# RE-SCALING THE MONETARY VALUE OF THE FOOD COMPONENT OF ABSOLUTE POVERTY BASKET: REVISION OF SAVING COEFFICIENTS AND ALTERNATIVE APPROACHES[1]

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**Abstract.** Aim of the paper is to describe the revision of the coefficients for re-scaling the monetary value of the food basket for absolute poverty estimates. This revision is part of the work of the Inter Institution Scientific Commission on Absolute Poverty (IISCAP) set up by Istat to revise and update the current methodology. The methodology proposed by Istat (2009) for re-scaling the monetary value of the food component of absolute poverty basket is based on Households' Budget Survey data and produces scaling coefficients representing savings that a family can achieve. The hypothesis that a household realizes actual savings from various dimensions of choice and that these vary with consumer demographics is well-described in economic literature (Griffith *et al.*, 2009) and is confirmed by the evidence. Current Istat methodology primarily reproduces the impact on food expenditure of promotions and surcharges on price levels associated with households' demographics, but it cannot isolate the other influences. The coefficients analysed and described in this paper are mainly based on the vast literature available for the equivalence scales. Therefore, the approach used for the revision of saving coefficients is potentially valid and suitable for new estimates of equivalence scales (Carbonaro, 1985; Betti, 1999). The Commission also defined a roadmap to infer the impact of discounts and surcharges on prices with the introduction of models based on prices/quotations from digital transaction recorded at the cash registers (Scanner Data).

## 1. Introduction

Food consumption is not only the result of individual behaviours; households' expenditure derives from the sum of quantities consumed by each member and is associated with a reference price. The total is not influenced by economies of scale arising when households with multiple members share common goods (e.g., as occurs with electrical appliances), but on the possibility of discounts.

[1] The work is the result of the overall contribution of the authors. However, paragraphs 2.1, 2.2 and 3. are attributable to Federico Di Leo, while paragraphs 2.3 and 2.4 are attributable to Isabella Corazziari. For details on the revision of the main components of the absolute poverty basket see the Special Issue on "New approaches for measuring poverty: studies and perspectives", published in *Rivista Italiana di Economia Demografia e Statistica*,Vol. LXXVIII, No. 4.

As the household size increases, there is the possibility to enjoy economic offers and/or to buy bigger packaging with lower prices per product unit. This hypothesis relies on the theory of differential buying behaviour (Griffith *et al*., 2009). Households' demographics influences food expenditure as it was empirically verified when studying consumption behaviours from the Household Budget Survey (HBS) data provided by the Italian National Institute of Statistic (Istat).

Current Istat methodology for re-scaling the monetary value of the food component of absolute poverty basket is obtained from the direct addition of individual expenses and a subsequent application of the specific coefficients. Such coefficients allow adjusting the households' spending according to saving opportunities. In principles they rely on packaging differences, geographical distribution of selling places, availability of discounts, depending on budget constraints and the actual possibility of purchasing in the large-scale retail trade (GD).

The final food basket monetary value results by increasing or decreasing the initial additive value according to the family dimension; a reference. dimension which is not associated with savings or not-savings is also estimated.

As it is not yet possible to obtain saving coefficients based on recorded prices of food goods and on households' choices, they are estimated from the parameters of specific regression models that are going to be described in the present work.

In order to model the households' saving behaviours Istat utilised an approach derived from the one applied to estimate the equivalence scale, known as the single-equational approach. The equivalence scale aims at assessing the "relative amounts of money two different types of households require in order to reach the same standard of living" (Muellbauer, 1977). When dealing with saving/not-saving coefficients the aim is to introduce economies of purchase and assessing the final basic monetary value of the considered basket, in this case the food one.

To estimate the saving/not saving coefficients (henceforth SCoef) we will refer, as already said, to the single-equational model developed in case of the equivalence scale, based on the food ratio approach according to Engel (1895).

