Poverty, richness, and inequality: evidence for Portugal using a housing comfort index

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With data for Portugal we propose an index of housing comfort based on the Household Budget Survey. This index covers housing and durable goods grouped in two dimensions: basic comfort and complementary comfort. Taking this index as starting point we make two contributions. First we quantify the phenomena of poverty, richness, and inequality in housing comfort. Second, using an ordered probit model, we evaluate the determinants of housing comfort in Portugal. The results show significant rates of poverty (12.41%) and richness (22.03%). The evidence sustains that the differences between households derive mainly from complementary comfort and to a lesser extent from basic comfort items. Inequality in housing comfort, measured by the Gini coefficient, stands at 0.1263. The econometric study reveals that the region of residence of the household and the educational level and labor market state of the household reference person are among the most critical determinant factors of housing comfort.

Keywords: wealth, Portugal, poverty, richness, inequality, housing comfort.

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1. Introduction

Theoretical and empirical attention to inequality, poverty, and more recently, richness has been a dynamic research field in the economic literature [1,2]. Critical to this emphasis is, obviously, the social importance of these phenomena and the consequent impact on policy agenda. The quality of the policy decisions critically depends on the correct evaluation and quantification of the phenomena [3]. This is usually grounded on well-established indicators of inequality and poverty (with the last ones also adapted for the case of richness).

Measuring these phenomena implies a vast range of methodological options. One of the most critical in this regard is the selection of the indicator of resources. In developed countries, where the majority of the empirical studies have been carried out, income and expenditure are the variables traditionally considered. However, this is due mainly to data restrictions as it is widely recognized that they are second-best proxies for measuring these critical social dimensions. As suggested by Cowell [1], wealth, lifetime income, and income are, in that order, the most adequate ones. Interestingly, this question arises with different contours in low- and middle-income countries, where income and expenditure data are in many cases unavailable, hard and expensive to collect, unreliable, or incomplete, thereby limiting the ability to adequately capture welfare trends.

Taking the considerations above into account, Montgomery et al. [4], Sahn et al. [5] and Filmer et al. [6] proposed the consideration of an asset based-approach. To that end, they create asset indices capturing dwelling infrastructures, building materials, and durable assets. These indices, extensively used since these pioneering contributions, can be seen as proxies for a household's welfare, long-run wealth, long-run economic status,

permanent income, capabilities, and living conditions [7-12].[1] One important reason for the recent popularity of this approach derives from the fact that, contrary to income or expenditure data, there are large databases for several years and countries regarding asset ownership (e.g., USAID-sponsored Demographic and Health Surveys). In addition, in several developed countries, the national household budget surveys include questions about this topic.

Of course, the consideration of asset indices as proxies for wealth is not immune to criticism. Two aspects are especially noteworthy. First, the data usually give us information only on the presence of goods and not on the ownership, except for the incurred expenditure in the reference period of the survey. Using the presence of goods as a proxy for asset ownership has the underlying assumption that the amortization of debts arising from consumption credit is achieved in the short-term. Second, the family's preferences regarding, for instance, the quality of the goods or the use of credit are not available in the surveys and therefore are not taken into account.

Even if we accept the gravity of these limitations, a measurement of poverty, richness, and inequality in terms of critical assets is still a valuable contribution to our knowledge of well-being. In this context, special attention is usually given to housing conditions since, as expressed by Navarro et al. [13], 'housing is undoubtedly one of the main components of material well-being' [p.597]. The idea that inequality, poverty, and richness depend on many dimensions of human life, including income, but also other aspects goes back to the seminal works by Townsend [14], Streeten [15], and Sen [16] and has recently received a great deal of attention. The list of areas already studied is long, covering dimensions such as health, education, time use, water, and food, among

[1]For additional discussion on the roots of the asset-based approaches, see for instance Filmer et al. [9] and Ward [12].

others. Housing conditions can be considered through an analysis of this aspect and its multiple facets alone or through its inclusion in composite measures of well-being. Studies that follow this second approach include, for instance, Young [17], Batana [18], Gasparini et al. [19], and Yu [20].

The present paper belongs to the asset based approach and, more specifically, assumes that access to house-related assets is a critical dimension of well-being.[2] More specifically, we consider a new concept, which we designate as "housing comfort". In this case the focus is put on house related variables, meaning that we try to capture, with the highest possible level of detail, the characteristics and quality of the house in which a household lives (both housing conditions and durables are taken into consideration). As occurs in the dominant literature, we derive an index to measure this concept. In comparison to other asset indices, our indicator has two main differences. First, it is built from a much larger set of housing features (see McKenzie [8] for a proposal with the highest degree of similarity to the one we present here). On the other hand, it excludes assets that are related to the house.

This study uses microdata from the Household Budget Survey for Portugal (2005/2006) and proposes an index of housing comfort that covers housing and durable goods grouped in two dimensions: basic comfort and complementary comfort. Based on this index we establish two additional goals. First we characterize housing comfort in Portugal through measures of poverty, richness, and inequality based on a wealth measure. Second, we identify the main determinant factors of housing comfort.

[2]The literature analysing the level of deprivation suffered by households also gives this level of attention to housing attributes [21-23]. Nevertheless, in this case, the analysis is concerned with the lack of access to basic conditions.

Portugal is a very interesting case study because it is among the European countries with the highest levels of income inequality and poverty. According to the European Union Statistics on Income and Living Conditions (EU-SILC), in 2013 Portugal was the second country in the EU-15 with the highest level of inequality[3] (5th in the EU-28) and the fourth country in the EU-15 with the highest level of poverty[4] (9th in the EU-28). Despite its importance and specificities, the Portuguese case has received little attention to date. Some studies have characterized poverty using income or expenditure, such as Rodrigues [24], Ferreira [25], Alves [26], Peichl et al. [27], Rodrigues et al. [28], and Crespo et al. [29]. Nevertheless, knowledge about the Portuguese case would benefit from studies capturing other features of wealth.

The remainder of the paper is structured as follows. Section 2 presents the index that supports the empirical analysis developed in the study. Section 3 discusses the measures of poverty, richness, and inequality in housing comfort. Section 4 presents the econometric model, and Section 5 performs a sensitivity analysis. Section 6 has some final remarks.

2. An index of housing comfort

2.1 Data

[3]Gini coefficient of equivalised disposable income.

[4]People at risk of poverty after social transfers(cut-off point: 60% of median equivalised income after social transfers).

Microdata from the Household Budget Survey (Inquérito às Despesas das Famílias – HBS) carried out in 2005/2006 by Statistics Portugal has been used in this study. The HBS is a large survey focusing on gathering information from the Portuguese households on income and expenditure as well as detailed data about the characteristics of the housing, the households, and the individuals.

The Household Budget Surveys are among the most comprehensive household surveys applied in all Member States of the EU. The particular version adopted in each country contains some specific elements regarding the structure and the group of topics covered but is based on common methodological guidelines provided by Eurostat. For a more detailed discussion of this survey see, for instance, the Methodological Manual [30] or the Quality Report [31].

