INSTITUTO NACIONAL DE ESTADÍSTICA

Poverty and its measurement

The presentation of a range of methods to obtain measures of poverty

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1.Introduction

The objective of this document is to provide a general view of how poverty is measured. Without aiming to cover all options, some of the most well known methods for measuring poverty are detailed below, focussing in greater depth on those that are normally used within the context of official statistics in the European Union.

Firstly, we outline the ideas on which the techniques for constructing poverty measures are based and which will be subsequently described, in other words, objective and subjective, absolute and relative poverty concepts are introduced, as well as persistent poverty and multi-dimensional deprivation.

Following this, the methods for developing poverty measures are presented. Very often, these methods use household surveys as the source of data, in particular the surveys on expenditure and income.

In Spain, surveys on expenditure have a long tradition. The first survey of this type was done by the National Statistics Institute (INE) in 1958. Since then, a number of surveys on household budgets have been carried out, some of them structural, such as those in 1964-65 or 1990-91 and others with short-term objectives, such as for example the continuous surveys on household budgets (HBCS 1985, HBCS 1997). In 2006, this survey's methodology was changed with the aim of improving it and addressing the new needs of the different users, researchers and official bodies.

On the other hand, for eight years (1994-2001), the INE carried out an income survey on an annual basis: European Union Household Panel (EUHP). This survey collected very rich and detailed information on people and households, their income and their social and economic characteristics. The EUHP was a harmonised survey in all European Union countries. This harmonisation was based on the use of a common questionnaire, as well as the existence of methodological recommendations provided by the European statistics office (EUROSTAT).

Given the growing need to obtain highly comparable data in the European Union and the desire to improve the EUHP, a new statistical source "Statistics on Income and Living Conditions (EU-SILC)" was created, which ensured a higher level of data harmonisation in the survey and allowed for greater measurement of poverty and living conditions. With this aim in mind, a regulation framework from the European Parliament and Council was developed, as well as various Commission regulations that regulate all aspects of the process up until the final collection of data (regulations on the sample and field work, definitions, variables and quality reports). Via these regulations, good quality and a high level of comparability between countries is ensured. In Spain, the EU-SILC took the name of the Living Conditions Survey (LCS) and it began to be carried out annually in 2004. The data from this first year were available in December 2005.

An understanding of the statistical information available for measuring poverty is essential and is the reason why the previous paragraphs have briefly described the INE sources. At the moment, official poverty measures are based on the LCS, as they follow the EUROSTAT recommendations, which in turn calculate poverty indicators for all European Union countries with data from the EU-SILC.

2. Different approaches to poverty

From a social researcher's point of view, poverty is a complex phenomenon influenced by a large number of factors and which can be studied from many different perspectives. The study and interpretation of poverty isn't a simple task, as there are as many ways of measuring poverty as there are ways of defining it.

Depending on the point of view adopted and the aspects that need to be highlighted, different poverty analyses can be carried out. Within the huge variety of possible studies, a first classification refers to the type of base information used and which can be termed objective and subjective poverty; likewise, depending on the scale or reference used to set the thresholds, we can speak of absolute and relative poverty. Finally, it is important to distinguish the static studies from the dynamic studies. Dynamic studies include an essential dimension: the length of duration of poverty. In this way, a difference arises between transversal poverty (in a fixed year) and long-term or persistent poverty.

From a completely different perspective, analyses based mainly on the impossibility of access to certain basic consumption elements are carried out, as it is understood that these limitations can result in a lack of social integration. The study of this aspect of social exclusion, which is strongly linked to poverty, is called multi-dimensional deprivation.

Objective poverty studies use information collected via variables whose measurement comes from a researcher's direct observation, which gives them a high degree of objectivity (the most commonly used variables are household income and expenditure). Subjective poverty studies are based on the perception that the individuals or households themselves have of their situation.

2.1. Objective poverty

By applying an objective focus, an analysis of both absolute and relative poverty is carried out. **Absolute poverty** is defined as a situation in which the individual's basic needs are not covered, in other words, there is a lack of basic goods and services (normally related to food, housing and clothes).

This concept of poverty is strongly linked to destitution and can be applied to all countries or societies. A person who is considered poor under this criterion is classified in the same way throughout the world. As will be seen later on, it is extremely difficult, if not impossible, to develop ways of measuring absolute poverty.

Relative poverty locates the phenomenon of poverty in the society under study. From this perspective, a person is considered poor when they are in a clearly disadvantaged situation, either financially or socially, with regards other people in their environment. This idea of poverty is closely linked to the notion of inequality.

The classification between poor people and those who are not poor, in accordance with this last criterion, depends on the degree of development of the society under study and cannot be transferred to a different society. For example, one country may consider poor people to be all those whose annual income is less than 3,000 Euros,

whereas another country may classify a person as being poor whose income is below 7,000 Euros. Thus, a supposedly poor person in the second country may not be classified as such if the first country's criteria are used.

Poverty is not a static phenomenon however and a person's situation may change with time, moving in and out of poverty. It is therefore essential to carry out dynamic poverty studies that take into consideration changes and transitions and analyse a population over a sufficiently long enough period of time, not only during specific years and in an isolated way.

Within this context, the so-called **persistent or long-term poverty** analyses are carried out. Following recommendations from the European Statistics Office (EUROSTAT) in European Union countries, a person is considered persistently poor if they have been classified as poor in the last year and at least during two of the three previous years. This concept of long-term poverty avoids transitory poverty situations, which do not generally cause changes in the living conditions of households. These studies are normally carried out from a relative monetary poverty point of view.

One of the essential questions in the interpretation of the phenomenon of poverty is the degree of mobility of individuals between different income strata. For example, if in one country and year after year the poor people are the same individuals, the situation will be more serious, or at least it will need to be addressed in a different way from a country where at least a certain percentage of poor people are not the same year after year. In this second case, mobility is greater, as you can come out of poverty or stop being poor with greater ease in the second case. When there is data on the same individuals over a number of years, mobility can be studied using movement in and out of poverty.

2.2. Subjective poverty

In the analyses on **subjective poverty**, as previously mentioned, information on the opinion of the individuals or households and their situation is used. This way of understanding poverty influences the subjective view that households have of their financial situation as opposed to the objective focus that only uses observable and measurable variables.