## 2. Saving/not-saving coefficients: overview

### *2.1. The data*

The data used to study the saving behaviors and to fit the selected model are derived from the Italian HBS, performed by Istat. Data refers to different waves of the survey. The first wave started in 2005 until 2013, the second from 2014 (2013

data were used only for the reconstruction of the time-series) to 2021, the third wave started in 2022 (with 2021 quarters used for the reconstruction of the time-series). In various sections of this paper we will reconsider the differences between the three waves.

### *2.2. The current methodology*

Saving/not-saving choices in customers' buying behaviours were observed in Italian HBS data since 2005, year of reference for the methodology to assess the absolute poverty (Istat, 2009) which has been revised in 2023.

It has been observed that the mean food expenditure per-capita decreases as the household's size increases. Larger families spend less by unit of products on average (Table 1) and such saving occurs for any type of household. Such decrement remains when focusing on families with lower capabilities of expenditures, i.e., those belonging to the first quintile of the total equivalent expenditure distribution.

**Table 1 –** *Monthly mean food expenditure per-capita of families (2005).*

| Number of family's members | Year 2005 | | | |
|---|---|---|---|---|
| | North | Centre | South and Islands | Italy |
| One | 310.2 | 285.1 | 269.3 | 293.7 |
| Two | 221.8 | 221.2 | 200.1 | 215.9 |
| Three | 175.8 | 181.9 | 167.4 | 174.5 |
| Four | 149.2 | 155.7 | 142.5 | 147.6 |
| Five | 134.6 | 140.1 | 127.7 | 132.0 |

*Source of data: Elaborations on the Istat HBS*

Considering more recent data referred to 2019, the same pattern of food expenditure per-capita has been observed (Table 2).

**Table 2 –** *Monthly mean food expenditure per-capita of families (2019).*

| Number of family's members | Year 2005 | | | |
|---|---|---|---|---|
| | North | Centre | South and Islands | Italy |
| One | 308.8 | 324.0 | 316.1 | 314.2 |
| Two | 255.2 | 255.5 | 240.7 | 251.1 |
| Three | 193.6 | 206.2 | 182.5 | 192.4 |
| Four | 164.8 | 171.5 | 158.8 | 163.8 |
| Five | 147.8 | 157.1 | 134.2 | 143.1 |

*Source of data: Elaborations on the Istat HBS*

This evidence suggested that the revision of the methodology to assess the absolute poverty and to evaluate the monetary food basket value, can be based, initially on an updating of the SCoef estimated in 2005.

### *2.3. The initial model and some attempted revisions*

The regression model developed in 2005 to estimate the SCoef was fitted on food and total expenditure with covariates related to the household's size and the geographical area of residence, from the data of the Italian HBS.

The logarithm of food expenditure is modelled as:

$$\ln(sa) = \alpha + \beta \cdot \ln(st) + \gamma \cdot \ln(nc) + \delta \cdot ds + \xi \quad (1)$$

where *sa* indicates the household's food expenditure and *st* the corresponding total one; *nc* is the number of family's members and *ds* is a dummy variable indicating the geographical area (1 for South and Islands and 0 otherwise).

The model was based on a selection of households to consider the most common consumption behaviours. Firstly, households with less than 5 members were selected as it was the more frequent families' size in the survey. Among them, the ones with all members aged 18-59 were chosen, on the hypothesis that their consumption behaviour is homogeneous. The aim was to avoid adjustments of the basket due to the presence of children or teen-agers, or of very old people.

Households with high or low share of food expenditure on the total were excluded (first and last quintile of the ratio between food and total expenditure, by family's size). Families purchasing meals and drinks outdoor were excluded too.

Finally, due to the small size of the sampled households, regression was shaped considering a sample referring to the three adjacent years 2003-2005 to assure a more robust model. Expenditures in previous years were adjusted to 2005 by multiplication with the median ratios (2005 vs previous year) of food and total expenditure.

