MULTIDIMENSIONAL POVERTY COMPARISONS
WITHIN EUROPE

– EVIDENCE FROM THE EUROPEAN COMMUNITY
HOUSEHOLD PANEL –

by
Monica Szeles

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Multidimensional Poverty Comparisons within Europe
Evidence from the European Community Household Panel survey

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Abstract:
This paper is a cross-sectional study on multidimensional poverty comparisons among the European Union countries, based on data provided by the European Community Household Panel (ECHP). In addition to the empirical results and the methodological problems, the study underlines the opportunities and the difficulties met while using the ECHP. The extended concept of poverty is relative and multidimensional and it reflects not only the financial aspects, but also dimensions like family composition, leisure, subjective deprivation, social participation, durable goods, housing conditions, access to education. Hence, it requires comparative assessments through ordinal measures. In order to compare the multidimensional poverty in 1999 and in a time interval (1994-1999), we have applied the Totally Fuzzy and Relative Method (TFR) in two forms: original (Cheli and Lemmi, 1995) and alternative (Cheli, D’Agostino and Filippone, 2001). The research reveals the hierarchy of countries according to different indicators of poverty. Although the rankings given by the two methods are similar in some parts, there are differences establishing the issues which arise when different features of deprivation are aggregated into a collective index. We show that the variables taken into account, the method and its interpretability, the data and the national particularities, they all have a big influence on the relative and comparative measurement of poverty.

Introduction

This paper is a cross-country comparative research of multidimensional poverty inside the European Union. In order to reveal differences in the standard of living, we have compared dimensions of various forms of deprivation and collective levels of multidimensional poverty, based on data provided by the European Community Household Panel (ECHP).

The study shows how EU countries rank on different poverty variables and how their hierarchy depends on the method of measuring deprivation. It also discusses the challenges we encountered while using the ECHP database and on the progress made along the six waves

∗ This research was (co-)funded by a grant of the European Commission under the Transnational Access to major Research Infrastructures contract HPRI-CT-2001-00128 hosted by IRISS-C/I at CEPS/INSTEAD Differdange (Luxembourg).
of collecting data in ECHP, with regard to the facility of comparing an increasing number of countries and variables.

We have selected from the set of multidimensional measures two fuzzy methods: the Totally Fuzzy and Relative (TFR) index (Cerioli and Zani, 1990) and an alternative of the TFR method (Filippone, Cheli and D’Agostino, 2000). The alternative method is based on the identification of the social relative position of the median unit of a group of population in a reference population. Aside from the comparative analysis of poverty dimensions, the research presents some issues related to the interpretability of the results provided by the two fuzzy methods.

The study is structured in five sections. It starts with a theoretical background of poverty definitions and measurements showing the transition from the absolute and one-dimensional space to the relative and multidimensional space. The second part presents the advantages of locating the comparative poverty analysis in the fuzzy framework, focusing on the two TFR methods. The third section describes the process of choosing the variables for the study, while the fourth contains the empirical research, where we make poverty comparisons among countries using the variables previously chosen and describe some of the challenges met while working with the ECHP. The last section elaborates on the conclusions of the study.

1. Theories on Poverty

This section presents the major steps made in the history of measuring the poverty, from the absolute and relative definitions to the latest multidimensional approaches. How to define and measure poverty are issues debated by scientists and politicians because the results determine the anti-poverty policies and have social, political and economical implications for a country. “There is no one correct, scientific, agreed definition because poverty is inevitably a political concept, and thus inherently a debated one.” (Pete Alcock, 1993)

Despite a considerable theoretical work behind each relevant method, empirical research shows that different approaches produce different results i.e. define different groups of population as poor. These differences are caused by the variables taken into account: in some cases only the actual consumption or the access to goods and services, while in others the capability to obtain them.

The contemporary concept of poverty overcomes the absolute limits defined by Rowntree in the early of the 20th century because now its main characteristics are the relativity, the multidimensionality and the national particularities.
The absolute approach defines and measures the poverty depending on the level of income compared to a minimum calculated base. Seebohm Rowntree used the absolute method in a first scientific study of poverty in the 19th century. He has defined a primary and a secondary poverty line. The primary line is obtained by calculating the minimum income necessary to secure the absolute necessities of life: shelter, food and clothing. The secondary line is based on a family income that would cover the basic needs, were it not spent on wasteful items.

In the absolute approach, a family is below the poverty line if its earnings are less than the level calculated for that line. These measures have a large popularity in the developing countries, but suffer from serious limitations that make them inappropriate for being applicable to the developed countries.

The relative approach defines the poverty line as a fraction of the median or mean income (usually 40%, 50% or 60%) and thus is strongly related to the income distribution. Many researchers (Atkinson, 1998; Hagenaars, 1991; Ravallion, 1998; Sen, 1992) consider this method more appropriate in advanced capitalist democracies because in these countries the absolute poverty does not have the same scope as the relative poverty. The relative approach facilitates the objective of reducing the gaps among different population groups. This is important because the contemporary life that has evolved from the concern with basic goods and services to other deprivation forms.

Amartya Sen introduced the ordinal approach to poverty in 1976, proposing the measurement of poverty in two phases: identification and aggregation. The problem of identification involves “the choice of a criterion of poverty”: the choice of an indicator and the choice of an analysis unit. Within the aggregation phase, all the information collected in the first phase is aggregated into an index of poverty. Sen introduced a distribution sensitive measure of poverty known as the Sen index. According to him, a transfer of income among persons in poverty should affect the poverty index.