2.3. Multi-dimensional deprivation

There is another concept called **multi-dimensional deprivation** that is closely linked to social exclusion and is related to deprivation or the lack of access to certain goods and services considered necessary for society, whether a basic need or not. Poverty is measured with non-monetary variables and deprivation indicators, using breakdowns of these indicators to construct poverty measures. This type of multi-dimensional deprivation has also been called **severe poverty**.

Each of these different ways of perceiving and measuring poverty offers a different perspective on the same phenomenon. The different approaches provide varied and rich information that should be combined to obtain the most complete general view

possible. For example, even though the isolated use of relative poverty measures provides data on the percentage of people who are in worse monetary conditions than other citizens, it doesn't explain whether the most basic needs of these people considered to be poor are met or whether they feel excluded. Therefore, the joint use of absolute and relative measures will help to achieve a greater understanding of poverty.

One important aspect to bear in mind when aiming to measure poverty is that the majority of studies carried out are based on data from household surveys. These surveys obviously do not collect information on homeless people or those living in institutions, which means that individuals from these groups, who are affected by poverty to a greater extent than the rest of the population, are not included in the measures that are usually carried out.

3. Poverty measures

In the objective methodologies presented in this document, the so-called poverty lines are used to classify people as poor or as not poor depending on which side of the line of barrier they are placed. The lines are normally expressed using indicator values, usually monetary, chosen to measure poverty.

In this section, the different poverty lines are presented that can be compiled according to the different approaches to poverty.

3.1. Absolute poverty lines

These lines reflect the value of the resources needed to maintain a minimum level of welfare. The aim is to measure the cost involved in purchasing a basket of essential products (goods and services), which allow a person to reach minimum levels of satisfaction in terms of basic needs.

One of the characteristics of the absolute poverty lines is that results can be taken from them that are sensitive to economic development, although this is shared out homogeneously amongst the population. For example, if there is an increase in income levels in a society, even though this increase is distributed homogeneously amongst the population, the percentage of poor people calculated with absolute poverty lines will decrease.

One of these absolute lines that is widely used fixes a dollar per capita a day as the value of minimum resources needed for a person to not be considered in poverty. This line can be used in a world context with the implication therefore that any person who lives on less than a dollar a day is poor.

In 1901, Rowntree developed a poverty line using a basket of products made up of all those essential goods and services needed to meet the minimum sustenance requirements in households. The poverty threshold is set using the monetary value of this basket plus a fixed amount of money aimed at covering other types of expenditure, such as petrol or rent. Every household whose income is less than this figure will be classified as poor.

The Rowntree line has received much criticism throughout the years as despite the minimum food needs being agreed upon, people have not agreed upon the other goods and services included in the basket. The choice of products tends to depend on the lifestyle of a particular society and therefore brings certain relativity to the supposed absolute poverty measure.

There are other absolute poverty lines, for example the Mollie Orshanski line (1963-1965), which is currently applied in the US with some changes and adaptations. This way of measuring poverty includes the consideration that expenditure on food in households is a constant proportion of total expenditure. The poverty line is fixed by multiplying the value of the basic food products by the reverse of the proportion that food expenditure signifies for total expenditure. For example, in the US in the 60s, this proportion was a third and the poverty threshold was therefore equal to the value of the basic food basket times three.

This line, which is developed under an absolute poverty philosophy, does not meet the requirements of a pure measure of absolute poverty either. It has been attacked with arguments stating that according to Engel's law, a country's greatest economic development decreases the proportion of food expenditure from the total. This fact has been empirically tested in some countries. Once again we return to demonstrating that it is fairly difficult to construct an absolute poverty line which is valid for different societies and eras.

Other absolute poverty lines that have been used at times are those that are constructed by fixing the maximum permitted value for the percentage of food expenditure against the total household income. In this way, poor people are considered to be all households that spend a higher percentage of their income than the accepted maximum on food.

Absolute lines are of limited interest in developed countries. In underdeveloped or developing countries they are better accepted and are used to a greater extent.

3.2. Relative poverty lines

Relative poverty lines classify people in the society under study into two groups; those that are most disadvantaged, who are called poor, and the rest.

If there is an homogenous increase of income in a society, for example a rise of 5% in the income of all households, the relative poverty lines provide the same poverty rates before and after this rise. The poverty threshold will be greater, but the proportion of poor people will remain the same. The number of poor people depends on the relative position of each household or individual in the society. If these relative positions are maintained, the relative poverty lines do not reflect changes that could result in economic development shared out equally. In order for the percentages of poor people calculated with this type of line to diminish, it is necessary for there to be changes in income distribution.

Relative poverty lines usually use indicators based on monetary variables such as income or expenditure. In both cases, a minimum variable level is fixed below which people are classified as poor and above which as not poor. If we suppose for example that the chosen variable is income, the level will depend on the population's income distribution. In fact, it is usually fixed at a certain percentage of a distribution measure, normally the average or the median.

PROCEDURE FOR THE MEASURING OF RELATIVE POVERTY

3.2.1. CHOICE OF MONETARY VARIABLE

The most common procedure when choosing which variable to use is to turn to those variables that represent an individual's income or expenditure. Both income and expenditure present advantages and disadvantages when it comes to using them as monetary variables for measuring poverty. Annual income, which in theory seems to be the best option, reflects a household's economic capacity, but it only provides a partial view. As well as income, households have goods, assets, etc, which also form part of their total wealth and influence the standard of living that households can support.

In addition, income can vary a lot from one year to the next without there being changes to living conditions. This could be the case of a household that has savings, access to credit or which expects that its future income will return to the same levels as before.

On the other hand, the expenditure variable is more stable, as households do not modify their spending habits when there are occasional decreases to income. In other words, expenditure depends more on the concept of permanent income (expected future income or income that will allow families to live in the same conditions without modifying their wealth) than on actual income. In turn, poverty is very closely linked to so-called permanent income and therefore expenditure would be a good variable with which to measure it.

The choice of expenditure as the monetary variable also has disadvantages. It is known that household consumption guidelines depend to a large extent on the environment in which the household lives and the customs acquired over time and in many cases, there is no direct relationship with the household's resources.

Notwithstanding, it is important to take into account that both variables, income and expenditure, are subject to measurement errors. It has been verified that fairly often the income figures collected in surveys undervalue actual income. This is the case with freelance working or capital income, whereas other kinds of income, such as income from working for someone else, is collected more accurately. This results in biases in the final information used to carry out poverty analyses.

