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Comparing non-monetary deprivation and inequality levels in the EU countries*

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Abstract

This paper analyzes the links between non-monetary deprivation and inequalities in poverty levels in Europe. Non-monetary deprivation is defined as an enforced lack of a combination of items depicting material living conditions, such as housing conditions, possession of durable goods and capacity to afford basic requirements. The analytical tools selected to compare the deprivation and inequality levels are the direct indicators of deprivation based on the fuzzy set theory and the Gini Index of Poverty (GIP). These two complementary indicators allow respectively to identify the principal characteristics of non-monetary deprivation and the determinants of the inequalities in poverty. The study makes use of data for 22 European Countries based on the 2007 wave of the EU-SILC survey.

Keywords: Multidimensional Poverty; Inequalities in poverty; EU-SILC; EU countries; Fuzzy set theory

JEL Classification: D31, D63, I32

1 Introduction

The last few decades have witnessed a growing interest in the measurement of poverty and inequality as important field of public economics. The main developments aimed to find out the principal determinants that cause poverty and inequality intensities.

Some researches point out a link between poverty and inequality. For example, on the one hand, Son (2003) provides a new poverty decomposition in which it is possible to explain poverty changes by inequality variations. On the other hand, the famous poverty Sen index can be explained by several components. More specifically, as noted by Xu & Osberg (2001), the Sen index is easily understandable precisely because of its decomposability into three measures: incidence (the poverty rate), depth (poverty gap), and inequality (1 plus the Gini index of poverty gaps). Therefore as the Sen index depends on the Gini coefficient, it relies on inequality. But, "inequality of what"? The Sen ratio captures the inequalities of poverty gaps, i.e., the inequalities of depth between each poor individual, but it does not offer any information on the determinants of the inequalities of poverty. Mussard & Pi Alperin (2007) proposed then the Gini Index of Poverty (GIP) which is a synthesis between multidimensional poverty and multivariate inequality. It provides a synthetic decomposition of the Gini index of multidimensional poverty gaps based on Dagum's seminal works on inequality (1997) and poverty (Dagum & Costa, 2004).

The aim of this paper is to apply the direct indicators of deprivation based on the fuzzy set theory and the GIP index to analyze and compare the non-monetary deprivation and the inequalities in poverty levels of 22 European Union countries using EU-SILC 2007. Non-monetary deprivation is defined as an enforced lack of a combination of items depicting material living conditions, such as housing conditions, possession of durable goods and capacity to afford basic requirements. The knowledge of the links between poverty and inequality levels would allow one to alternatively settle the poverty reduction policies targets in terms of decrease of poverty levels or in terms of reduction of inequalities in multidimensional deprivation.

This article is organized as follows. Section 2 presents the basic notions of the multidimensional approach to poverty based on the fuzzy set theory. Section 3 proposes a brief description of the GIP index. Section 4 exposes the principal characteristics of the EU-SILC database, followed by the application of the two selected methodologies to the measurement of the non-monetary deprivation and inequalities in poverty levels of 22 European countries.

2 Individual indicators of deprivation: the fuzzy set technique

Direct measures of deprivation summarize multiple directly observable indicators of living conditions (such as the possession of particular goods, housing conditions, the absence of particular financial difficulties, etc.).

The technique adopted in this paper to aggregate the multiple dimensions is referred to as the ‘fuzzy set approach’. Lets briefly summarize the basic concepts related to the multidimensional analysis of poverty in the framework of the fuzzy set theory.¹

Let $I = \{1, \dots, i, \dots, N\}$ be the population object of research, where N is the cardinality of the set I , and $X = \{X_1, \dots, X_j, \dots, X_M\}$ be the vector of attributes. Then B is a fuzzy sub-set of households in I such that any household $i \in B$ presents some degree of deprivation in at least one of the M attributes selected to study multidimensional deprivation.

The degree of membership x_{ij} is defined as the quantity of the j -th attribute ($j=1, \dots, M$) possessed by the i -th household. In particular: (i) $x_{ij} = 1$, if the i -th household is fully deprived in the j -th attribute; (ii) $x_{ij} = 0$, if the i -th household possesses the j -th attribute; and (iii) $0 < x_{ij} < 1$, if the i -th household possesses the j -th attribute with an intensity belonging to the open interval $(0,1)$.

The degree of membership of the i -th household to B is defined as a weighted average of x_{ij} :

$$\phi_i = \frac{\sum_{j=1}^M x_{ij} w_j}{\sum_{j=1}^M w_j}; 0 \leq \phi_i \leq 1 \quad (1)$$

The Equation 1 yields the multidimensional deprivation index of the i -th household. It is a weighted function of the M attributes, where w_j is the weight attached to the j -th attribute. In particular: (i) $\phi_i = 0$ if i is completely non-poor in the M attributes; (ii) $\phi_i = 1$ if i is totally poor in the M attributes; and (iii) $0 < \phi_i < 1$ if i is partially or totally deprived in some attributes but not fully deprived in all of them.

The weight w_j attached to the j -th attribute used in this paper was proposed by Betti & Verma (1998). It takes into account the intensity of deprivation of X_j , and it limits the influence of those indicators that are highly correlated. They defined the weight of any attribute as follows:

$$w_j = w_j^a * w_j^b \quad (2)$$

¹See for instance Cerioli & Zani (1990) who developed the first multidimensional method based on fuzzy set theory.

where w_j^a only depends on the distribution of the j -th attribute, whereas w_j^b depends on the correlation between X_j and the others items.