From the parameters estimated in (1) the value the variable $\epsilon$ was obtained as follows:

$$\epsilon = \frac{\gamma}{1-\beta} \quad (2)$$

where $\epsilon^2$ is the elasticity providing the SCoef by household size and geographical areas. When $\epsilon < 1$ the hypothesis that larger families (more than 3 members) realize savings is confirmed. The coefficient $\epsilon$ in 2005 was 0.76.

The final step to calculate the SCoef was to identify the household size benchmark.

The household size is the one with no saving/not-saving possibility: three components household is the size for which forms of saving/not-saving are assumed to be nil. This size has been estimated comparing the mean food expenditure of the households belonging to the first quintile of the total equivalent expenditure distribution and the additive food basket.

To evaluate the monetary value of the food basket, the minimum price collected in each region's capital represents the minimum price for the most frequently sold reference (not of all the available ones) in the sampled selling points (Istat, 2009).

The SCoef is calculated for each family and applied to the additive basket referred to the family size [*nc*], according to the following formula:

$$\mathrm{SCoef}_{nc} = \frac{3}{nc} \cdot e^{\left(\epsilon \cdot \ln\left(\frac{nc}{3}\right)\right)} \tag{3}$$

The first attempt to update the saving/not-saving coefficients started in 2016 following the indications of the "Inter-Institutional Working Group"[3]. The Group provided several indications; among them, to use the new survey conducted with Computer Assisted Personal Interview (CAPI) started in 2014 with a comparing sample in 2013, and the traditional one in Paper and Pencil Interview (PAPI) lastly undertaken in 2013, by replicating the model used in 2005. In both cases, the model was applied considering a two-year sample of the survey instead of three[4]. For the PAPI model the referred to years 2012-2013 while for the CAPI polling sample refers to years 2013-2014[5].

Results from the two reference years 2013 and 2014 referring respectively to the samples PAPI and CAPI did not provide evidence about the need to update the methodology[6].

[2] Details about $\epsilon$, and its link with the Engel's law can be found in the volume Istat (2009), p. 43-45. As $\epsilon$ is obtained considering the ratio between the food and the total expenditures, given the model (1), the geographical area effect disappears.

[3] Delibera N.8 della Presidenza dell'Istat del 22 ottobre 2015.

[4] The current sample is larger than the 2005 one, allowing to change decisions about how many surveys to consider as the pool of data.

[5] 2013 was the last survey year for the old PAPI survey. The CAPI survey is available since 2014 with a pilot run for the year 2013. The parallel run (PAPI-CAPI) is the basis for the time series reconstruction.

[6] Cf. MASI A. Room Document produced for the Istat Inter-Istitutional Working Group on Absulte Poverty, Roma, 2016.

The PAPI elasticity $\epsilon_{2013}$ was greater than the 2005 one (0.81 vs 0.76) but did not cause significant differences in poverty estimation with respect to corresponding estimate based on the 2005 elasticity. Indeed, the new 0.81 elasticity would have caused a decrease in the incidence of the family's poverty between -0.1% and -0.2%, while the individual poverty incidence would have not changed.

The CAPI elasticity $\epsilon_{2014}$ was close to 1. Consequently, the use of the new survey data suggested reconsidering the criteria about the households' selection to fit the model, in particular the exclusion of families with too high or too low food expenditures with respect to the total expenditure.

The Inter-Institutional Scientific Commission (IISCAP[7]) introduced firstly an update of the elasticity and the related SCoef using 2018-2019 data (two years pooling), i.e. close to the final reference year 2022. It was inevitable to avoid the use of 2020 and 2021 data due to the COVID-19 pandemic that strongly affected costumers and families' behaviours and consequently survey estimates. After the 2019 exercises, the 2022 data have been used to fit the final model.