The last decades have moved the attention from the traditional approach, based on a single indicator showing the level of deprivation (income or consumption), to the multidimensional approach, based on various aspects of poverty and living conditions. The

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1 The first major contribution to the poverty literature belongs to S. Rowntree and C. Booth. They used quite different methodologies for measuring and analyzing the poverty but their general objective has been the same: poverty reduction. C. Booth investigated the causes of poverty and the social classes’ structure by issuing a poverty map based on a large volume of information on London lifestyle. S. Rowntree estimated the minimal food requirements using nutritional standards in order to calculate the income necessary to buy food.

2 Booth (1969), Rowntree (1901), Orshansky (1965) and Watts (1967) have contributed to the development of the absolute approach by introducing different poverty thresholds alternatives based on some basic needs.
multidimensional methods offer the possibility to investigate the standard of life by including in a single index various forms of deprivation, not just the monetary ones (Whelan, 1993). The multitude of well-being dimensions was the central subject in the recent welfare literature that proposes a set of indicators describing the quality of life\(^3\). They are related to economic resources, education, health, social relations, leisure, subjective deprivation etc.

From a theoretical perspective, the capability approach (Sen, 1987, 1992, 1993, 1994, 1997) provides the most exhaustive framework for defining the multidimensional poverty. The approach defines the poverty in terms of *capability deprivation* (whose determinants could be others than a low income), and *space of functionings* – the various things that a person may value doing or being.

The first multidimensional study of poverty belongs to Townsend (1979) who has introduced a deprivation index based on twelve indicators selected from a group of 60 indicators of common activities in society. Later, Mack and Lansley (1985) have derived the majority necessity index (MNI) which is based on the social perception of social needs. This index is conceived in a way as to eliminate a voluntary lack of resources. Other researchers (Heikka, 1990; Hallerod, 1991) have analysed the possibility to apply a *consensual dual condition* and to develop a *consensual deprivation index*, although in this framework some measurement problems remain unsolved.

The fuzzy measures, developed by Zadeh (1965), are based on the idea of fuzzy sets characterized by “continuum of grades of membership”. The fuzzy set theory can be used in the multidimensional measurement because an individual can be considered poor according to some criteria, while according to others he certainly is non-poor. The fuzzy approach was applied first to the poverty measurement by Cerioli and Zani (1990) who have introduced the Totally Fuzzy Approach (TFA). This method was later improved by Cheli and Lemmi (1995), who proposed the Totally Fuzzy and Relative Approach (TFR). The TFA and TFR methods are analysed in the next section.

This theoretical background has shown that in the last century the poverty measurement studies have moved from absolute to relative measures and from consumption-based measures to income-based measures. The measures proposed and analysed in this paper put in evidence the advantages of relative and fuzzy approaches, at least for their use in measuring the poverty in the economic developed countries.

\(^3\) Townsend (1985), Hagenaars (1986), Human Development Index (computed and analyzed by the UNDP Reports), Schokkaert, Van Ootegem (1990), Van Praag (1991), Brandolini, D’Alessio (1998) etc.
2. The Fuzzy Methods

From a methodological point of view, the paper follows the fuzzy methods. We consider that this is the most appropriate framework to analyse the multidimensional poverty and to run cross-section and inter-temporal well-being comparisons. The main argument in favour of fuzzy measurement methods is that a sharp arbitrary division poor – non-poor facilitated by the traditional poverty line produces loss of information about the degree of deprivation of each individual or household. They also allow a multidimensional representation of poverty and preserve the relative poverty as basic approach.

The theory of fuzzy sets is applied in economics, sociology and other sciences as a base for multidimensional measurement methods. The first economic studies that use fuzzy sets are recent, especially those that propose quantitative measures for inequality, poverty or well-being. The fuzzy methods investigated here are the Totally Fuzzy Approach (Cerioli and Zani 1990), the Totally Fuzzy and Relative Approach (Cheli and Lemmi 1995) and the social position of the median unit in a reference population (Filippone, Cheli and D’Agostino 2001).

Applying the Fuzzy methods implies performing the following steps:

A. Selecting the welfare indicators
B. Selecting the membership function
C. Aggregating the data in an index
D. Weighting the variables

A. Selecting the welfare indicators

The fuzzy methods of poverty measurement demand first the choice of the well-being indicators and then the aggregation of data upon the selected indicators. Although we have found in the poverty measurement literature different alternatives of the fuzzy measure, we

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4 In many papers (Mack and Lansley 1985, Basu 1987, Ok 1995, Betti, D’Agostino and Neri 2000) it is suggested that in any poverty measurement study the character of ambiguity should be preserved because poverty is not an exact but rather vague concept.


have chosen to develop a single fuzzy measure for all the variables of multidimensional poverty.\(^7\)

The selection of indicators should not be arbitrary. They should be based on a consensual list of functionings that consider various aspects of life. There is no agreement in the poverty literature on such a list. The differences between the developing and developed countries and the particularities of each country also make difficult the choice of a common list designed to facilitate the cross-country comparisons (Martinetti, 2000). Nevertheless, the consideration of all the elements of well-being demands the existence of a very large database, providing comparable information related to the standard of life for many developing and developed countries, database which does not exist at present (and whose perspectives are not favorable).\(^8\) In consequence, Sen’s capability approach is difficult to be made operational.

B. Selecting the membership function

The purpose of selecting a membership function is to establish the degree in which each statistical unit belongs to the poor or non-poor subgroups of population, on the basis of a list of deprivation indicators. These indicators are variables that can be continuous, categorical or dichotomous.

Let us assume that \(X\) is the set of the entire population, \(x\) being the elements of \(X\), and \(A\) is the fuzzy subset of poor population with \(A=\{x, g_A(x)\}\). Then a membership function \(g_A(x)\) always takes values in the interval \([0, 1]\) and denotes the degree of membership of each statistical unit \(x\) from the set \(X\) to the fuzzy subset \(A\).

