iii) $y^e > y^e_{0.25}$ is assigned degree of membership to **B** equal to 0, and to the case (ii) $y^e_{0.05} \leq y^e_i \leq y^e_{0.25}$ is assigned degree of membership to **B** between 0 and 1, assuming a linearly decreasing path **a + b** y^e_i from $y^e_{0.05}$ to $y^e_{0.25}$ with **a + b** $y^e_{0.05}$ **=1, a + b** $y^e_{0.25}$ **= 0**: therefore for $y^e_{0.05} \leq y^e_i \leq y^e_{0.25}$ the degree of membership to **B** is **(**$y^e_{0.25}$ **-** y^e_i**) / (**$y^e_{0.25}$ **-** $y^e_{0.05}$**)**.

The immediate and natural criticism to the degrees of membership outlined in Tables A.1 – A.7 is to consider the choices carried out as arbitrary and subjective. It is certainly a valid criticism, but is also important to observe how the unidimensional framework implies x_{ij} **= 1** for **i = 1, … , n** and **j = 2, …, m**, that is clearly an unlikely proposal: the only correct alternative to Tables A.1 – A.7 is to suggest a different assignation of the x_{ij}, varying their values, but without setting to one all x_{ij}.

In the next paragraph are illustrated and discussed the results related to the fuzzy set poverty ratios obtained for the European countries by means of the 7 indicators considered.

4. Results

The main results of the analysis consist in the construction of unidimensional poverty ratios by attribute, which allow to obtain multidimensional poverty measures. Table 3 reports these results by country. Even if national (social, cultural, geographic, etc.) differences can explain to some extent the different values, which unidimensional poverty ratios show by country, nevertheless their analysis allows powerful insights on the poverty structure in European countries.

Table 3

Unidimensional poverty ratios $\mu_B(X_j)$ by attribute and by country

Country	$\mu_B(X_1)$	$\mu_B(X_2)$	$\mu_B(X_3)$	$\mu_B(X_4)$	$\mu_B(X_5)$	$\mu_B(X_6)$	$\mu_B(X_7)$
D	0.136	0.265	-	0.063	0.093	0.244	0.266
DK	0.132	0.209	0.034	0.023	0.076	0.262	0.193
NL	0.125	0.105	0.062	0.066	0.278	-	0.384
B	0.141	0.189	0.059	0.131	0.081	0.278	0.262
F	0.133	0.242	0.085	0.069	0.084	-	0.268
UK	0.139	0.150	0.047	0.056	0.142	0.235	0.288
IRL	0.133	0.176	0.044	0.110	0.206	0.359	0.403
I	0.128	0.365	0.071	0.094	0.099	0.401	0.222
GR	0.139	0.468	0.062	0.235	0.072	0.351	0.269
SP	0.134	0.243	0.044	0.326	0.127	0.357	0.324
P	0.131	0.343	0.087	0.505	0.070	0.438	0.287
A	0.130	0.239	0.030	0.102	0.129	0.303	0.326

The poverty ratios $\mu_B(X_1)$, related to the first income-based indicator, are quite stable across countries, ranging from 0.125 of the Netherlands to 0.141 of Belgium. A quite more strong variability is detectable in the poverty ratios for the second indicator, which considers the dimension of the household residence: in all countries, with the exception of Denmark, the Netherlands, Belgium, United Kingdom and Ireland, $\mu_B(X_2)$ assumes high values, with the maximum 0.468 for Greece. Environmental and crime problems, considered in $\mu_B(X_3)$, seem to only slightly affect European households, and also heating and bath facilities are common and widespread in all countries, but in Greece, Spain and Portugal, where $\mu_B(X_4)$ is quite high. Poverty ratios for the 5th indicator, concerning household type and activity status, reach their highest values

for the Netherlands, United Kingdom and Ireland, while they assume the lowest values for Portugal and Greece. The level of education (X_6) seems to represent a common factor of poverty in all the countries and in particular for Portugal and Italy. Also the activity performed by the reference person (X_7) seems to be a common source of social exclusion, with its highest values for Ireland and the Netherlands.