Concerning the Portuguese case, the HBS sample is composed of 10,403 households and 28,359 individuals. The survey is associated to a questionnaire including a log-book to be fulfilled by the selected private household. The information includes the whole set of collective and individual expenditures during two weeks. Additionally, it is also collected (through interview) demographic data, income data and data on non-frequent consumed goods and services. In the sampling process, representativeness of monetary expenditure by region and product class was assured, through a strengthening of the sample in areas where non-response rates are more frequent.

Initial data management and file creation was completed using Microsoft Excel 2010 from Microsoft Office Professional Plus 2010. All software used in this paper were run on a Toshiba Qosmio F750 laptop equipped with an Intel® Core™ i7-2630QM CPU, running at 2.00GHz with 8GB of memory, with Windows 7 32-bit Enterprise operating system.

In this study, the demographic unit is the household. The corresponding extrapolation coefficients are used as the weighting structure in determining the average housing comfort for all the households based on the sampling results. The use of simple averages based on sample observations would not be correct to make inferences about the population given the characteristics of the sample [32] and the calibration process associated with extrapolators [33].

2.2 The index

We start the empirical analysis by constructing an index of housing comfort for each household i (hereinafter designated as HCI_i). This exercise is conducted through a multidimensional indicator that includes two dimensions: basic comfort (i.e., housing and durable goods vital to provide a minimum level of well-being) and complementary comfort (i.e., nonessential items). Within each one of these dimensions three sub-dimensions are considered: housing conditions, household equipment, and communication and leisure equipment. McKenzie [8] observes that 'the housing quality, household infrastructure, and durable asset indicators (...) are the assets most commonly used in the literature when constructing proxies for wealth levels' [p.251].

Table 1 presents the scores given to each element. In our baseline scenario we attribute a maximum score of 65 points to basic comfort and 35 to complementary comfort, for a total of 100 points (the best possible situation).

[Insert Table 1]

We are aware that this is an inherently subjective exercise, therefore requiring sensitivity analysis in order to check the robustness of the conclusions. A preliminary exercise in this direction will be conducted in Section 5.

Table 2 presents the effective (average) scores for the several items of housing comfort (disaggregation levels 1 – 4). Additionally, with the aim of facilitating the interpretation of the results, column (3) shows the ratios between these effective scores and their potential maximum values (column (2), which corresponds of course, for each level of disaggregation, to the values already presented in Table 1).[5]

[Insert Table 2]

The evidence shown in Table 2 allows us to retain four main conclusions. First, the overall index reaches on average only 58.04% of its maximum potential. Second, there is a considerable difference between the average value for the Basic Comfort Index (BCI) (44.96 out of 65.00 corresponding to a ratio of 69.17%) and the Complementary Comfort Index (CCI) (13.08 out of 35.00, corresponding to a ratio of 37.37%). Third, using the disaggregation level 3, it is in the basic component of comfort, more precisely in the basic housing conditions and in the domestic equipment, that the highest shares of comfort are found (81.11% and 71.48%, respectively). Fourth, the items with the highest ratios between effective and potential scores are seen in electricity (99.67%), refrigerator (99.01%), and piped water (98.49%), all of them included in the BCI.

In order to get a more comprehensive perspective on this topic it is also interesting to explore the distribution of the housing comfort index (Figure 1).

[5]The individual indices of housing comfort were calculated through Microsoft Office Excel 2007. The distribution of the housing comfort index presented in Figure 1 was also obtained using this software.

[Insert Figure 1]

The housing comfort index leads to a distribution whose minimum value lies at 2.25 and the maximum at 94.83, with a mean of 58.04 (as we saw in Table 2) and a standard deviation of 13.00. Approximately 20.0% of households show a comfort index less than 50.0 while about 20.0% show comfort indices above 70.0.

3. Poverty, richness, and inequality in Portugal

3.1 Measures

To measure poverty and richness, we first need to define poverty and richness lines. A poverty line separates the poor from the non-poor, while a richness line sets the limit above which individuals are classified as rich. The key methodological option here is between absolute or relative lines. In the first case the thresholds are defined without reference to the pattern prevailing in the society. In the second case that reference is taken into account and thus the poverty and richness lines correspond to a given percentage of the average or median level of housing comfort in society. Following the most common option, we adopt a relative poverty line (z) defining as poor a household with a housing comfort index below a given proportion (ρ) of the median of HCI. The richness line (δ) is obtained in a symmetric way, a rich household being one with a value for HCI_i above that threshold.

We evaluate the incidence, intensity, and severity of poverty through the well-known P_α proposed by Foster et al. [34]. For α = 0, the poverty incidence is measured by the headcount index, applied to households, which gives us the percentage of poor households compared to the total number of households. With α = 1, the intensity of poverty is obtained, measuring the amount of housing comfort necessary to bring poor households up to the poverty line, divided by the total number of households. For α = 2, a greater weight is assigned to larger deviations in order to evaluate the inequality among the poor, capturing the concept of poverty severity. Therefore, we have:

$$P_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{z-HCI_i}{z}\right)^\alpha, (\alpha \geq 0) \quad (1)$$

in which H is the number of poor households and N is the overall number of households.

Households at risk of poverty (ARP) are obtained through the difference between the poverty incidences calculated for two different poverty lines: (i) $z = \rho \times$ median; and (ii) $z_1 = (\rho + \kappa) \times$ median.

Regarding the evaluation of richness, we can conceive, with the appropriate adaptations, indicators similar to those used in the analysis of poverty to measure the corresponding richness dimensions (which we will designate as $R_0, R_1,$ and R_2). The richness line (δ) is defined as:

$$\delta = \rho \times \text{median} + (1 - \rho). \quad (2)$$

In conclusion, households are classified as having one of three possible housing comfort states (y_i):

$$y_i = \begin{cases} 1\ if\ HCI_i < z\ (poor) \\ 2\ if\ z \leq HCI_i \leq \delta\ (middle\ class). \\ 3\ if\ HCI_i > \delta\ (rich) \end{cases} \quad (3)$$

Finally, inequality is measured through alternative indicators: the Theil measures and the Gini index.

3.2 Evidence

The measures presented in Section 3.1 were applied to Portuguese data and the results are shown in the first column of Table 3.[6]

[Insert Table 3]

In this analysis, the following values were considered for the parameters: $\rho = 0.75$ and $\kappa = 0.05$. The results show that poor households correspond to 12.41% of the whole distribution, with comfort indices equal to or less than 43.67, with an average of 36.64. The average intensity of poverty, measured by the average deviation from the poverty line, is, for these households, 0.0200, and the inequality among the poor households 0.0069. At the top of the distribution, the rich households in housing comfort make up 22.03% of all, with an average comfort index of 75.31. For these

[6]Evidence presented in this section was obtained using Microsoft Office Excel 2007 and validated through IBM SPSS Statistics 21 and STATA/SE version 12. In this last case, we used the INEQUAL7 module for Stata by Van Kerm [35]. This module computes a set of standard inequality measures.

households, the average intensity of richness is 0.0212 and the inequality among them stands at 0.0031.

