A Multidimensional Poverty Analysis.
Evidence from Italian Data

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Abstract

Conventional poverty measures, showing that poverty and inequality have increased in Italy over the past fifteen years, are based on household income. The main drawback of this method is that it does not include other non-monetary variables relevant for defining households' necessities. It is now widely agreed that poverty should be conceptualised as a multidimensional phenomenon, more related to the standard of living of the person or household than to the simple inability of satisfying basic subsistence needs. In this paper we propose to measure poverty in Italy by complementing income information with non-monetary indicators. To this end a multidimensional poverty analysis is performed by using a representative sample based on the first wave (2004) of the Italian component of the European Statistics on Income and Living Conditions (EU-SILC). Starting from the concept of deprivation, a non linear principal component analysis is applied to selected items in order to reveal underlying latent dimensions to be interpreted as deprivation indicators. We then examine how such measures can be combined with income measures in order to obtain a better identification of the poor. Finally we examine the overlapping between the income poor and the deprived and provide an analysis of deprivation profiles. Our results show that a more comprehensive poverty measure, combining deprivation criteria and income poverty, leads to a different identification of poor people, compared to analyses based only on income measures.

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1 Introduction

It is now widely recognized that poverty should be more properly conceptualized as a multidimensional phenomenon, related to the condition of exclusion from the life of society that some individuals experience because of a lack of resources. Accordingly, poverty does not simply imply the inability to satisfy some basic needs essential for physical survival, but rather the involuntary absence of material, social and cultural resources considered as necessary by the society as a whole.

Traditionally, empirical studies have relied on income and monetary indicators to identify the poor in the population. Specifically, the poor are defined as those people whose income is below a certain threshold, normally set at a certain percentage of the average or median income of the population. Even though these approaches are satisfactory, providing relatively simple and comparable measures of poverty, they also entail some limitations, as has been highlighted in the literature.

A variety of alternative approaches have been put forward to overcome such critiques. Among them, studies proposing to adopt non monetary indicators have multiplied in the last decades particularly following the well-known Ringen (1988) suggestion about the opportunity to simultaneously employ direct and indirect (income-based) indicators of poverty. According to Ringen, the use of a one-dimensional indicator does not allow the researchers to have a comprehensive picture of the individual standard of living. However, the adoption of a broader set of information (relating, for instance, to the ownership of consumer goods or the access to various goods and services) raises the complex issue of deriving measures of standard of living that are of a multidimensional nature.

The approach we propose aims at providing a more comprehensive picture of the poor in Italy by developing multidimensional measures of poverty. The analysis is based on the information contained in the first wave of the Italian component of the *European Statistics on Income and Living Conditions* (*EU-SILC*).

Along the lines suggested by other studies, we derive deprivation indices on the basis of direct, non-monetary standard of living indicators. As a second step, the relationship between income and non-income indicators of poverty in Italy is investigated, in order to examine to what extent alternative, multidimensional measures could be combined with income to better identify the poor. Our results confirm the common finding that income-indicators are able to measure poverty only to a certain degree. The next step has then been to explore the main socio-economic characteristics qualifying different patterns of deprivation.

In the subsequent analysis, a distinction is made between the concepts of income-poverty and deprivation. In our work, income-poverty relates to a situation where a lack of disposable income is experienced, while deprivation implies a more general exclusion from the patterns of consumption and activities that constitute the minimum acceptable standard of living of the society. Accordingly, multidimensional poverty is a more

comprehensive concept, being "the result of an accumulation of deprivation in both resources and the way of life" (Ringen, 1988; p.173).

The present investigation appears to be particularly relevant for the Italian case. Firstly, it provides empirical support to the advantage of integrating income-based measures with non-monetary information, by showing to what extent the main results obtained for other countries may hold also for Italy. Secondly, an analysis of poverty based on non-income may be particularly useful for a country such as Italy, where income data are not very reliable, because of the extent of under-reporting and tax evasion.

The paper is organized as follows. In Section 2 a review of the literature on multidimensional poverty measurement is provided, while Section 3 describes the data that are used and the available variables. In Section 4 the methodology we employed to derive different dimensions of deprivation is explained, and Section 5 presents the results of our multidimensional analysis of poverty in Italy, by examining the degree of overlapping between income-poor groups and deprived groups and exploring their different profiles.

Finally, concluding comments are given in Section 6.

2 The meaning and measurement of poverty

2.1 Theoretical background

The definition and measurement of poverty are issues debated both in the theoretical literature and the policy arena since different methodological choices affect anti-poverty strategies and have relevant social and economic implications.

Many theoretical works and empirical research have tackled the task of measuring poverty. Different approaches can be distinguished on the basis of the variables taken into account: income, actual consumption, access to goods and services or the capability to obtain them. Empirical research on poverty shows that different approaches provide different results about its size and evolution.

Traditional approaches to the measurement of poverty are unidimensional, since they are based on a single indicator, generally income or expenditure, as a proxy of the level of deprivation. These monetary measures separate the population between poor and non-poor through the identification of thresholds which can be "absolute" or "relative".

According to the absolute approach, thresholds are defined on the basis of the amount of money necessary to secure a minimum standard of living[1]. While these measures are widely used in the developing countries, they tend to be considered inadequate for the developed countries.

