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Abstract

We propose a new and integrated approach to the measurement of inequality in income distribution, poverty, and richness. The proposed broad set of indicators is neutral and easy to calculate. The method allows a specific interpretation of the results, a decomposition according to households' characteristics, and an immediate comparison of the results between different countries and time periods. We illustrate the application of the proposed measures and their decomposition based on evidence from Portugal. In addition, we characterize households in accordance with their position in the income distribution.

Keywords: income inequality, poverty, richness, measurement.
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An integrated approach for the measurement of inequality, poverty, and richness

1. Introduction

The analysis of income inequality and poverty are well established research fields in the economic literature.[1] That analysis can be justified on several grounds. On one hand is the humanitarian wish to address an issue that many see as socially unfair. On the other hand, economic policy concerns have brought the issue of poverty and inequality to the center of public debate, intensifying the research into their determinants among other topics. A full knowledge of the real dimension and characterization of these phenomena is thus of widespread interest, seeking a more adequate definition of appropriate economic policies interventions.

The study of the top income distribution has also recently emerged (Piketty, 2005; Saez and Veall, 2005; Piketty and Saez, 2006; Roine and Waldenström, 2008; Bach et al., 2009; Atkinson and Piketty, 2010).[2] The analysis of richness has focused on three areas: income as a source of power; wealth is control over resources; and the economic importance of the top income group in terms of income taxes and pensions (Atkinson and Piketty, 2010). Central to all this literature has been the discussion of the procedures and indicators for the measurement of income inequality, poverty, and richness.

The present paper contributes to this line of research by proposing a new methodology that allows an integrated approach of the inequality, poverty, and richness phenomena. The suggested approach also meets the following characteristics: (i) simplicity in application terms; (ii) neutrality; (iii) an objective interpretation of the results; (iv) a straightforward comparison of the results between different economic spaces and time periods; (v) the possibility of knowing the contribution of population's sub-groups.

The paper is structured as follows. Section 2 summarizes the main methodological options used in the literature. Section 3 presents the new approach in which new measures of inequality, poverty, and richness are advanced. Section 4 illustrates the

[1] A number of recent books addressing the state of the art in income distribution, inequality, and poverty do exist apart from a multiplicity of other empirical and theoretical contributions – Kamanou (2005), Heshmati (2007), Haughton and Khandker (2009), Salverda et al. (2009), and Wolff (2009).

[2] One can consider Peichl et al. (2010) and Peichl and Pestel (2010) for a multidimensional analysis of richness.

application of the proposed measures. Section 5 attempts to characterize households in respect to their position in the income distribution. Section 6 presents some final remarks.

2. Methodological options and indicators

For the empirical analysis of inequality, poverty, and richness, one needs to choose from among previous methodological options as well as choose the indicator(s) that will be used to measure the phenomena. In this section, we summarize the main existing options and common choices.

2.1 Methodological options

The measurement of inequality in income distribution, poverty, and richness implies making choices among certain methodological options. Four of these options are common to the analysis of the three phenomena while another is specific to the analysis of poverty and richness. The first group involves choices at four levels: (i) the indicator of resources; (ii) the demographic unit; (iii) equivalence scales; (iv) the weighting of the demographic unit. Defining of a poverty/richness line is also needed in order to measure poverty and richness.

In relation to the indicator of resources, Cowell (1995) suggests that richness, lifetime income, and income are, in that order, the most adequate ones, even though none of them "covers completely the command over resources for all goods and services in society" (Cowell, 1995, p. 5). The ease of calculation and, mainly, data availability usually justify income as the favored option. There is also the issue regarding the concept of income that is used. The most common option – given the availability of statistical information – is monetary disposable income. It could be defined as the sum of work income (from either employees or self-employed earners), property income, pensions, other social transfers, and other private transfers after the deduction of the taxes on income and social contributions. This choice is subject to criticism because of the exclusion of all non-monetary forms of income (income in kind such as self-consumption) and also of the past accumulation effect through savings and indebtedness.

The second methodological choice relates to the demographic unit, usually between the individual and an aggregate, family or household, the latter also including individuals at the same address who are not part of the nuclear family. The option for households is mainly followed in the literature because of the income sharing phenomenon within the household.

Directly related to the previous option is the issue of comparing unlike units. Households with different compositions and dimensions are indeed significantly different. They also have distinct needs and thus require different levels of income to achieve similar levels of well-being. The use of equivalence scales allows calculating equivalent adults for each household. A frequently used equivalence scale is the OECD modified scale, which gives a weight of 1 to the first adult, 0.5 to each of the remaining adults, and 0.3 for children under 14 years of age.[3] The income adjusted by the composition and dimension of the household – the adult equivalent income – represents a refinement of the income per capita, not neglecting the existence of economies of scale due to the share of housing and expenses.[4]

The fourth option has to do with the weighting of the demographic unit, that is, the choice of the receiving units of a given income, say households, individuals, or adult equivalents. The usual choice is to assume the number of a household's individuals. So, for instance, if there are five individuals in a given household, that corresponds to the observation of five income equivalents.

The fifth element is considered exclusively in the analysis of poverty and richness, and has to do with drawing a poverty/richness line. Let us focus on the most common case, the poverty line, separating the poor from the non-poor. The main methodological option in this context is the choice between an absolute or relative poverty line. In the first case the poverty threshold is defined without reference to the standard of living prevailing in society. In the second case that reference is taken into account.[5]

The poverty definition based on the notion of subsistence or, more widely, on the basic needs approach[6] sets the threshold at the minimum income level needed for fulfilling the needs regarded as basic. A common way of establishing such a poverty line involves

[3] Since there are no unequivocal reasons supporting the use of a given scale, sensitivity analyses employing alternative scales are frequently opted for.

[4] Disregarding inequality within the household is the main limitation of this concept. For instance, as stressed by Haddad and Kambur (1990) or Sutherland (1997), it implies the under-estimation of the actual degree of inequality existing in society.

[5] Regarding the measurement of richness, one can use a relative line established in a similar way as and adapted from the poverty line.

[6] See, for instance, Morse (2004).

the definition of a minimum basket of goods that guarantees bare sustenance and, subsequently, the application of a multiplicative factor reflecting the cost of the non-food items.

Defining diet in accordance with the existing food norms and, more broadly, basic needs by taking into account the existing consumption patterns, necessarily implies some relativity in poverty definitions (White, 2002). This way of determining the poverty line makes it specific to a given country or region and thus more difficult to make comparisons between economies (Hayami and Godo, 2005). An alternative is to use an absolute level of income usually near the minimum for survival and fixed in time and space as the reference for a poverty line. Here the two poverty lines proposed by the World Bank are of great popularity among researchers given their convenience and simplicity.

When considering the concept of relative poverty, the conditions seen as basic must be evaluated in the context of the individual's society, differing between countries. This way of defining the poverty line – usually a percentage of the mean or median of the income distribution – has been widely applied. Another option is to take 60% of the median income, although frequently followed by sensitivity analysis (using, for instance, 50% or 70% of that median income).

2.2 Indicators

After taking into account the methodological options mentioned above, one must choose the indicators to use.

