**Innovation to improve data quality: the case of Italian Household Budget Survey**

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**Abstract**

*The recent redesign of the Italian Household Budget Survey (HBS) represents the starting point of this contribution whose aim is to assess the impact of both methodological changes and innovation in data collection on the estimates of household consumption expenditures. In 2014, many innovations were introduced in the HBS, in response to changes in European recommendations and purchasing behaviours (in terms of habits and with respect to the choice of goods, services and places of purchase), and to an increased demand for information in the context of social and economic research. New instruments and techniques have been introduced, together with more accurate methodologies, with the aim of improving the estimation quality of household consumption expenditures and of other derived statistics (as the Italian measures of relative and absolute poverty). Because the old and new HBS were conducted in parallel during the last two quarters of 2012 and during all quarters of 2013, it has been possible to compare the effects of the abovementioned changes on the consumption expenditure estimates. The aim of the paper is not only devoted to the impact of different methodological choices but rather to the implications of differences in data collection and variables definition. Moreover, the impact is evaluated not only in terms of levels, but also taking into account the whole distribution. Finally the paper contains an error profile analysis, with the aim of distinguishing changes due to innovations from possible bias linked to sampling coverage or households' selection. Although our considerations refer to the Italian situation, some evidence and, in particular, the models and analytical procedures may be extended to other realities.*

**Keywords:** Consumption expenditure, Data Quality; Survey instruments, Survey techniques

**1. Introduction**

Household consumption expenditure constitutes a relevant source of statistical information for: i) estimating the weighting system of the consumer price index; ii) estimating the final consumption component within the National Account System and iii) the analysis of living standards and behaviours of households and individuals.

In Italy, even if regularly conducted since the 1960’s, the Household Budget Survey (HBS) has been deeply redesigned in 2014, in response to changes in European recommendations and in people purchasing behaviours, and to the increased demand for information in the context of social and economic research.

The redesign of Italian HBS introduced new instruments and techniques, together with more accurate methodologies, with the aim of improving the estimation quality of household consumption expenditures and of other derived statistics (as the measures of poverty). After a system of experimental surveys, the *Former* and the *New HBS* were conducted in parallel during the last two quarters of 2012 and during all quarters of 2013 (Grassi et al. 2015), as suggested by the specific literature (van den Brakel et al 2017).

In this paper, we concentrate on the specific effect of each introduced innovation on the estimates of consumption expenditures, inequality and poverty.

**2. The Former and New HBS**

The HBS, in Italy, represents one of the primary sources for estimating the households’ final consumption in the National Accounts System. This requirement determines the need to estimate the expenses for all the items included in the 5-digit international Classification of Individual Consumption by Purpose (Coicop), during time increasingly detailed, on a quarterly basis. Timeliness and detail are therefore the basic requirements.

In order to achieve these goals, the survey has been deeply modified in all the aspects listed in table 1.

The consumption expenditure levels in the *New HBS* are higher than in the *Former HBS*: in 2013, the difference in the average monthly household consumption expenditure is 4.7% and is 3.1% in equivalent terms[[1]](#footnote-1). The coefficient of variation reduces of about 2% and 8% respectively.

The density curve for the *New HBS* (Figure 1) has more mass to the right than the density curve for the *Former HBS*. Indeed, the first distribution clearly dominates the second distribution from the 7th decile onwards.