Parameters estimates in relation to the model (1) and corresponding elasticity $\epsilon_{2019}$ were similar and not statistically too different from the corresponding values in 2005. Considering different selection of families, the corresponding elasticities were $0.73 < \epsilon_{2019} < 0.81$.

### *2.4. Methodology update*

The first working hypothesis proposed by the IISCAP has been the introduction of new variables related to the residence area of the families as the type of municipality. Other variables to be tested in the model refer to the families' members characteristics: age expressed by both the mean age of the members and the variance; the percentage of females. The model fit improvement due to the introduction of the new variable has been not so relevant.

The IISCAP discussed the possibility to explore also different models as for example simultaneous equation models and complete economic systems.

However, quotation from Scanner Data can be the best solution to assess the saving/not-saving behaviours considering observed prices of different packaging by product. Such solution requires long in-depth analysis to implement a valid outcome using prices of many different products, with different packaging and from different retailers. Prices from traditional retailers, especially for fresh food products, must be integrated with Scanner Data.

[7] Cf. ISTAT DOP/932/2021 16 December 2021.

The final revision considering in-depth analysis constraints, confirmed the use of model (1) considered as a reasonable solution even if not the optimal one.

The revision was mainly focused on studying the effect of different selections of the households included in the model, and the possibility to use only one year data survey instead of a pooling (2022).

The following three nested scenario have been tested.

a. As regards to the two expenditures considered in (1), total - *st* - and food - *sa* - the estimates were based on selected products as considered in the new basket of absolute poverty. In particular, we discarded products not included in the basic food basket, i.e. products too expensive or not included in the diet defined by the Nutritional Institute as the minimal one[8]. From the total expenditure are excluded extraordinary maintenance costs, life insurances and annuities expenses. People aged 18-69 instead of 18-59 as previously done were chosen to consider demographic changes in the population, its aging in particular.
b. After the first scenario, it was decided to consider families with a small spending for meals and drinking outside the house, i.e., families with such spending lower of the corresponding median, still discarding families with higher spending for meals or drinking outdoor.
c. As a third step, we have discarded families with uncommon behaviour in term of food expenditure. In particular, the discarded families were characterized by nil spending in the last two weeks on fresh fruits and vegetables, breads, meat and cheese. Using new variables in the questionnaire referring to the place of spending, especially for frequent used products it was possible to identify these families[9]. To define such behaviour as uncommon we used other variables, i.e., the notes of the interviewers. We found that some families have no income; others received money from relatives living in other houses, were guests in other houses living with a disability pension, did not go out due to health problems taking meals at relative's home, or ate at work etc.

The analysis based on the three above scenarios (Table 3) which are a final selection from different hypothesis, provides the coefficients estimates of (1), required to finally assess the impact of saving/not-saving behaviours. In particular it was possible to determine the impact of the saving/not-saving scale on the absolute poverty, provided by the third scenario, the one based on a more complete set of hypotheses.

[8] Cf. CORAZZIARI I. *Il modello e le stime delle scale di risparmio / non risparmio*, Room Document, Roma, 2022.
[9] Cf. DI LEO F. *I luoghi di acquisto nell'indagine sulla spesa delle famiglie*, Room Document, Roma, 2022.

**Table 3 –** *Regression parameters to calculate elasticity $\epsilon$ (2019).*

| Model (1) parameters | Selection of families | | |
|---|---|---|---|
| | Scenario a) | Scenario b) | Scenario c) |
| $\alpha$ | 1.899 | 1.988 | 2.043 |
| $\beta$ | 0.461 | 0.445 | 0.451 |
| $\gamma$ | 0.394 | 0.419 | 0.354 |
| $\delta$ | 0.092 | 0.103 | 0.091 |
| $\epsilon$ | 0.732 | 0.755 | 0.645 |
| $R^2$ | 0.502 | 0.522 | 0.508 |
| F Value | 632.010 | 1,261.670 | 894.930 |
| Selected Observations | 1,887 | 3,476 | 2,600 |