Inequality indicators

Four main groups of inequality indicators can be considered. The first one refers to measures that compare the income share of the top x% of the income distribution with that of the bottom x%. Frequent values for x are 5, 10, and 20. The main advantage of this type of indicator – and the reason for its strong support (at least as a preliminary indicator) – is the ease of calculation and interpretation. However, evaluating inequality through these measures is limited because the income distribution inside each income group is not considered (Haughton and Khandker, 2009).

The most widely used measure of income inequality is the well-known Gini coefficient, an indicator that varies between 0 (total equality) and 1 (maximum inequality). Non-decomposability is one of its main limitations, that is, the impossibility to evaluate the contribution of each subgroup of the population (defined by a given economic or population criterion) to overall inequality.

A third way to measure inequality consists of using the index proposed by Atkinson (1970). Its most important characteristic is making the value judgments involved in measuring inequality explicit by taking into account a parameter ε capturing inequality aversion. That parameter can vary between 0 (inequality indifference) and $+\infty$ (corresponding to the Rawlsian criterion that values only the income of the poorest).

Finally, another group of inequality indicators is composed of the generalized entropy (GE) measures, including the Theil indices and the mean log deviation measure (Cowell, 1977; Cowell and Kuga, 1981a,b). Similar to the Atkinson index, GE measures clearly assume the incorporated value judgments through the parameter α representing the attributed weight to income differences in different parts of the distribution. The most common values for α are 0, 1, and 2. The inexistence of inequality implies that GE measures assume a value of zero. The increase of the value of such indicators thus corresponds to an increase in inequality. GE measures are additively decomposable, a crucial property for the evaluation of inequality determinants.

Poverty indicators

There are also a number of poverty measures available in the literature, capturing the different dimensions of the phenomenon. The most simple poverty measure is the headcount index (P_0), measuring the proportion of individuals classified as poor (that is, with an income lower than the poverty line) in the total population. The main merit of this measure is the simplicity of calculation and interpretation. However, an important weakness of P_0 is the fact that it is only an accounting of the poor, with no sensibility regarding the magnitude of the problem, that is, *how* poor the poor are. Enlarging existing poverty situations leaves P_0 unaltered.

A second poverty measure is the poverty gap index (P_1). This index measures the mean deviation of income from the poverty line. Thus P_1 overcomes the main limitation of P_0.

The poverty severity index (P_2) – also called squared poverty gap index – is a third poverty measure. It attempts to measure the inequality among the poor by calculating the sum of poverty gaps proportionally weighted by their own gaps (Haughton and Khandker, 2009). Thus P_2 is especially affected by extreme poverty situations.

A particularly appealing way to present the three above measures of poverty is through the class of poverty measures proposed by Foster et al. (1984):

$$P_\alpha = \frac{\sum_{i=1}^{N} \left(\frac{G_i}{z} \right)^\alpha}{N} \qquad (1)$$

in which N is the total number of individuals in the population, Z the poverty line, and G_i the poverty gap associated with individual *i*. G_i will be zero if the income of *i* (Y_i) is greater than or equal to Z and will be ($Z - Y_i$) in the opposite case (i.e. when i is poor). The parameter α ($\alpha \geq 0$) represents the index sensibility to poverty. When α is 0, 1, and 2, one obtains the poverty measures mentioned above, that is, the headcount index, the poverty gap index, and the poverty severity index, respectively. Decomposability is a very interesting property of P_α.

The index proposed by Sen (1976) – attempting to capture in a single measure the three above dimensions – does not satisfy that property. As shown by Blackwood and Lynch (1994), the Sen index is more sensitive to a reduction in the headcount compared to a decrease in the poverty gap or in the inequality among the poor. Therefore, "the Sen index is somewhat biased toward policies that reduce the number of poor" (Blackwood and Lynch, 1994, p. 571).

Richness indicators

While methodologies used to analyze inequality and poverty are well consolidated in the literature, this is not so for the evaluation of richness (Peichl and Pestel, 2010). In that context, the most commonly applied measures are the income share of the top x% of the income distribution and headcount measures. As stated above, both measures have serious limitations and thus only give a partial indication of the richness

phenomenon. An important contribution is given by Peichl et al. (2010) who have suggested a class of richness measures analogous to poverty measures.

3. A new approach for the measurement of inequality, poverty, and richness

In the previous section we synthesized the most common methodological options for the measurement of inequality, poverty, and richness, as well as the main indicators available, stressing their specificities and (implicit or explicit) value judgments.

In this section, we propose a new approach for measuring these phenomena. This approach has five appealing characteristics. First, they are part of an integrated approach of the phenomena under scrutiny (inequality, poverty, richness), that is, their quantification results are from a common conceptual framework. Second, they are as neutral as possible in terms of value judgments, seeking only the quantification of the phenomena. Third, they are extremely easy to calculate. Fourth, the values obtained for each indicator have a concrete economic interpretation and not only with reference to similar values reached in different time periods or spaces. Fifth, they are decomposable into subgroups, enabling a more in-depth analysis of the phenomena.

Our point of departure is a new measure of inequality. We then derive poverty and richness measures, capturing the different dimensions of the phenomena.

Regarding the methodological questions presented in the previous section, we assume the most common choices concerning the second and third questions – households as recipient units of income and an equivalence scale (namely the OECD modified scale) to account for the existence of economies of scale – while following a different approach in relation to the fourth and fifth questions previously mentioned.[7]

3.1 Income inequality

Inherent to the inequality measure we propose is a concept of income inequality defined as the difference between the existing income distribution and the egalitarian one. In other words, the income inequality measure proposed quantifies how far we are from an

[7] The first option is unnecessary for the present section. We will return to that subject in Section 4.

equality situation, indicating the percentage of total income that would be necessary to redistribute in order to eliminate inequality.[8] The inequality index (I) is defined as:

$$I = \chi \sum_{i=1}^{N} \left| \psi_i - \lambda_i \right| \tag{2}$$

in which

$$\psi_i = \frac{Y_i}{\sum_{i=1}^{N} Y_i} \tag{3}$$

and

$$\lambda_i = \frac{D_i}{\sum_{i=1}^{N} D_i} \tag{4}$$

N is the total number of households, Y_i represents the total income of household i, and D_i expresses the number of adult equivalents in that household. Thus, ψ_i is the income weight of household i and λ_i its weight in adult equivalents terms. There will be an equality situation in the income distribution when all households have an income share equal to their share in adult equivalents terms, that is, when $\forall_i, \psi_i = \lambda_i$.

If we set $\chi = 0.5$, the possible values for I are in the range $[0,1[$.[9] An open range at right is due to the fact that the value of 1 corresponds to a situation where the full amount of income is held by households of a zero dimension, an impossible scenario.

Taking into account the proposed inequality measure, I, we can deepen the analysis, proposing poverty and richness measures. The first step is to set criteria to define if household i is poor (P), rich (R) or in an intermediate situation, what we will call middle class (MC). These criteria are based on the comparison between what the household has in income terms with what it should have, considering its dimension and composition, in order to obtain an equal distribution of resources:

[8] Applying the terminology used in the poverty analysis, we have a measure of inequality intensity.