[1] Absolute approaches include the "Budget Standard Approach", the "Food Ratio Method" and the "Social Security Poverty Line Approach". Nolan and Whelan (1996) provide a description of the advantages and shortcomings of these methods.

Conversely, relative income measures set the poverty line at a certain percentage of median or mean income (usually 50 or 60%), assuming that those falling below such threshold are unlikely to be able to fully participate in the life of the community. The relative approach, that has been adopted in a number of recent studies by the OECD and Eurostat, among others, is considered more adequate than the absolute one in advanced capitalist societies (Atkinson, 1998; Ravallion, 1998), where poverty cannot be seen only in terms of availability of essential goods, but other forms of deprivation emerge.

Although income measures have some advantages in terms of easiness of computation and comparability across countries, they also present some drawbacks mainly related to the way income is usually measured. Firstly, components such as savings, non-official incomes, benefits provided by the family or friends, home production as well as consumption of public services are not taken into account or are not very reliable. Accordingly, income provides only a partial description of the individual "command over resources". Secondly, income is an indirect measure of poverty since it relates only to resources required to achieve well-being, not to the outcomes, the final conditions of the individual. The third argument refers to the period of observation. Empirical research supports the view that current disposable income fails to capture longer term accumulation and erosion of resources (Whelan et al., 2001) and that income and asset accumulation over a much longer period should be considered for evaluating living standards. Furthermore, reported income on which poverty measures are based is often affected by underestimation problems that throw doubts on the reliability of poverty analyses.

Building on these shortcomings, during the last decades traditional unidimensional approaches have been questioned and alternative, multidimensional approaches have been put forward. Multidimensional methods allow the researchers to consider various aspects of both material and social deprivation in explaining poverty and living conditions.

According to the more recent literature, poverty is widely conceptualized in terms of exclusion from the life of society because of a lack of resources, while being "excluded" means experiencing various forms of what society considers as serious deprivation (Nolan and Whelan, 1996). Consequently, poverty should be best treated as multidimensional, and non-monetary indicators should complement monetary ones in order for measurement procedures to offer a correct identification of poor people (Ringen, 1988; Nolan and Whelan, 1996).

The use of non-monetary, standard of living indicators can be defended on the basis of several arguments, which represent in some way the disadvantages of the income-based measures. Direct indicators can provide a better description of the income-poor, explaining the different kinds of deprivation they may experience. Accordingly, they may serve to better identify poor individuals by integrating income information. If a

strong relationship between income and the standard of living is supposed to exist, direct indicators may be useful to determine a poverty threshold, as in Townsend (1979). Otherwise, a combination of both types of indicators is needed to provide a correct identification of the poor, according to Ringen (1988). Finally, direct indicators can be used as an alternative basis for the measurement of poverty, focusing directly on the "standard of living" in terms of insufficient quantity of the usual goods and services, rather than of insufficient resources enjoyed (Martinez and Ruiz-Huerta, 2000).

Despite these advantages, poverty measures which incorporate information from various indicators have also some drawbacks, mainly concerning the difficulties in managing the multidimensionality and the use of non-monetary variables. When trying to make operational a multidimensional poverty concept, many theoretical and methodological choices must be faced. Since all these choices significantly affect final results, it is important to clarify them.

2.2 Existing multidimensional approaches

When poverty is conceptualized as the occurrence of various cumulative deprivations, it should be measured through the "aggregation" of the different hardship factors experienced by the individuals.

Accordingly, measuring multidimensional poverty usually involves the construction of deprivation indices which incorporate the information provided by several indicators of deprivation. These indices are derived on the basis of specific hypotheses relating to:

- the selection of the indicators to be considered;
- the definition of a weighting structure for each item;
- the aggregation of the indicators;
- the identification of a threshold which separates deprived and non-deprived individuals.

All of these issues should be carefully considered in the development of multidimensional poverty measures[2]; we only briefly review each of them, highlighting the choices made in the definition of our deprivation indices.

The first step in building a summary measure of poverty concerns the selection of the appropriate indicators. Obviously, the choice depends on data availability, but the variables considered affect the type of poverty that can be analyzed. Specifically, information about the availability of non-necessary goods may be considered irrelevant according to a "necessities approach" to the standard of living, while it may be

[2] See, for example, Nolan and Whelan (1996) for a detailed discussion.

included in the analysis when a "life-style approach" is followed (Martinez and Ruiz-Huerta, 2000). In any case, the selection of elementary indicators heavily relies on the arbitrary choices of the researchers that must face a trade-off between possible redundancies caused by overlapping information and the risk to loose some relevant information (Perez-Mayo, 2005). A partial solution to such arbitrariness is provided by the use of multivariate statistical tools (e.g. factor analysis), which allows the researchers to reveal the underlying correlation between basic items and retain only the sub-set that best summarizes the available information.

In this work, we select forty-six items from the original dataset, on the basis of their relation with the individual deprivation condition. These items cover different life aspects, enabling us to identify a range of deprivation dimensions. By adopting a comprehensive and relative definition of poverty, we do not consider only "basic necessities" for the inclusion in the deprivation index but a wider set of goods identifying the common society's living standard. Items related to education or the labor market status, however, have not been included in our analysis since we consider them as determinants rather than indicators of deprivation. Furthermore, we use both objective and subjective indicators[3] even though a number of theoretical issues can be raised when subjective items are considered. We agree with Cheli and Lemmi (1995) in sustaining that the inclusion of subjective indicators can offer a better picture of the everyday reality of poverty. Finally, to account for the possible influence of preferences and tastes in shaping the individual status of deprivation, we choose to consider as a signal of personal disadvantage only those goods whose absence is due to an "enforced lack" (Mack and Lansley, 1985)[4].