In particular, w_j^a is determined by the coefficient of variation of the attributed concerned:

$$w_j^a = \left[\frac{\sum_{i=1}^N (x_{ij} - \bar{x}_j)^2}{N} \right]^{1/2} \cdot \left[\frac{\sum_{i=1}^N x_{ij}}{N} \right]^{-1} \quad (3)$$

The weights w_j^b are computed as follows:

$$w_j^b = \left[1 + \sum_{j'=1}^M \rho_{j,j'} | \rho_{j,j'} < \rho_H \right]^{-1} \cdot \left[\sum_{j'=1}^M \rho_{j,j'} | \rho_{j,j'} \geq \rho_H \right]^{-1} \quad (4)$$

where $\rho_{j,j'}$ is the correlation between the two indicators. In the first factor of the equation, the sum is taken over all the indicators whose correlation with the j -th attribute is less than a certain value ρ_H (determined by dividing the ordered set of correlation values at the point of the largest gap). The sum in the second term always includes the case $j' = j$, since the correlation coefficient is 1.

Following the decomposition techniques it is possible to calculate the contribution of each attribute to the multidimensional deprivation index for each one of the N households:²

$$\phi_i = \sum_{j=1}^M z_{ij} \quad (5)$$

where:

$$z_{ij} = \frac{x_{ij} w_j}{\sum_{j=1}^M w_j} \quad (6)$$

that is the contribution level of the j -th attribute to the i -th household's global deprivation level.

3 Inequalities in multidimensional deprivation

The literature offers many ways to deal with inequalities in poverty. The most common approach was introduced by Sen (1976) with the Gini index of poverty gap ratio, which is a fundamental component of Sen's poverty index. The poverty gap ratio of the i -th household is defined as:

$$\beta_i = \begin{cases} \frac{y-v_i}{y} & \text{for all } y > v_i \\ 0 & \text{otherwise} \end{cases}$$

where y is the poverty line and v_i a variable such as income, consumption, etc. Then, β_i reflects the difficulty of the i -th household to reach a standard level of life.

²See Mussard & Pi Alperin (2007) who further developed the study of multidimensional poverty using fuzzy sets by introducing a mixture of decomposition analysis.

Applying the well-known Gini index on the vector $\vec{\beta} = (\beta_1, \dots, \beta_i, \dots, \beta_N)$, it is possible to implement the Gini index of poverty gap ratios $G(\vec{\beta})$. The problem is that $G(\vec{\beta})$ does not offer suitable information on the determinants of inequalities. Are the inequalities in poverty generated by education, health, or consumption? A simple way to deal with this type of questions is to gauge the poverty gap ratio related to each dimension X_j :

$$\beta_{ij} = \begin{cases} \frac{y_j - v_{ij}}{y_j} & \text{for all } y_j > v_{ij} \\ 0 & \text{otherwise} \end{cases}$$

where β_{ij} is the poverty gap ratio of the i -th household associated with the j -th attribute X_j . Afterwards, it is possible to compute the Gini index of these poverty gap ratios $G(\vec{\beta}_j)$ where $\vec{\beta}_j = (\beta_{1j}, \dots, \beta_{ij}, \dots, \beta_{Nj})$. But another problem arises. Indeed, $G(\vec{\beta}_j)$ produces a wide range of poverty inequality indexes, but there is no link between them. Therefore, it is not possible to evaluate the contribution of one particular attribute X_j to the global index of inequality.

A solution was proposed by Mussard & Pi Alperin (2007). In Equation 6 the M attributes of poverty are linearly aggregated in the so-called contributions z_{ij} . The authors presented the Gini index that gauges the inequalities in multidimensional deprivation. It can be expressed as:

$$GIP(\phi) = \frac{\sum_{i=1}^N \sum_{r=1}^N |\phi_i - \phi_r|}{2N^2\mu} \quad (7)$$

where ϕ_r stands for the poverty index of the r -th household and μ stands for the arithmetic mean of the household's poverty index ϕ_i for all i . Given that each household poverty index is linearly desegregated (see Equation 6), it is possible to compute the following equation:³

$$GIP(\phi) = \frac{\sum_{i=1}^N \sum_{r=1}^N \left| \sum_{j=1}^M z_{ij} - \sum_{j=1}^M z_{rj} \right|}{2N^2\mu} \quad (8)$$

where z_{ij} is the contribution of the j th dimension to ϕ_i . Let $z_{ir,j}^*$ be the operator that takes the j -th contribution of the minimum between the poverty indexes ϕ_i and ϕ_r . This entails the attribute decomposition of the Gini index of poverty:

$$GIP(\phi) = \sum_{j=1}^M \left[\frac{\sum_{i=1}^N \sum_{r=1}^N (z_{ij} + z_{rj} - 2z_{ir,j}^*)}{2N^2\mu} \right] \quad (9)$$

Consequently, the differences in poverty are determined by the M explanatory attributes X_j .

³See the methodology proposed by Mussard (2004)

4 Empirical Study: The European Union countries

4.1 Database

EU-SILC (*European Union Statistics on Income and Living Conditions*) is an instrument aiming at collecting comparable cross sectional and longitudinal multidimensional micro data on income poverty and social exclusion. The EU-SILC survey was developed to be a flexible yet comparable instrument between the EU countries. It covers data and data sources of various types depending on the country: cross-sectional and longitudinal; household-level and person-level; economic and social; from new and existing national surveys, registers or other sources.

This study deals with the cross-sectional data of the EU-SILC 2007. Deprivation and inequality indexes were calculated for 22 countries: Austria (AT), Belgium (BE), France (FR), Portugal (PT), Finland (FI), Poland (PL), Lithuania (LT), Latvia (LV), Slovenia (SK), Estonia (EE), Czech Republic (CZ), Spain (ES), Island (IS), Ireland (IE), United Kingdom (UK), Italy (IT), Netherlands (NL), Cyprus (CY), Luxembourg (LU), Hungary (HU), Norway (NO), Greece (GR). The analysis will be conducted at the household level.⁴

4.2 The selection of items

In addition to the level of monetary income, the standard of living of households, or individuals, can be studied looking at the non-monetary deprivation dimensions such as housing conditions, possession of durable goods, the general financial situation, and others.