There are also problems with the measurement of expenditure, which is generally linked to the methodologies of surveys that include household consumption. When aiming to provide an annual consumption figure of households, imbalances are produced given the transformation process of expenditure collected weekly, monthly and quarterly etc. into an annual variable, which aims to reflect a household's usual consumption. In any case, it is important not to forget that the majority of measurement errors are inevitable. They are the result of problems inherent in household surveys and cannot be avoided regardless of how well the surveys have been designed. The quality of the expenditure variable is also affected by the difficulty arising from obtaining this type of information, by the effort that needs to be made by households to note down detailed expenditure during the required period.

Therefore, the choice of a monetary variable is not a banal question and ultimately affects the poverty measurements provided. In the last few years in Europe, income has been used as the official variable for the compilation of statistics on poverty and social exclusion.

3.2.2. INCOME PER CONSUMPTION UNIT

Below is an explanation of the construction of poverty lines using the income variable. This construction would be very similar to the consumption expenditure variable of households.

Relative poverty lines based on income are constructed in the following way:

The total income of each household is calculated. The income usually used to construct this calculation is: income from freelance work, income from being employed by someone else, capital income, social benefits, income tax payments or returns, imputed rent, social assistance income, transfers between households, credited mortgage payments, regular capital gains and taxes and property income.

One of the decisions that affects the final results of relative poverty line analysis is the analysis unit used, either the household or the individual. At the beginning, the household was used, but lately, preference has been given to the individual, as it is people that are truly affected by poverty and the household is a theoretical concept. To all intents and purposes, even though a person is used as the analysis unit, it is assumed that personal situations depend on the total income of a household and not only on personal income.

In order to recognise the influence of a household on an individual, an income is allocated to all household members that depend on the household's total income. All household members are allocated the same income. This income allocated to the individual could be the income per capita (which is calculated by dividing the household's total income between the number of members), but in official European Union statistics it is preferable to use another income called income per consumption unit or equivalent income. This income per consumption unit is the household's total income divided between the number of consumption units (c.u.) in the household.

This preference for income per consumption unit over income per capita is due to the fact that the first of these takes into account other factors such as economies of scale and the existence of equivalent consumption units in the household.

3.2.3. EQUIVALENCE SCALES

The objective is to determine which part of household income corresponds to each one of its members with the aim of calculating an average income per individual in the most coherent way.

Equivalence scales aim to reflect reality in households, based on theories expounding the existence of economies of scale and equivalent consumption units.

The existence of so-called economies of scale in households implies that an increase in the number of household members doesn't have to be accompanied by the same proportional increase in income in order to maintain the same levels of welfare (in terms of sharing household, dwelling, household equipment expenditure etc.). The theories on equivalent consumption units in households state mainly that children's consumption guidelines are different from those of adults and that this difference should be reflected in the number of consumption units in the household.

Consumption units (c.u.) are calculated using what is called an equivalence scale. There are multiple options for choosing equivalence scales and the most used ones are those that calculate consumption units according to the following methods:

Statistical scales

- *The Organisation for Economic Cooperation and Development's scale (OECD) or the Oxford scale*

  The number of consumption units in a household (c.u.) is calculated as the combination of the weightings allocated to each member. The weightings are allocated in the following way:

First adult	1
Second adult and subsequent adults	0.7
Under 14 years old	0.5

  In other words, the number of c.u. is calculated in the following way:

  No. of c.u.= 1 + (a-1) x 0.7 + b x 0.5
  (*a* is the number of adults and *b* is the number of minors)

Example:

If there are two people aged 14 or above in a household and two under 14, the number of c.u. is calculated thus: 1+ (2-1) x 0.7 + 2 x 0.5=2.7

- *Modified OECD scale*

The number of consumption units in a household is calculated as the combination of weightings allocated to each member. The weighting are allocated in the following way:

First adult	1
Second adult and subsequent adults	0.5
Under 14 years old	0.3

In other words, the number of c.u. is calculated thus:

No. of c.u. 1 + (a-1) x 0.5 + b x 0.3 where *a* is the number of adults and *b* is the number of minors.

Example:

If there are two people aged 14 or above in a household and two under 14, the number of c.u. is calculated thus: 1+ (2-1) x 0.5 + 2 x 0.3=2.1

This scale is generally used by EUROSTAT. The scale is used to construct the so-called Laeken indicators for example.

Parametric indicators (Buhman et al. 1988)

These scales have been recommended by some experts in the study of income distribution and are used in the international field to carry out comparisons between countries:

The consumption units are calculated in the following way:

No. of c.u.= n^m

Where n is the number of household members and m is the parameter known as **equivalence elasticity**.

If m = 1 there are no economies of scale. Elasticity under 1 indicates the existence of economies of scale in the needs of households, in other words each additional member needs less than a proportional increase in household income in order to maintain the same levels of welfare.

The scale with elasticity m = 0.5, has been used recently in some OECD studies. No. of c.u. $\sqrt{n}$

Example:
If elasticity m = 1/3 is used, the number of c.u. is calculated thus:
No. of c.u. = $\sqrt[3]{n}$ where *n* is the number of members.
If there are four people in a household, the number of consumption units will be $\sqrt[3]{4}$ =1.587.

Scale with two parameters (USA)

The consumption units are calculated in the following way:

No. of c.u. $=(a+kb)^{m}$ where a is the number of adults
b is the number of children under 14 years
$0 \leq k \leq 1$ and $0 \leq m \leq 1$

Example:

If a household has two adults and two children under 14 years, the number of consumption units will be: $(2+K2)^{m}$

If we assume that the elasticises k = m = 0.5 are used, the number of consumption units will be:

No. of c.u.$=(2+0{,}5 \times 2)^{0{,}5} = (3)^{0{,}5} = 1.732$

3.2.4. FIXING OF THE POVERTY LINE

Once the equivalence scale has been chosen and each household member has been allocated income per consumption unit in their household, the median of this distribution of individual income is calculated (the individual income is ordered from least to greatest income per consumption unit and the income value per c.u. is calculated, which leaves 50% of individuals on the left), in other words the value not reached by 50% of the individuals.

Up until some years ago, the measure used was the average. However, in the last few years, the median has been used as this avoids the results being affected by an excess of extreme income data that do not reflect reality in the majority of the population.

The poverty line or threshold is fixed at a percentage of this median and can be 40, 50, 60 or 70 percent, or even 20 or 25 percent where severe poverty is being studied. EUROSTAT currently fixes the poverty threshold at 60 percent of the median of income distribution per consumption unit.