Consider that:

- \(g_A(x_i) = 0\) indicates that the individual \(x_i\) is not poor,
- \(g_A(x_i) = 1\) indicates that the individual \(x_i\) is poor,
- \(0 < g_A(x_i) < 1\) indicates that the individual \(x_i\) belongs partially to the poor subset, the respective value indicating the degree of membership.

\(^7\) By example, Betti, D’Agostino and Neri (2000) considered two distinct fuzzy measures: Fuzzy Monetary and Fuzzy Supplementary; the first relies on monetary variables and the later on housing conditions, durable goods etc.

\(^8\) The ECHP is the largest longitudinal European database and its availability for six years (in June 2003) has evidenced the difficulty of creating comparable data. The increase in the number of states participating to ECHP (or to other EU panel data) imposes serious efforts for the statistical coordination.
In the original fuzzy sets approach to the multidimensional measurement of poverty (Cerioli, Zani, 1990), one is considered poor if one’s income is below a poverty threshold $y'$ and non-poor if it is above a non-poverty threshold $y''$. The degree of poverty in between is given by the distance between the individual income and the non-poverty threshold, relative to the distance between the two thresholds. If $Y$ represents the equivalent income (this applies to any other continue variable), the membership function to the subset of the poor is defined in the following way:

$$
\begin{align*}
    f(y_i) &= 1 & \text{if } 0 \leq y_i \leq y' \\
    f(y_i) &= \frac{y'' - y_i}{y'' - y'} & \text{if } y' \leq y_i \leq y'' \\
    f(y_i) &= 0 & \text{if } y_i > y''
\end{align*}
$$

Where $y'$ and $y''$ are two income thresholds selected for making the distinction between the poor and non-poor.9

An analog methodology is followed when the characteristic is of the ordinal type, which presumes that the modalities of the variable are equidistant one from another (a theoretical hypothesis).

The form of the first membership function was criticized by other researchers because the choice of two thresholds preserves all the inconveniences of the traditional approach (with the difference of using two thresholds instead of one) and the assumption of linear forms for some functions makes the calculations easier but often it does not conform to the theoretical and empirical evidences.10 They have proposed alternatives to the original fuzzy approach to poverty, trying to present as exhaustively as possible the real dimensions of the multidimensional poverty in the fuzzy framework.

Cheli and Lemmi (1995) suggested that this approach to poverty is not only fuzzy but also totally relative. They have proposed the ranking of modalities in increasing order with respect to the risk of poverty associated to them, in order to avoid the assumption of equidistance between the modalities of variables. The new form of the membership function, under this condition is:

$$
g(x_{ij}) = H(x_j)
$$

9 The traditional approach (Cerioli and Zani, 1990) is a particular case of the fuzzy approach, when $y'$ and $y''$ are replaced by $z$, the poverty line (Cheli and Lemmi, 1995).

Where \( H(x_j) \) is the distribution function of the variable \( x_j \), ordered upon the risk of poverty

\[
g(x_i) = \frac{H(x_i) - h(x_i)}{1 - h(x_i)}, \quad x_i = x_k, \ k = 1, \ldots, m
\]

Where \( x_1, \ldots, x_m \) are categories of variable \( X \) sorted in increasing order with respect to the risk of poverty

\( h() \) is the function of the relative frequencies of any category of \( X \)

\( g(x_i) \) is an individual index of deprivation for the variable \( X \)

C. Aggregating the data in an index

The Totally Fuzzy and Relative index, which is a collective index of deprivation, is defined as the arithmetic mean of the membership function in the population. It does not have an intrinsic meaning, being an ordinal index. The new form of the membership function and the TFR index were quickly adopted in the poverty literature because they overcome the distinction between qualitative and quantitative indicators and the selection of arbitrary poverty thresholds.

Continuing the ‘Cheli and Lemmi’ line of research, Filippone, Cheli and D’Agostino (2001) have found a new specification for the membership function that becomes the following after a few manipulations:

\[
H'(x_i) = \frac{1}{2} h(x_1) \quad \text{if } x_i = x_1
\]

Or,

\[
H'(x_i) = H(x_{(k-1)}) + \frac{1}{2} h(x_k) \quad \text{if } x_i = x_k \quad (k > 1)
\]

They sustain the necessity of a new specification of the TFR index by finding a weak point in the original formulation: when the frequency distribution of a variable is symmetric around a category or value that is in the middle between welfare and hardship, the TFR index should be equal to \( \frac{1}{2} \). The empirical evidence shows that sometimes this condition is not met in the context of the TFR index. They suggested that it is possible to overcome this restriction by establishing a relationship between each situation and a reference situation. Under all these new conditions, the TFR index is replaced by a new index \( P \) that expresses the relative social position of the average household in the population analysed, according to a specific variable. The value of the new TFR index is equal to \( \frac{1}{2} \) independently on the variable distribution.
The practical significance of the “P” index is that its value expresses the relative social position of the median household in the population analysed according to an indicator X. Compared to the original specification of the TFR index, the alternative one is different in the way it treats the units sharing the same category of a variable. While in the old specification all these units are considered equally deprived, with the new one, half of them are situated better off than the rest.

The relative social position of the median household B in a reference situation A is determined as follows:

\[ P_{B/A} = \sum_{i=1}^{n} g^A(x) h^B(x) \]

- \( n \) – number of categories of variable \( x \)
- \( g^A(x) \) – TFR index computed on the base of the new specification
- \( h^B(x) \) – distribution of variable \( x \)

The comparative analysis of TFR index under the two formulations depends on the type of variable considered. When the variable is continuous, the two specifications coincide. When the variable is binary, the membership function takes values 0 or 1 for the TFR index and in the [0,1] interval for the new TFR index. Intuitively, the values should be 0 or 1 since they denote the existence or lack of a poverty symptom. This disadvantage of the new specification made us reconsider the original membership function. The only real difference between the methods occurs in the case of categorical variables. When a categorical variable has a distribution symmetric around a category, the alternative method shows an improvement.