*Source of data: Elaborations on the Istat HBS, wave 2019*

The final choice about the selection of the families to fit the model are:

a. Households not belonging to the first or last quintile of the food expenditure per-capita distribution obtained for different household sizes. We discarded families spending for food too less or too much compared to the corresponding mean.
b. Households with at most 5 members, all aged between 18 and 69 years, according to the hypothesis that they behave more homogenously, avoiding adjustments in the food basket due to the presence of children or teenagers, or older people.
c. Spending per-capita for meals and drinking outdoor less than the median (about 1€ per-capita, or about 30€ monthly).
d. Households were excluded with no spending on products considered as necessary, as fresh fruits or vegetables, meat, cheese, bread in the last two weeks before the interview.

Note that elasticity is estimated on a selection of families according to the homogeneity considerations, but it is applied to the spending of all the families.

Main differences in terms of saving/not-saving coefficients (Table 4) refer to families of singles or more than 4 members. Introducing such differences in the final estimate of the absolute poverty determined an increase of poverty level for singles and a reduction for large families.

A simulation about the absolute poverty estimates has been performed on 2019 data, to compare individuals and households' absolute poverty between 2005 and 2019.

**Table 4 –** *Saving/not-saving coefficients - years 2005 and 2019.*

| Number of families' members | Coefficients | |
|---|---|---|
| | 2005 | 2019 |
| One | 1.302 | 1.477 |
| Two | 1.102 | 1.155 |
| Three | 1.000 | 1.000 |
| Four | 0.933 | 0.903 |
| Five | 0.885 | 0.834 |
| Six | 0.847 | 0.782 |

*Source of data: Elaborations on the Istat HBS*

New coefficients affect the households' poverty incidence increasing from 6.4% to 6.9%, i.e., of about 123.000 families (greater impact in the North), but do not affect individual incidence (Table 5).

**Table 5** – *Absolute poverty incidence by geographical areas - Year 2019, in thousands and percentages.*

| | North | | Centre | | South and Islands | | Italy | |
|---|---|---|---|---|---|---|---|---|
| | 2019 | 2019(c) | 2019 | 2019(c) | 2019 | 2019(c) | 2019 | 2019(c) |
| Poor Families | 729 | 793 | 242 | 255 | 709 | 754 | 1,679 | 1,802 |
| Resident Families | 12,474 | 12,474 | 5,337 | 5,337 | 8,268 | 8,268 | 26,079 | 26,079 |
| Poor People | 1,859 | 1,891 | 661 | 660 | 2,059 | 2,043 | 4,580 | 4,595 |
| Resident People | 27,508 | 27,508 | 11,894 | 11,894 | 20,370 | 20,370 | 59,772 | 59,772 |
| **Poverty Incidence %** | | | | | | | | |
| Families | 5.8 | 6.4 | 4.5 | 4.8 | 8.6 | 9.1 | 6.4 | 6.9 |
| People | 6.8 | 6.9 | 5.6 | 5.5 | 10.1 | 10.0 | 7.7 | 7.7 |

*Source of data: Elaborations on the Istat HBS*

Poverty incidence for singles would increase from 5.7% to 7.1%, slightly higher than the total households' one and lower than the individual one. Such increment looks coherent with studies about poverty indicating that the eldest living alone and larger families experiment increasing poverty levels.

### *2.5. Results 2022 and the new poverty estimates*

Table 6 shows the new saving/not-saving coefficients from model (1) fitted on 2022 survey, evaluated according to the c) scenario.

**Table 6 –** *Saving/not-saving coefficients – years 2005, 2019 and 2022.*

| Number of families' members | Coefficients | | |
|---|---|---|---|
| | 2005 | 2019 | 2022 |
| One | 1.302 | 1.477 | 1.504 |
| Two | 1.102 | 1.155 | 1.162 |
| Three | 1.000 | 1.000 | 1.000 |
| Four | 0.933 | 0.903 | 0.899 |
| Five | 0.885 | 0.834 | 0.827 |
| Six | 0.847 | 0.782 | 0.773 |

*Source of data: Elaborations on the Istat HBS, waves 2003-2005; 2019; 2022*

Table 7 shows the regression results for model (1) fitted on 2022 data evaluated as indicated in scenario c).