The middle class (MC) households in terms of housing comfort account for 65.56% of all households, with an average comfort index of 56.28.

Inequality in housing comfort, measured by the Gini coefficient, stands at 0.1263, which suggests a quite homogeneous distribution. This evidence seems to be in line with the Theil index (Theil T) and the mean log deviation (Theil L) results (0.0265 and 0.0297, respectively), the latter being more sensitive to changes on housing comfort at the bottom of the distribution, showing more inequality, whereas the former gives identical weights to the distances between the comfort indices across the entire distribution.

In order to provide a more detailed perspective, Table 3 also shows, in columns (2) and (3), the inequality, poverty, and richness measures applied to BCI and CCI. The most remarkable result that emerges from this evidence is the greater levels of inequality and poverty associated with CCI. For example, it is possible to see that the incidence of poverty corresponds to 36.57% when we consider CCI and only 4.78% when BCI is taken into account. Considering this evidence together with the results for inequality measures makes clear the existence of a much more homogeneous distribution in the case of basic comfort.

4. Model and results

In order to complement the descriptive analysis conducted in Section 3, we now investigate the most important determinant factors of housing comfort states (y_i). Since

this variable is classified into discrete categories that have an ordinal nature (1, 2, 3), the ordered probit model is a fairly used framework [36]. This model is based on a latent measure of housing comfort (y_i^*) – a continuous and unobserved variable – which can be defined as a linear function of the observed explanatory variables (X) and a random error term (ε) normally distributed with zero mean and unit variance:

$$y_i^* = \beta' X_i + \varepsilon_i. \tag{4}$$

The value observed in y_i is determined by the value of y_i^*:

$$y_i = \begin{cases} 1 \text{ if } -\infty \leq y_i^* \leq \mu_1 \\ 2 \text{ if } \mu_1 < y_i^* \leq \mu_2 \\ 3 \text{ if } \mu_2 < y_i^* \leq \infty \end{cases} \tag{5}$$

in which μ_1 and μ_2 are thresholds to be estimated.

The probabilities associated with the possible values assumed by y_i are:

$$\Pr(y_i = 1) = \Pr(y_i^* \leq \mu_1) = \Pr(\beta' X_i + \varepsilon_i \leq \mu_1) = \Phi(\mu_1 - \beta' X_i) \tag{6}$$

$$\Pr(y_i = 2) = \Pr(\mu_1 < y_i^* \leq \mu_2) = \Pr(\beta' X_i + \varepsilon_i \leq \mu_2) - \Pr(\beta' X_i + \varepsilon_i \leq \mu_1) = \Phi(\mu_2 - \beta' X_i) - \Phi(\mu_1 - \beta' X_i)$$

$$\Pr(y_i = 3) = \Pr(y_i^* > \mu_2) = \Pr(\beta' X_i + \varepsilon_i > \mu_2) = 1 - \Phi(\mu_2 - \beta' X_i)$$

where Φ is the standard normal cumulative distribution function. The parameters of the ordered probit model are estimated by the method of maximum likelihood.

The vector of explanatory variables (X) includes two groups of factors that are likely to affect housing comfort: household related variables (region of residence and household type) and household's reference person related variables (gender, age,

education, and labor market state). The household's reference person is the individual with the largest proportion of the annual net total income of the household. Table 4 presents the definition of the explanatory variables and shows the estimation results. These estimations were obtained using Stata/SE version 12. No special packages or code modules were used.

The final size of the sample used in this econometric exercise dropped to 10,396 due to the need to exclude households that did not respond to the questions supporting the explanatory variables.

[Insert Table 4]

The changes in the probability levels of the dependent variable are also estimated, providing an interpretation of the impact of the independent variables (Table 5). These are measured relative to a reference case in which all the dummy variables are set equal to 0, allowing us to interpret changes in the probability of the housing comfort states for a change in a given parameter relative to the reference case. Since all the independent variables are dummy variables, the marginal effects correspond to a discrete change from 0 to 1 in the dummy variable. In the reference case the estimated probabilities of being poor, middle class, and rich in terms of housing comfort are 5.29%, 75.38%, and 19.33%, respectively.

[Insert Table 5]

From the results shown in Tables 4 and 5, we conclude that there are important spatial differences in terms of housing comfort. This result is not surprising since, as

documented, for example, by Hoeller et al. [37], regional inequality is a fundamental characteristic of the Portuguese economy. The best situation is found in the region of *Lisboa*, the most developed part of the country, confirming the evidence obtained by Crespo et al. [29] using income as variable of reference. In fact, households living in other regions register higher probabilities of poverty and lower probabilities of richness. The worst situation is *Madeira*, where the likelihood of poverty increases by 229.89% and the probability of richness decreases by 68.46%.

Concerning the dimension and composition of the household, an interesting result can be pointed out: households with children have a higher probability of richness and lower of poverty. This is in line with the results for Spain obtained by Navarro et al. [13]. At the other extreme, households composed of only one senior adult without children register, on average, the lowest probability of richness (with a decrease of 46.86% vis-à-vis the reference case) and the highest of poverty (with an increase of 111.35%).

Let us now consider the influence of the household's reference person related variables. Regarding the influence of age, it is possible to detect an inverse U-shaped relationship with housing comfort. Effectively, it is for households whose reference person is aged between 45 and 64 that housing comfort index is, on average, higher, followed by the age category between 30 and 44. In turn, the extreme age groups reveal the worst housing conditions, confirming the conclusions of Rodrigues et al. [28] using monetary income and Crespo et al. [29] with total income. Considering the case of the youngest reference persons, the probability of poverty increases tremendously (153.37%) when compared with the category of reference. For the oldest individuals, the corresponding increase in the probability of poverty is lower but still high (72.67%),

which is consistent with the results obtained by Tsakloglou et al. [38] for the Greek case.

Education emerges as a critical variable to explain housing comfort, with monotonic influence and the expected sign. The positive impact of education on well-being is a consistent result from the literature, including earlier evidence for Portugal [26,29]. This directly derives from the monetary and non-monetary benefits associated with education [39]. The households with a reference person with the highest level of education considered in this study (TERTIARY) have probabilities of 0.14%, 30.70%, and 69.16% of being poor, middle class, and rich, respectively, showing therefore a much better condition than that seen in the reference case, in which as we saw above, the probability of richness, for example, is only 19.33%. When we consider the individuals without education, the probability of poverty increases to 25.94% and that of richness reduces to 3.30%, while 70.76% is expected to belong to middle class in terms of housing comfort.