The two principal criteria that guided the selection of the non-monetary dimensions in this paper, are not only based on a group of items adopted in various European publications, but also by the information provided by the EU-SILC 2007 database. Then, total non-monetary deprivation can be described by a host of indicators related to the enforced lack of a combination of items depicting material living conditions: economic strain deprivation, enforced lack of durable goods and housing facilities and deterioration.⁵

The 'economic strain' dimension concerns the lack of ability to afford most basic requirements. This dimension regroups:

- the ability to make ends meet;

⁴Table 6, in Appendix 1, shows the sample sizes by country.

⁵Appendix 2 describes the construction of the selected attributes.

- the ability to keep home adequately warm (household's principal accommodation);

- inability to meet scheduled payment;
- paying for a week annual holiday away from home;
- eating meat or fish every second day;
- capacity to face unexpected expenses.

In EU-SILC, questions on durable goods enable distinguishing between lack of items (due to choice) and enforced lack of items (people would like to possess the items but cannot afford them). Only this latter group was considered as reflecting 'deprivation', in order to exclude lifestyle preferences from the concept of deprivation. In doing so, we focus on items whose absence is attributed to limited resources rather than differences in taste and constraints such as ill health, location or others. The 'enforced lack of durable goods' dimension regroups:

- to have a computer;
- to have a washing machine;
- to have a personal car or van.

Finally, 'housing' dimension is related to the absence of housing facilities (so basic that one can presume all households would wish to have them) and serious problems with accommodation. This dimension regroups:

- no indoor flushing toilet for sole use of the household;
- no bath or shower;
- leaking roof, damp walls, floors, foundation or rot in windows frames;
- lack of space.

In the following subsection, we expose the principal results from the application of the two chosen methodologies to study the links between non-monetary deprivation and inequality in poverty levels in the European Countries.

4.3 Results

A first study compares the global deprivation level and the deprivation level by dimension ('economic strain', 'enforced lack of durable goods' and 'housing') among the 22 European Union countries. Table 1 presents three kinds of information for each country: (i) the deprivation index by dimension; (ii) the contribution level of each dimension to global deprivation; and (iii) the global non-monetary deprivation.

The richest countries (in terms of non-monetary deprivation) are the Netherlands, with only 1,44% of their global population affected by some degree of deprivation, followed by Norway (1,70%), Luxembourg (3,25%) and Iceland (3,47%). The poorest are four recent European Community countries, Latvia (20,41%), Poland (15,43%), Hungary (14,41%) and Lithuania (14,22%).

Table 1. *Multidimensional deprivation by dimension*

Country	Dim. 1	Contr. 1*	Dim. 2	Contr. 2	Dim. 3	Contr. 3	Total**
Austria	0,0779	(0,6267)	0,0286	(0,2297)	0,0179	(0,1436)	0,0414
Belgium	0,1220	(0,5457)	0,0713	(0,3189)	0,0303	(0,1354)	0,0745
Cyprus	0,2233	(0,8342)	0,0339	(0,1267)	0,0105	(0,0391)	0,0892
Czech Rep.	0,1220	(0,6501)	0,0435	(0,2318)	0,0222	(0,1181)	0,0625
Estonia	0,1058	(0,3753)	0,0812	(0,2882)	0,0948	(0,3365)	0,0939
Spain	0,0825	(0,7576)	0,0181	(0,1663)	0,0083	(0,0762)	0,0363
Finland	0,0539	(0,4891)	0,0483	(0,4384)	0,0080	(0,0725)	0,0367
France	0,1151	(0,7029)	0,0347	(0,2119)	0,0140	(0,0852)	0,0546
Greece	0,1979	(0,5991)	0,1144	(0,3463)	0,0180	(0,0545)	0,1101
Hungary	0,2711	(0,6272)	0,0931	(0,2154)	0,0680	(0,1574)	0,1441
Ireland	0,1005	(0,6053)	0,0541	(0,3260)	0,0114	(0,0687)	0,0554
Island	0,0949	(0,9106)	0,0038	(0,0364)	0,0055	(0,0530)	0,0347
Italy	0,1822	(0,7931)	0,0327	(0,1423)	0,0148	(0,0646)	0,0766
Lithuania	0,2313	(0,5422)	0,1198	(0,2808)	0,0755	(0,1770)	0,1422
Luxembourg	0,0540	(0,5533)	0,0243	(0,2492)	0,0193	(0,1976)	0,0325
Latvia	0,3005	(0,4908)	0,1925	(0,3144)	0,1193	(0,1948)	0,2041
Netherlands	0,0331	(0,7673)	0,0072	(0,1663)	0,0029	(0,0663)	0,0144
Norway	0,0360	(0,7061)	0,0112	(0,2206)	0,0037	(0,0733)	0,0170
Poland	0,2908	(0,6283)	0,0768	(0,1659)	0,0952	(0,2058)	0,1543
Portugal	0,1364	(0,6001)	0,0651	(0,2862)	0,0259	(0,1137)	0,0758
Slovenia	0,1437	(0,6561)	0,0592	(0,2701)	0,0161	(0,0737)	0,0730
U.Kingdom	0,0976	(0,7706)	0,0247	(0,1947)	0,0044	(0,0347)	0,0422

* Contribution of the dimension to global deprivation index

** Global deprivation index.

We have estimated then the individual deprivation indicators for each dimension to identify the main characteristics of the poor households. Among these three dimensions, the 'economic strain' appears as the most important characteristic of deprivation for all countries followed by the 'enforced lack of durable goods' (except for Estonia, Island and Poland). However, the intensity of the deprivation withing each country is different. In Latvia, for example, 30,05% of the population have some degree of difficulties to afford most basic requirements, whereas only 3,31% of households living in Netherlands are in the same situation.