[9] The value of $\chi = 0.5$ allows a more intuitive interpretation of the results and is thus more adequate than alternatives such as $\chi = 1$, according to which I would vary between zero and two.

$$S_i = \begin{cases} R \text{ if } \dfrac{\psi_i}{\lambda_i} > \upsilon \\ MC \text{ if } \dfrac{1}{\beta} \le \dfrac{\psi_i}{\lambda_i} \le \upsilon \\ P \text{ if } \dfrac{\psi_i}{\lambda_i} < \dfrac{1}{\beta} \end{cases} \tag{5}$$

in which $\beta, \upsilon \ge 1$.

Once we classify each household according to its position in the income distribution, we can then obtain aggregated measures of poverty and richness.

3.2 Poverty

As seen above, the analysis of poverty should take into account three dimensions: incidence, intensity, and severity. Following the approach presented in the previous section, we now propose poverty measures that focus on each of these dimensions.[10]

(i) Poverty incidence

We start by defining a measure of poverty incidence, POV. Defining H_i as the number of individuals of household *i*, then:

$$POV = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} H_i} \tag{6}$$

POV is a headcount index indicating the percentage of individuals that belong to poor households in relation to the total number of individuals.

[10] Composite measures simultaneously capturing more than one of these dimensions are equally possible.

(ii) Poverty intensity

Additionally, we can define an index of poverty intensity (POV'). Let us start by calculating the following:

$$\theta_i = \frac{\lambda_i}{\beta} - \psi_i \tag{7}$$

θ_i expresses the percentage of the total income in the economy that household i would have to receive in order to become non-poor. Thus, POV' corresponds to the percentage of the total income in the economy that needs to be transferred from the non-poor to the poor in order to eradicate poverty:

$$POV' = \sum_{\substack{i=1 \\ (S_i=P)}}^{N} \theta_i \tag{8}$$

If we divide POV' by the number of poor households, we will obtain an indicator of the average intensity of poverty.

(iii) Poverty severity

The third poverty dimension that needs to be taken into account is its severity. To capture this dimension, we follow two (complementary) approaches. The first one takes into account a new poverty threshold reflecting a higher degree of resource privation. The second approach involves adapting the inequality measure proposed above in order to quantify the degree of inequality among the poor. Let us examine each.
Regarding the first approach, we define a situation of extreme poverty as:

$$S_i = SP \text{ if } \frac{\psi_i}{\lambda_i} < \frac{1}{\zeta\beta} \tag{9}$$

in which $\zeta > 1$.

The incidence of severe poverty can be defined in relation to either the total population or the poor population, expressing each case, respectively, as follows:

$$S-POV(1)=\frac{\sum_{\substack{i=1\\(S_i=SP)}}^{N} H_i}{\sum_{i=1}^{N} H_i} \tag{10}$$

$$S-POV(2)=\frac{\sum_{\substack{i=1\\(S_i=SP)}}^{N} H_i}{\sum_{\substack{i=1\\(S_i=P)}}^{N} H_i} \tag{11}$$

In a similar vein, the intensity of severe poverty can be calculated by reference to either the poverty line or the severe poverty line, being measured, respectively, as:

$$S-POV'(1)=\sum_{\substack{i=1\\(Si=SP)}}^{N} \theta_i \tag{12}$$

$$S-POV'(2)=\sum_{\substack{i=1\\(Si=SP)}}^{N} \omega_i \tag{13}$$

in which θ_i corresponds to its expression in (7) and:

$$\omega_i=\frac{\lambda_i}{\zeta\beta}-\psi_i \tag{14}$$

The measures of severe poverty intensity express the percentage of the total income in the economy that would be necessary to transfer to the extreme poor in order to take them out of poverty (in the case of S-POV'(1)) or in order for them to become non-severe poor, even though still being poor (in the case of S-POV'(2)).
In relation to the second approach, we calculate the inequality index among poor (I_P) as the following:

$$I_P = k \sum_{\substack{i=1 \\ (Si=P)}}^{N} \left| \eta_i - \rho_i \right| \tag{15}$$

in which:

$$\eta_i = \frac{Y_i}{\sum_{\substack{i=1 \\ (Si=P)}}^{N} Y_i} \tag{16}$$

and

$$\rho_i = \frac{D_i}{\sum_{\substack{i=1 \\ (Si=P)}}^{N} D_i} \tag{17}$$

This indicator quantifies the percentage of the total income of poor households that has to be re-affected among them for an equal intensity of poverty.

(iv) The near-poor

An effective poverty policy cannot focus only on the poor, but should, in line with the analysis of poverty vulnerability (Pritchett et al., 2000; Guimarães, 2007; Zhang and Wan, 2009), also give special attention to those who are very near of being poor in order to avoid the emergence of new poverty cases. Accordingly, we propose measures to capture the importance of this phenomenon. We can define:

$$S_i = P^+ \text{ if } \frac{1}{\beta} \leq \frac{\psi_i}{\lambda_i} < \varepsilon \tag{18}$$

in which $\frac{1}{\beta} \leq \varepsilon < 1$.

Near-poverty incidence representing the percentage of total individuals that belong to near-poor households is given by:

$$POV^+ = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} H_i} \tag{19}$$

In this context it is also interesting to know the safety net that the near-poor population has relative to a poverty situation. For household *i*, that safety margin is given by the symmetric of θ_i. In overall terms, we quantify this as:

$$POV'^+ = \sum_{\substack{i=1 \\ (S_i = P^+)}}^{N} \left(\psi_i - \frac{\lambda_i}{\beta} \right) = \sum_{\substack{i=1 \\ (S_i = P^+)}}^{N} (-\theta_i) \tag{20}$$

expressing the percentage of the total income in the economy according to which the near-poor are above the poverty line. The average safety margin of near-poor can be obtained dividing POV'^+ by the number of near-poor households.

3.3. Richness

The indicators used in the analysis of poverty can be adapted for the measurement of the corresponding richness dimensions. We thus conceive incidence, intensity, and severity measures of richness. For terminological reasons, we opt to designate the last case as "richness depth".

(i) Richness incidence

Let us start by defining RICH as the ratio between the number of individuals in rich households and the total number of individuals:

$$RICH = \frac{\sum_{i=1}^{N} H_i}{\sum_{i=1}^{N} H_i} \quad (S_i = R) \tag{21}$$

(ii) Richness intensity

To obtain a measure of richness intensity, we define:

$$\delta_i = \psi_i - \upsilon\lambda_i \tag{22}$$

Then, richness intensity is given by:

$$RICH' = \sum_{\substack{i=1 \\ (S_i = R)}}^{N} \delta_i \tag{23}$$

representing the percentage of the total income in the economy according to which the rich are above the richness line. Dividing RICH' by the number of rich households we can obtain the average intensity of richness.

(iii) Richness depth

Finally, we also need to attend to richness depth. We do so using the same two methodologies we have applied in the poverty case. The first approach involves, as a first step, the definition of what we can define as extreme richness line, above which households are classified as extremely rich:

$$S_i = ER \text{ if } \frac{\psi_i}{\lambda_i} > \sigma\upsilon \tag{24}$$

in which σ>1.