The categorical and binary variables always provide values different from 0 or 1 in the new index. This makes the specification inappropriate because some categories of the binary and categorical variables express very well the presence or the absence of deprivation.

D. Weighting the variables

In order to compute the collective index of global deprivation, we need to use a weighting system to give more importance to some aspects of deprivation relatively to others. The weighting function can be the logarithm function, the exponential function, the inverse function and any other function. The choice of a particular function depends on the
importance given to the extremely rare poverty symptoms in the measurement of relative poverty.

3. Variables of Multidimensional Poverty

The goal of this section is to describe the type of variables used in the empirical research and their meaning in the context of multidimensional analysis. A particular issue is dealing with the missing and non-applicable values found in ECHP.

The selection of the appropriate variables for the comparative measurement is difficult because this decision must consider some criteria and respond to a lack of resources in the ECHP database. We have considered the following categories of indicators: economic status, subjective deprivation, durable goods, education, social participation, leisure, family structure and housing conditions.

When the consumption variable is missing from the ECHP panel, the quantitative variables describe only the monetary aspects of poverty and usually (excepting the non-monetary approaches to poverty) these are the aspects considered in a fuzzy measurement method. A special problem arises if we consider that a quantitative variable cannot represent a poverty symptom but it can be seen as a continuous indicator of the risk of poverty (Cheli and Lemmi, 1995). According to this assumption, not only income but also other indicators (e.g. unemployment) should be treated in a different way than the rest of poverty indicators. Despite these considerations, we treat the monetary variable in this study without making a difference between the indicators of the poverty risk and the rest of them.

The monetary variable in this empirical research is the disposable income, even if in the poverty literature many other variables are used to measure economic resources. The disposable income is an indicator of financial risk. It reflects the gross income, including social income transfers, minus taxes and other payments. Following most poverty studies, we have standardized the income threshold by family size using the equivalence scale of the Organization for Economic Cooperation and Development (Atkinson, 1998). According to the OECD scale, the head of the household weights as one, additional adults as 0.5 and children as 0.3.

In any poverty research, a permanent group of variables is called durable goods. We have limited this group to several variables because many of the families possessing material goods suffer from serious economic deprivation (Lichter, 1997). This happens especially in
the developed countries where the absence of some durable goods recorded in the ECHP panel can be explained also by its uselessness to some individuals (lack of a colour TV set, CD player, dishwasher, VCR, microwave oven and even car).

One of the most evident patterns of poverty is given by the sheltering conditions, interpreted as household size and possession of a heating system.\textsuperscript{11} The reason of including them in a poverty assessment study is that inappropriate sheltering conditions are a symptom of social exclusion and poverty and also because a house means more than a roof for everyone; it means stability, security, a lighting and heating system, the access to the basic infrastructure etc.

A special group of variables defines the incidence of poverty within a population. These variables are associated with the risk of being or becoming poor. According to many empirical studies, the risk of poverty is expressed by labour market factors and factors like “culture of poverty”, education, socioeconomic status, marital status, age, number of children, gender, residence, type of household etc. The most important causal factor of poverty is the lack of employment, measured as a lack of economic resources or as different forms of social deprivation (Kangas and Ritakallio, 1998).\textsuperscript{12} The education can be considered both a causal and an effect social indicator. In the developed countries, such in the case of the EU countries, the education is a mean of rising in the social hierarchy (Erikson and Goldhorpe, 1992) while low educational achievements may influence the life chances and increase the risk of experiencing poverty and social exclusion.

The poverty risk is also associated to the household type. The most severe risk of poverty exists for those households headed by single parents (Mitchell, 1991; Smeeding and Torrey, 1988). The intensity of this association is influenced by the social policies of each country and thus is different from country to country. The number of children represents another determinant of poverty (Smeeding and Torrey, 1988), especially when the poverty is analysed by income measures. Regarding the vulnerability of different age groups to poverty, it is difficult to establish a poverty cycle or a relation in the contemporary world, even given that one of the first poverty studies (Rowntree) done in 1901 showed a strong association between the life cycle and the poverty cycle.

Often invocated in the poverty measurement, the subjective deprivation is reflected in the ECHP database by a particular group of variables. The choice of the subjective variables

\textsuperscript{11} The choice of the two variables mentioned before for describing the sheltering conditions is derived from the selection of three types of indicators made by Sara Lelli (2001): a crowding index, the availability of a heating system and a subjective variable on the level of satisfaction about one’s housing situation.

\textsuperscript{12} This is captured by the ECHP variable Main activity status.
in this paper is influenced by many factors. Because of the limitations that occur in the ECHP variables construction, some of those variables were eliminated. In the assessment of subjective poverty, the type of question and its meaning play a significant role. Flick and Van Praag estimated in 1991 that the variations in the subjective poverty thresholds could vary by more than 200%. Researches on subjective poverty have found that small modifications in the wording, the type and the construction of a question can produce large variations in the responses. However, to be a consistent basis for comparative measurement of poverty, the subjective variables should be investigated over a period of time, even in the cases of large sample sizes (ECHP). The difficulties mentioned above may raise many questions about which variables from the ECHP should be considered. Our proposal is the variable called ‘Are housing costs a financial burden?’