Once a set of deprivation items has been selected, their aggregation into a multidimensional index implies choosing an adequate weighting structure. Different weights have been used in the literature, even though no clear theoretical justification can be provided for any of them. Some studies apply equal weighting for each item (Townsend, 1979; Mack and Lansley, 1985; Nolan and Whelan, 1996, among others), avoiding the need to give different importance to the different dimensions. Other studies develop their indices of deprivation by aggregating the variables on the basis of their relative frequencies (Hallerod, 1995, for example), or relying on statistical methods, such as factor analysis or latent class analysis (Whelan and others, date; Dewilde, 2004; Perez-Mayo, 2005). This approach, followed also in our work, will be discussed in more detail in Section 4. At this point it is worth to note that there is considerable controversy in the literature on the opportunity to aggregate all the indicators in a single overall deprivation index or, alternatively, to maintain separate different dimensions of poverty[5].

[3] A subjective indicator is represented by the answer to questions relating, for instance, to payment arrears (somewhat of a burden or a heavy burden), or difficulty to make ends meet (difficult or very difficult to make ends meet).

[4] Mack and Lansley (1985) define poverty as an "enforced lack of socially-perceived necessities". Their approach aims at distinguish when the lack of a certain good is the result of constraints or individual preferences. Accordingly, only those who cannot afford some items can be counted as deprived.

[5] Bourguignon and Chakravarty (2003), for example, support the need to maintain a multidimensional perspective and argue

Finally, the identification of deprived people requires the definition of a threshold raising several theoretical and empirical problems. Regardless of the chosen threshold, the identification of those to be considered poor always implies some degree of arbitrariness. Different strategies range from establishing an income poverty level, below which deprivation increases markedly (Townsend, 1979), to setting a cut-off point equal to a certain percentage of the deprivation index (Tsakloglou and Papadopoulos, 2002). An alternative solution proposes to combine income and standard of living information in order to identify the "consistent" poor in the population (Nolan and Whelan, 1996; Whelan and others, 2006, 2007). In this approach, material deprivation and income poverty are viewed as two different measures of the same phenomenon. Individuals are "consistently" poor when their income is below the poverty threshold and they also experience some form of deprivation. In some studies, the deprivation threshold is set at a level where the proportion of deprived people is the same as the income poor. A common (and perhaps surprising) finding in this literature is that the degree of overlapping between poverty and deprivation measures is far from being complete.

The latter is the approach adopted in the present paper, since it is coherent with the definition of poverty as a low standard of living due to lack of resources.

3 The data

In this paper, we use data from the Italian component of the *European Statistics on Income and Living Conditions* (*EU-SILC*). EU-SILC is a voluntary survey of private households, which replaces the European Community Household Panel (ECHP) previously adopted. EU-SILC represents the most recent and, probably, the richest dataset currently available for realizing multidimensional analysis of poverty and deprivation in Italy.

The first release of the cross sectional data refers to 2003 and to a sample of 24.204 households (61.429 individuals). A two-stage sample design has been employed: the primary sampling units are the municipalities, that are stratified according to their size in terms of number of residents and the region (NUTS2)[6], while the second stage units are the households.

In the data-set a range of questions relating to non-monetary variables are available as well as income and monetary information. The main income components are employee and self-employed net income, other direct income including pension from private pension plans, interests dividends and social transfers. In order to identify income-poor people, the equivalent disposable household income, applied to each member of the

that existing attempts of aggregating various attributes into a single poverty index are a mere redefinition of the concept of poverty, which then essentially remains a one dimensional concept.

[6] Four municipalities are selected in each stratum with probabilities inverse to the demographic size. Then, in each sampled municipality, a simple random sample of households is drawn.

household is used[7].

As far as non monetary indicators are concerned, the questions posed cover a wide spectrum of items ranging from possession of consumer durables, availability of certain basic goods and services, quality of housing and neighborhood environment, health status.

For a first set of items concerning relatively basic expenses and the possession of certain durable goods (such as satellite dish, CD player, washing machine, video recorder, fridge, ...), respondents were asked if they possess the item, if they do not possess the item either because they could not afford it or for other reasons. The way in which answers are articulated allows us to capture only the aspect of "enforced lack" of a good or service as indicator of deprivation.

A second set of items relates to household dwelling; specifically, the questions investigate if individuals possess some specific amenities such as hot water, internal toilet, bath or shower. Given the widespread availability of these items, we can assume that their absence is mainly due to inability to afford them.

A third set of variables concerns the quality and the environment of the dwelling. In this case, households were asked if their dwelling suffered from leaking roof, noise from neighbors, pollution, stain or other environmental problems.

Building on the large body of evidence showing the relationship between deprivation and health conditions, a fourth set of items relates to the health status of the household members aged sixteen and over (or selected respondent where it applies). We considered that respondents are experiencing health problems when they answered "bad" and "very bad" to the question relating to their general health status, when they suffered from any chronic illness or when they have been hindered in their usual activities for at least the previous six months due to health problems.