The measurement of the contribution levels allows to identify the most explicative dimensions to global deprivation. Indeed, the contributions are useful since they provide suitable statistical information to decision makers as it appears obvious to reduce poverty for the majority of the population which is in need. We found the same results as previously, that is for all countries the dimension 'economic strain' has the most important contribution level (but with different intensities), followed by the 'enforced lack of durable goods'. Both dimensions explain in average 88,45% of total deprivation.

Figures 1 and 2 show for each country the intensity of deprivation in each dimension and their contribution level to global deprivation, respectively. In both Figures, countries are ordered from poorest to richest in terms of non-monetary deprivation.

We can notice that the intensity of deprivation of each dimension decreases as the total deprivation level decreases (see Figure 1) while the contribution levels do not depend on global deprivation levels (see Figure 2).

Figure 1: The intensity levels

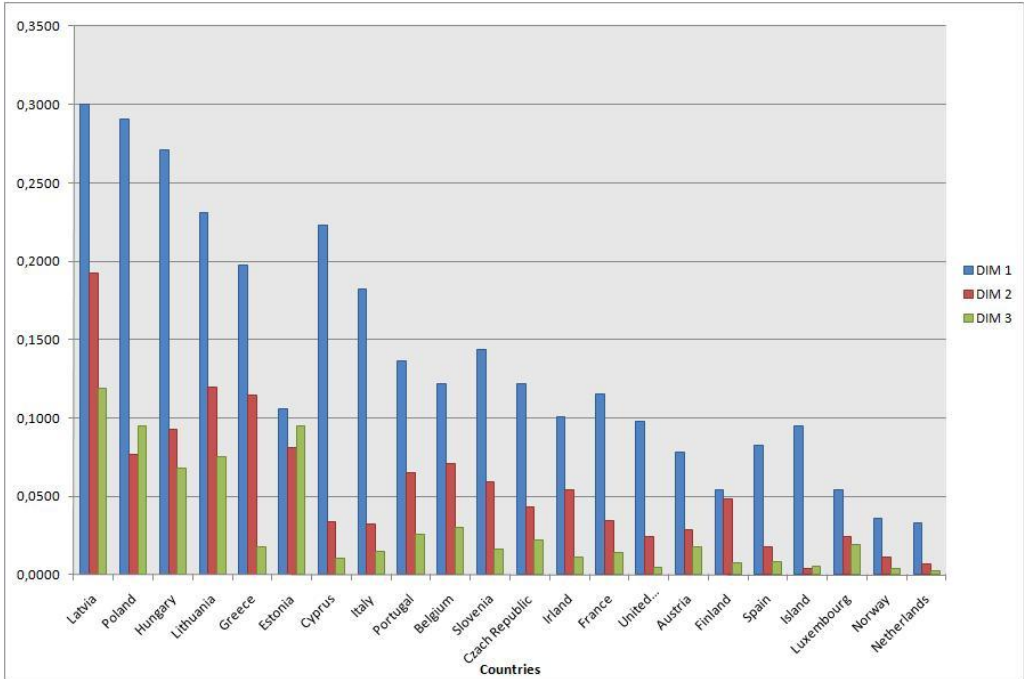
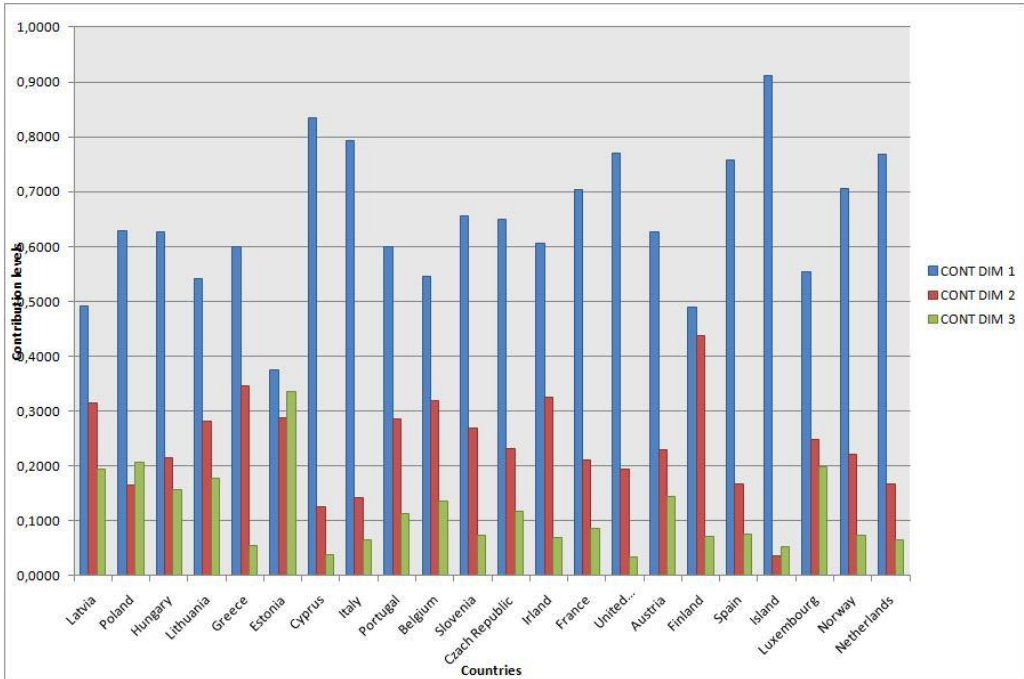


Figure 2: The contribution levels



We propose then a more detailed study to analyze which are the most affected

items withing each dimension (results are shown in Tables 2, 3 and 4). Concerning the dimension 'economic strain', the most explicative items are the 'capacity to face unexpected expenses' (for AT, GR, IE, IS, LU, FI, FR, NL and UK), 'paying for a week annual holiday' (for EE, ES, HU, IT and LT); 'eating meat or fish every second day' (for LV, SK and CZ); 'ability to keep home adequately warm' (for BE, CY and PT); and the 'inability to meet scheduled payment' (for NO and PL). Finally, the 'ability to make ends meet' does not appears as one of the most important item withing this dimension.