A recent group of indicators related to poverty and social exclusion is that of social participation. The reason for considering a variable of this type is that the lack of social participation causes social isolation which is an indirect dimension of poverty even if the empirical evidence of the three waves of ECHP has shown a weak correlation between social participation and permanent financial poverty (Whelan et al., 2001). Social participation indicators like the interaction with friends or the participation in informal networks were recently investigated by several researchers:

- Putnam (2000) has analyzed the concept of social capital;
- Gallie and Paugam (2000) have searched for a relation between social participation, social isolation and unemployment.

The health indicators are the only indicators not included in this study although they are mentioned as social indicators by the European Commission in the National Action Plans (Atkinson et al., 2002). The ECHP panel contains a group of health indicators which theoretically should be considered in any multidimensional analysis of poverty since they are related to the psychological distress (Sara Lelli, 2001), to the access to medical services and to the professional capacity. We assume they have a lower importance in the assessment of multidimensional poverty because of the data availability during the last waves, the national particularities in creating the variables and the architecture of the European health insurance system.

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14 Atkinson et al. classify the social indicators, based on the recommendations of the European Commission, as follows: (1) financial, (2) education, (3) employment, (4) health, (5) housing, (6) social participation.
15 In order to put in evidence a negative type of functioning strongly related to one’s health, Sara Lelli investigated 12 categorical health indicators based on the Panel Study on Belgian Households (1998).
In addition to the theoretical considerations, the missing and non-applicable values played a significant role in the selection of variables. The very high percent of missing and non-applicable values for many countries and deprivation variables determined the elimination of three countries from the working database: Germany, Luxembourg and Sweden. We had to choose between keeping all the countries and distorting the values associated to several representative deprivation variables. This choice has preserved a significant percent of the initial ECHP database, as shown in the following table:

<table>
<thead>
<tr>
<th>Wave</th>
<th>W1</th>
<th>W2</th>
<th>W3</th>
<th>W4</th>
<th>W5</th>
<th>W6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working database*</td>
<td>72.72%</td>
<td>71.95%</td>
<td>78.30%</td>
<td>70.61%</td>
<td>72.50%</td>
<td>72.48%</td>
</tr>
</tbody>
</table>

* The percents represent the proportion of the new working database in the initial ECHP database, after dealing with the missing and non-applicable values.

The explanation for the high percent of missing and non-applicable values in ECHP (for some countries in particular) is that the deprivation variables were chosen and designed to be applicable to any wave, in order to form together an overall and anytime deprivation function. We could notice that the percentage of missing and non-applicable values has decreased over the six years, mainly due to the improvements in the process of integrating the data. As a particular group, all the subjective deprivation variables are affected by a very high percent of “-8” and “-9” values (together representing over 50% from the values of those variables for some countries).

We have applied the principal component analysis in the selection of variables. This analysis reveals different features of deprivation by creating poverty dimensions and by establishing degrees of association based on the variables from the working database. The variables chosen are organized as qualitative and quantitative variables, covering all the types: binary, categorical and continuous. See Appendix 1 for details.

The poverty function that we propose has a small number of variables with a low correlation among them and it is applicable to the 6 ECHP waves and to 12 countries (according to the year of their participation in the ECHP project).
4. Empirical Analysis

The objective of this research is to develop multidimensional poverty comparisons within the European Union. In order to have a cross-sectional and temporal picture of poverty based on ECHP, we have used all the waves, between 1994 and 1999.¹⁶

The ECHP is the most representative European database for comparative multidimensional poverty studies. It was designed as a household panel survey that facilitates both longitudinal and cross-national analysis. The data were collected in eight waves in the period 1994-2001, from 15 countries. Austria, Finland and Sweden participated in the ECHP project since 1995, 1996 and 1997 respectively. The ECHP was stopped in 1997 for Germany, Luxembourg and the UK, but data are available from national panels (SOEP in Germany, PSELL in Luxembourg and BHPS in the UK). The ECHP is based on a harmonized questionnaire and the data were collected in each country by national data collection units.

There are two major registers within ECHP, one called personal register and one called household register. Their dimension has increased in 1996 and 1997 by adding new countries (Austria, Finland, Sweden), and it has decreased in 1998 and 1999 because of high attrition rates. Overall, the wave 6 sample size is 83% as large as the wave 2 sample in the personal register and 86.1% in the household register.

In this research, we chose the household as the analysis unit because we consider that in the multidimensional analysis of poverty the household characteristics are more appropriate than the individual ones.

The methodology plays an important role in any empirical research of poverty because different methods produce different pictures of poverty. The use of a single measure summarizes a single face of poverty and generates the loss of other valuable information. This is the reason that a complex analysis of poverty requires a multidimensional method of measurement (Kangas and Ritakallio, 1998). In this study, we have confined ourselves to two fuzzy methods, although the field of multidimensional measurements is more representative.

According to the fuzzy measures, the way in which the variables are arranged and aggregated for describing the multidimensional poverty is the following:

The aggregation process involves first the calculation of collective deprivation indexes upon the variables considered, for all the 12 countries available in the ECHP working file, and secondly the aggregation of the partial indexes in a collective TFR index. As we explained in the theoretical part, the aggregation process should include a weighting procedure in order to stress the most discriminate aspects of deprivation.