Unidimensional poverty ratios concur to the multidimensional measure together with the weights w_j which are reported in Table 4. In the 12 analysed countries, the highest w_j is, on average, w_3, indicating how living in an area with environmental and crime problems strongly influences the poverty status of an household. In all the countries but Denmark, France and Portugal, w_3 is the highest weight in the multidimensional poverty ratio. From the other side, the lowest weight is, on average, w_6, signalling how educational level of the reference person is not possessed by many of the households and how the degrees of membership x_{i6}, $i = 1, \ldots, n$, are generally high. Furthermore, it is interesting to observe how the weights attached to the income-based indicator X_1 are quite stable among the countries, ranging from 1.96 of Belgium to 2.08 of the Netherlands.

Table 4

Weight w_j attached to the j-th attribute by country

Country	w_1	w_2	w_3	w_4	w_5	w_6	w_7
D	1.99	1.33	-	2.77	2.38	1.41	1.36
DK	2.03	1.57	3.39	3.76	2.58	1.34	1.64
NL	2.08	2.26	2.78	2.72	1.28	-	0.96
B	1.96	1.66	2.83	2.03	2.51	1.28	1.34
F	2.02	1.42	2.46	2.67	2.48	-	1.32
UK	1.97	1.90	3.06	2.89	1.95	1.45	1.25
IRL	2.01	1.74	3.11	2.21	1.58	1.02	0.91
I	2.05	1.01	2.64	2.37	2.32	0.91	1.50
GR	1.97	0.76	2.77	1.45	2.63	1.05	1.31
SP	2.01	1.42	3.12	1.12	2.07	1.03	1.13
P	2.03	1.07	2.44	0.68	2.66	0.83	1.25
A	2.04	1.43	3.50	2.29	2.05	1.19	1.12

From the unidimensional poverty ratios $\mu_B(X_j)$ and from the weights w_j, it is possible to obtain the multidimensional poverty ratio: Table 5 reports the quantities $\mu_B(X_j)w_j \left/ \sum_{j=1}^{m}\mu_B(X_j)w_j \right.$, $j=1,\ldots,7$, i.e. the contribution to the multidimensional poverty ratio of the 7 indicators used in the analysis.

The greatest contribution to multidimensional poverty ratio is given, on average, by the 7th indicator, related to the principal activity of the reference person, but it is possible to distinguish a wider set of indicators, represented by X_7, X_6 and X_2, which are the main factors of poverty.

In the 12 European countries the structure of poverty is therefore made by education and activity of the reference person and by the dimension of the household residence.

The income-based indicator X_1 gives, on average, a contribution of about 14% to the overall measure, while the influence of X_4 (heating and bath facilities) and X_5 (household type) is around 13%. The indicator which less contributes to μ_B is the third, for environmental and crime problems in the area of residence of the household.

Table 5

Contribution to the multidimensional poverty ratio by attribute and by country

(per cent values)

Country	X_1	X_2	X_3	X_4	X_5	X_6	X_7
D	15.69	20.43	-	10.12	12.83	19.95	20.97
DK	16.13	19.75	6.94	5.20	11.80	21.13	19.05
NL	16.52	15.08	10.95	11.41	22.61	-	23.43
B	14.30	16.23	8.64	13.76	10.52	18.41	18.16
F	17.14	21.92	13.34	11.75	13.29	-	22.57
UK	14.86	15.47	7.81	8.79	15.03	18.50	19.54
IRL	13.29	15.22	6.80	12.08	16.18	18.20	18.23
I	13.33	18.72	9.52	11.32	11.67	18.53	16.91
GR	13.28	17.71	8.33	16.53	9.18	17.88	17.03
SP	12.74	16.33	6.50	17.28	12.44	17.40	17.32
P	12.68	17.50	10.12	16.37	8.88	17.34	17.11
A	13.70	17.66	5.42	12.07	13.66	18.63	18.86

Finally, Table 6 reports the multidimensional poverty ratio for the 12 European countries analyzed in this study.

Table 6

Multidimensional poverty ratios μ_B by country

Country	D	DK	NL	B	F	UK	IRL	I	GR	SP	P	A
μ_B	0.152	0.102	0.130	0.142	0.127	0.127	0.160	0.154	0.172	0.177	0.191	0.142

The lowest diffusion of poverty occurs in Denmark, followed by France and the United Kingdom, while the maximum of poverty refers to Portugal, Spain and Greece. It is also interesting to note how, comparing Table 6 to the first column of Table 3, the top as well as the bottom of the list change considerably: by taking into account only the equivalent income Belgium, United Kingdom and Greece are the poorest countries, while the lowest diffusion of poverty occurs in the Netherlands, Italy and Austria. Only Greece maintains, in the two contexts, the same position at the bottom of the list, while United Kingdom shifts from the bottom, on the basis only of the equivalent income, to the top in the multidimensional context.