Focusing our attention now on the labor market state of the reference person, we find that households with an unemployed reference person have a higher probability of poverty, which is in accordance with the prediction of Moller et al. [40]. The households that exhibit better comfort conditions are those with self-employed reference persons. In this case, the probability of poverty registers a decrease of 76.73%, while the probability of richness increases by 110.46%. The same occurs, although to a much lesser extent, in the cases of employed and retired individuals.

The evidence in the last columns of Table 4 reports the results obtained from the ordered probit models estimated assuming BCI and CCI separately. From this evidence we can retain as the main conclusion the existence of a substantial variation in the impact of the type of household on HCI, BCI, and CCI. The differences among

household types that we found in HCI seem to be mainly explained by very distinct situations in CCI. In addition, it is noteworthy that although households composed of one adult with children and those with two or more adults with children are found to be similar in terms of HCI, this hides significant differences in the origin of this comfort (BCI vs. CCI).

Some other results should be highlighted. First, the negative impact of living in *Alentejo* in terms of overall housing comfort (when compared to *Lisboa*) is found only for the case of complementary housing comfort, while no difference between the two regions is suggested concerning basic housing comfort. Second, there is a gender influence regarding complementary comfort, although quantitatively small. Finally, the positive gap between households with retired versus unemployed reference persons derives from CCI, since the effect associated with BCI is not significant.

5. Some further analysis

In the above sections we quantified the phenomena of poverty, richness, and inequality in terms of housing comfort in Portugal and analyzed their determinant factors. This was done through the consideration of a baseline scenario, which implies the assumption of specific values in order to obtain the poverty and richness lines as well as the weight given to basic and complementary comfort in the overall index. However, obviously this is a subjective exercise that should be submitted to sensitivity analysis to test the robustness of the conclusions. This is the goal of the present section.

For each case (definition of poverty/richness lines and weights to basic/complementary comfort) we construct two new scenarios and investigate the

respective implications on: (1) the measures of poverty, richness, and (when it is the case) inequality; and (2) the determinant factors of housing comfort.

Columns (4) to (7) from Table 3 show the indicators already discussed for the four new scenarios. Let us start by addressing the impact associated with alternative thresholds to separate the poor from the non-poor and the rich from the non-rich. While in the baseline scenario we considered $\rho = 0.75$, we now investigate what happens when $\rho = 0.7$ (scenario 1) and $\rho = 0.8$ (scenario 2). Obviously, the incidence, intensity, and severity of poverty and richness increase with ρ. Two more specific conclusions can be drawn. First, the evidence shows that the incidence of poverty (P_0) is more responsive to changes in higher values of ρ than is the incidence of richness. Second, in relative terms, the variation in the severity of poverty (P_2) is slightly stronger than that observed in the case of richness.

The other two alternative scenarios aim to evaluate the sensitivity to different breakdowns between basic and complementary comfort: (1) scenario 3 assumes 60 points to basic comfort and 40 to complementary comfort; and (2) scenario 4 gives 70 points to basic comfort and 30 to complementary comfort. In order to obtain these new indices we take as reference the baseline scenario and proportionally adjust the scores given to each item.

As the weight given to basic comfort increases: (1) the average of the overall comfort index varies positively; (2) inequality becomes lower according to all measures considered; and (3) the incidence, intensity, and severity of poverty and richness decrease.

In addition, taking the baseline scenario as reference, a comparison of the responsiveness of the poverty and richness measures to changes in the poverty/richness lines and to the weight of basic and complementary comfort sustains that the

methodological option regarding the lines has a stronger impact. If we take the case of P_0 for example, in the baseline scenario, the incidence of poverty is 12.41%. Establishing ρ at 0.7 and 0.8 makes this indicator vary to 7.90% and 19.12%, respectively. On the other hand, if we vary the weight of basic comfort (scenarios 3 and 4), P_0 assumes the values of 14.82% and 10.34%, respectively.

Regarding the influence on the determinants of housing comfort, we now estimate the model presented in Section 4 to each of the four new scenarios. Tables 6 and 7 show the evidence.

[Insert Table 6]

[Insert Table 7]

Focusing on the major conclusions that can be drawn from a comparative analysis of these tables, there are four findings to highlight.

First, the changes introduced in the definition of the poverty/richness lines and in the relative weights assigned to basic/complementary comfort do not alter the list or the ranking of the determinant factors that were identified as being the most important to explain the likelihood of poverty and richness in housing comfort (education, region of residence, age group of the household's reference person, and household type).

Second, evidence suggests that estimated effects have more sensitivity to the methodological options concerning lines than weights. Let us take, for example, the variables related to education. In the baseline scenario, compared to those with primary education, having higher education increases the probability of richness by 49.8 percentage points (p.p.) and decreases the likelihood of poverty by 5.1 p.p.. When the line of poverty is established with $\rho = 0.7$ (scenario 1) and $\rho = 0.8$ (scenario 2), the

probability of richness increases by 48.6 p.p. and 50.8 p.p., respectively, and the likelihood of poverty drops by 2.6 p.p. and 8.5 p.p., respectively. Instead, when we vary the weight assigned to basic comfort (scenarios 3 and 4), the likelihood of richness increases by 50.4 p.p. and 49.7 p.p. and that of poverty falls by 6.1 p.p. and 4.3 p.p., respectively.

Third, as expected, establishing a less demanding poverty/richness line reduces the differences between households in the different housing comfort states and therefore the impact of the different determinants becomes smaller (scenario 1). The opposite occurs in the case of scenario 2. For example, in the baseline scenario in comparison to households with two or more adults with children, households with two or more adults without children have a likelihood of richness that is 7.8 p.p. lower and their probability of poverty increases by 4.6 p.p.. In turn, in scenarios 1 and 2, the likelihood of poverty is estimated to rise by 2.4 p.p. and 6.6 p.p. and that of richness to drop by 5.5 p.p. and 10 p.p., respectively.

Fourth, a similar pattern of less pronounced impacts of the determinant factors on the likelihood of poverty and richness can be found when more weight is assigned to basic comfort (scenario 4), since this component includes assets that, in comparison to items included in complementary comfort, households tend to prioritize.

6. Final remarks

In the most recent literature, asset ownership indices have emerged as an important proxy for wealth or long-run welfare. The present study is a contribution to this line of research, by providing evidence for a developed economy using this type of approach

and adding to what is already known from research on income and expenditure distributions in Portugal.

Using microdata from the Household Budget Survey for Portugal, we started by proposing an index of housing comfort covering items categorized into basic comfort and complementary comfort. Then, standard measures of poverty, richness, and inequality were applied to the distribution of the housing comfort index. Using a poverty line calculated at 0.75 of the median, we find that poor households represent 12.41% of the sample while the rich households are 22.03%. Another important finding is the level of inequality in housing comfort measured by the Gini coefficient, which stands at 0.1263, suggesting a fairly homogeneous distribution. The results from the Theil index and the mean log deviation point in the same direction, however, showing that there is more inequality when more weight is given to distances between the comfort indices in the lower tail of the distribution.