In order to choose a weighting function we compared collective indexes of deprivation computed using different weighting functions. The results are presented in the table below:

<table>
<thead>
<tr>
<th>TFR index (without weights)</th>
<th>$\ln \frac{1}{f_j}$</th>
<th>$1 - \sqrt{f_j}$</th>
<th>$\frac{1}{f_j}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK (BHPS)</td>
<td>0.1979</td>
<td>0.1709</td>
<td>0.1944</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.2108</td>
<td>0.1536</td>
<td>0.2044</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0.2344</td>
<td>0.1457</td>
<td>0.2064</td>
</tr>
<tr>
<td>Finland</td>
<td>0.2373</td>
<td>0.1803</td>
<td>0.2303</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.2449</td>
<td>0.2017</td>
<td>0.2376</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.2522</td>
<td>0.1793</td>
<td>0.2403</td>
</tr>
<tr>
<td>France</td>
<td>0.2610</td>
<td>0.1980</td>
<td>0.2462</td>
</tr>
<tr>
<td>Austria</td>
<td>0.2669</td>
<td>0.2234</td>
<td>0.2593</td>
</tr>
<tr>
<td>Italy</td>
<td>0.3513</td>
<td>0.2489</td>
<td>0.3330</td>
</tr>
<tr>
<td>Greece</td>
<td>0.3756</td>
<td>0.3222</td>
<td>0.3636</td>
</tr>
<tr>
<td>Spain</td>
<td>0.3973</td>
<td>0.3212</td>
<td>0.3816</td>
</tr>
<tr>
<td>Portugal</td>
<td>0.4490</td>
<td>0.3270</td>
<td>0.3793</td>
</tr>
<tr>
<td>UE</td>
<td>0.2936</td>
<td>0.2493</td>
<td>0.2835</td>
</tr>
</tbody>
</table>

Based on ECHP, 1999 wave 6
The TFR index places Netherlands, Denmark, UK, Finland and Ireland in the group with the lowest relative deprivation while Spain, Greece and Portugal form the group affected by the highest relative deprivation, according to all the weighting functions.

The results show that the square root function produces the less discriminate results (the difference between weighting the index with this function and not weighting it at all is negligible) while the inverse function gives the most discriminate results. The logarithmic function has an average weighting power and because of this, it is used in most empirical studies. The choice of a weighting function is very important because different functions produce different hierarchies.\(^{17}\)

The results presented above and those mentioned in Appendix 3 should be interpreted carefully because they do not reflect the dimensions of the absolute deprivation, but those of the relative deprivation. An example of the pitfalls induced by the relative deprivation concept regards the heating system possession. In Portugal, where the weather does not make the acquisition of heating systems strictly necessary, the deprivation index has the lowest value, suggesting that the majority does not possess this good and thus the relative deprivation

\(^{17}\) The hierarchies established according to the three weighting functions are exposed in Appendix 2.
is the lowest while the absolute deprivation is highest. However, this variable is not representative for what deprivation means in Portugal.

The TFR index was applied not only in a static poverty comparison among countries at the level of 1999, but also in a temporal perspective, between 1994 and 1999. The analysis shows that the most spectacular improvement regards four variables: the subjective deprivation, the possession of a heating system, the possession of a car and the social participation (by the variable “Can the household afford having friends or family for drink or meal at least once a month?”). The subjective deprivation was the most dynamic variable during the six years – it decreased from 0.49 in 1994 to 0.38 in 1999 at EU level, suggesting that the population views an improvement in the standard of life for this period.

The variables regarding the sociological type of household and the leisure had “negative” dynamics during this period. The TFR index for the “sociological type of household” increased from 0.24 in 1994 to 0.49 in 1999, caused by changes in the contemporary family structure, which influences the risk of poverty (a pattern more evident for advanced economic countries as are those included in ECHP). For leisure, expressed by the variable “Can the household afford paying for a week’s annual holiday away from home?” the index has increased with 1% every year.

For a more robust analysis, we applied besides the traditional TFR method a new specification of this one proposed by Filippone, Cheli, D’Agostino (2001). The alternative method consists in establishing the relative social position of the median unit of a population A in a reference population B. The main advantage is that with the new specification the poverty indicators become homogeneous and similarly interpretable. We have shown in a previous section that the new specification of TFR index is relevant only for categorical variables. For continuous variables, the methods are similar and for binary variables, the form of the membership function is not appropriate.

To illustrate the functioning of this method, we propose the analysis of two suggestive categorical variables:

a) “Are housing costs a financial burden?” and
b) “Highest level of general or higher education completed”.

See Appendix 4 for values of indexes for these two variables.
The subjective variable provides information about the way in which individuals perceive their standard of living. The ranking established by the indexes $\mu_1$ and $\mu_2$ from Appendix 4 shows some differences, due in part to the weighting system. In Ireland, Portugal, Spain, Belgium, Italy and Greece the median individuals feel to be more deprived in terms of the subjective housing cost then the median individual in EU. Generally, the subjective deprivation is more evident in the less developed countries from EU because for the rest the housing cost is not a problem in absolute terms, maybe sometimes just in relative terms. However, the results should be interpreted considering the dynamic model of needs and aspirations for each particular country because this is a subjective variable.

The education variable shows a better social relative position for the median individual in UK, Belgium, Finland, Denmark, Austria and Ireland compared to the EU median, in terms of educational attainments.