This line divides people into those considered poor and those considered not poor. All people whose income per c.u. is under the poverty threshold are considered poor.

3.2.5. INCIDENCE, DISTRIBUTION AND INTENSITY OF POVERTY

When dealing with a poverty study in a society, incidence, distribution and intensity of poverty measures should be used.

The **incidence poverty measures** provide information on the extent of the problem, in other words they provide data on the quantity of people or households that are affected. They are normally expressed as a percentage of the population. These measures can be calculated across the whole population and in all the subgroups required. In this way, the most vulnerable groups in terms of poverty can be seen.

The **poverty distribution measures** indicate how poor people are distributed and the characteristics that they share. These are measures that provide the analyst with descriptive information on a group of poor people.

It is also important to have available data on **the intensity of poverty**. This type of measure allows us to understand up to what point poverty affects the population. Therefore, it focuses on the degree of poverty suffered by people, more than the number of individuals considered to be poor.

Via the joint use of incidence and intensity poverty measures, it is possible to describe in a more detailed way what is happening in a society. It is possible to have a large variety of situations, from a society with a high percentage of poor people where all those who are poor are located very close to the threshold, to another society where there is a small percentage of poor people, but who are located far from the poverty threshold.

Another of the key factors for analysing poverty is to have available measures that take into consideration the inequality between poor people themselves.

All of these measures are essential for obtaining a comprehensive view of the phenomenon and their complementary use is fundamental in the carrying out of in-depth analyses on poverty.

INCIDENCE OF POVERTY

The indicator that measures the incidence of poverty will be the percentage of poor people (under the relative poverty threshold) within the total population. This percentage is called the poverty rate of the poverty risk rate (PR) and it is calculated in the following way:

$$Poverty\_rate(PR) = \frac{p}{n}$$

where *p* is the number of poor people and *n* is the total number of people, poor or not, in the group within which the poverty rate is being calculated.

Very often, the poverty rate is called H (headcount ratio).

Poverty rates can be calculated for different population groups according to demographic or socio-economic variables: sex and age, level of education, professional situation, etc.

For example, the poverty rate of older people over 65 years is calculated as the number of poor older people over 65 years within the total number of older people over 65 years.

Example:

If we assume that we have a population of 20 people with annual income (per consumption unit) expressed in thousands of Euros and the following ages:

People	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Income c.u. (thousands of Euros)	2	2	3	3	3	5	5	5	6	6	7	7	8	8	9	9	9	10	10	10
Ages	15	51	24	22	55	47	20	78	64	50	32	33	42	57	61	21	12	35	48	25

In order to calculate the first relative poverty threshold, we take the distribution median (the value that remains on the left of 50% of the individuals). The median is calculated as the arithmetic average of the intermediate data (income data for people 10 and 11). The median is therefore 6.5 and the threshold (using the 60% criteria) is 0.6×6.5, in other words 3.9.

The income of people 1, 2, 3, 4 and 5 is under the threshold and the number of poor people is therefore equal to five.

The poverty rate will be: the number of poor people amongst the total population, in other words:

P.R.= $\frac{5}{20}$ =0.25 or 25% of the population is poor.

If for example we want to get the poverty rate for people between 50 and 64 years, we calculate: the number of poor people in this age group and the number of people in this age group.

There are six people aged between 50 and 64 years and two of these (the second and the fifth) have annual income per consumption unit that is under the threshold (3,900€).

Therefore, the poverty rate for the age group between 50 and 64 years is:

T.pop_(50-64years)=2/6=0.33, in other words a third of people in the age group from 50 to 64 years are poor.

POVERTY DISTRIBUTION

Within the poverty analysis, as we have just mentioned, it is particularly interesting to carry out a study of poor people, their characteristics and their living conditions. To do this, we study the distribution of poor people by age and sex, by level of education, by their dwelling tenancy regime, etc.

The distribution of poor people by ages, for example, would provide information on the percentage of people over 65 years among those that are poor, calculated as: the number of poor people over 65 years among the number of poor people.

Example:

Using the same example as in the incidence of poverty, we can now calculate the distribution of the population in the following age groups:

	No. of people	No. of poor people	Distribution of poor people
Under 16 years	2	1	20%
Between 16 and 24 years	4	2	40%
Between 25 and 49 years	7	0	0%
Between 50 and 64 years	6	2	40%
65 years or above	1	0	0%

In this simple case, we can see that one in every five poor people are under 16 years, in other words 20% of poor people are under 16 years, 40% are aged between 16 and 24 and the remaining poor people are aged between 50 and 64 years. In a real situation, we'd have poor people of all ages and the distribution would tell us about the age structure of poor people.

The distribution study according to different variables allows us to understand the characteristics of poor people and therefore facilitates the design of more efficient measures in the fight against poverty.

INTENSITY OF POVERTY

One of the most influential factors on the seriousness of the poverty phenomenon is its intensity. Using relative measures does not provide us with information on the degree of poverty suffered by poor people. It is therefore necessary to use some kind of indicator of the depth of poverty alongside the relative measures that provides information on the financial situation of poor people and the differences with the rest of the population.

Poverty gaps, measurements defined in a number of ways, are measures that usually measure the intensity of poverty.

- The *poverty gap (PG)* is a measure of the distance of individual poor people from the poverty threshold and it is constructed in the following way:

$$PG = \sum_{i=1}^{p} (u - x_i)$$

where *u* represents the poverty threshold, x_i is the equivalent income of person *i* and *p* is the number of poor people in the population.

- There are another two measures related to the intensity of poverty that use this measure as a base element.

  The first measure is usually called the *income gap (I)* and is calculated by dividing the poverty gap among the minimum income poor people would have to have in order to stop being poor. It is expressed in the following way:

  $$I = \frac{PG}{pu} = 1 - \frac{\mu_p}{u}$$

  where μ_p is the average income per c.u. of poor people.

  The second measure is called the *relative poverty gap (HI).* It is calculated as the coefficient between the poverty gap and the number of people in the poverty threshold, in other words, as though everyone was in the poverty threshold:

  $$\text{Re}\,lative\_poverty\_gap(HI) = \frac{\sum_{i=1}^{p}(u - x_i)}{nu} = TP \times I$$

  where *u* is the poverty threshold, x_i is the equivalent income of person *i* and *n* is the total number of people in the population.