Furthermore, the evidence sustains that the differences between households derive mainly from complementary comfort and to a lesser extent from basic comfort items.

To further understand which factors are most important in determining the probability of a household being poor, middle class, or rich in living conditions, an ordered probit model was estimated using two groups of explanatory variables: household related variables and household's reference person related variables. Concerning the first group of variables, we conclude that: (1) there are important regional differences; and (2) households with children have higher probability of richness and lower of poverty. As for the impact of the characteristics of the reference person, the worst housing conditions occur when this person belongs to extreme age groups, has a low level of education, and is unemployed.

In order to assess the sensitivity of our conclusions to the methodological options concerning the definition of the poverty/richness lines and to the weights given to complementary comfort, we constructed four alternative scenarios and repeated the empirical analysis. The evidence obtained in this exercise points to two key points. First, in qualitative terms the main conclusions remain valid in the four scenarios. Second, there seems to be more sensitivity to changes in the lines than in the weights given to basic and complementary comfort.

The empirical results suggest the existence of a wide space for intervention in terms of regional, labor market, and education policies seeking to improve the welfare for the Portuguese population. Let us consider some of the most important potential actions. First, the Portuguese population has for many years been below the European average levels in educational attainment, with a clear deficit in terms of secondary and tertiary education. Several governments have prioritized this issue and significant convergence has been achieved. However, the crisis that started to affect the country in 2008/2009, which culminated in the sovereign debt crisis and bailout program, helped to mitigate these efforts, prioritizing fiscal consolidation instead. Putting education back at the center of the economic policy is crucial to promote social cohesion. Second, the regional differences are in large part explained by specialization patterns. Living conditions seem to be better in regions more diversified in terms of economic activities. A long-term strategy should be defined in order to explore the comparative advantages of these less developed areas, so that these populations can also seek and achieve higher levels of welfare. Third, another important action could be the promotion of entrepreneurship, through funding schemes for high-quality projects in key sectors and various consultancy services (filling possible gaps in terms of critical skills), reducing bureaucracy (minimizing the costs of starting and operating a business), and improving

legislation. Fourth, a decisive area of intervention concerns reinforcing the effectiveness of the public employment services aiming to decrease the duration of unemployment spells either by enlarging their portfolio of employment and training opportunities or by guaranteeing a more active job search from unemployment insurance beneficiaries.

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Table 1. Housing comfort index: weighting structure of the baseline scenario.

Indicator	Weighting structure					
	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1
Housing comfort						100.00
Basic comfort					65.00	
Basic housing conditions				34.00		
Year of building of the house			5.00			
< 1930		0.25				
1930 to 1959		0.50				
1960 to 1969		1.00				
1970 to 1979		2.00				
1980 to 1989		3.00				
1990 to 1999		4.00				
> 1999		5.00				
Piped water			5.00			
Sewer system			5.00			
Electricity			5.00			
Complete sanitary installation			5.00			
Number of available divisions (4 m^2 or more) per person			5.00			
< 1		0.25				
= 1		2.00				
= 2		3.50				
= 3		4.25				
= 4		4.75				
> 4		5.00				
Space heater (e.g., gas space heater, …)			2.00			
Water heater (e.g., gas water heater, …)			2.00			
Domestic equipment				17.50		
Refrigerator			4.00			
Equipment for cooking			4.50			
Gas/electric stove + Microwave oven		4.50				
Gas/electric stove		4.00				
Microwave oven		1.00				
Equipment for the maintenance of clothes			6.00			
Washer-dryer combination + Washing machine + Dryer		6.00				
Washer-dryer combination + Washing machine		5.50				
Washer-dryer combination + Dryer		5.00				
Washer-dryer combination		4.00				
Washing machine + Dryer		5.00				
Washing machine		3.00				
Dryer		2.00				
Dishwasher			3.00			
Communication and leisure equipment				13.50		
Televisions per person			3.00			
< 0.5		0.25				
0.5 to 1		0.50				
≥ 1		3.00				
Telephone			4.00			
Fixed phone and mobile phone		4.00				
Fixed phone		1.50				
Mobile phones per person		3.00				
< 1	0.50					
≥ 1	3.00					
Personal computer, portable or not, with internet connection			4.00			
Personal computer, portable or not, without internet connection			2.50			

Table 1. Housing comfort index: weighting structure of the baseline scenario. (cont.)

Indicator	Weighting structure					
	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1
Complementary comfort					35.00	
Additional housing conditions				14.00		
Piped gas			4.00			
Equipment for adjusting temperature and humidity			6.00			
Central heating system + Air conditioner + Electric dehumidifier		6.00				
Central heating system + Air conditioner		5.50				
Central heating system + Electric dehumidifier		3.50				
Air conditioner + Electric dehumidifier		4.50				
Central heating system		3.00				
Air conditioner		4.00				
Electric dehumidifier		1.00				
Garage (or parking space) in the main residence			4.00			
Domestic equipment				3.50		
Vacuum cleaner			1.50			
Freezer			1.50			
Sewing machine			0.50			
Communication and leisure equipment				17.50		
Equipment for the reproduction of sound			3.00			
CD player + Record player + Radio		3.00				
CD player + Record player		2.50				
CD player + Radio		2.50				
Record player + Radio		1.50				
CD player		2.00				
Record player		1.00				
Radio		1.00				
Equipment for the reproduction of sound and picture			3.00			
DVD player + Video player		3.00				
DVD player		2.50				
Video player		1.00				
Equipment for the recording of sound and picture			5.00			
Camcorder		2.00				
Photographic equipment		2.00				
Audio tape recorder		1.00				
Television			5.00			
Cable or satellite TV + Satellite dish		5.00				
Cable or satellite TV		4.00				
Satellite dish		3.00				
Game console			1.50			

Table 2. Housing comfort index: comparison between effective and potential scores.

Indicator	Effective score (1)	Potential score (2)	Ratio (%) (3) = (1)/(2)
Housing comfort	58.04	100.00	58.04
Basic comfort	44.96	65.00	69.17
Basic housing conditions	27.58	34.00	81.11
Year of building of the house	2.38	5.00	47.68
Piped water	4.92	5.00	98.49
Sewer system	4.87	5.00	97.37
Electricity	4.98	5.00	99.67
Complete sanitary installation	4.79	5.00	95.84
Number of available divisions (4 m^2 or more) per person	2.75	5.00	54.91
Space heater (e.g., gas space heater, …)	1.30	2.00	64.92
Water heater (e.g., gas water heater, …)	1.58	2.00	79.02
Domestic equipment	12.51	17.50	71.48
Refrigerator	3.96	4.00	99.01
Equipment for cooking	4.34	4.50	96.53
Equipment for the maintenance of clothes	3.16	6.00	52.71
Dishwasher	1.04	3.00	34.72
Communication and leisure equipment	4.87	13.50	36.09
Television per person	1.61	3.00	53.81
Telephone	1.66	4.00	41.40
Personal computer, portable or not, with internet connection	1.14	4.00	28.56
Personal computer, portable or not, without internet connection	0.46	2.50	18.40
Complementary comfort	13.08	35.00	37.37
Additional housing conditions	3.45	14.00	24.66
Piped gas	0.95	4.00	23.63
Equipment for adjusting temperature and humidity	0.66	6.00	11.01
Garage (or parking space) in the main residence	1.85	4.00	46.16
Domestic equipment	2.35	3.50	67.22
Vacuum cleaner	1.20	1.50	79.90
Freezer	0.95	1.50	63.09
Sewing machine	0.21	0.50	41.55
Communication and leisure equipment	7.27	17.50	41.57
Equipment for the reproduction of sound	1.83	3.00	60.88
Equipment for the reproduction of sound and picture	1.53	3.00	51.16
Equipment for the recording of sound and picture	1.74	5.00	34.72
Television (cable, satellite)	1.91	5.00	38.28
Game console	0.26	1.50	17.52