The incidence of extreme richness can be expressed in relation to either the total population or the rich population. In each case we have respectively:

$$E-RICH(1) = \frac{\sum_{\substack{i=1 \\ (S_i=ER)}}^{N} H_i}{\sum_{i=1}^{N} H_i} \tag{25}$$

$$E-RICH(2) = \frac{\sum_{\substack{i=1 \\ (S_i=ER)}}^{N} H_i}{\sum_{\substack{i=1 \\ (S_i=R)}}^{N} H_i} \tag{26}$$

In turn, taking as a reference either the richness line or the extreme richness line, the intensity of extreme richness can be defined respectively as:

$$E-RICH'(1) = \sum_{\substack{i=1 \\ (Si=ER)}}^{N} \delta_i \tag{27}$$

$$E-RICH'(2) = \sum_{\substack{i=1 \\ (Si=ER)}}^{N} \varphi_i \tag{28}$$

where δ_i is expressed in (22) and:

$$\varphi_i = \psi_i - \sigma\upsilon\lambda_i \tag{29}$$

As severity of poverty, the richness depth can also be captured through an inequality measure applied exclusively to the rich population:

$$I_R = \phi \sum_{\substack{i=1 \\ (Si=R)}}^{N} \left| \varpi_i - \mu_i \right| \tag{30}$$

in which:

$$\varpi_i = \frac{Y_i}{\sum_{\substack{i=1 \\ (Si=R)}}^{N} Y_i} \tag{31}$$

and

$$\mu_i = \frac{D_i}{\sum_{\substack{i=1 \\ (Si=R)}}^{N} D_i} \tag{32}$$

3.4 Middle class inequality

As mentioned in the Introduction, the evaluation of richness has recently joined the well-established analyses of inequality and poverty. Least explored has been the study of income distribution in the middle class. However, this is also a relevant issue since the degree of inequality present in this income group is an important indicator of countries' economic and social cohesion.[11]

To conceive such an indicator, we start by focusing on households in which S_i = MC, calculating:

$$I_{MC} = \tau \sum_{\substack{i=1 \\ (Si=MC)}}^{N} \left| \vartheta_i - o_i \right| \tag{33}$$

[11] See, for instance, Gigliarano and Mosler (2009) or Winkelmann and Winkelmann (2010) for an analysis of the influence of middle-class inequality.

in which:

$$\vartheta_i = \frac{Y_i}{\sum_{\substack{i=1 \\ (Si=MC)}}^{N} Y_i} \tag{34}$$

and

$$o_i = \frac{D_i}{\sum_{\substack{i=1 \\ (Si=MC)}}^{N} D_i} \tag{35}$$

I_{MC} is an income inequality measure for the middle class. It indicates the percentage of the total income of the middle class that, if adequately redistributed among middle class households, would eliminate the inequality in that income group.

4. Inequality, poverty, and richness – an application with evidence from Portugal

4.1 Data and empirical evidence

In order to illustrate the application of the set of inequality, poverty, and richness measures presented in the previous section, we consider data from Portugal, since it is among the European countries with the highest levels of inequality and poverty. The evidence from the European Union Statistics on Income and Living Conditions (EU-SILC) indicates that in 2008 Portugal was the fourth country in the EU-27 with the highest level of inequality and the fifth country in the EU-15 with the highest level of poverty (in the 10th position considering EU-27).

We have used micro-data on the income and structure of households living in Portugal resulting from the Office of National Statistics (INE)'s Household Budget Survey (IDEF).[12] We have used the last available wave of that survey, of 2005/2006.[13] The results are based on a representative sample of the Portuguese economy with 10,403

[12] Statistics on household budgets is information followed at an European level – Household Budget Survey.

[13] This is the seventh wave of this type of survey in Portugal. The first goes back to the 1967-68 period. The following waves have enlarged the range of covered questions, allowing a more detailed analysis of the population's living conditions.

households and a total of 28,359 individuals.[14] The IDEF is a large-dimension survey associated with a questionnaire filled in by households with detailed information on the whole set of collective and individual expenditures. It also includes demographic data, income data, and data on non-frequently consumed goods and services, collected through direct interview.

Information on income includes both monetary and non-monetary income components. The subsequent analysis takes into account not only monetary income but also total income. The comparison of the results is particularly important for two reasons: (i) the relative weight of non-monetary income, rising to approximately 19% of total income; (ii) the asymmetry in the non-monetary income distribution.

Table 1 presents the results of the application of the proposed indicators taking as a reference the following values of parameters: χ=0.5, β=2, υ=2, ζ=2, κ=0.5, ε=0.6, σ=2, ϕ=0.5, and τ=0.5.

Table 1 – Inequality, poverty, and richness indicators for Portugal (%)

	Monetary income	**Total income**
Inequality		
I	26.14	23.78
Poverty		
POV	21.85	17.78
POV'	2.99	2.09
S-POV(1)	3.13	1.85
S-POV(2)	14.31	10.41
S-POV'(1)	1.00	0.54
S-POV'(2)	0.20	0.09
I_P	11.04	9.58
POV+	10.42	10.52
POV'+	0.52	0.54
Richness		
RICH	7.94	7.03
RICH'	9.15	7.18
E-RICH(1)	1.09	0.77
E-RICH(2)	13.77	10.98
E-RICH'(1)	4.56	3.17
E-RICH'(2)	2.33	1.59
I_R	15.14	13.88
Middle class - inequality		
I_{MC}	15.19	14.97

Source: own calculations based on IDEF

[14] See INE (2008) for a detailed description of the sample construction process.

Focusing on the results based on total income, we find the need to redistribute 23.78% of the total income in the economy to reach a situation of equality in income distribution.[15]

Regarding to the distribution of individuals by income groups, we conclude that 17.78% are poor, 7.03% are rich, and the remaining 75.19% are from the middle class. Concentrating on the bottom of the income distribution, we see that 10.41% of the poor (corresponding to 1.85% of the total population) face a situation of severe poverty (a situation in which households possess a resource proportion lower than 25% of the proportion in adult equivalents terms). Additionally, individuals that can be classified as near-poor (i.e. middle-class individuals that are close to a situation of poverty and thus face a serious risk of changing to that state) comprise 10.52% of the total population. Finally, when focusing on the top of the income distribution, we identify 10.98% of the rich (0.77% of the total population) exhibiting an extreme richness situation (here defined as a situation where the household has a relative weight in terms of income at least four times higher than its weight in terms of adult equivalent dimension).

The analysis of poverty intensity allows us to conclude for the need of a value equivalent to 2.09% of the total income in the economy in order to eliminate it. That amount includes a fraction of 0.54% of the total income in the economy corresponding to what is necessary in order to eliminate severe poverty situations and thus raising those households to the poverty line level. Only 0.09% of the total income in the economy would be needed to reach the goal of eradicating severe poverty. Another way of measuring the existing inequality among the poor population is to apply an inequality measure exclusively to the poor. In that case, we observe a need to re-affect (at least) 9.58% of the poor income to remove that inequality and thus have the different poor households at the same distance from the poverty line. In addition, the near-poor possess, as a whole, a safety net equivalent to 0.54% of the total income.

Concerning the evaluation of richness, the income surplus from the richness line equals 7.18% of the total income. A value equivalent to 3.17% of that total income is the amount needed to reduce the income of those classified with extreme richness to the richness line level. That income reduction to the level of the extreme richness line implies the movement of 1.59% of the total income in the economy. The measurement

[15] Note that such an overall value presupposes an adequate redistribution of income, that is, one that does not waste resources.

of richness inequality indicates the need to re-affect 13.88% of the total income of the rich population in order to eliminate that inequality.

Finally, looking at the middle class, we find that 14.97% of the income in middle-class households would have to be redistributed among them to ensure total income equality for the middle-class.