  As you can see in the formula, this measure of poverty intensity can be expressed as the poverty rate by the income gap.

- The *poverty gap* provided by EUROSTAT in its list of indicators is defined as the difference between the threshold and the median of income per c.u. of people placed below this threshold, expressed as a percentage of the poverty threshold.

  $$Eurostat\_poverty\_gap = \frac{(Threshold) - (Median\_Poorpeople)}{Threshold}$$

Example:

Continuing with the same example used in the poverty incidence and distribution, the poverty gap will be calculated using the last definition (EUROSTAT).

The poor people are the first five individuals:

Person	1	2	3	4	5
Income c.u. (thousands of Euros)		2	2	3	3	3

The median of the income of poor people is 3. In this way, the poverty gap is calculated as:

$$Poverty\_gap = \frac{(3900) - (3000)}{3900} = 0{,}23$$

In other words, the poverty gap is 23% of the threshold.

3.2.6. OTHER POVERTY MEASURES

The measures described above are poverty measures that are almost exclusively used to understand the incidence or intensity of poverty. There are however other ways of measuring poverty, the majority of which are more complicated and difficult to interpret than those mentioned in this document. The special feature of these measures is that they aim to provide information on the three essential factors for poverty: its incidence, its intensity and inequality amongst poor people. Below, we present some of these measures although we do not intend to describe them in detail:

- ***The Sen Index***

  This is a weighted total of individuals' poverty gaps. The weightings depend on the relative position of each poor person. The index is similar to the following expression depending on how the number of poor people grows:

  $$S = TP \times (I + (1 - I)G_p)$$

  where G_p is the Gini index for the total poor population.

- ***The Thon Index (a variation of the Sen Index)***

  For a sufficiently large p, it can be expressed in the following way:

  $$T = TP \times (S + 2(1 - TP)I)$$

- ***Family of poverty indices by Foster, Greer and Thorbecke***

$$FGT(\alpha) = \frac{1}{n}\sum_{i=1}^{p}\left[\frac{(u - x_i)}{u}\right]^{\alpha}, \ \alpha \geq 0$$ (poverty aversion parameter)

For individual α the FGT indices coincide with other poverty measures that we have already presented, for example:

$FGT(0) = TP$
$FGT(1) = HI$

- ***The Hagenaars Index***

$$HAG = \frac{p}{n}\left[\frac{\log u - \log \mu_p^*}{\log u}\right]$$ where μ_p^* is the geometric average of poor people's income.

- ***TIP poverty curves***

These are curves that reflect the three dimensions of poverty, its incidence, its intensity and the inequality between poor people. They are compiled using a philosophy that is similar to the Lorenz curve (used to measure the inequality of income and expenditure). They represent the percentages of poor people in the horizontal axis and the poverty gaps accumulated from these percentages of poor people in the vertical axis.

3.2.7. PERSISTENT OR LONG-TERM POVERTY

Without leaving behind the context of relative poverty and in order to incorporate the time dimension into the analysis, measures of persistent of long-term poverty are calculated.

Persistent or long-term poverty measures deal with information over a number of years in order to calculate the number of poor people. In the case of EUROSTAT, the persistent poverty rate is calculated in the following way:

Information is obtained from people over four consecutive years. People are classified as poor or not in each of these four years following relative poverty criteria. The threshold is calculated each year and people are classified (the threshold varies from one year to the next). A person will be considered persistently poor if they are classified as poor during the last year and in at least two of the three previous years.

Persistent poverty indicators aim to reflect structural poverty situations and they therefore do not consider people as poor who have circumstantially or momentarily fallen into poverty. For example, a person who loses their job, is unemployed for one

year and finds another job the following year. Although their income decreases a lot during this year, it is probable that the person has savings, access to credit etc. that allows them to continue with the same standard of living until they are able to find work again. By compiling a measure that takes into consideration information from four different years however, to a certain extent it is possible to avoid counting this type of person as poor.

Example: The "poor" variable in each year is defined in the following way:

$$\text{Poor}(i) = \begin{cases} 0 & \text{if the person is not classified as poor in the corresponding year } i \\ 1 & \text{if the person is classified as poor in the corresponding year } i \end{cases}$$

If we assume that we have three people and their situations (with regards monetary poverty) during four consecutive years (1994-1997):

	Poor (1994)	Poor (1995)	Poor (1996)	Poor (1997)
Person 1	0	0	0	1
Person 2	1	0	1	1
Person 3	1	0	0	1

If we just focussed on the situation in 1997, three people would be classified as poor. Although these three people are below the poverty line in 1997, when we look at their situation over the previous three years, differences are highlighted. During the last four years, person 1 has only been poor in the last year. Person 2 has been under the poverty line twice in the last three years.

With just these data, it isn't possible to understand the reality of each person and it is possible to assume, without the risk of making a mistake, that person 2 is in a worse situation than person 1, at least up until now (1997). A momentary fall into poverty does not necessarily mean a drastic change in living conditions, but remaining in poverty for a number of years, whether consecutively or intermittently, in the majority of cases does have an influence on the quality of life in households.

Using the definition of persistent poverty applied by a European Union agreement, person 2 would be classified as persistently poor, whereas person 1 and person 3 are not persistently poor, although they would have been classified as poor in 1997.

3.3. Subjective poverty lines

Subjective poverty lines are based on the opinion held by individuals on themselves in relation to society as a whole. In other words, the concept of poverty used in these lines to divide the population into poor and not poor is based on the perception households and individuals themselves have in relation to what it is to be poor.

When using this focus for measuring poverty, it is assumed that "*each individual is the best judge of their own situation*" (Van Praag et al, 1980) and we avoid therefore to a certain extent the opinions of value implicit in the relative poverty measures, choice of threshold, use of equivalence scales, etc.

The best-known subjective poverty lines are the Kapteyn and Leyden lines. The Deleeck line is also well-known, although interest in this particular line has decreased over the years. These three lines construct the poverty threshold using the responses given by households to certain questions in household surveys, from which subjective information is collected.

3.3.1. THE KAPTEYN LINE

In the case of the *Kapteyn line*, households are researched with the aim of obtaining information on the minimum income that each household believes is necessary to make ends meet. The question is usually formulated like this:

"In your opinion, what is the minimum net monthly income needed for a household like yours to make ends meet?"

Under the hypothesis that the minimum income stated by the household to make ends meet depends fundamentally on its size and the level of income it has, a model is constructed[1] which links these three variables, where the dependent variable is the minimum income to make ends meet and the explanatory variables are the size of household and the actual income.