**Table 7 –** *Regression parameters to calculate elasticity $\epsilon$ (2022).*

| Model (1) parameters | Selection of families | | |
|---|---|---|---|
| | Scenario a) | Scenario b) | Scenario c) |
| $\alpha$ | 1.915 | 1.980 | 2.182 |
| $\beta$ | 0.452 | 0.442 | 0.430 |
| $\gamma$ | 0.444 | 0.441 | 0.358 |
| $\delta$ | 0.138 | 0.142 | 0.139 |
| $\epsilon$ | 0.809 | 0.790 | 0.629 |
| $R^2$ | 0.508 | 0.518 | 0.501 |
| F Value | 1,373.54 | 1,956.98 | 1,325.83 |
| Selected Observations | 3,990 | 5,461 | 3,958 |

*Source of data: Elaborations on the Istat HBS, wave 2022*

The choice of one year only dataset reduces the number of observations used to fit the model consequently increasing the errors of the parameters estimates and decreasing the overall index of fit R-squared adjusted for multiple explicative variables in the model. At the same time in 2022, the total sample was larger, so the number observations provide more robust estimates than what obtaining by testing the model on year 2019.

Comparing the 2022 regression goodness of fitting indicators with the ones obtained in 2005, we can note a worsening of the overall model fitting. A model based on the size of the family, the share of the food spending on the total one and by a dummy variable distinguishing only the South and Islands by the rest of Italy seems to become more and more rigid to describe families' saving/not-saving behaviours. Such behaviours are conditioned also to the availability of offers of cheap products at reasonable distance from home.

The coefficients effect on food expenditures is equivalent in all the Italian regions. If we consider the value of the food basket of Lombardia, Lazio and Campania for a family made by adults only (30-59 years) the amount for a single is respectably 298.15€, 276.83€ and 245.72€. For six members [$nc$ = 6] household the amount is approximately three times, i.e., ($nc$*SCoef$_{nc}$ [0.773] / SCoef$_1$ [1.504]) the basket of a single.

## 3. Saving coefficients and equivalence scales

Notwithstanding the proposed modelling allows developing interesting research lines, as already stated, the model is implicitly an equivalence scale where we limited the observations used to avoid extreme consumption behaviours.

The proposed approach can be of stimulus to discuss improvements in the estimation of equivalence scale, based on estimation of Engel curves (Betti, 1999).

The elasticity $\epsilon$ in (2) is obtained by the double logarithm function used to estimate the Engel curve for food goods (Carbonaro, 1985). Developing the formulas to calculate the SCoef [4] the link with the equivalence scale is evident. In particular, the expression (4) - similar to (3) - is the one used to estimate the "Carbonaro scale", that allows to assess from the Engel curve the same level of utility/well-being for two families, A e B, of different sizes:

$$e^{\left(\epsilon \cdot \ln\left(\frac{nc_a}{nc_b}\right)\right)} \tag{4}$$

The Carbonaro scale is obtained based on the estimated $\gamma$ and $\beta$ parameters, with $nc_b$ = 2; the saving/not-saving coefficient are calculated with $nc_b$ = 3 and multiplying the equivalence scale times the ratio between the size of the considered family and the reference one[10].

Finally, it is possible to compare the equivalence scale (Carbonaro) with the implicit equivalence scale 2022 derived from the coefficient estimated on the revision of saving coefficients (Table 8). The increasing diversification of products can be a possible explanation for the reduction of the coefficients together with other factors which should be analysed and considered like changes in commercial distribution.