Table 3. Housing comfort: measures of inequality, poverty, and richness.

Indicators	Baseline scenario HCI	BCI	CCI	Scenario 1 $\rho = 0.7$	Scenario 2 $\rho = 0.8$	Scenario 3 BCI: 60pts; CCI: 40pts	Scenario 4 BCI: 70pts; CCI: 30pts
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Overall index	58.04	44,96	13.08	58.04	58.04	56.45	59.63
Inequality							
Gini index	0.1263	0.0840	0.3259	0.1263	0.1263	0.1354	0.1180
Theil T	0.0265	0.0132	0.1821	0.0265	0.0265	0.0301	0.0234
Theil L	0.0297	0.0153	0.2124	0.0297	0.0297	0.0336	0.0264
Poverty							
P_0	0.1241	0.0478	0.3657	0.0790	0.1912	0.1482	0.1034
P_1	0.0200	0.0103	0.1702	0.0143	0.0285	0.0237	0.0172
P_2	0.0069	0.0042	0.1105	0.0054	0.0090	0.0079	0.0062
ARP (near poor)	0.0672	0.0263	0.0186	0.0451	0.0762	0.0643	0.0608
HCI (poor)	36.64	26.59	5.21	33.41	39.65	35.66	37.44
Richness							
R_0	0.2203	0.2204	0.2451	0.1751	0.2696	0.2229	0.2190
R_1	0.0212	0.0146	0.0595	0.0148	0.0296	0.0231	0.0197
R_2	0.0031	0.0015	0.0219	0.0019	0.0049	0.0037	0.0027
HCI (rich)	75.31	53.52	22.99	76.75	73.90	74.44	76.18
Middle class							
HCI (MC)	56.28	43.58	14.23	56.25	56.62	54.97	57.66

Table 4. Variable definitions and estimation results.

Variables	Definition	*HCI*	*BCI*	*CCI*
	Household related variables			
Region of residence (reference: *Lisboa*)				
Norte	1 if lives in *Norte*, 0 otherwise	-0.300 (0.000)	-0.181 (0.000)	-0.312 (0.000)
Centro	1 if lives in *Centro*, 0 otherwise	-0.243 (0.000)	-0.114 (0.025)	-0.307 (0.000)
Alentejo	1 if lives in *Alentejo*, 0 otherwise	-0.264 (0.000)	-0.022 (0.681)	-0.453 (0.000)
Algarve	1 if lives in *Algarve*, 0 otherwise	-0.229 (0.000)	-0.124 (0.019)	-0.288 (0.000)
Açores	1 if lives in *Açores*, 0 otherwise	-0.340 (0.000)	-0.179 (0.003)	-0.226 (0.000)
Madeira	1 if lives in *Madeira*, 0 otherwise	-0.681 (0.000)	-0.641 (0.000)	-0.439 (0.000)
Household type (reference: two or more adults with children)				
Adult with children	1 if household with one adult with children, 0 otherwise	-0.013 (0.906)	0.343 (0.003)	-0.271 (0.004)
Senior no children	1 if household with one senior adult without children, 0 otherwise	-0.400 (0.000)	-0.009 (0.906)	-0.962 (0.000)
Non-senior no children	1 if household with one non senior adult without children, 0 otherwise	-0.343 (0.000)	0.122 (0.154)	-1.004 (0.000)
Adults no children	1 if household with two or more adults without children, 0 otherwise	-0.331 (0.000)	-0.025 (0.581)	-0.518 (0.000)
	Household's reference person related variables			
Female	1 if female, 0 otherwise	-0.011 (0.773)	0.010 (0.818)	-0.096 (0.011)
Age group (reference: age 45-64)				
Age 16-29	1 if aged 16-29, 0 otherwise	-0.510 (0.000)	-0.551 (0.000)	-0.468 (0.000)
Age 30-44	1 if aged 30-44, 0 otherwise	-0.218 (0.000)	-0.315 (0.000)	-0.090 (0.035)
Age over 64	1 if aged over 64, 0 otherwise	-0.285 (0.000)	-0.268 (0.000)	-0.468 (0.000)
Education (reference: primary education)				
No qualification	1 if has no education, 0 otherwise	-0.972 (0.000)	-0.831 (0.000)	-0.941 (0.000)
Secondary education	1 if highest educational level is secondary education, 0 otherwise	0.918 (0.000)	0.812 (0.000)	0.856 (0.000)
Tertiary education	1 if highest educational level is tertiary education, 0 otherwise	1.366 (0.000)	1.105 (0.000)	1.275 (0.000)
Labor market state (reference: unemployed)				
Self-employed	1 if self-employed, 0 otherwise	0.630 (0.000)	0.426 (0.000)	0.526 (0.000)
Employee	1 if employee, 0 otherwise	0.327 (0.002)	0.268 (0.014)	0.272 (0.003)
Retired	1 if retired, 0 otherwise	0.251 (0.026)	0.075 (0.527)	0.194 (0.063)
Other inactive	1 if another type of inactive, 0 otherwise	0.107 (0.438)	0.013 (0.933)	0.067 (0.620)
Ancillary parameters				
μ_1		-1.617 (0.000)	-1.966 (0.000)	-0.892 (0.000)
μ_2		0.866 (0.000)	0.935 (0.000)	0.526 (0.000)
Number of observations		10396	10396	10396
Log-likelihood		-2636009.9	-2284518.3	-3210687.8
Pseudo R-*squared*		0.2078	0.1563	0.2232

Note: *p-values* are in parentheses.

Table 5. Marginal effects of the housing comfort states (HCI).