The concrete results naturally depend on the values assumed for the different parameters. However, there are no valid reasons to unequivocally support certain values for those parameters, namely the ones that are a reference for the definition of the income groups, and thus sensitivity analyses based on alternative values are welcomed. A preliminary analysis of the kind is presented in annex Table A.1 considering other values for β, υ, and ε.[16]

The graphic representation of the measures calculated in the present section is presented in annex Figure 1.[17]

Annex Table A.2 provides detailed information about the income distribution in accordance with the assumed values for $\frac{\psi_i}{\lambda_i}$. We can verify, as expected, a strong asymmetry in the income distribution, with households having a resource fraction lower than their relative dimension corresponding to 65.42% of the total households. That household group possesses an income equivalent to only 41.57% of the total income. The usual concentration on the bottom of the distribution is thus obvious and especially significant for values of $\frac{\psi_i}{\lambda_i}$ between 0.4 and 0.9.

4.2 Decomposition by households' characteristics – an example

As previously stressed, the measures proposed in Section 3 allow their decomposition by any household's characteristic, such as type of household (dimension and composition), region of residence, or variables associated with the individual of reference of that household, such as age, gender, educational level, labor market state, among others. We have conducted a decomposition by region of residence to illustrate that possibility rather than proceeding to a detailed analysis of that evidence. Such an

[16] A more in-depth analysis of the issue should also consider alternative values for ζ and σ.
[17] In that figure, Y represents income and H the number of individuals, as previously defined.

exercise allows focusing on the existence of regional inequalities in Portugal for the dimensions analyzed in this paper.

Table 2 – Regional decomposition of inequality, poverty, and richness indicators

Region / **Index**	***Norte***	***Centro***	***Lisboa e Vale do Tejo***	***Alentejo***	***Algarve***	***Açores***	***Madeira***	**∑**
Inequality								
I	4.41	3.45	4.09	3.04	3.40	2.44	2.97	**23.78**
Poverty								
POV	3.99	2.60	1.47	2.44	2.02	2.02	3.23	**17.78**
POV'	0.42	0.33	0.19	0.30	0.25	0.20	0.40	**2.09**
S-POV(1)	0.45	0.21	0.16	0.20	0.21	0.14	0.48	**1.85**
S-POV(2)	2.54	1.19	0.87	1.13	1.17	0.79	2.72	**10.41**
S-POV'(1)	0.13	0.07	0.05	0.07	0.06	0.04	0.13	**0.54**
S-POV'(2)	0.021	0.011	0.011	0.013	0.010	0.005	0.021	**0.09**
Ip	2.13	1.44	0.78	1.44	1.08	0.91	1.80	**9.58**
POV^{+}	2.44	1.76	0.56	1.79	1.21	1.04	1.71	**10.52**
POV'^{+}	0.13	0.09	0.03	0.10	0.06	0.05	0.08	**0.54**
Richness								
RICH	1.13	0.84	1.87	0.69	1.16	0.81	0.52	**7.03**
RICH'	0.97	1.00	2.54	0.47	0.99	0.85	0.38	**7.18**
E-RICH(1)	0.13	0.09	0.31	0.04	0.09	0.09	0.03	**0.77**
E-RICH(2)	1.81	1.30	4.36	0.50	1.30	1.30	0.40	**10.98**
E-RICH'(1)	0.41	0.48	1.32	0.11	0.30	0.46	0.08	**3.17**
E-RICH'(2)	0.16	0.27	0.69	0.04	0.11	0.28	0.03	**1.59**
Ir	2.10	1.81	4.33	1.05	1.96	1.90	0.73	**13.88**
Middle class								
I_{MC}	2.85	2.21	1.96	2.21	2.29	1.40	2.05	**14.97**
$\sum_{i=1}^{N}(\psi_i - \lambda_i)$	-1.735	-0.724	4.372	-1.222	0.964	0.338	-1.993	**0**

Source: own calculations based on IDEF.

Table 2 illustrates the decomposition by regions of all the measures calculated in Table 1. Additionally, the last row presents evidence in relation to $\sum_{i=1}^{N}(\psi_i - \lambda_i)$, allowing to emphasize the regions where households' weight in income terms exceeds their respective weight in dimension terms.

The reading of both incidence and intensity indicators is immediate. The value corresponding to each region should be interpreted in the same way as the overall indicator, though applied exclusively to the given region. Let us consider the poverty indicators as examples. Regarding POV, we found a poverty incidence at the national level of 17.78%. A disaggregation by regions reveals that 3.99% of the individuals from the sample are poor living in the *Norte* region, 2.60% in the *Centro*, 1.47% in the region of *Lisboa e Vale do Tejo*, etc. Adding up the values of the different regions we obtain

the incidence of poverty at the national level.[18] In the same vein, regarding POV', we can say, for instance, that the amount necessary to eradicate poverty in the *Algarve* corresponds to (at least) 0.25% of the total income in the economy, while for *Madeira* that value is equivalent to 0.40% of the total income in the economy. In the national total, as has been seen, a mobilization of 2.09% of the total income in the economy is needed to overcome poverty. The interpretation made for the values of POV and POV' is also valid for the other incidence or intensity indicators – S-POV(1), S-POV(2), S-POV'(1), S-POV'(2), POV^{+}, POV'^{+}, RICH, RICH', E-RICH(1), E-RICH(2), E-RICH'(1), and E-RICH'(2).

Concerning the inequality indicators (I, I_P, I_R, and I_{MC}), the value regarding each region expresses half of the deviation assigned to households of that region in relation to an egalitarian situation (having in income terms the same weight as in adult equivalent terms). So, for instance, taking into account the overall indicator of inequality (I), the deviation from the egalitarian situation of households living in the *Norte* region equals 8.82% of the total income in the economy.[19]

Finally, looking at the last row of Table 2, we can identify three regions (*Lisboa e Vale do Tejo, Algarve, and Açores*) in which their weight in overall income is higher than the correspondent weight in adult equivalents. *Lisboa e Vale do Tejo* – the most developed region in the country – has the largest difference. On the contrary, the *Madeira* region shows the most significant negative deviation.

5. Analyzing income groups

In this section, we seek to identify the way in which certain characteristics associated with households and the individual of reference of the household determine their probability of belonging to a given income group (considering the three main income groups identified in the above sections). To do this we have developed an econometric model that includes the main characteristics of households and the household's individual of reference as independent variables (section 5.1). Additionally, we have

[18] A different concept is the measurement of poverty incidence within the context of each given region.

[19] The percentage of the total income in the economy needed to eradicate inequality within each region cannot, in this case, be identified, because there are inter-regional transfers of income apart from intra-regional transfers. The transfers between regions are net positive amounts transferred to other regions when $\sum_{i=1}^{N}(\psi_i - \lambda_i) > 0$ and net positive amounts received from other regions in the opposite case.

characterized the income groups in relation to their expenditure structure attempting to clarify how it differs as a function of the income level (section 5.2).