5. Conclusion

The multidimensional approach offers fuzzy set poverty ratios for: (*i*) each household; (*ii*) the population of households; and (*iii*) the population of households by attribute. These ratios accurately represent the state of poverty, social exclusion and deprivation of the poor, and clearly identify the causes of poverty by order of importance.

The information provided by the European Community Household Panel allow to obtain a set of 7 composite indicators for 12 European countries. Among these indicators the main factors of poverty are identified in the education and the activity of the reference person and in the dimension of the household residence. It is quite interesting to observe the great stability of poverty structure among European countries, which share the same problems in the field of social exclusion. Only for Spain an high source of poverty is detectable in heating and bath facilities of the household residence, while in the Netherlands and Ireland the fifth indicator (household structure and activity of the reference person) seems to be a relevant element in poverty condition.

By identifying the poverty structure, the multidimensional approach can be extremely useful in order to implement socio-economic actions to reduce poverty diffusion: on the basis of the previous results, these actions should be addressed to reform educational system and labour market and to improve housing conditions.

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Appendix

Table A.1

Household equivalent total net income (HI100, HD004)

	Degree of membership
$y^e_i < y^e_{0.05}$	1
$y^e_{0.05} \leq y^e_i \leq y^e_{0.25}$	$b\, y^e_i + a$
$y^e_i > y^e_{0.25}$	0

$y^e_{0.05} = 5^{th}$ percentile of y^e, $y^e_{0.25} = 25^{th}$ percentile of y^e and y^e is the household equivalent total net income

Table A.2

Household size (HD001) and number of rooms without kitchen (HA006)

Household size	N. of rooms	Degree of membership
1	1	1
1	2	0.25
1	> 2	0
2	1	1
2	2	0.5
2	3	0.25
2	> 3	0
3	1-2	1
3	3	0.5
3	4	0.25
3	> 4	0
4	1-3	1
4	4	0.5
4	5	0.25
4	> 5	0
≥ 5	1-3	1
≥ 5	4-5	0.5
≥ 5	6	0.25
≥ 5	> 6	0

Table A.3

Environmental (HA021) or crime (HA022) problem and tenure status (HA023)

Tenure status	Problems in the area of the household residence		
	Neither environmental nor crime	Environmental or crime	Both environmental and crime
Owner	0	0	0.5
Paying rent	0	0.3	1
Rent-free	0	0.3	1

Table A.4

Bath/shower and flushing toilet (HA009, HA010) and heating (HA012)

Heating	Neither bath/shower nor flushing toilet	Bath/shower or flushing toilet	Both bath/shower and flushing toilet
Yes	0	0.5	1
No	0.5	1	1

Table A.5

Household type, economical typology, focused on persons aged 65 or more (HD006B) and main activity status of the reference person (PE002)

Household type	Main activity of the reference person		
	Normally working (15+ hours/week) or retired	Unemployed	Inactive
1-person householder 65	0	1	1
2 adults both under 65	0	0.25	0.25
2 adults with one aged 65 or more	0	0.75	0.75
2 adults with both aged 65 or more	0	1	1
Other household without children	0	0.5	0.5
Single parents with 1 or more child	0	1	1
2 adults with 1 child	0	0.5	0.5
2 adults with 2 children	0	0.75	0.75
2 adults with 3 or more children	0	1	1
Other household with children	0	0.5	0.5

Table A.6

Higher level of education completed by the reference person (PT022)

	Degree of membership
Recognised third level education (ISCED 5-7)	0
Second stage of secondary level education (ISCED 3)	0.25
Less than second stage of secondary education (ISCED 0-2)	0.5

Table A.7

Principal activity performed by the reference person (PE006C, PE001A, PE002)

	Degree of membership
Legislators, senior officials and managers	0
Professionals	0
Technicians and associate professional	0
Clerks	0.2
Service, shop and market sales workers	0.3
Skilled agricultural and fishery workers	0.3
Craft and related trades workers	0.3
Plant and machine operators and assemblers	0.3
Elementary occupations	0.3
Retired	0.2
Unemployed	1
Inactive	1
Miscellaneous occupations	0

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