Variables	Marginal effects			Change relative to the reference case (%)		
	Poor	MC	Rich	Poor	MC	Rich
Region of residence						
Norte	0.041(0.000)	0.030(0.042)	-0.071(0.000)	77.48	4.04	-36.99
Centro	0.032(0.000)	0.028(0.027)	-0.060(0.000)	60.02	3.68	-30.79
Alentejo	0.035(0.000)	0.029(0.031)	-0.064(0.000)	66.25	3.84	-33.10
Algarve	0.030(0.000)	0.027(0.027)	-0.056(0.000)	55.92	3.56	-29.21
Açores	0.048(0.000)	0.031(0.059)	-0.079(0.000)	90.39	4.18	-41.04
Madeira	0.122(0.000)	0.011(0.742)	-0.132(0.000)	229.89	1.42	-68.46
Household type						
Adult with children	0.001(0.906)	0.002(0.904)	-0.004(0.905)	2.73	0.29	-1.87
Senior no children	0.059(0.000)	0.032(0.103)	-0.091(0.000)	111.35	4.20	-46.86
Non-senior no children	0.048(0.001)	0.032(0.062)	-0.080(0.000)	91.49	4.19	-41.37
Adults no children	0.046(0.000)	0.031(0.054)	-0.078(0.000)	87.40	4.16	-40.14
Female	0.001(0.774)	0.002(0.773)	-0.003(0.773)	2.30	0.24	-1.58
Age group						
Age 16-29	0.081(0.000)	0.028(0.270)	-0.109(0.000)	153.37	3.67	-56.31
Age 30-44	0.028(0.000)	0.026(0.022)	-0.054(0.000)	52.73	3.46	-27.93
Age over 64	0.038(0.001)	0.030(0.034)	-0.068(0.000)	72.67	3.97	-35.37
Education						
No qualifications	0.206(0.000)	-0.046(0.333)	-0.160(0.000)	390.20	-6.13	-82.90
Secondary education	-0.047(0.000)	-0.280(0.000)	0.328(0.000)	-89.39	-37.18	169.48
Tertiary education	-0.051(0.000)	-0.447(0.000)	0.498(0.000)	-97.31	-59.28	257.86
Labor market state						
Self-employed	-0.041(0.000)	-0.173(0.000)	0.213(0.000)	-76.73	-22.93	110.46
Employee	-0.027(0.015)	-0.075(0.000)	0.102(0.000)	-50.96	-9.90	52.57
Retired	-0.022(0.053)	-0.054(0.015)	0.076(0.020)	-41.65	-7.16	39.32
Other inactive	-0.011(0.441)	-0.020(0.442)	0.031(0.438)	-20.00	-2.67	15.87

Notes: *p-values* are reported in parentheses. Probabilities associated with the reference scenario: 5.29% (poor), 75.38% (MC), and 19.33% (rich).

Table 6. Estimation results and marginal effects of the housing comfort states (scenarios 1 and 2).

Variables	Scenario 1 Coefs.	Scenario 1 - Marginal effects			Scenario 2 Coefs.	Scenario 2 - Marginal effects		
		Poor	MC	Rich		Poor	MC	Rich
Region of residence								
Norte	-0.329 (0.000)	0.027 (0.000)	0.032 (0.030)	-0.060 (0.000)	-0.323 (0.000)	0.064 (0.000)	0.033 (0.031)	-0.096 (0.000)
Centro	-0.228 (0.000)	0.017 (0.002)	0.027 (0.018)	-0.044 (0.000)	-0.319 (0.000)	0.063 (0.000)	0.033 (0.030)	-0.095 (0.000)
Alentejo	-0.272 (0.000)	0.021 (0.001)	0.030 (0.021)	-0.051 (0.000)	-0.317 (0.000)	0.062 (0.000)	0.033 (0.030)	-0.095 (0.000)
Algarve	-0.258 (0.000)	0.020 (0.001)	0.029 (0.020)	-0.049 (0.000)	-0.261 (0.000)	0.050 (0.000)	0.030 (0.018)	-0.080 (0.000)
Açores	-0.340 (0.000)	0.028 (0.001)	0.033 (0.032)	-0.061 (0.000)	-0.356 (0.000)	0.071 (0.000)	0.033 (0.045)	-0.105 (0.000)
Madeira	-0.655 (0.000)	0.073 (0.000)	0.024 (0.392)	-0.097 (0.000)	-0.673 (0.000)	0.161 (0.000)	0.013 (0.680)	-0.173 (0.000)
Household type								
Adult with children	0.072 (0.553)	-0.004 (0.530)	-0.012 (0.581)	0.016 (0.567)	-0.067 (0.528)	0.011 (0.545)	0.011 (0.500)	-0.022 (0.521)
Senior no children	-0.470 (0.000)	0.044 (0.000)	0.034 (0.099)	-0.078 (0.000)	-0.394 (0.000)	0.081 (0.000)	0.034 (0.068)	-0.115 (0.000)
Non-senior no children	-0.443 (0.000)	0.041 (0.001)	0.034 (0.077)	-0.075 (0.000)	-0.381 (0.000)	0.078 (0.000)	0.034 (0.058)	-0.111 (0.000)
Adults no children	-0.299 (0.000)	0.024 (0.000)	0.031 (0.024)	-0.055 (0.000)	-0.334 (0.000)	0.066 (0.000)	0.033 (0.035)	-0.099 (0.000)
Female	-0.048 (0.252)	0.003 (0.277)	0.007 (0.264)	-0.010 (0.252)	-0.024 (0.525)	0.004 (0.529)	0.004 (0.524)	-0.008 (0.524)
Age group								
Age 16-29	-0.594 (0.000)	0.062 (0.000)	0.029 (0.270)	-0.091 (0.000)	-0.573 (0.000)	0.130 (0.000)	0.024 (0.371)	-0.154 (0.000)
Age 30-44	-0.259 (0.000)	0.020 (0.001)	0.029 (0.018)	-0.049 (0.000)	-0.212 (0.000)	0.039 (0.000)	0.027 (0.012)	-0.066 (0.000)
Age over 64	-0.312 (0.000)	0.025 (0.004)	0.032 (0.023)	-0.057 (0.000)	-0.347 (0.000)	0.069 (0.000)	0.033 (0.039)	-0.103 (0.000)
Education								
No qualifications	-0.914 (0.000)	0.125 (0.000)	-0.011 (0.789)	-0.114 (0.000)	-0.967 (0.000)	0.262 (0.000)	-0.046 (0.311)	-0.217 (0.000)
Secondary education	0.998 (0.000)	-0.024 (0.000)	-0.300 (0.000)	0.324 (0.000)	0.926 (0.000)	-0.077 (0.000)	-0.277 (0.000)	0.354 (0.000)
Tertiary education	1.408 (0.000)	-0.025 (0.000)	-0.460 (0.000)	0.486 (0.000)	1.381 (0.000)	-0.085 (0.000)	-0.423 (0.000)	0.508 (0.000)
Labor market state								
Self-employed	0.656 (0.000)	-0.021 (0.002)	-0.172 (0.000)	0.194 (0.000)	0.585 (0.000)	-0.062 (0.000)	-0.158 (0.000)	0.220 (0.000)
Employee	0.355 (0.001)	-0.015 (0.021)	-0.078 (0.000)	0.093 (0.000)	0.321 (0.001)	-0.041 (0.006)	-0.075 (0.000)	0.116 (0.000)
Retired	0.302 (0.011)	-0.014 (0.043)	-0.064 (0.006)	0.077 (0.007)	0.208 (0.047)	-0.029 (0.069)	-0.044 (0.033)	0.073 (0.041)
Other inactive	0.052 (0.726)	-0.003 (0.726)	-0.009 (0.727)	0.012 (0.726)	0.035 (0.787)	-0.006 (0.787)	-0.006 (0.788)	0.012 (0.787)
Ancillary parameters								
μ_1	-1.945 (0.000)				-1.350 (0.000)			
μ_2	1.096 (0.000)				0.596 (0.000)			
Number of observations		10396				10396		
Log-likelihood		-2149108.2				-3054195.5		
Pseudo R-*squared*		0.2249				0.2046		