In our analysis we consider information from all the individuals in the data-set. Accordingly, when information was collected at the household level, it has been attributed to each individual.

Indicators adopted in the subsequent analysis are listed in Table 1.

4 Measuring deprivation: methodology

As we stated in paragraph 2, the aggregation of basic indicators to define multidimensional poverty measures can be achieved in many ways. Multivariate statistical analyses provide valuable solutions in helping to select and aggregate the elementary variables in one or more indices.

If poverty can be defined as a condition where several deprivations in different domains accumulate (Dekkers, 2003), we can assume that these deprivations may be seen as latent dimensions of poverty. Factor

[7] The equivalence scale employed is the "modified OECD scale". It attributes a weight of 1 to the first adult, 0.5 to each subsequent adult (aged 14+ living in the household) and 0.3 to each child aged less than 14.

Analysis (FA) and Principal Component Analysis (PCA) are statistical techniques used to identify latent, non observable structures in a set of data, by exploiting the associations among the observed variables. Each latent variable is a weighted function of the original variables, where the weights are optimally defined because they are based on the correlations between the variables. The more the observed variables are correlated to each other, the more likely they represent the same dimension of deprivation.

Several studies have applied Factor Analysis methods to measure poverty. Among them, Whelan and others (2006) use FA to identify five distinct dimensions of deprivation, while Dekkers (2003) complements the results obtained through a confirmatory FA with a cluster analysis which groups households on the basis of the average distance between their factor scores.

The applicability of classical factorial techniques is generally limited by the kind of the available data. Specifically, standard PCA can in principle be applied only if all the variables are numeric (interval or ratio) and the relationships between variables are assumed to be linear. Conversely, the variables available in our dataset (like many variables used in multidimensional poverty analyses) are categorical, measured at nominal and ordinal level. Accordingly, linear or classical PCA could not be the most appropriate method, although it is commonly used[8].

To avoid limitations of the standard PCA, we propose to adopt an alternative approach, allowing us to treat categorical variables. Specifically, we rely on non linear PCA (Gifi, 1990; Meulman and others, 2004), which has the same purpose of traditional PCA, but is suited for variables of mixed measurement level not necessarily linearly related to each other, since it is applied to nonlinearly transformed data.

In our work, therefore, the identification of the underlying theoretical dimensions that could explain the levels of individual poverty is realized by applying a non linear PCA to a subset of the original dataset, in order to reduce the multidimensionality of the data to a much smaller number of components, by simultaneously retaining as much information as possible. This goal is pursued by following a two step procedure.

As a first step, the Optimal Scaling approach is used in order to provide a quantification of the selected variables. In the second stage, a Principal Component Analysis is performed on the variables transformed through Optimal Scaling, allowing us to reduce the multiplicity of the variables and identify the underlying dimensions of deprivation.

[8] The use of categorical and binary variables poses a problem to the application of factorial techniques, since these methods derive the latent structure on the basis of the Pearson correlation-matrix of the original variables. When such data are used, "the contingency table of the variables is used in lieu of the correlation matrix and the assumptions of the factor analysis model based on the Pearson correlation matrix of the variables would be violated" (Kamanou, 2005).

4.1 The Non Linear Principal Component Analysis

In this paragraph we briefly introduce the statistical method adopted for summarizing information from the original variables and identifying different dimensions of deprivation.

Like the linear PCA, the nonlinear PCA reduces the variables in a data set to a smaller number of components that reproduce the information in the variables as closely as possible. The main difference is that non linear PCA can simultaneously handle variables of different analysis levels, using Optimal Scaling to quantify the categories. The PCA model is then applied to nonlinearly transformed data.

The Optimal Scaling approach provides a framework for analyzing multivariate data mainly in two cases:

- when data consist of qualitative or categorical variables, describing the objects on the basis of a limited number of categories;
- when data consist of numerical variables, but a linear relationship among them cannot be assumed.

The Optimal Scaling process transforms qualitative variables into quantitative ones, by assigning optimal scale values to the categories, which finally result in numeric valued transformed variables. The transformation process is "optimal" because all the information in the original categorical data is retained in the optimal quantifications, depending upon the optimal scaling level that can be chosen for each variable separately (for more details, see Meulman and others, 2004).

The PCA is defined as an orthogonal linear transformation procedure that transforms a number of correlated variables into a smaller number of uncorrelated variables called principal components, which are linear combinations of the original variables. The coefficients of the components are calculated so as to minimize the sum of the squares of the differences between the original and the quantified data.

Let H represent a $n \times m$ table of data (where n = number of observations and m = number of variables). The linear PCA provides an optimal approximation of H through the product of two matrices, X, which is a matrix of unit coordinates ($n \times p$, where p is the number of principal components), and A, which is a matrix of variable coordinates ($m \times p$). The goal of a linear PCA is to minimize the difference $|H - XA'|$, or, alternatively, to minimize $SSQ(H - XA')$ (where SSQ is the sum of squares).