We see that normally, households with high income say that they need a lower amount than actually enters the household to make ends meet, whereas in households with low income, the opposite usually occurs. These households state that they need higher minimum income to make ends meet than they actually receive. Therefore it seems logical to assume that it is the households with income close to the required minimum that define these minimums the most precisely.

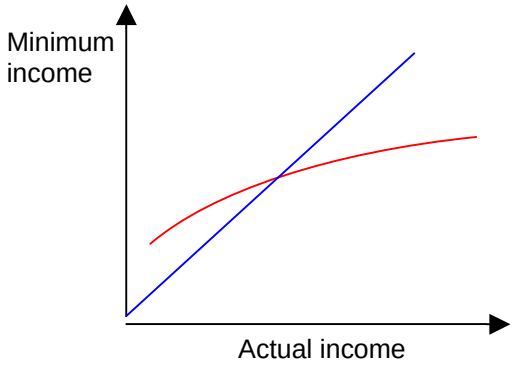
[1]The proposed model and that which links the three variables is the following regression model:

$$\log (y_{min}) = a_0 + a_1 \log (nm) + a_2 \log (y) + \varepsilon$$

where $y_{min:}$ minimums stated by households to make ends meet
nm: number of household members or size of household
y: actual income received by households.

The following graph represents the regression model (in red) having fixed a size of household and the line at which the minimum income is equal to actual income (in blue). The two hypotheses meet at the intersection and this is therefore the ideal value at which to fix the poverty line. Households with income under this value are considered poor.

Graph I: Intersection between the model adjusted to the data and the line at which the minimum income is the same as the actual income stated.



In this way, each size of household will have a different poverty threshold constructed using the information provided by households on what they consider to be necessary to make ends meet.

Other methodologies have been developed using Kapteyn's line with the aim of constructing subjective poverty lines. In some cases, characteristics other than the size of household are entered as explanatory variables, such as the age of the main breadwinner, the number of minors, etc.

3.3.2. LEYDEN'S LINE

The Leyden line uses the income that households link to six economic situations from worst to best. The question used in the surveys is the following one:

Given the current situation in your household, state approximately what net monthly income you would associate with each of the following economic situations:

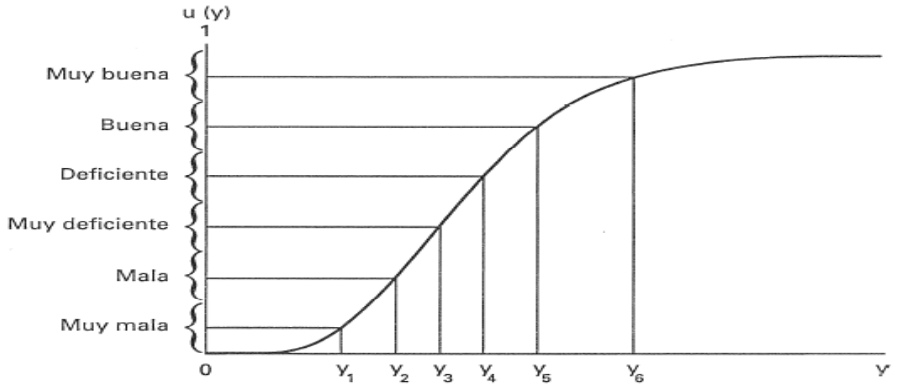
Very poor _ _ _ _ _ _ €
Poor _ _ _ _ _ _ €
Inadequate _ _ _ _ _ _ €
Very inadequate _ _ _ _ _ _ €
Good _ _ _ _ _ _ €
Very good _ _ _ _ _ _ €

The link between welfare and household income is represented using a function called U, "individual welfare function from income". U is a useful cardinal function that links

the income stated by households with usefulness (welfare), which is represented on a scale between 0 and 1.

The usefulness function can be estimated for each household with information provided by the previously mentioned question. For each household, we have six points for the usefulness function: (y_1, 1/12), (y_2, 3/12), … (y_6, 11/12). It is therefore understood that households allocate a usefulness close to 1/12 to income provided by a "very poor" economic situation, a usefulness close to 3/12 to a "poor" economic situation and so on.

There are studies that ensure that the individual welfare function from income can be approximately described with the function of lognormal distribution[2]. Thus, this usefulness function for each household is completely determined by its average (μ_t) and its standard deviation (σ_t).



A hypothesis is constructed that states that the average μ_t depends on the household's actual income y and $_t$ its size f_t (number of members). The average can be linked to the actual income and the size of household using a regression model[3], which can be estimated.

Variance $\sigma_t^{\,2}$ is estimated by the standard deviations of all households in the sample, $\overline{\sigma}$

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[2] Where $y_{i,t}$ is the income variable for household t and which provides usefulness $\frac{i-\frac{1}{2}}{6}$, it can be said that: $\text{Ln } y_{i,t} = \mu_t + \sigma_t u_i$ (i=1…6), where $N(u_i) = \frac{i-\frac{1}{2}}{6}$ (where N(.) a normal distribution of 0 average and 1 variance).

[3] $\mu_t = \beta_0 + \beta_1 \ln y_t + \beta_2 f_t$, where y_t is the household's actual income and f_t the size of household.

A different poverty line is constructed for each size of household f. A minimum welfare line (usefulness) is fixed α and all households with a welfare level lower than α are poor.

Income "y" is looked for, as this provides a level of welfare on which to fix the poverty threshold and to classify as poor those people whose income is lower than "y".

As it is the lognormal usefulness function, determined therefore by its average (which only depends on income y^t for a fixed household size f) and its variance (estimated by $\overline{\sigma}$), we can forget the formula [4] which links income with usefulness, the income that provides the level of usefulness α. This income, which is what is used to fix the poverty line, depends on the regression model's coefficients, on $\overline{\sigma}$, the size of household f and the level of usefulness α chosen and can be obtained using the following formula:

$$\text{Ln y} = \frac{1}{(1-\hat{\beta}_1)}(\hat{\beta}_0 + \hat{\beta}_2 f + \overline{\sigma} u^{\alpha})$$

3.3.3. THE DEELECK LINE

The Deeleck line uses the information provided by the question on the minimum income needed by a household to make ends meet (question used in the Kapteyn line) and information from the following question:

In relation to the household's total monthly net income, how do you usually make ends meet?