Although each variable provides valuable information on deprivation, the collective TFR index has a particular relevance. The following table presents the TFR indexes determined according to the original and alternative specifications:

<table>
<thead>
<tr>
<th>Country</th>
<th>TFR$^*$ (original specification)</th>
<th>TFR$^{**}$ (alternative specification)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK</td>
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<td>0.4075</td>
</tr>
<tr>
<td>Denmark</td>
<td>0.1291</td>
<td>0.4221</td>
</tr>
<tr>
<td>Netherland</td>
<td>0.1281</td>
<td>0.4407</td>
</tr>
<tr>
<td>Finland</td>
<td>0.2373</td>
<td>0.4462</td>
</tr>
<tr>
<td>Belgium</td>
<td>0.1694</td>
<td>0.4539</td>
</tr>
<tr>
<td>Ireland</td>
<td>0.2522</td>
<td>0.4613</td>
</tr>
<tr>
<td>Austria</td>
<td>0.2669</td>
<td>0.4653</td>
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<tr>
<td>France</td>
<td>0.1739</td>
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<td>Italy</td>
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</tr>
<tr>
<td>Portugal</td>
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<td>0.5088</td>
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<td>Greece</td>
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<td>0.5329</td>
</tr>
<tr>
<td>Spain</td>
<td>0.3973</td>
<td>0.5397</td>
</tr>
</tbody>
</table>

ECHP, 1999

Notes:
* The TFR index in the original form is computed by using the logarithm function to weight.
** The alternative specification of the TFR index is computed by using the logarithm function to weight and uses the EU population as reference.
Although the methods produce different index values, in the comparative assessment of deprivation the same group of countries (Portugal, Greece and Spain) is considered among the most deprived, the difference residing in the rankings inside the same group. The indexes give totally different results and ranks for UK: first place (as the less deprived country) based on the alternative method and fifth place based on the original method.

5. ECHP considerations

Studying the opportunities provided by the ECHP, we concluded that to deal with the ECHP means, above all, to assume a compromise between using all data and countries and keeping only the “clean” variables and those countries that ran the ECHP over a significant number of years. However, once this trade-off is assumed and solved in one way or the other, other challenges may appear.

One of the difficulties generated by the ECHP database construction is the lack of a consumption variable. This should be an explicative variable, disposable in any poverty research because poverty means above all deficient consumption (Mack and Lansley, 1985). Most economists consider that the consumption is a more appropriate indicator for measuring the poverty than the income, when the income cannot be estimated with accuracy (especially in the developing countries, where consumption could refer to other sources than income).
Anyway, a consumption indicator is relevant only over a shorter period of time and in general, the correlation between income and consumption is rather weak. McGregor and Borooah (1992) have investigated the poverty rate using the consumption expenditure and the income based poverty methods; they have obtained different results (15% and 12.2%). It is interesting to note that sometimes, many of those defined as poor have affluent lifestyles based on income measures of poverty (Slesnick, 1993). Anyway, the consumption measures long-term resources (Jorgenson, 1998), being an indicator of the material well-being of families. Considering all the above, we suggest that the consumption is not a substitute for income within poverty assessment and thus it should be included in the ECHP.

A rather strange result of the study is related to the educational attainments and to the access to education in a comparative perspective. The variable taken from the ECHP database concerns the highest level of general or higher education completed and its construction is based on the International Standard Classification of Education (ISCED), which provides comparable tools for systems that differ in terms of institutional structures. Behind the comparability allowed by standards, it is interesting the way in which the classification is interpreted in each country, especially the standards ISCED 2 and ISCED 3. This research found, as other studies, a high proportion of population with good educational attainments in the UK, which could denote an overestimation due to the way the variable is taken and adapted from BHPS to ECHP.18

ECHP is a large European database and its relevance for the poverty and well-being assessment is evident. Despite all inconveniences mentioned above it has facilitated over a few years a significant number of comparable studies. The coordination and harmonization efforts have been remarkable during this period, but the enlargement of the European Union in 2004 provides new opportunities within a wider European space, with the perspective of creating empirical evidence for new comparative studies.

6. Conclusions

The TFR methods applied on ECHP within a cross-sectional analysis of multidimensional poverty inside EU have revealed empirical results and methodological conclusions that are worth summarizing here.

---

18 Steedman (1999) analyzed the impact of equivalences of qualifications inside a country on the ranking of states with respect to educational attainments and he found that the wide range of qualifications in UK made difficult the association with ISCED standards.
1. The ranking of countries depends on the weighting function used in the calculation of the index. Because the square root function determines almost the same result as using no weight, the choice of a weighting function should be made between the logarithmic and the inverse functions in such a way as to not overestimate the relative poverty by a too powerful weighting system (as it could be the case with the inverse function).

2. Differences between the two TFR methods – although both methods consider the same countries in the most deprived group (Greece, Spain and Portugal), they lead to different results for the less deprived countries:
   - Original TFR: Denmark, Netherlands, Belgium and France
   - New TFR: UK, Denmark, Netherlands and Finland

3. Rankings of EU countries
   - The relative deprivation based on the original TFR index is the lowest in Netherlands, Denmark, UK, Finland and Ireland and the highest in Spain, Greece and Portugal, according to all the weighting functions.
   - For the ‘housing cost’ variable, the median individual feels to be more deprived in Ireland, Portugal, Spain, Belgium, Italy and Greece than the median individual in EU.
   - For the ‘education’ variable, the median individual is in a better position in UK, Belgium, Finland, Denmark, Austria and Ireland compared to the EU median.

4. Temporal comparisons for the six ECHP waves
   - The deprivation decreased for the following four variables: the subjective deprivation, the possession of a heating system, the possession of a car and the social participation. The subjective deprivation decreased from 0.49 in 1994 to 0.38 in 1999 at EU level, suggesting that the population views an improvement in the standard of life for this period.
   - The deprivation increased for the sociological type of household and the leisure. The TFR index for the “sociological type of household” increased from 0.24 in 1994 to 0.49 in 1999, caused by changes in the contemporary family structure (more single parents). For leisure, expressed by the variable “Can the household afford paying for a week’s annual holiday away from home?” the index has increased with 1% every year.
5. Recommendations for interpreting poverty studies

- Considering that the differences in poverty are cross-country rather than temporal (Atkinson, 1998), the analysis of cross-national variations and the influence of causal factors is essential in understanding the contemporary concept of poverty (Cantillon, 1997; Brady, 2001).