The same criterion of optimality is adopted in the non linear PCA, even though here the goal is to minimize $SSQ(H - QA')$, where Q is a $(n \times m)$ matrix, whose columns are optimal non linear transformations of the corresponding columns in the matrix H: $q_j = \varphi_j(h_j)$ (see Gifi, 1990 and Costantini and others (2007), for a more detailed analysis[9]).

[9] The nonlinear PCA solution is not obtained from the correlation matrix of the observed variables, as for the linear solution, but is computed from the data themselves by an iterative process involving also optimal scaling. The optimal scaling procedure maximizes the sum of the first p eigenvalues of the correlation matrix of the quantified variables. Simultaneously, the linear

As for the linear technique, also in the non linear PCA eigenvalues can be used to determine the number of extracted factors from the observed data. The size of each eigenvalue expresses the amount of variance in the variables accounted for by each component, and principal components are ordered in accordance with their eigenvalues. The first component accounts for the largest possible proportion of the total variability in the data. The second component accounts for the next largest amount of variability not accounted by the first component and so on for the higher order components.

The sum of the eigenvalues over the principal components summarizes the variance explained by all the principal components. The components may be interpreted on the basis of the component loadings, which express the correlation between each variable and a principal component. Variables which score higher are used to give meaning to each factor.

Finally, each unit (individuals, in our case) obtains an individual score on each component, called component (or factor) score. Such individual scores can then be interpreted as indicators of the individual condition on each dimension of deprivation.

5 Results

In our analysis of multiple deprivations in Italy we use forty-six indicators from the original EU-SILC data set (see Table 1). Dimensions of deprivation representing the latent structure underlying the data are uncovered by applying the non linear principal component methodolody described in the previous paragraph. Individual component scores are then used to order individuals on the basis of their personal degree of deprivation on each dimension.

The PCA applied on the quantified variables, after a Varimax rotation of the solutions[10], allows us to identify twelve components corresponding to a significant eigenvalue (higher than 1).

However, only the first six components (accounting for almost 42% of the total variance) can be easily interpreted as dimensions of deprivation. Accordingly, we retain only these components for the subsequent analysis. The interpretation is obtained by considering component loadings. In other words, the highest loadings on each dimension enable us to relate each variable to the different components, which can be accordingly interpreted and defined. The results stemming from the rotation are presented in Table 1. The six distinct dimensions of deprivation are labeled as "maintenance capacity", "consumption deprivation", "health status", "capacity to repay debts", "basic housing furniture", "housing condition"[11].

PCA model is estimated on the quantified variables. Model estimation and optimal quantification are then alternated during the iterative process, until the model parameters and quantifications are optimal (Costantini and others, 2007).

[10] The varimax rotation method is chosen to obtain uncorrelated components in the rotated solution.

[11] The first three dimensions are characterized by high levels of the Cronbach's alpha reliability index, which is based on the average correlation between the component items. See Table 3

For an easier interpretation, only the highest loadings for each dimension are displayed.

The first dimension includes fifteen items[12] and can be defined in terms of the individual ability to meet ordinary needs. This dimension summarizes items whose deprivation may be considered a serious indicator of exclusion from a common acceptable standard of life. It should also be noted that this first dimension can be considered the most important in our multidimensional poverty analysis, explaining the largest percentage of the variance in the original data set.

The second dimension comprises nine items referring to a range of consumer durables (such as computer, telephone, car, dishes machine, video recorder, camera and capacity to connect to internet). The loadings on these items are relatively more homogeneous compared to those associated to the first dimension. Even though "enforced lack" of these items can be considered a less serious form of exclusion than that implied in the previous dimension (Whelan and others, 2006), we can suppose that their absence may cause personal unease and distress, since they are owned by the vast majority of the population.

The third dimension relates to the health status of the individuals. The four items included concern general health status, limitation in activities because of health problems, the existence of chronic illness and incapacity to search for a job because of health problems. The loadings are very high and homogeneous, covering an extremely narrow range (except for "incapacity to search for a job because of health problems").

The four items explaining the fourth dimension are related to the individual capacity of paying debts or arrears[13], while the fifth dimension consists of seven items relating to rather basic housing facilities.

The last dimension comprises seven items correlated to housing condition. The more relevant items for this component are those referring to "noise from neighbors or from the street", "pollution, grime or other environmental problems" and the "presence of crime violence or vandalism in the area". Rather weaker loadings are found for housing deteriorating elements such as "damp, leaking roof and too dark rooms".

Once the main dimensions of deprivation have been identified, we can consider how individuals place themselves with respect to each component. As we noted above, the PCA provides component scores for each individual on different dimensions. The way on which we defined our variables allows us to interpret individual scores as an indicator of the personal degree of deprivation on each dimension. Accordingly, individuals that score lower on the first dimension, for example, can be considered more deprived on this

[12] They include arrears on utility bills, ability to keep home warm, ability to purchase food, ability to purchase clothes, ability to afford health expenses, ability to afford educational expenses, ability to afford transport expenses, ability to pay taxes, financial burden of the total housing cost, ability to make ends meet, capacity to afford a holiday away from home at least once a year, capacity to afford a meal with meat, chicken or fish, capacity to go to the doctor, capacity to go to the dentist and capacity to face unexpected expenses.