Table 2. Unidimensional deprivation indexes

Items	Austria	Belgium	Cyprus	Czech Rep.	Estonia	Spain	Finland
Ends-meet	0,3266 (5,07)*	0,3333 (5,94)	0,5825 (9,67)	0,4747 (6,46)	0,3363 (3,93)	0,4710 (9,84)	0,2605 (5,91)
Warm	0,0299 (7,20)	0,1670 (12,75)	0,3017 (16,57)	0,0724 (11,26)	0,0457 (5,18)	0,0684 (13,29)	0,0132 (5,92)
Inability	0,0305 (7,11)	0,0648 (8,39)	0,1980 (14,67)	0,0443 (9,25)	0,0611 (5,91)	0,0806 (13,80)	0,0735 (8,24)
Holiday	0,2629 (9,01)	0,2953 (9,79)	0,4951 (15,40)	0,3645 (12,28)	0,5018 (9,95)	0,3631 (15,85)	0,1793 (9,79)
Eating	0,0969 (9,60)	0,0526 (8,34)	0,0727 (11,89)	0,1393 (12,89)	0,0626 (4,84)	0,0190 (8,41)	0,0285 (6,60)
Expenses	0,3295 (9,64)	0,2963 (9,35)	0,4569 (15,23)	0,4439 (12,87)	0,2142 (7,73)	0,3217 (14,58)	0,3246 (12,44)
Computer	0,0632 (8,53)	0,0961 (11,79)	0,1047 (6,44)	0,1100 (9,06)	0,0878 (9,39)	0,1038 (8,51)	0,0472 (14,21)
Machine	0,0073 (5,44)	0,0348 (7,56)	0,0111 (2,33)	0,0092 (3,50)	0,0433 (7,27)	0,0021 (1,49)	0,0244 (10,25)
Car	0,0734 (8,87)	0,1170 (12,55)	0,0382 (3,90)	0,1533 (10,63)	0,1516 (12,16)	0,0597 (6,62)	0,1044 (19,3)
Toilet	0,0186 (5,12)	0,0090 (1,47)	0,0074 (4,00)	0,0081 (1,29)	0,1336 (7,66)	0,0018 (0,45)	0,0053 (1,02)
Bath	0,0108 (4,05)	0,0121 (6,68)	0,0086 (0,43)	0,0077 (1,26)	0,1817 (8,14)	0,0034 (0,57)	0,0094 (1,30)
Roof	0,0950 (8,53)	0,1623 (6,81)	0,1970 (2,92)	0,1420 (7,11)	0,2022 (12,17)	0,1905 (6,22)	0,0462 (4,16)
Size	0,0031 (1,16)	0,0347 (3,58)	0,0006 (0,16)	0,0134 (2,16)	0,0295 (5,68)	0,0008 (0,38)	0,0016 (0,77)

* Contribution of the j th attribute to global deprivation

The item with the most important contribution to explain the deprivation level of the dimension 'enforced lack of durable goods' is 'to have a computer' for CY, ES, GR, IT, LU, FR and PT and 'do not have a personal car' for the other countries.

Finally, for the 'housing' dimension, the item 'leaking roof, damp walls, floors, foundation or rot in windows frames' represents the item with the highest contribution level in all the studied countries.

Table 3. Unidimensional deprivation indexes - continuation

Items	France	Greece	Hungary	Ireland	Island	Italy	Lithuania
Ends-meet	0,4099 (6,81)*	0,6310 (7,50)	0,6031 (5,34)	0,4425 (7,35)	0,2875 (9,58)	0,6185 (7,50)	0,4716 (4,92)
Warm	0,0533 (11,50)	0,1388 (10,28)	0,1226 (9,68)	0,0499 (9,00)	0,0930 (2,49)	0,1307 (14,25)	0,2314 (10,32)
Inability	0,0868 (12,34)	0,2426 (10,76)	0,1876 (10,34)	0,0930 (10,29)	0,0688 (14,83)	0,1416 (14,33)	0,1255 (8,36)
Holiday	0,3311 (13,73)	0,4625 (11,66)	0,6377 (11,83)	0,2626 (11,40)	0,1485 (13,37)	0,4602 (15,32)	0,4471 (11,31)
Eating	0,0752 (11,97)	0,0666 (7,24)	0,2561 (11,02)	0,0394 (8,77)	0,0375 (11,38)	0,9140 (13,29)	0,1569 (8,64)
Expenses	0,3888 (13,93)	0,3231 (12,49)	0,6859 (11,72)	0,4820 (13,73)	0,2884 (18,41)	0,4280 (14,61)	0,3294 (10,67)
Computer	0,0862 (9,83)	0,1724 (14,44)	0,1677 (7,60)	0,1090 (12,20)	0,0113 (1,49)	0,0939 (6,74)	0,1294 (9,11)
Machine	0,0120 (4,07)	0,0505 (7,52)	0,0263 (3,75)	0,0139 (5,34)	0,0005 (0,33)	0,0097 (2,55)	0,0824 (8,05)
Car	0,0463 (7,30)	0,1808 (12,68)	0,2749 (9,27)	0,1411 (15,06)	0,0171 (1,83)	0,0487 (4,94)	0,1647 (10,92)
Toilet	0,0073 (0,95)	0,0133 (0,90)	0,1524 (5,88)	0,0072 (0,75)	0,0050 (0,77)	0,0025 (0,47)	0,0784 (3,34)
Bath	0,0063 (0,91)	0,0084 (0,71)	0,0397 (2,90)	0,0082 (0,83)	0,0005 (0,26)	0,0049 (0,63)	0,0902 (3,48)
Roof	0,1452 (5,93)	0,1437 (3,17)	0,2481 (7,59)	0,1671 (5,03)	0,1083 (3,76)	0,2435 (4,53)	0,1922 (6,41)
Size	0,0025 (0,73)	0,0053 (0,68)	0,0387 (3,07)	0,0007 (0,26)	0,0027 (0,50)	0,0083 (0,83)	0,0373 (4,47)