With great difficulty
With difficulty
With some difficulty
With a fair amount of ease
With ease
With great ease

In order to construct the poverty line with the Deeleck methodology, only the information from households who have answered in the previous question that they make ends meet "with some difficulty" is used. These are households therefore that suffer from poverty, but in a moderate way, or in other words, households that are probably placed close to the poverty threshold.

By limiting ourselves to these households that make ends meet "with some difficulty", a new variable is calculated called minimum income. This minimum income is obtained in the following way:

[4] $\ln y = \mu_t + \sigma_t u_\alpha$ in other words, $\ln y = \hat{\beta}_0 + \hat{\beta}_1 \ln y + \hat{\beta}_2 f + \overline{\sigma} u_\alpha$ where we can forget ln y

Minimum income = minimum (y*, $y^{mín}$), where:

y* is the household's actual income and

$y^{mín}$ is the minimum income that a household thinks a household like theirs needs to make ends meet (response to the question asked to construct the Kapteyn poverty line).

According to the study we want to carry out, households can be divided into groups depending on the characteristics that are wanted and different poverty lines can be calculated for each group.

Taking the minimum income variable, the average and μ the standard deviation of each group is estimated (σ). Atypical values are eliminated, those that are outside the interval, $(\mu - 2\sigma, \mu + 2\sigma)$ and the average is calculated again with this new set of data. The poverty line for each group will be the new average calculated with the households that make ends meet with some difficulty and once the atypical values have been eliminated.

This line has been criticised for excessively reducing the sample, as it only uses the opinion of households who make ends meet with some difficulty. The decision to eliminate the poverty line of very rich and very poor households from the calculation has also been discussed, as by not taking them into account, there may be a significant element of bias in the estimated poverty line.

4.Multi-dimensional deprivation

Returning to what was set out in the introduction, it is important to remember that poverty is a phenomenon that shows itself in very different ways and is the result of multiple factors. Therefore it is impossible to define it in a single and absolute way and behind each analysis there is a concrete definition or way of conceiving this concept.

It is important to highlight the importance of undertaking poverty analyses that take into account the different aspects of the phenomenon and its multi-dimensional dimension. Up until now, this document has tried to give a view of some of the basic methods for measuring poverty, but all of them have a monetary focus in some way or another and are based on actual income or the income subjectively fixed by households. In this type of poverty measure, income is considered a good proxy variable for a household's resources and its possible access to certain living conditions.

For some time now, the need to provide other poverty measures has been highlighted. Measures that are not only based on monetary indicators, but on variables that directly reflect the deprivation suffered by households, therefore aiming to extend the concept of poverty and to link it to social exclusion.

This growing need to provide non-monetary deprivation measures has many reasons. On the one hand, monetary poverty only shows a part of the phenomenon and assumes that households with the same income have similar standards of living. In addition, although income is a good indicator of standard of living, it does not reflect all possible situations and sometimes, its measurement is complicated and difficult to adjust, for example in the case of freelance workers.

On the other hand, individuals have other kinds of resources that are not reflected in monetary poverty measures and which could be used to avoid poverty and to achieve an acceptable standard of living. This would be the case of people who have savings, equity, etc. There is also another group of resources that can influence a household's situation and which is not directly and uniquely linked to current material wealth, for example education, the support of family or friends, access to credit, etc.

As well as these theoretical considerations, studies have been carried out that analyse the link between material deprivation and monetary poverty. These studies classify the population in two groups, poor people and those that are not poor, using both monetary poverty measures and also multi-dimensional deprivation measures.

In these studies, the conclusion was reached that the two groups of poor people obtained were different. There was a fairly large common group, households and people considered poor under the two criteria, but there were also many other households that were classified as poor according to one criteria and not according to the other. The characteristics of the groups that showed inconsistencies were studied and it was noted that in many cases, individual characteristics explained that some households had sufficient income but suffered deprivation or vice versa, they did not have sufficient income, but they didn't suffer from deprivation.

It was therefore shown that the link between monetary poverty and multi-dimensional deprivation is not perfect and highlighted the need to obtain and use other analysis measures of deprivation and social exclusion that are different from monetary

measures in order to complete the analysis and to give the most complete general view of the phenomenon possible.

Moreover, in Europe and in particular following the expansion of Europe to 25 countries, the importance of having poverty measures that can be used to make comparisons between countries is being highlighted. Relative monetary poverty measures have a fair number of disadvantages in this sense, as sometimes they provide similar results for countries that have a very different standard of living. A possible solution is currently being investigated to the official use of non-monetary deprivation indicators.

4.1. Background to the multi-dimensional deprivation study

The multi-dimensional deprivation study dates back to the 80s when the first attempts to analyse poverty and social exclusion using non-monetary indicators were carried out. The first people to construct deprivation indices or indicators were: Peter Townsend in 1979, Joanna Mack and Stewart Lansley in 1985 and Tim Callan, Brian Nolan and Christopher T. Whelan in 1993.

4.1.1. TOWNSEND

In 1979, Peter Townsend constructed a multi-dimensional deprivation index using sixty indicators that reflected living conditions and which gave information on food, clothes, health, leisure, household equipment, durable goods, etc. From these sixty indicators, he randomly chose twelve considered basic and valid regardless of sex or age.

Townsend constructed the multi-dimensional deprivation index by a simple breakdown of the indicators relating to un-owned goods and services. The index gave a value of 0 if no deprivation was identified in the twelve basic indicators, 1 if one of the twelve were missing, 2 if there was deprivation in two of the listed elements and so on successively. Townsend gave the same importance to the twelve basic indicators, in other words, the same influence was given to a household that didn't have a fridge as a household that didn't have breakfast on the majority of days of the week.

With this multi-dimensional deprivation breakdown indicator, Townsend was looking to study a level of income from which the amount of deprivation increased outrageously, in other words where living conditions declined drastically. In this case, this level of income could be taken as the poverty threshold.

4.1.2. MACK AND LANSLEY

In 1985, Mack and Lansley set up a new multi-dimensional deprivation indicator. Among the basic indicators, they differentiated between forced and voluntary shortage and only considered that deprivation existed when the lack of a good or service etc. was forced and not a product of the individual preferences or decisions of households.

Mack and Lansley used a set of thirty five indicators, choosing eighteen that were used to construct a broken down deprivation index. The criteria for choosing the eighteen final indicators were determined by the interviewers themselves, who classified the specific goods and services in the original thirty five indicators as necessary or not.