[13] In this dimension the strongest loadings are associated with "arrears on hire purchase instalments or other loan payments" (0.911) and "financial burden of the repayment of debts from hire purchases or loans" (0.912). The other loadings are slightly lower, respectively 0.431 for "arrears on mortgage or rent payments" and 0.383 for the item related to "existence of a heavy burden associated with the total housing cost".

dimension[14]. Individuals can then be sorted in ascending order according to their deprivation-ranking scores, which provide a description of their standard of living with respect to distinct life domains.

We are interested in highlighting whether our analysis is helpful in better identifying poor individuals compared to income measures only. In other words, we want to know if our deprivation measures and income measures significantly overlap, by capturing the same "poor" people, or, conversely, if some deprived individuals cannot be captured by income indicators and vice versa. To this end, we consider the equivalent disposable income as the appropriate indicator to measure income poverty. As poverty threshold we adopt the most commonly used at the European level, corresponding to 60 percent of the median equivalent income.

As is shown by Figure 1, relating to the first dimension of deprivation, the degree of overlapping between the income poor and the deprived is far from being complete. On the horizontal axis, a dummy variable separates individuals that are poor due to their low income (poverty indicator equal to 1) from non poor individuals (poverty indicator equal to 0). On the vertical axis, individual component scores are reported. As the circles corresponding to individuals reveal, there are some individuals that are poor according to the poverty threshold, but score very high on the basis of the first dimension of deprivation. On the contrary, there are some non income-poor individuals that present very low deprivation scores, testifying their belonging to a situation of social exclusion, at least on the first dimension. Even though they are not reported, results concerning the other dimensions highlight very similar patterns.

The question remains to know to what extent income poverty and deprivation indices overlap.

On the basis of the specified income threshold, a percentage equal to 16.67 percent of the Italian individuals are poor.

In order to be able to compare the results provided by different measures, we assume that the same proportion of people (16.67 percent) is poor whatever poverty indicator is used. We have, therefore, the same proportion of poor people when income or deprivation measures are used. We then want to check to what extent the same individuals fall within the group of the poor in each case. In defining individuals that are experiencing both income poverty and deprivation, we adopt the concept of "consistent" poor put forward by Whelan and others (2006).

In Table 2 we compare the percentages of income poor and "consistent" poor, on the basis of different dimensions of deprivation, for individuals that are below the income poverty threshold. As far as the first dimension is concerned, less than half of the total income poor population is at the same time also deprived: 41 percent are "consistent" poor while the remaining are considered poor only on the basis of an income criterion. Percentages of "consistent" poor are also lower when the other deprivation dimensions are

[14] It implies that such individuals experience deprivation on several items included in the dimension.

considered: around 23 percent (20 percent for the "housing condition" dimension) compared to above 76 percent of those that are "income-poor".

These figures therefore strengthen the intuition provided by Figure 1, that income and deprivation measures do not allow us to capture the same poor individuals and that perhaps income as the only indicator of poverty "is not enough". This suggests to investigate further, in order to better identify persons experiencing financial difficulties and marginalization problems.

To this end, we examine in more detail who is deprived according to the various dimensions. As noted above, we take the same proportion of deprived people corresponding to the income poverty threshold (the lowest 16.67 percent of all individuals, ranked on the basis of the deprivation scores on different dimensions). We consider only those individuals who are not "consistent" poor, i.e. deprived on one dimension, but not income-poor.

Since the probability of experiencing deprivation in various fields depends on a range of individual characteristics, we consider several socio-economic characteristics to provide a better picture of the deprived in Italy.

Table 4 reports the results of a series of logistic regressions with "being deprived on only one dimension" as the dependent variable[15].

Independent variables have generally a significant impact. Thus the probability of experiencing deprivation on the basis of each dimension increases with the age of the individual, while it decreases if the individual lives in the North or Center of Italy. This holds for the first two dimensions, while it is not true for the other dimensions. This result can probably be explained by considering that problems related to dwelling conditions and degraded environment, such as noise, pollution, as well as crime and violence are felt as particularly relevant in large urban areas, characterizing northern and central Italy.

The probability of being deprived is lower for more educated individuals (except for dimensions 4 and 6) and tends to be higher if the individual has a temporary job.

As far as the working sector is concerned, only some activities significantly affect the probability of deprivation. Compared to our reference category (working in the manufactoring sector), some sectors are associated to a lower probability of being deprived (especially, working in agriculture and in the financial sector).

Finally, with respect to married, cohabitee couples, other forms of marital status correspond to a higher probability of deprivation.

[15] Differences in deprivation probabilities across individuals are evaluated by assuming, as our reference category, a female individual, aged 45, who is married and cohabitee, who lives in the South of Italy and has a middle school education and a permanent job in the manufactoring sector.

By looking at the probability of being deprived according to at least one deprivation indicator, some of the previous results are confirmed. Specifically, this probability is increasing with the age and if individuals live in the North or Center of Italy, probably testifying that many of the items included in the analysis can be considered more common in these areas of the country. Accordingly, their enforced absence can be perceived more problematic than in the South of Italy.

Finally, an ordered probit allows us to evaluate the severity of deprivation experienced by the most disadvantaged individuals. In this case, the dependent variable is an indicator equal to zero if people are over the poverty line and not deprived at all, one if people are deprived at least in one dimension regardless the income level, two if people are deprived in two dimensions and so on. Obviously, the dependent variable increases (from zero to six) with the severity of deprivation. Positive coefficients associated to the different covariates suggest the likelihood of more severe deprivation. Table 6 shows the results of the ordered probit model[16].