* Contribution of the j th attribute to global deprivation

As we are doing a comparative study for several countries, we must consider the fact that some items could be not significant to study non-monetary deprivation whereas for other countries they are. For example, this is the case of the item 'to have a computer'. In Netherlands only 1,54% of the population do not have a computer because they can not afford it. Then, it can be considered as a non-significative item in this country. Whereas the same item in Latvia represents 23,47% of the population.

Luxembourg is one of the richest countries with 3,25% of its global population affected by some degree of non-monetary deprivation. This level can be explained at 55,33% by the dimension 'economic strain', at 24,92% by the dimension 'enforced lack of durable goods' and at 19,75% by the 'housing' dimension. Within this dimensions we have identified the principals affected attributes. They are the 'capacity to face unexpected expenses' (which explains 14,60% of global deprivation), 'do not have a computer' which have a contribution level of 10,87%, and finally, the 'leaking roof, dam walls, or rot in windows' explaining 12,53% of total non-monetary deprivation.

Table 4. Unidimensional deprivation indexes - continuation

Items	Luxembourg	Latvia	Netherlands	Norway	Poland	Portugal	Slovenia	U.Kingdom
Ends-meet	0,2601 (7,21)*	0,6050 (4,40)	0,1599 (12,65)	0,1912 (9,76)	0,5283 (6,69)	0,5774 (6,43)	0,5166 (6,74)	0,3601 (9,92)
Warm	0,0124 (5,37)	0,2331 (8,92)	0,0125 (9,06)	0,0087 (7,70)	0,2247 (11,00)	0,4218 (13,37)	0,0449 (8,98)	0,0528 (13,22)
Inability	0,0470 (9,96)	0,1266 (8,18)	0,0201 (10,52)	0,0698 (16,64)	0,1847 (11,63)	0,0539 (8,54)	0,0564 (7,94)	0,0709 (12,94)
Holiday	0,1694 (10,76)	0,6350 (9,31)	0,1111 (15,35)	0,0560 (13,27)	0,5300 (11,35)	0,6071 (12,20)	0,5114 (13,86)	0,2576 (13,78)
Eating	0,0305 (7,43)	0,3744 (9,51)	0,0134 (9,84)	0,0234 (10,12)	0,2182 (10,62)	0,0483 (,21)	0,3146 (14,28)	0,0513 (11,77)
Expenses	0,3241 (14,60)	0,6688 (8,76)	0,1654 (19,31)	0,1124 (13,12)	0,5384 (11,53)	0,2330 (11,25)	0,4567 (13,81)	0,3347 (15,43)
Computer	0,0553 (10,87)	0,2347 (10,45)	0,0154 (5,88)	0,0167 (7,11)	0,1742 (6,69)	0,1889 (13,01)	0,1620 (10,47)	0,0559 (8,00)
Machine	0,0073 (4,31)	0,1091 (9,11)	0,0009 (1,55)	0,0022 (2,82)	0,0178 (2,63)	0,0175 (5,10)	0,0102 (3,50)	0,0059 (3,03)
Car	0,0402 (9,74)	0,3367 (11,88)	0,0433 (9,20)	0,0514 (12,13)	0,2434 (7,28)	0,1322 (10,51)	0,2739 (13,04)	0,0618 (8,44)
Toilet	0,0174 (3,15)	0,1421 (3,94)	0,0002 (0,18)	0,0024 (0,77)	0,0552 (3,18)	0,0296 (1,91)	0,0088 (1,02)	0,0087 (0,60)
Bath	0,0043 (1,65)	0,1923 (4,32)	0,0029 (0,67)	0,0004 (0,33)	0,0730 (3,59)	0,0320 (2,00)	0,0063 (0,86)	0,0015 (0,25)
Roof	0,1964 (12,53)	0,2669 (7,94)	0,1605 (5,61)	0,0823 (5,79)	0,3333 (9,45)	0,2233 (6,51)	0,0414 (3,58)	0,1598 (2,58)
Size	0,0062 (2,43)	0,0392 (3,27)	0,0001 (0,17)	0,0005 (0,44)	0,0538 (4,36)	0,0033 (0,94)	0,0163 (1,92)	0,0001 (0,05)

* Contribution of the j th attribute to global deprivation

Table 5 presents the Gini index of poverty. Precisely, it exposes two kinds of information for each country: (i) the inequality levels of global non-monetary deprivation; and (ii) the inequality levels when non-monetary deprivation is partitioned into its three principals dimensions.