5.1 Explaining income levels: model and results

A multinomial logit model is estimated in order to identify how certain characteristics of households and the household's individual of reference influence their likelihood of being poor, middle class, and rich. The dependent variable, T_i, assumes the following values:

$$\mathrm{Ti} = \begin{cases} 1 \text{ if } \mathrm{S_i} = \mathrm{M}C \\ 2 \text{ if } \mathrm{S_i} = \mathrm{P} \\ 3 \text{ if } \mathrm{S_i} = \mathrm{R} \end{cases} \tag{36}$$

Being from the middle class is considered as reference. The probability of a household being observed in one of the other groups of income *j* is given by:

$$\text{Prob } (\mathrm{T_i}=\mathrm{j}) = \frac{\exp(\alpha_j + \beta_X X_{ij} + \beta_V V_{ij})}{1 + \Sigma_{c=2}^{3} \exp(\alpha_c + \beta_X X_{ic} + \beta_V V_{ic})} \tag{37}$$

where X is a vector of variables associated with the household and V is a vector that includes variables related to the individual of reference of the household.[20] The subscript c is associated with the alternatives to being in the reference income class (c=2,3). The explanatory variables are defined in Table 3. The source of all variables is IDEF.

[20] According to INE, the household's representative is the individual with the largest proportion of the annual net total income of the household.

Table 3 – Definition of explanatory variables

Variables associated with the household	
Region	Dummies for each of the Portuguese regions: Norte, Centro, Lisboa e Vale do Tejo, Alentejo, Algarve, Madeira, and Açores.
Type of household	Dummies for each type of household: one adult with dependent children (type 1), one senior adult without dependent children (type 2), one non-senior adult without dependent children (type 3), two or more adults with dependent children (type 4), two or more adults without dependent children (type 5).
Main source of income	Dummies for each main source of income of the household: labor, capital, social benefits, others.
Variables associated with the individual of reference of the household	
Age	Dummies for the age group of the individual of reference: 16-29, 30-44, 45-64, and over 64.
Gender	Dummy with the value of 1 if the individual of reference is a female.
Educational level	Dummies for the education level of the individual of reference: primary, secondary, and tertiary education.
Labor market state	Dummies related to the labor-market state of the individual of reference: employer, self-employed with no employees, employee, unemployed, and inactive.
Marital status	Dummy with the value of 1 if the individual of reference is married.
Spouse's labor market state	Dummy with the value of 1 if the spouse of the individual of reference is unemployed or inactive.

Note: The reference group for each variable is the option with the greatest frequency in the sample.

We have estimated two different models: the non-spouse model and the spouse model. The difference between them resides in the variables included in vector *V*. For the non-spouse model, vector *V* includes the following variables: age, gender, educational level, and labor-market state. In turn, the non-spouse model also considers the variables related to the spouse of the individual of reference, namely a dummy for the marital status of the individual of reference and another to reflect the labor-market state of the spouse.[21] The estimated results of these two models are presented in Table 4.

[21] The sample is reduced to 9,325 households when these variables are taken into account because the spouse can only be identified when the individual of reference of the household is both its representative and spouse. The household's representative corresponds to the household's individual identified as such by the remaining household's individuals.

Table 4 – Multinomial logit estimations of S_i (Portugal 2005/2006)

	Non-spouse model				*Spouse model*			
	S_i=2		**S_i=3**		**S_i=2**		**S_i=3**	
	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.	Coef.	s.e.
Household related variables								
Region (Reference = *Norte*)								
Centro	0.93	*(0.09)*	1.08	*(0.17)*	1.03	*(0.09)*	1.08	*(0.18)*
Lisboa e Vale do Tejo	0.63***	*(0.11)*	2.18***	*(0.15)*	0.65***	*(0.11)*	2.15***	*(0.15)*
Alentejo	0.89	*(0.09)*	0.79	*(0.18)*	0.92	*(0.09)*	0.79	*(0.18)*
Algarve	0.66***	*(0.1)*	1.58***	*(0.16)*	0.71***	*(0.1)*	1.52***	*(0.16)*
Madeira	1.1	*(0.09)*	0.78	*(0.2)*	1.11	*(0.1)*	0.89	*(0.21)*
Açores	0.97	*(0.11)*	2.09***	*(0.18)*	0.97	*(0.12)*	2.24***	*(0.19)*
Type of household (Reference = Type 5)								
Type 1	3.42***	*(0.17)*	0.35***	*(0.32)*	2.30***	*(0.2)*	0.47*	*(0.39)*
Type 2	1.02	*(0.09)*	1.32	*(0.22)*	(0.98	*(0.13)*	1.75*	*(0.32)*
Type 3	1.63***	*(0.13)*	1.14	*(0.17)*	1.19	*(0.17)*	1.58	*(0.29)*
Type 4	2.21***	*(0.09)*	0.59***	*(0.11)*	2.56***	*(0.1)*	0.37***	*(0.13)*
Main income source (Reference = Labor)								
Capital	0.57	*(0.44)*	4.19***	*(0.35)*	0.49	*(0.45)*	4.47***	*(0.36)*
Social benefits	2.33***	*(0.11)*	0.93	*(0.22)*	2.04***	*(0.12)*	1.1	*(0.24)*
Other	1.25**	*(0.11)*	0.7	*(0.24)*	1.08	*(0.12)*	0.79	*(0.24)*
Household's individual of reference related variables								
Age group (Reference = 45 – 64 years)								
16-29	1.38**	*(0.13)*	0.10***	*(0.27)*	1.51**	*0.19)*	0.11***	
30-44	1.1	*(0.09)*	0.49***	*(0.11)*	1.25**	*0.1)*	0.61***	*(0.12)*
>64	1.33***	*(0.1)*	0.48***	*(0.18)*	1.16	*0.1)*	0.52***	*(0.19)*
Gender (Female = 1)	1.64***	*(0.06)*	0.65***	*(0.1)*	1.61***	*0.07*	0.70***	*(0.11)*
Education (Reference = Primary)								
Secondary	0.23***	*(0.17)*	9.03***	*(0.13)*	0.22***	*0.20*	9.36***	*(0.13)*
Tertiary	0.06***	*(0.34)*	45.59***	*(0.12)*	0.08***	*0.36*	48.42***	*(0.13)*
Labor market state (Reference = Employee)								
Employer	0.64**	*(0.18)*	2.61***	*(0.17)*	0.65**	*(0.18)*	2.79***	*(0.18)*
Self-employed no employees	1.78***	*(0.12)*	1.08	*(0.21)*	1.86***	*(0.12)*	1.13	*(0.21)*
Unemployed	2.76***	*(0.15)*	0.59	*(0.4)*	2.59***	*(0.17)*	0.56	*(0.43)*
Inactive	1.79***	*(0.13)*	1.75**	*(0.23)*	1.59***	*(0.14)*	1.69**	*(0.24)*
Marital status and labor market state of individual of reference's spouse								
Marital status (married = 1)					0.27***	*(0.15)*	2.57***	*(0.26)*
Spouse – Labor market state (Non employment = 1)					3.66***	*(0.1)*	0.54***	*(0.14)*
Constant	0.08***	*0.1*	0.03***	*0.16*	0.12***	*0.16*	0.02***	*0.3*
Number of observations	*10372*				9325			
Log likelihood	*-6052.7*				-5469.23			
Pseudo R^2	*0.20*				0.22			

Notes: (i) Robust standard deviations are presented in italic; (ii) * significant at 10%; ** significant at 5%; *** significant at 1%.