Our outcomes show that the severity of deprivation increases with age and decreases for individuals living in the North and Center of Italy, compared to individuals living in the South. A higher level of education reduces the severity of deprivation, while being in a temporary job is associated with a higher probability. Moreover, a marital status different from married cohabitee arises the probability of being deprived in many dimensions.

Finally, in almost all the working sectors considered severity tends to decrease with respect to working in the manufactoring sector.

6 Conclusions

In this paper we have exploited the information contained in the Italian component of the new EU-SILC dataset to investigate the relationship between monetary and non-monetary poverty measures.

Adopting a multidimensional perspective, several basic items have been selected from the original dataset and summarized in six dimensions of deprivation which provide a more comprehensive picture of the individual living conditions.

Different dimensions of deprivation have been obtained by applying a Non Linear Principal Component Analysis, which enabled us to reduce the multiplicity of the original variables by retaining as much information as possible. The use of the Optimal Scale technique was required to treat categorical and binary variables. Individual scores provided by the Non Linear PCA for each dimension allowed us to rank individuals on the basis of their personal degree of deprivation on different dimensions.

[16] All variables are retained in the model since they are expected to have some effect on the deprivation severity.

As noted in previous analyses for other countries, also in Italy an imperfect overlap exists between the income poor and the people suffering from serious forms of deprivation. In order to compare the results provided by income and non-income criteria, we have assumed that the low-income and high-deprivation groups represent the same proportion of the population, corresponding to the percentage of the relative poor in Italy (16.67 percent of the population whose income is below the 60 percent of the median equivalent income). We have observed that, for all the dimensions considered, only a small percentage of the total income-poor population is at the same time also deprived. Specifically, as far as the first dimension of deprivation is concerned ("maintenance capacity"), only 41 percent can be considered "consistent" poor (Whelan and others, 2006), while the proportion is also lower for the remaining dimensions.

Since our analysis suggested that income and deprivation measures capture different individuals, further investigations was needed to better identify disadvantaged people. Accordingly, we have examined several socio-economic characteristics in order to have a more comprehensive picture of individuals who are deprived on the basis of each dimension, but non-income-poor. A series of logit estimations showed that the probability of experiencing deprivation generally tend to increase with the age of the individual and to decrease with the educational level as well as if the individual lives in the North or Center of Italy compared to living in the South. The probability of being deprived is higher also if the individual has a temporary job, while it is lower if she works in agriculture or in the financial sector. Finally, compared to married, cohabitee couples, other forms of marital status are associated to a higher probability of being deprived.

Some of these results have been confirmed by our subsequent analyses. The severity of the deprivation status experienced by some individuals has been evaluated through an ordered probit, where the value of the dependent variable increases from zero to six with the harshness of personal conditions. Our outcomes have highlighted that the probability of accumulating different forms of deprivation increases with age and decreases for individuals better educated and living in the North and Center of the country. A higher probability is associated with temporary jobs, while working in sectors other than the manufactoring sector reduces the risk of experiencing several forms of deprivation. Finally, the probability of being deprived in many dimensions arises for individuals in marital status different from married cohabitee.

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Table 1: Factor Analysis Varimax Rotation Solution

	Deprivation Dimensions					
Description	Maintenance capacity	Consumption deprivation	Health status	Capacity to repay debts	Basic Housing forniture	Housing Condition
Ubill arrears	.433					
Warmhouse ability	.436					
Food purch ability	.618					
Clothes purch ability	.721					
Health exp ability	.706					
Educat exp ability	.635					
Transport exp ability	.733					
Tax	.747					
Housingcost burden	.311					
Endsmeet ability	.311					
Holiday	.481					
Meat meal	.384					
Doctor exp ability	-.217					
Dentist exp ability	-.238					
Unex expenses	.499					
Computer		-.737				
Phone own		.376				
Car		.409				
Dishes machine		.737				
Vhs		-.711				
Camera		-.816				
Aerial		-.801				
Internet		-.830				
Phone house		.380				
Cronic illness			.764			
Health limitation			.788			
Health status			.745			
Nojobsearch			-.438			
Mort arrears				.358		
Instalm arrears				.925		
Debtrepay burden				.927		
Mortgagehouse burden				.346		
TV					.374	
Washing machine					.516	
Bath					.628	
Indoor toilet					.473	
Hot water					.602	
Fridge					.311	
Dark house					.277	
Dampness					.236	
Noise						.649
Pollution						.667
Crime						.548
Leaking roof						.264
House density						.196
Renthouse burden						-.460

Table 2: Comparison between consistent poor and income poor

		Frequency	Percentage
First	inc. poor only	6079	59.0
dimension	consistent poor	4216	41.0
Second	inc. poor only	7842	76.2
dimension	consistent poor	2453	23.8
Third	inc. poor only	7882	76.6
dimension	consistent poor	2413	23.4
Fourth	inc. poor only	7860	76.3
dimension	consistent poor	2435	23.7
Fifth	inc. poor only	7521	73.1
dimension	consistent poor	2774	26.9
Sixth	inc. poor only	8231	80.0
dimension	consistent poor	2064	20.0

Table 3: Reliability levels for deprivation dimensions (Total Cronbach's Alpha is based on the total Eigenvalue)

Dimension	Cronbach's Alpha	Total (Eigenvalue)	Percentage of Variance
1	.891	7.768	16.887
2	.724	3.423	7.442
3	.614	2.503	5.441
4	.516	2.021	4.393
5	.469	1.847	4.016
6	.410	1.669	3.629
Total	.969	19.232	41.809

Table 4: Logit estimation for the six dimensions (significant level:* of 0.1, ** of 0.05 and *** of 0.01).