The countries with the highest inequalities in poverty levels are Norway (0,8545), Netherlands (0,8047), Finland (0,7858) and Luxembourg (0,7608). These values are very high showing that the intensity of deprivation is very different among poor people. The European Countries with the less inequalities in poverty levels are Latvia (0,4841), Hungary (0,5323) and Poland (0,5606).

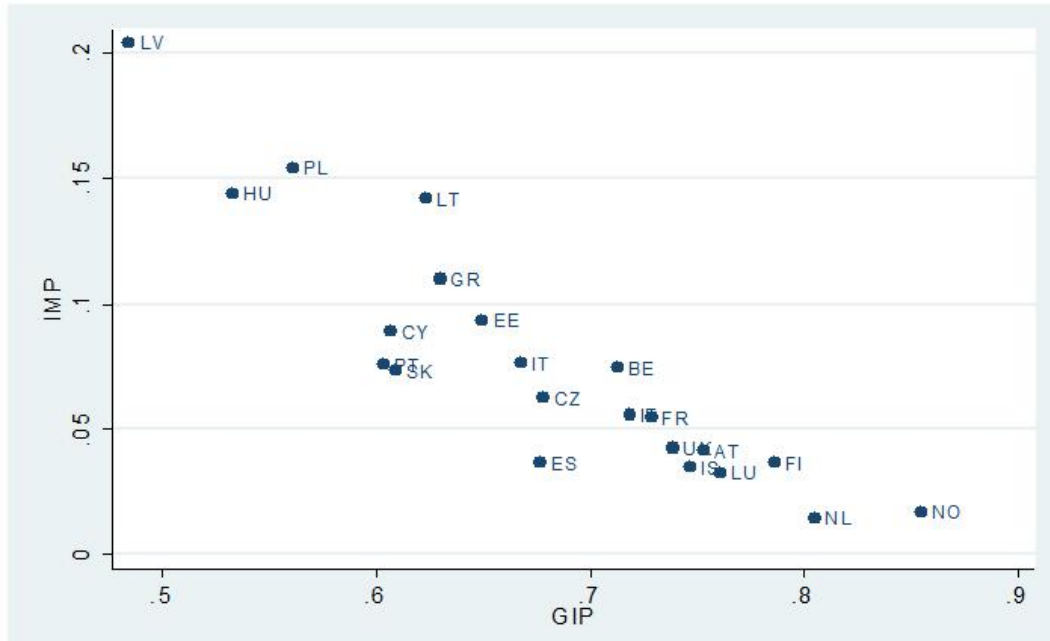
Notice that the major inequalities in deprivation levels are present in the richest countries while the minors are in those whose non-monetary deprivation levels are the most important. Figure 3 shows an almost perfect decreasing linear relationship between inequalities and poverty, that means that the intensities of deprivation are similar when more people is affected by some degree of poverty. This information is confirmed by a significant coefficient of correlation of -0,9013.

Table 5. Gini index of poverty by dimension

Country	GIP Dim. 1	GIP Dim. 2	GIP Dim. 3	GIP Total
Austria	0,7299	0,9156	0,9114	0,7528
Belgium	0,7127	0,8785	0,8559	0,7124
Cyprus	0,5691	0,8925	0,8469	0,6063
Czech Rep.	0,6618	0,8577	0,8823	0,6778
Estonia	0,6857	0,8767	0,7565	0,6494
Spain	0,6814	0,8908	0,8409	0,6763
Finland	0,7474	0,9093	0,9565	0,7858
France	0,6967	0,9106	0,8854	0,7285
Greece	0,6296	0,7682	0,8953	0,6294
Hungary	0,5110	0,7721	0,7514	0,5323
Ireland	0,6926	0,8396	0,8602	0,7180
Island	0,7220	0,9767	0,9103	0,7464
Italy	0,6240	0,9163	0,8108	0,6673
Lithuania	0,6278	0,8220	0,8044	0,6226
Luxembourg	0,7671	0,9403	0,8482	0,7608
Latvia	0,5076	0,7001	0,7041	0,4841
Netherlands	0,8534	0,9614	0,8600	0,8047
Norway	0,8647	0,9558	0,9307	0,8545
Poland	0,5549	0,7617	0,7637	0,5606
Portugal	0,5860	0,8069	0,8394	0,6030
Slovenia	0,5741	0,7696	0,9475	0,6088
U.Kingdom	0,7244	0,9209	0,8668	0,7383