- The relative measures of poverty should be interpreted as ordinal and not as absolute and cardinal measures. A high value of the TFR index aggregated upon a particular variable can hide a situation in which the global level of deprivation is low, while just a few individuals feel deeply deprived compared to the others.

- The comparative analysis of multidimensional poverty can be developed by applying any one of the TFR methods, starting with a comparative analysis upon each variable assumed and then aggregating in a collective TFR index. The study had shown that the ranking of countries upon the collective level of deprivation depends on the variables assumed.

- Many economists and econometricians agree on that “for being a science, the economics must be first a mathematic science” (Jevons, 1924). We consider that the attempt to quantify every social characteristic could generate the loss of the conceptual richness and that is why we should be cautious in interpreting the numbers without understanding the specifics of each country.

- Not only the measurement method is responsible for the realism of results, but also the national particularities regarding the poverty definition, the variables used, or the quality and the characteristics of the database. In Netherlands the educational attainment attests the lowest level of deprivation and one of the lowest values of the TFR collective index (in the original specification) while the financial deprivation is one of the highest.
Appendix 1 – Variables of multidimensional poverty

Dimension one: Household conditions
- Durable goods: own a car – variable HB001
- Utilities: Does the dwelling have heating or electric heaters? – variable HA012
- Type of accommodation – variable HA005
- Does the accommodation have damp walls, floors, foundations etc? - variable HA019

Dimension two: Education
- Highest level of general or higher education completed – variable PT022

Dimension three: Subjective deprivation
- Are housing costs a financial burden? – variable HA036

Dimension four: Social participation
- Can the household afford having friends or family for drink or meal at least once a month? – variable HF008

Dimension five: Economic status
- The net equalized disposable income
- Main activity status – Pe001

Dimension six: Leisure
- Can the household afford paying for a week’s annual holiday away from home? – HF004

Dimension seven: Family composition (indicator of poverty risk)
- Household type (sociological typology) – HD006
Appendix 2 – Ranking of countries according to different weighting functions\(^{19}\) based on the TFR index in the original specification

<table>
<thead>
<tr>
<th>Country</th>
<th>Logarithmic function</th>
<th>Inverse function</th>
<th>Square root function</th>
<th>Any weight</th>
</tr>
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<tbody>
<tr>
<td>UK</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
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<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
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<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
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<tr>
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<td>5</td>
<td>3</td>
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<td>5</td>
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<td>11</td>
</tr>
<tr>
<td>Portugal</td>
<td>12</td>
<td>12</td>
<td>11</td>
<td>12</td>
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</tbody>
</table>

\(^{19}\) The most deprived country takes the position 12 while the lesser deprived country takes the position 1.
Appendix 3

In the next table, the variables of multidimensional poverty are aggregated for the entire population by using as weighting system the traditional function of logarithm.

<table>
<thead>
<tr>
<th>Country</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
<th>X7</th>
<th>X8</th>
<th>X9</th>
<th>X10</th>
<th>X11</th>
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<tbody>
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<td>.20</td>
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<td>.23</td>
<td>.65</td>
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<td>.17</td>
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<td>.26</td>
<td>.70</td>
<td>.31</td>
<td>.45</td>
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<td>.49</td>
<td>.38</td>
<td>.46</td>
<td>.14</td>
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<td>.17</td>
<td>.35</td>
<td>.16</td>
<td>1.03</td>
<td>.08</td>
<td>.33</td>
<td>.20</td>
<td>.46</td>
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<tr>
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<td>1.31</td>
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<td>.30</td>
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<td>.63</td>
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<td>.77</td>
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<td>.45</td>
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<td>.37</td>
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<td>.23</td>
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<td>.90</td>
<td>.39</td>
<td>.33</td>
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<td>Portugal</td>
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<td>1.19</td>
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<td>.50</td>
<td>.44</td>
<td>.29</td>
<td>.39</td>
</tr>
</tbody>
</table>

ECHP, 1999

Legend:
X1 – income deprivation
X2 – sociological household type
X3 – deprivation as lack of a heating system
X4 – social participation determined as the frequency of having guests during a month
X5 – leisure
X6 – housing deprivation
X7 – subjective housing cost
X8 – dwelling conditions
X9 – main activity status
X10 – owning a car (durable goods)
X11 – education attainments
Appendix 4 – Subjective deprivation and educational attainments

µ1 – subjective TFR index, based on the traditional method, without using any weighting system;
µ1' – subjective TFR index determined by using the logarithmic function as weighting function;
µ2 – subjective TFR index, according to the new specification (reference population here is EU).

“Are housing costs a financial burden?”

<table>
<thead>
<tr>
<th></th>
<th>µ1</th>
<th>µ1'</th>
<th>µ2</th>
</tr>
</thead>
<tbody>
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<td>0.64</td>
<td>0.5</td>
</tr>
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<td>0.7156</td>
</tr>
</tbody>
</table>

ECHP, 1999

Housing costs a financial burden?
“Highest level of general or higher education completed”

<table>
<thead>
<tr>
<th></th>
<th>$\mu_1$</th>
<th>$\mu_1'$</th>
<th>$\mu_2$</th>
</tr>
</thead>
<tbody>
<tr>
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<td>0.13</td>
<td>0.6453</td>
</tr>
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ECHP 1999
References


IRISS-C/I is currently supported by the European Community under the Transnational Access to Major Research Infrastructures action of the Improving the Human Research Potential and the Socio-Economic Knowledge Base programme (5th framework programme)

[contract HPRI-CT-2001-00128]

Please refer to this document as IRISS Working Paper 2004-05, CEPS/INSTEAD, Differdange, G.-D. Luxembourg.