Variable	Dim 1	Dim 2	Dim 3	Dim 4	Dim 5	Dim 6
age	0.003***	-0.005***	0.038***	0.027***	0.004***	0.001
age2	0.000**	0.000	0.000***	0.000***	0.000***	-0.000
north	-0.776***	-0.312***	0.005	0.060*	0.185***	0.248***
center	-0.434***	-0.324***	0.215***	-0.091***	0.151***	0.145***
hschool	-0.380***	-0.316***	-0.226***	0.322***	-0.201***	0.055*
degree	-0.800***	-0.669***	-0.515***	0.674***	-0.188***	0.189***
post_graduate	-0.415***	-0.343***	-0.724***	-0.406***	-0.208***	0.154**
male	0.010	0.012	-0.050*	-0.126***	0.108***	-0.013
temporary_job	0.307***	0.194***	0.171***	-0.146***	0.240***	-0.105**
agriculture	-0.340***	-0.170*	-0.411***	-1.534***	0.130	-1.031***
construction	0.117	0.165**	-0.420***	-1.080***	0.296***	-0.025
trade	-0.053	-0.055	-0.449***	-0.985***	0.057	0.120**
restaurant	0.266**	0.139	-0.314**	-1.234***	0.356***	0.338***
transport	0.217**	0.200**	-0.439***	-0.747***	0.131	0.281***
financial	-0.336*	-0.355**	-0.196	-0.720***	0.182	0.324***
real_estate	-0.033	-0.155	-0.286***	-0.739***	0.119	0.250***
public_admin.	-0.126	0.035	-0.377***	-0.855***	0.318***	0.149**
education	-0.172*	-0.045	-0.333***	-0.835***	0.144*	0.299***
health	-0.035	0.011	-0.185*	-0.942***	0.294***	0.225***
social_service	0.042	0.139*	-0.310***	-0.855***	0.342***	0.143**
single	0.222***	0.091***	0.734***	0.302***	0.316***	0.043
married ncoh	0.325***	0.298***	0.138	0.068	0.692***	0.132
separated	0.366***	0.393***	0.236**	-0.268**	0.597***	0.294***
divorced	0.389***	0.348***	0.454***	-0.141	0.349***	0.311***
widow	0.121**	0.209***	0.080**	-0.085**	0.345***	0.021
Log.Like*1000	-19.268	-20.657	-21.179	-21.986	-22.473	-23.930
Obs.	61429	61429	61429	61429	61429	61429

Table 5: Logit estimation. Deprived in at least one dimension (significant level:* of 0.1, ** of 0.05 and *** of 0.01).

Variable	Coefficient	MargEfct
age	0.009***	0.0023
age2	0.000***	0.0000
north	0.066***	0.0158
center	0.023	0.0054
hschool	-0.010	-0.0024
degree	0.083**	0.0200
post_graduate	-0.236***	-0.0572
male	-0.005	-0.0011
temporary_job	0.105***	0.0253
agriculture	-0.552***	-0.1334
construction	-0.084	-0.0202
trade	-0.170***	-0.0412
restaurant	-0.009	-0.0023
transport	0.023	0.0056
financial	-0.078	-0.0188
real_estate	-0.12**	-0.0299
public_admin.	-0.015	-0.0035
education	-0.049	-0.0118
health	-0.010	-0.0024
social_service	-0.050	-0.0121
single	0.223***	0.0539
married ncoh	0.345***	0.0834
separated	0.237***	0.0572
divorced	0.157**	0.0379
widow	0.053	0.0127
Log.Like*1000	-40.987	
Obs.	61429	

Table 6: Ordered Probit Estimation- Model results

Variable	Coefficient	p-value
age	.00753	0.000
age2	.0001443	0.000
north	-.5785196	0.000
center	-.5076556	0.000
hschool	-.2601822	0.000
degree	-.3336598	0.000
post_graduate	-.3235453	0.000
male	.01184	0.229
temporary_job	.1333712	0.000
agriculture	-.138958	0.000
construction	-.013424	0.644
trade	-.1386614	0.000
restaurant	.0216641	0.610
transport	-.0658095	0.065
financial	-.1270204	0.006
real_estate	-.0912192	0.004
public_admin.	-.1771915	0.000
education	-.1764278	0.000
health	-.0818949	0.011
social_service	.0732039	0.010
single	.2268298	0.000
married ncoh	.4393292	0.000
separated	.4601196	0.000
divorced	.3784146	0.000
widow	.1712981	0.000
Thresholds		
cut1	-.8677075	
cut2	.0922197	
cut3	.8654527	
cut4	1.537343	
cut5	2.292467	
cut6	3.17272	
Num. of obervation	59216	
Log.Like*1000	-75.656	

Figure 1: Relationship between income and deprivation indicator