We will start with the analysis of the results from the non-spouse model. The first group of variables included in the estimation of this model contains certain household characteristics (region of residence, type of household, and main source of income). As for the region of residence, we see that living in the *Algarve* or in *Lisboa e Vale do Tejo* substantially reduces the probability of the household being poor and raises that of being rich. This is particularly true for the region of *Lisboa e Vale do Tejo* where, by comparison to *Norte* (the reference region), the probability of being poor falls by more than 1/3 and that of being rich is more than doubled. Living in *Açores* also substantially rises the probability of the household being rich.

Taking into account the type of household, the most striking element is the significant increase of the probability of the household being poor in relation to the household of reference (two or more adults without children) when the household has one adult with children or two or more adults with children. In both cases the probability of being rich also diminishes considerably.

The results from the main source of income are as expected. Indeed, in comparison with households having labor as their main source of income, households whose main source of income is capital income have a greater probability of being rich. On the contrary, there is a much greater probability (more than double) of households living mainly from social benefits to be poor and the same is true, despite the much lower magnitude, for those that have other main sources of income.

The second group of variables under scrutiny is a set of characteristics from the individual of reference of the household (age, gender, educational level, and labor-market state).

The effect of the age variable shows a clear pattern. The reference age group (45-64 years of age) has the greatest probability of richness and the lowest probability of poverty when compared to both 16-29 and over 64 age groups. If the individual of reference is between 16 and 29 years of age, the probability of that household being poor rises 38% while it increases 33% for the age group of 64 and over. In any event, the probability of being rich diminishes to less than half in relation to the reference age group.

The gender evidence suggests that the probability of the household being poor rises 64% and that of being rich falls by 35% when the individual of reference of the household is a female.

Evidence reveals a huge impact of education variables. Additional levels of education from the individual of reference of the household enormously increase the probability of that household being rich and diminish that of being poor when compared with households whose representative has a much lower educational level.

Finally, the labor-market state of the individual of reference of the household is also decisive. As expected, when the representative is unemployed the probability of the household being poor increases significantly. On the other hand, being an employer has a strong increase in the probability of being rich and reduces by 36% that of being poor. An inactivity situation raises the probability of both richness and poverty.

In addition to the initial model, we have also estimated a second model including variables associated with the spouse of the individual of reference (spouse model). According to this model, the influence of the variables already included in the first model does not show substantial changes, while the new variables provide important additional explanations of the phenomena under scrutiny. Indeed, when the individual of reference of the household is married the probability of that household being rich rises and that of being poor falls. On the other hand, if the spouse is unemployed or inactive, the probability of the given household being poor increases, while the probability of being rich drops by 46%.

5.2 Structure of expenditures

As a complement to the previous analysis, we have investigated whether households in different levels of the income distribution have characteristics distinguishing them in terms of expenditure distribution. We have once again used IDEF, since it provides information on the structure of the expenditures of each household. That information is presented in different levels of disaggregation. For the present analysis we have used the more aggregated information encompassing 12 categories of expenditures, as illustrated in Table 5.

Table 5 – Weights of the different categories of expenditure by income situation

$\frac{\psi_i}{\lambda_i}$	1	2	3	4	5	6	7	8	9	10	11	12
]0; 0.25[	26.16	5.72	3.38	27.32	4.09	6.77	7.08	4.45	3.36	0.71	6.47	4.50
[0.25; 0.5[	24.49	3.85	3.35	28.27	3.84	9.05	7.42	3.40	3.45	0.51	7.27	5.12
[0.5; 0.6[	21.79	2.77	3.46	29.67	4.02	8.12	9.73	3.23	3.64	0.44	7.58	5.57
[0.6; 1[	18.45	2.85	3.71	29.47	3.87	6.66	12.28	3.20	4.05	0.78	9.13	5.54
[1; 2[	14.00	2.08	4.14	27.44	4.58	5.88	13.72	2.99	5.74	1.44	11.62	6.36
[2; 4[	10.26	1.27	4.60	25.64	7.00	5.10	14.38	2.79	7.83	2.27	11.93	6.93
≥4	8.18	1.12	5.10	23.76	10.90	4.53	12.36	2.35	8.05	3.63	12.79	7.25

Note: 1 – food and non-alcoholic beverages; 2 – Alcoholic beverages, tobacco, and narcotics; 3 – Clothing and footwear; 4 – Housing, water, electricity, gas and other fuels; 5- Furnishing, household equipment, and routine maintenance; 6 – Health; 7 – Transport; 8- Communication; 9 – Leisure, recreation, and culture; 10 – Education; 11 – Hotels and restaurants; 12 – Miscellaneous goods and services.

An examination of Table 5 reveals some interesting results. First, we confirm the existence of significant differences according to income and thus that seems to be a crucial factor of expenditure structure. Second, as expected, basic consumption goods show a greater weight in the expenditure structure of households with lower levels of income. This is especially the case for category 1 (food and non-alcoholic beverages)

and also the case for categories 2 (alcoholic beverages, tobacco, and narcotics), and 8 (communication).[22] Third, opposed to what is reported above, other categories of goods and services – namely categories 3 (clothing and footwear), 5 (furnishing, household equipment, and routine maintenance), 7 (transport), 9 (leisure, recreation, and culture), 11 (hotels and restaurants), and 12 (miscellaneous goods and services) – represent a greater fraction for richer households. Fourth, category 4 (housing, water, electricity, gas, and other fuels) is – independently of the income situation – the most important fraction of total expenditures, with a result higher than 25% for all the income categories considered except for richer households, in which the weight is slightly lower (23.76%). Fifth, regarding to education expenditures, we find, as expected, a significant importance only in the higher income groups.

6. Final Remarks

The main contribution of this paper is the proposal of an integrated approach for the measurement of inequality, poverty, and richness. We have proposed a number of indicators characterized by their simplicity in application, neutrality, and decomposability and also for allowing a concrete economic interpretation of the results obtained.

The proposed measures were applied, for illustrative purposes, to the Portuguese economy, using IDEF data. Taking total income as a reference, that application has identified 17.78% of individuals in poor households, 7.03% in rich households, and the remaining 75.19% as part of the middle class. A severe poverty situation was found in 1.85% of the individuals analyzed (10.41% of the poor). Particularly important in quantitative terms is the near-poverty phenomenon (non-poor households very close to the poverty situation), accounting for 10.52% of the population. In inequality terms, we have calculated the need to re-affect (at least) 23.78% of the total income in the economy to reach a full equality situation. With a focus on poverty intensity, we conclude that 2.09% of the total income in the economy is the amount needed to be transferred from the non-poor to the poor in order to eradicate poverty. Additionally, the evidence from comparing total income with monetary income stresses important

[22] The mobile telephone penetration rate in Portugal is very high – 14.9 million subscribers of the land mobile service in the year 2008 (1.4 per capita on average) (INE, 2009).

differences in the results and thus highlights the importance of accounting for total income.

All the proposed measures can be decomposed with reference to a given characteristic of the household. We have illustrated that property by considering a regional decomposition that included the seven Portuguese NUTS II regions. In that analysis we found the region of *Lisboa e Vale do Tejo* (the most developed region in the country) to be the most favorable in terms of poverty and richness.