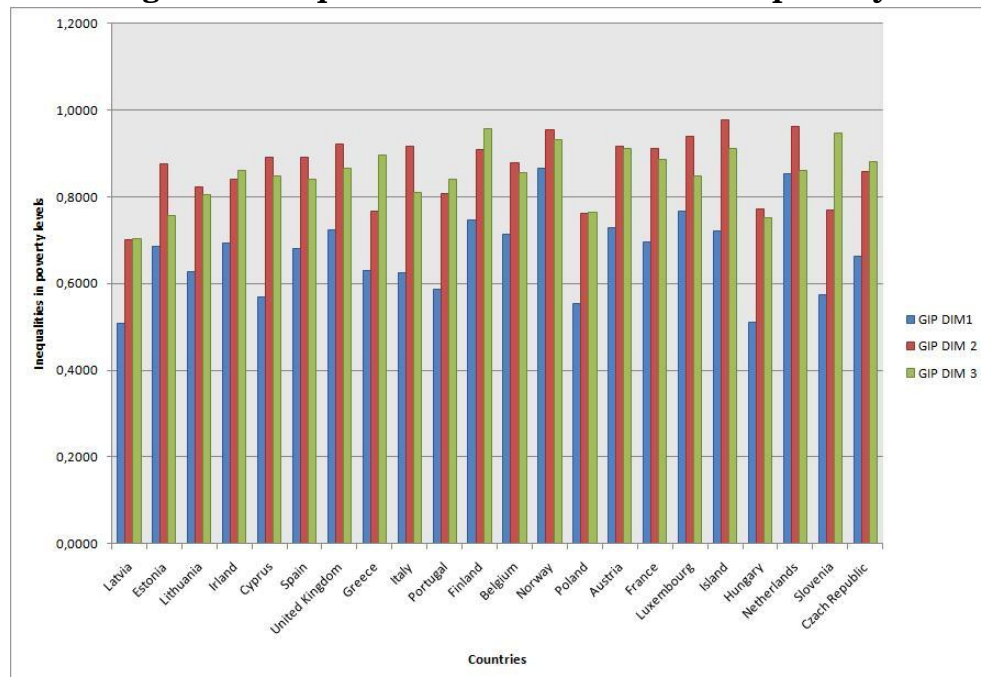
It is also possible to distinguish the main dimensions of the inequalities in deprivation levels decomposing global non-monetary deprivation into its three principals dimensions. The most important intensities of deprivation are presented in the 'enforced lack of durable goods' dimension (for AT, BE, CY, EE, HU, FR, IS, IT, LT, NL, NO, LU, UJ and ES) and in 'housing' dimension (for CZ, FI, GR, IE, LV, PL, PT and SK). The different intensities of deprivation in dimension 'economic strain' are not the most important among the three studied dimension but they are still very important with values going from 0,5076 (in Latvia) to 0,8647 (in Norway). Observe that the most important disparities among poor households are not present in the most explicative dimensions to global non-monetary deprivation.

Figure 3: Correlation between deprivation and inequality levels



In Figure 4 we can see the inequalities in poverty levels for each one of the main dimensions of the non-monetary deprivation by country (ordered from poorest to richest in terms of non-monetary deprivation). It shows that even if the inequality levels are very high in all countries, they are higher in those countries whose deprivation level is less important.

Figure 4: Inequalities in multidimensional poverty



Luxembourg is situated among those countries with the highest levels of inequalities in poverty (0,7608). The inequality levels in 'enforced lack of durable goods', 'housing' and 'economic strain' deprivations are very important. These values are 0,9403, 0,84823 and 0,7671, respectively.

The deprivation and inequality situation of Luxembourg is similar as the other rich European countries, that is, lows levels of non-monetary deprivation and strong disparities. In contrary, the more recent European Community countries have more important deprivation levels but with a more similar intensity of deprivation between poor people.

Several studies examine non-monetary (or material) deprivation in the enlarged EU countries using EU-SILC data (see Whelan et. al 2008, Whelan & Maître 2008, and Guio et al. 2009). Authors differ from the selection of items and the weighting system in the aggregation method to summarize the whole information. Nevertheless, they all have almost the same ranking of poorest and richest countries and similar values for each dimension of deprivation. Then, all these studies give complementary information about deprivation in the EU countries.

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6 Appendix 1: Sample sizes

Table 6. *Sample sizes*

Country	Frequency	Percentage
AT	4.085	5,34
BE	3.881	5,07
CY	812	1,06
CZ	5.564	7,27
EE	831	1,09
ES	4.373	5,72
FI	6.276	8,20
FR	6.674	8,72
GR	1.427	1,87
HU	2.016	2,64
IE	2.083	2,72
IS	2.216	2,90
IT	6.061	7,92
LT	255	0,33
LU	2.586	3,38
LV	1.274	1,67
NL	10.023	13,10
NO	4.607	6,02
PL	1.068	1,40
PT	1.657	2,17
SK	2.851	3,73
UK	5.888	7,70
Total	76.508	100

Source: EU-SILC 2007.

7 Appendix 2: The membership functions of selected attributes

7.1 Economic strain

Table 7. Ability to make ends meet

Characteristics	Degree of membership
With great difficulty	1
With difficulty	0,75
With some difficulty	0,50
Fairly easily	0,25
Easily	0
Very easily	0

Table 8. Keeping home (household's principal accommodation) adequately warm

Characteristics	Degree of membership
Yes	0
No	1

Table 9. Inability to meet scheduled payment

Characteristics				Degree of membership
Arrears on mortgage on rent payments	yes	arrears on utility bills	yes	1
Arrears on mortgage on rent payments	yes	arrears on utility bills	no	0,75
Arrears on mortgage on rent payments	no	arrears on utility bills	yes	0,75
Arrears on mortgage on rent payments	no	arrears on utility bills	no	0

Table 10. Paying for a week annual holiday away from home

Characteristics	Degree of membership
Yes	0
No	1

Table 11. Eating meat or fish every second day, if the households wanted to

Characteristics	Degree of membership
Yes	0
No	1

Table 12. Capacity to face unexpected expenses

Characteristics	Degree of membership
Yes	0
No	1

7.2 Enforced lack of durable goods

Table 13. Do you have a computer?

Characteristics	Degree of membership
Yes	0
No	1

Table 14. Do you have a washing machine?

Characteristics	Degree of membership
Yes	0
No	1

Table 15. Do you have a car?

Characteristics	Degree of membership
Yes	0
No	1

7.3 Housing

Table 16. Indoor flushing toilet

Characteristics	Degree of membership
Yes	0
No	1

Table 17. Bath or shower

Characteristics	Degree of membership
Yes	0
No	1

Table 18. Leaking roof, dam walls, or rot in windows

Characteristics	Degree of membership
Yes	1
No	0

Table 19. Dwelling size

Characteristics	Degree of membership
$\Omega \leq 2$	0
$2 < \Omega \leq 3$	0,5
$\Omega > 3$	1

Ω is the number of current household members divided the number of rooms available to the household.



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