[10] As assessed in the past, "the additive food basket per-capita and the mean food spending per-capita of households belonging to the first quintile of food expenditure [HBS] intersect for the family size equal three, that is the reason why the size of the reference family, i.e. the family with no saving/not-saving benefits is 3". (Istat, 2009, p. 44)

**Table 8 –** *The Carbonaro equivalence scale (1985) and the implicit equivalence scale (2022).*

| | Family members | | | | | | |
|---|---|---|---|---|---|---|---|
| | One | Two | Three | Four | Five | Six | Seven |
| Carbonaro scale | 0,60 | 1,00 | 1,33 | 1,63 | 1,90 | 2,16 | 2,40 |
| Equivalence scale 2022 | 0,65 | 1,00 | 1,29 | 1,55 | 1,78 | 2,00 | 2,20 |

*Source of data: Elaborations on the Istat HBS*

A different equivalence scale has multiple impacts on inequality measures, like relative poverty measurement and equivalent expenditure. Istat publishes annually several indicators, and it is possible to assess the impact of the implicit equivalence scale (2022) on equivalent-expenditure thresholds (expenditure deciles).

In 2022 the first monthly equivalent-expenditure decile threshold[11] (referring to the less well-off households) was 1,140.98€ while the ninth decile threshold (referring to the better-off households) was 4,735.56€. The distance between the two extreme thresholds was 4.15, i.e., the equivalent expenditure of the "richest household" was more than four times bigger.

With the adoption of the implicit equivalence scale (2022) the distance is relatively smaller (3.99) with a higher first decile threshold (1,144.57€) and a lower ninth decile threshold (4,566.34€).

This paper is not dedicated to the measures of inequality and to the tools to measure it, however the revision of the equivalence scale is an outcome of IISCAP and will be considered in the next future.

## 4. Concluding remarks

The non-linear relationship between price and quantity of the purchased products is quite clear (Armstrong, 2016). Therefore, it is necessary to consider households' purchasing behaviour and to isolate and measure the impact of promotions and surcharges. Ignoring saving/not-savings behaviour implies biased estimates of poverty. The absolute poverty incidence for households net of saving/not-saving coefficients, would be lower (7.3% instead of 8.3% in 2022) while the number of individuals suffering an absolute poverty condition would increase (from 5.7 to about 6 million in 2022).

The availability of a big database of prices, in particular the Scanner Data, will provide, in the future, the possibility to reconsider the current saving/not-saving

[11] E.g. the value that separates the 10% of households with the lowest equivalent expenditure from the other 90%.

scale. According to a study conducted in the UK and based on Scanner Data "low-income households do not have the flexibility, in terms of storage, transport, or liquidity, to take advantage of sales" while single young households tend to buy more on sales like large families (Armstrong, 2016).

According to this evidence the coefficients proposed in this paper are a partial and imperfect solution to the bias induced by using standard prices for products within the food component of the total households' basket.

The proposed model is not bias-free. The coefficients based on family size only without differentiations based on age or family composition seem to be not fully representative of the different behaviours.

The decreasing of the food per-capita spending as the family size increases can be explained by other than the offers and discounts of the commercial distribution.

One possible alternative explanation can be found in the production of food waste. The domestic food waste is a known and studied phenomenon in literature (Oláh *et al.*, 2022) and in Italy the CREA has created a "Food waste Observatory"[12].

Saving coefficients analyse price non-linearity from the demand side, however it would be challenging to consider the impact on prices of other phenomena from the supply side like shrinking inflation. This point has been considered by the IISCAP to be included in the future work to improve the Istat methodology to estimate the absolute poverty basket.

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[12] The Agricultural Research Council (CREA), as of 2017, has set up an 'Observatory on surpluses, recoveries and food waste', located at the CREA Food and Nutrition Research Centre. See: https://www.crea.gov.it/web/alimenti-e-nutrizione/-/osservatorio-sugli-sprechi-alimentari

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