The evaluation of the main income groups' determinants through a multinomial model brought some interesting conclusions: (i) reinforcing the previous conclusion, a household from the region of *Lisboa e Vale do Tejo* has the lowest probability of being poor and the highest of being rich; (ii) the probability of being poor rises if the household is composed of only one adult (with or without dependents) or two or more adults with at least one dependent child/youth; (iii) households with social benefits as main source of income have a greater probability of being poor while households mainly living with income capital have higher probability of being rich; (iv) the richness probability increases and that of poverty decreases when the age group is between 45 and 64 years of age for the individual of reference of the household; (v) if that individual is a female the probability of poverty rises and that of richness falls; (vi) higher educational levels have strong implications, increasing the probability of richness and restricting the probability of poverty; (vii) an unemployment situation for the individual of reference augments the probability of poverty; (viii) if that household's representative is married the probability of a rich household increases and of a poor household diminishes; (ix) the opposite is found for an unemployed or inactive spouse.

The analysis of the expenditure structure of households in different income classes confirms the existence of profound divergences in those structures, with a larger weight of basic consumption goods for poorer households.

Important and diversified research topics remain regarding of the analysis of this paper. In methodological terms, the main challenge resides in testing the robustness of the results based on alternative values for the parameters in order to check the sensitivity of these results to alternative values. This is especially important for the parameters (β, υ, ζ, σ, and ε) that distinguish the main income categories, that is, poor, rich, middle class, severe poor, extremely rich, and near-poor.

In applied terms, cross-country comparative studies also enable raising the knowledge on the phenomena under examination for a wide range of countries with distinct

characteristics. The same comparative analysis could be conducted at the regional level, emphasizing the regional inequalities prevailing within a given country.

Finally, the enlargement of the determinants considered in models characterizing different income categories would also be interesting. The new explicative variables could, for instance, include more detailed aspects about the household members or features characterizing the regions of residence, deepening as much as possible the regional disaggregation used.

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Annex

Table A.1 – Inequality, poverty, and richness indicators for Portugal using both monetary and total income – sensitivity tests

	β = 2.1; υ = 2.1; ε = 0.6		**β = 1.9; υ = 1.9; ε = 0.6**		**β = 2.1; υ = 1.9; ε = 0.55**	
	Monetary income	Total income	Monetary income	Total income	Monetary income	Total income
Inequality						
I	26.14	23.78	26.14	23.78	26.14	23.78
Poverty						
POV	19.43	15.46	24.54	20.45	19.43	15.46
POV'	2.49	1.69	3.62	2.59	2.49	1.69
S-POV(1)	2.69	1.60	3.58	2.22	2.69	1.60
S-POV(2)	13.87	10.33	14.58	10.85	13.87	10.33
S-POV'(1)	0.82	0.43	1.21	0.68	0.82	0.43
S-POV'(2)	0.16	0.07	0.24	0.12	0.16	0.07
I_P	10.96	9.50	11.11	9.66	10.96	9.50
POV+	12.84	12.84	7.73	7.85	2.45	2.40
POV'+	0.80	0.82	0.29	0.30	0.16	0.15
Richness						
RICH	7.18	6.22	8.96	8.08	8.96	8.08
RICH'	8.39	6.51	9.99	7.94	9.99	7.94
E-RICH(1)	0.94	0.67	1.29	0.92	1.29	0.92
R-RICH(2)	13.07	10.82	14.36	11.35	14.36	11.35
E-RICH'(1)	4.12	2.90	5.08	3.55	5.08	3.55
E-RICH'(2)	2.13	1.45	2.57	1.77	2.57	1.77
I_R	15.01	13.77	15.35	14.05	15.35	14.05
Middle class						
I_{MC}	15.98	15.72	14.27	14.10	15.16	14.90

Table A.2 – Distribution of households and individuals by income levels

$\frac{\psi_i}{\lambda_i}$	Households			Individuals			Adult equivalents		Income	
	No.	%	% accu.	No.	%	% accum.	%	% accum.	%	% accu.
]0, 0.1[	7	0.07	0.07	16	0.06	0.06	0.06	0.06	0.0047	0.0047
[0.1, 0.2[	61	0.59	0.66	182	0.64	0.70	0.61	0.67	0.099	0.10
[0.2, 0.3[	281	2.70	3.36	744	2.62	3.32	2.59	3.26	0.661	0.76
[0.3, 0.4[	585	5.62	8.98	1531	5.40	8.72	5.42	8.68	1.92	2.68
[0.4, 0.5[	991	9.53	18.50	2568	9.06	17.78	9.14	17.82	4.14	6.82
[0.5, 0.6[	1115	10.72	29.22	2983	10.52	28.30	10.61	28.43	5.85	12.67
[0.6, 0.7[	1085	10.43	39.64	2915	10.28	38.58	10.36	38.79	6.72	19.39
[0.7, 0.8[	1064	10.23	49.87	2995	10.56	49.14	10.47	49.26	7.83	27.22
[0.8, 0.9[	884	8.50	58.37	2552	9.00	58.14	8.85	58.11	7.49	34.71
[0.9, 1[	733	7.05	65.42	2067	7.29	65.43	7.23	65.34	6.86	41.57
[1, 1.1[	616	5.92	71.34	1712	6.04	71.47	6.04	71.38	6.33	47.90
[1.1, 1.2[	513	4.93	76.27	1427	5.03	76.50	5.02	76.4	5.76	53.66
[1.2, 1.3[	343	3.30	79.57	945	3.33	79.83	3.35	79.75	4.18	57.84
[1.3, 1.4[	310	2.98	82.55	878	3.10	82.93	3.07	82.82	4.14	61.98
[1.4, 1.5[	270	2.60	85.15	724	2.55	85.48	2.57	85.39	3.72	65.70
[1.5, 1.6[	209	2.01	87.16	570	2.01	87.49	2.00	87.39	3.11	68.81
[1.6, 1.7[	186	1.79	88.95	512	1.81	89.30	1.79	89.18	2.95	71.76
[1.7, 1.8[	142	1.36	90.31	401	1.41	90.71	1.39	90.57	2.43	74.19
[1.8, 1.9[	127	1.22	91.53	347	1.22	91.93	1.22	91.79	2.25	76.44
[1.9, 2[	109	1.05	92.58	296	1.04	92.97	1.05	92.84	2.05	78.49
[2, 2.1[	87	0.84	93.42	229	0.81	93.78	0.82	93.66	1.68	80.17
[2.1, 2.2[	82	0.79	94.20	230	0.81	94.59	0.80	94.46	1.73	81.90
[2.2, 2.3[	59	0.57	94.77	156	0.55	95.13	0.56	95.02	1.26	83.16
[2.3, 2.4[	51	0.49	95.26	127	0.45	95.58	0.47	95.49	1.09	84.25
[2.4, 2.5[	67	0.64	95.90	173	0.61	96.20	0.61	96.10	1.51	85.76
[2.5, 3[	184	1.77	97.67	468	1.65	97.85	1.69	97.79	4.63	90.39
[3, 4[	155	1.50	99.17	392	1.38	99.23	1.42	99.21	4.86	95.25
[4, 5[	41	0.39	99.56	101	0.36	99.23	0.36	99.57	1.60	96.85
≥ 5	46	0.44	100	118	0.42	100	0.43	100	3.15	100
∑	10403	100		28359	100		100		100	

Figure 1 – Inequality, poverty, and richness in Portugal