With this broken down indicator, the population was classified in the following way: all those people who were deprived of three of the goods and services included in the reduced group of eighteen indicators were considered poor.

In this case, Mack and Lansley used multi-dimensional deprivation to directly measure poverty, not to fix a monetary poverty threshold, which was Townsend's objective.

4.1.3. CALLAN, NOLAN AND WHELAN

Callan, Nolan and Whelan carried out a study in 1993 in which they aimed to delve deeper into the link between income and material living conditions.

The living conditions were measured directly using non-monetary indicators. The method used can be summarised in the following way:

They started with a group of 24 indicators and using factorial analysis they studied whether the different conditions, goods and services considered in the indicators could be classified in different groups (clusters) that identified possible dimensions of material deprivation.

The three dimensions obtained from the data analysis were the following:
The "dwelling and durable goods" dimension, the "basic" dimension (included elements defined by a large group of interviewers as needs) and the "social aspect and others" dimension.

They considered a person to be poor (according to multi-dimensional deprivation criteria) if they were deprived of any of the goods, services or living conditions that are grouped in the basic dimension. The goods etc. included in the other dimensions were not taken into consideration, as it was considered that they did not include true needs or that the needs included were due to specific factors that were not linked to general material deprivation.

This study compared the characteristics of the groups of poor people that arose using this deprivation indicator and the indicator obtained when applying monetary poverty

criteria. They observed that many people who were not classified as monetarily poor suffered material deprivation, whereas others who were considered poor, monetarily speaking, did not suffer deprivation.

4.2. Non-monetary indicators within the European Union context

Faced with the need to obtain multi-dimensional deprivation measures, the European Statistics Office (EUROSTAT), in particular the Indicators Subgroup of the Social Welfare Council, is developing a methodology to construct non-monetary deprivation indicators. These indicators will provide information that complements the information already provided by the other social exclusion indicators, although without the intention of covering all existing areas of social exclusion.

EUROSTAT has published two reports in connection with multi-dimensional material deprivation:[5] (2000 and 2003) and an article[6] in 2005.

The official methodology to be adopted by EUROSTAT for the calculation of these indicators is not yet known. In this document, we only express the ideas set out in the 2003 report and in the article by Anne-Catherine Guio in 2005. This article defines material deprivation based on the conditions in a dwelling, the availability of durable goods, delays in payments and the inability to meet basic material needs.

A series of elements, goods, services and material living conditions are taken as basic indicators that are used to detect material deprivation.

It is desirable that the basic indicators used reflect a dimension of living conditions that are common to the European Union and which allow comparisons to be made between various time periods. International comparisons do not require basic indicators to be the same in all countries. It is sufficient if the total set of basic indicators (even though they are different in each country) bring together the same information. Despite this fact, if we want to use harmonised data throughout Europe, the solution would be to use the available harmonised information and it would therefore contain the same basic indicators in all countries.

BASIC INDICATORS AND DIMENSIONS OF DEPRIVATION

The basic indicators taken into account in the article are grouped in the following way:

Economic difficulties:

- Being able to afford holidays away from home for at least one week a year

[5] EUROSTAT (2000) "European Social Statistics: Income poverty and Social Exclusion (1st Report)", KS-29-00-181-EN-C

EUROSTAT (2003) "European Social Statistics: Income poverty and Social Exclusion (2nd Report)", KS-BP-02-008-EN-C

[6] Guio A-C (2005) "Material Deprivation in the EU", European Statistics in Focus, 21/05

- Delays in mortgage, rent, water, electricity payments, etc., shopping paid for in instalments
- Being able to afford meat, chicken or fish (or the vegetarian equivalent) at least every other day
- Being able to maintain the dwelling at an adequate temperature during the cold months

Durable goods:

A household is considered to suffer the deprivation of a good if this lack is due to economic resources.

- Colour TV
- Telephone
- Car for personal use

Dwelling

- The existence of leaks, damp in the walls, floors, ceilings or foundations or rotten floors, window or door frames
- Shortage of natural light in a room
- Bathroom or shower in the dwelling
- Toilet with running water inside the dwelling for the household's exclusive use

These three groups of indicators reflect three dimensions of material deprivation, which can be studied together or separately.

In the article, the basic indicators are grouped into these three dimensions, as this structure is based on what was obtained from a previous factorial analysis that was undertaken to explore the European Community Household Panel (ECHP) data and on another factorial analysis that was applied to data available from the Statistics on Income and Living Conditions (data from the countries that carried out the EU-SILC-2003) and which confirmed the results of the first analysis and concluded that the structure obtained with the first analysis continued to be valid.

The factorial analysis concluded that the best solution was to use these three dimensions, even though just two could be used without losing too much precision and gaining simplicity. The structure with two dimensions is achieved by joining the economic difficulties and the durable goods into one single dimension.

With these basic indicators and the dimension structure adopted, a threshold has to be defined in order to determine when a person is considered to have suffered material deprivation. In the article, the threshold is fixed arbitrarily, considering that a person is poor in this sense if they lack at least one good or service etc., included in the basic indicators for the size of dwelling and the two from the joint dimension that brings together the economic difficulties and the durable goods. This threshold is used to construct deprivation rates.

The article discusses the possible decisions that can be taken in terms of giving certain weightings or not to the material deprivation elements, depending on their relative importance.

It can be assumed that all material living condition elements that are included in the basic indicators have the same importance in terms of deprivation. By treating the basic indicators in this way, the interpretation of measures that can be constructed from them is facilitated, although they do not seem to reflect reality in a correct way.

In order to introduce differences between the elements, different weightings could be allocated. The weightings should be based on what the population considers to be most necessary for living, but as this information is not usually available, one solution would be to use the percentages of people that possess or have each good or service in order to construct the weightings. This last approximation assumes that if for example the possession of a durable good is common, the probability that a person feels deprived if they are not able to afford this good is high.

The decision to use weightings or not depends on whether an interpretation of the results is preferred, or whether it is better to reflect, as far as possible, the differences between the goods and services in the index to be used.

4.3. Obtaining of non-monetary material deprivation indicators in the future in the European Union

Even though EUROSTAT has not released the official methodology for the calculation of indicators, it seems obvious that there is a clear intention to encourage the future obtaining of non-monetary indicators for all countries in the European Union and in this way provide more official measures that can be used to carry out a more complete analysis of poverty.

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