Notes: *p-values* are reported in parentheses. In the scenario 1, the probabilities associated with the reference case are: 2.59% (poor), 83.75% (MC), and 13.66% (rich). In scenario 2, these probabilities are: 8.84% (poor), 63.59% (MC), and 27.57% (rich).

Table 7. Estimation results and marginal effects of the housing comfort states – Alternative housing comfort index (scenarios 3 and 4).

Variables	Scenario 3 Coefs.	Scenario 3 - Marginal effects			Scenario 4 Coefs.	Scenario 4 - Marginal effects		
		Poor	MC	Rich		Poor	MC	Rich
Region of residence								
Norte	-0.329 (0.000)	0.052 (0.000)	0.028 (0.085)	-0.080 (0.000)	-0.292 (0.000)	0.035 (0.000)	0.032 (0.027)	-0.067 (0.000)
Centro	-0.280 (0.000)	0.043 (0.000)	0.027 (0.056)	-0.070 (0.000)	-0.223 (0.000)	0.025 (0.000)	0.028 (0.019)	-0.053 (0.000)
Alentejo	-0.312 (0.000)	0.049 (0.000)	0.027 (0.073)	-0.076 (0.000)	-0.238 (0.000)	0.027 (0.000)	0.029 (0.020)	-0.056 (0.000)
Algarve	-0.266 (0.000)	0.040 (0.000)	0.026 (0.050)	-0.066 (0.000)	-0.242 (0.000)	0.028 (0.000)	0.029 (0.020)	-0.057 (0.000)
Açores	-0.338 (0.000)	0.054 (0.000)	0.028 (0.093)	-0.081 (0.000)	-0.320 (0.000)	0.039 (0.000)	0.033 (0.034)	-0.073 (0.000)
Madeira	-0.649 (0.000)	0.126 (0.000)	0.006 (0.833)	-0.133 (0.000)	-0.711 (0.000)	0.116 (0.000)	0.013 (0.690)	-0.130 (0.000)
Household type								
Adult with children	-0.047 (0.674)	0.006 (0.684)	0.007 (0.658)	-0.013 (0.669)	0.012 (0.919)	-0.001 (0.918)	-0.002 (0.920)	0.003 (0.919)
Senior no children	-0.489 (0.000)	0.086 (0.000)	0.023 (0.336)	-0.109 (0.000)	-0.374 (0.000)	0.048 (0.000)	0.035 (0.055)	-0.082 (0.000)
Non-senior no children	-0.423 (0.000)	0.071 (0.000)	0.026 (0.196)	-0.098 (0.000)	-0.317 (0.000)	0.039 (0.003)	0.033 (0.036)	-0.072 (0.000)
Adults no children	-0.358 (0.000)	0.058 (0.000)	0.028 (0.111)	-0.085 (0.000)	-0.277 (0.000)	0.033 (0.000)	0.032 (0.024)	-0.064 (0.000)
Female	-0.024 (0.535)	0.003 (0.540)	0.004 (0.536)	-0.007 (0.534)	-0.006 (0.878)	0.001 (0.878)	0.001 (0.878)	-0.002 (0.878)
Age group								
Age 16-29	-0.506 (0.000)	0.090 (0.000)	0.022 (0.384)	-0.112 (0.000)	-0.543 (0.000)	0.079 (0.000)	0.030 (0.252)	-0.109 (0.000)
Age 30-44	-0.183 (0.000)	0.026 (0.001)	0.021 (0.031)	-0.047 (0.000)	-0.262 (0.000)	0.031 (0.000)	0.031 (0.020)	-0.061 (0.000)
Age over 64	-0.312 (0.000)	0.049 (0.000)	0.027 (0.071)	-0.076 (0.000)	-0.280 (0.000)	0.033 (0.002)	0.032 (0.022)	-0.065 (0.000)
Education								
No qualifications	-0.988 (0.000)	0.232 (0.000)	-0.064 (0.182)	-0.168 (0.000)	-0.924 (0.000)	0.174 (0.000)	-0.025 (0.587)	-0.149 (0.000)
Secondary education	0.917 (0.000)	-0.056 (0.000)	-0.275 (0.000)	0.331 (0.000)	0.965 (0.000)	-0.040 (0.000)	-0.301 (0.000)	0.341 (0.000)
Tertiary education	1.376 (0.000)	-0.061 (0.000)	-0.443 (0.000)	0.504 (0.000)	1.373 (0.000)	-0.043 (0.000)	-0.454 (0.000)	0.497 (0.000)
Labor market state								
Self-employed	0.633 (0.000)	-0.048 (0.000)	-0.170 (0.000)	0.218 (0.000)	0.637 (0.000)	-0.035 (0.001)	-0.177 (0.000)	0.212 (0.000)
Employee	0.339 (0.001)	-0.032 (0.009)	-0.076 (0.000)	0.108 (0.000)	0.347 (0.001)	-0.024 (0.014)	-0.081 (0.000)	0.106 (0.000)
Retired	0.283 (0.010)	-0.028 (0.028)	-0.060 (0.005)	0.088 (0.007)	0.236 (0.039)	-0.018 (0.073)	-0.051 (0.025)	0.069 (0.030)
Other inactive	0.088 (0.526)	-0.010 (0.525)	-0.016 (0.532)	0.026 (0.527)	0.081 (0.561)	-0.007 (0.563)	-0.015 (0.563)	0.022 (0.561)
Ancillary parameters								
μ_1	-1.528 (0.000)				-1.704 (0.000)			
μ_2	0.835 (0.000)				0.905 (0.000)			
Number of observations		10396				10396		
Log-likelihood		-2732804				-2523936.3		
Pseudo R-*squared*		0.2152				0.2067		

Notes: *p-values* are reported in parentheses. In scenario 3, the probabilities associated with the reference case are: 6.33% (poor), 73.49% (MC), and 20.18% (rich). In scenario 4, these probabilities are: 4.42% (poor), 77.31% (MC), and 18.27% (rich).

Figure 1: Housing comfort index: Cumulative frequency curve