**Table 1 – Main characteristics of the Former and New Italian HBS**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Former HBS** | | **New HBS** | |
| **Sampling design** | Stratified two-stage random sample, with stratification at the first stage (480 municipalities). Within each region, municipalities are stratified by demographic size. Substitutions allowed. | | Stratified two-stage random sample, with stratification at the first stage (502 municipalities). Within each region, municipalities are stratified by municipality typology and demographic size. Substitutions allowed. | |
| **Survey units** | Household- it includes all people living together with marriage, kinship, affinity, adoption, protection or affective ties. | | Household –it includes all people living together with marriage, kinship, affinity, adoption, protection or affective ties, also sharing income or consumption expenditures. | |
| **Survey technique** | Mixed mode PAPI (1 direct interview) -CADI (of self filled diary) | | Mixed mode CAPI (2 direct interviews) -CADI (of self filled diary) | |
| **Interviewers network** | Interviewers selected by municipalities’ statistical offices, trained by regional ISTAT offices. | | Professional interviewers selected by a private company, trained by the central ISTAT office. | |
| **Collected information** | All the expenditures incurred to directly satisfy household’s member’s needs (including self-consumption, imputed rent and gifts). | | All the expenditures incurred to directly satisfy household’s member’s needs (including self-consumption, imputed rent and gifts), together with purchasing month and place. | |
| **Coicop classification** | COICOP 1993 (producing 265 expenditures items) | | COICOP 2013 (producing 482 expenditures items) | |
| **Reference periods** | 7 days | Food, self-consumption, catering services (including canteen), non-food goods and services frequently purchased (110 items). | 14 days | Food, self-consumption, catering services, non-food goods and services frequently purchased (168 items) |
| Last month | Clothing, furniture, household items, health, holidays, sport, culture, education, transport (90 items) | Last month | Clothing, canteens, sport, household items and small appliances, vehicle maintenance (54 items) |
| Last 3 months | Fuels and utilities, housing maintenance, durable goods, means of transport and of communication (62 items) | Last 3 months | Furnishings, health, holidays and transport services (68 items) |
| Last 12 months | Exceptional expenditures and vehicles insurance (3 items) | Last 12 months | Fuels and utilities, housing maintenance, means of transport and of communication, education, vehicles insurance, durable goods (192 items) |
| **Self-consumption** | Amount of produced goods daily consumed and self-assessment of its monetary value, collected by a separate diary delivered only to households declaring self-consumption. | | Amount of produced goods daily consumed, collected by a specific section included in the expenditures diary. The monetary value is estimated by the market prices available from consumption prices ISTAT Unit. | |
| **Missing expenditures values** *(zero expenditures)* | No imputation | | Imputation of missing expenditures when the purchasing month and/or place are collected. | |
| **Weighting system** | Calibration estimator.  The final coefficients are obtained in three steps:  1. basic coefficient (or direct weight) is given by the reciprocal of the inclusion probability (extraction probability of the residence municipality and extraction probability of the household among the eligible households of the municipality);  2. corrective factor for non-response as inverse of the response rate;  3. corrective factor to match known population totals:   1. Resident population by geographical area, sex and age class (0-14, 15-29, 30-59, 60-74, 75 and over); 2. Resident population by region; 3. Resident households by region.   The final weight is obtained by multiplying the direct weights by the corrective factors. | | Calibration estimator.  The final coefficients calculation includes three steps:  1. basic coefficient (or direct weight) of each individual is given by the reciprocal of the inclusion probability (extraction probability of his residence municipality and extraction probability of his household among the eligible households of the municipality).  2. corrective factor for non-response as inverse of the response rate;  3. corrective factor to match known population totals:   1. Resident population by geographical area, sex and age class (0-14, 15-29, 30-44, 45-59, 60-74, 75 and over); 2. Resident population by region; 3. Resident households by region; 4. Resident population by geographical area and municipality typology; 5. Resident households by geographical area and municipality typology; 6. Foreign population by geographical area and sex; 7. Population of 15 years and over by geographical area, employment status and position; 8. Population by geographical area and participation month; 9. Households by geographical area and participation month.   The final weight is obtained by multiplying the direct weights by the corrective factors. | |

The differences emerge along the whole distribution although the effect is more marked in the bottom part: for the first two deciles, the variations are 13% and 9.8%, respectively, while in the other deciles they do not reach 9% (it is 3.6% in the last one).

**Figure 1 - Equivalent consumption expenditure distribution in Former HBS and New HBS. Year 2013 (values in euros)**

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*Source: own calculations based on Former HBS and New HBS data*

**3. Response rate and error profile**

The above mentioned evidences could be due to a selection bias, that is to say that the final sample of the *New HBS* could have not been representative of the population with the lowest consumption levels. First of all, the sample size of the *New HBS* is markedly lower than the *Former HBS*: the ratio of final sample size (including substitutions) to the theoretical sample is 58.6%, against a value of 74% for the second one. However the response rate of the *Former HBS* was markedly higher in Italy than in the other European Countries (in 2010, it ranged from 5.6% in Belgium and 20% in The Netherlands to 76.4% in Cyprus and 87.6% in Romania). This evidence also characterises the comparison with other households surveys conducted in Italy; in particular the Bank of Italy Survey on Household Income and Wealth (SHIW), conducted every two years, shows a response rate equal to 52.7% in 2010, 52.6% in 2012 and 53.3% in 2014; it must be noted that the survey has a panel component, so that the response rate reduces to about 36% for non-panel households.

The adoption of a computer-assisted system, which tends to eliminate interviewer discretion in managing survey time constraints and substitution rules seem to be the main cause of the reduced response rate.

By construction, in the *New HBS* the final weighted sample is representative of households and population by region and municipality typology, but also of population by sex and age, citizenship and occupational/professional status. Even if all these variables are associated with consumption levels, the main thing to check was the representativeness of different subpopulations in terms of expenditure levels. For this aim, through the comparison of *New HBS* results with the universe of tax returns, we investigated whether households with different levels of income were likely to be differently represented in the *New HBS*[[2]](#footnote-2).

Through an exact linkage, by individual fiscal code (tax identification number), between the fiscal archive and each of the HBSs, two main aspects have been tested: i) the sample representativeness of population in terms of tax income in the *New HBS* (columns A and B in Table 2); and ii) the presence of bias in the distribution of households by equivalent fiscal income class, also in comparison to the *Former HBS* final sample (columns B and C in Table 2).

**Table 2 - Distribution of resident and sample households by equivalent fiscal income class. Year 2013-2014 (percentage values)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Equivalent fiscal income class** | **Resident households** | **New HBS 2014**  **Theoretical sample**  **(A)** | **New HBS 2014**  **Final sample**  **(B)** | **Former HBS 2013**  **Final sample**  **(C)** |
| I | 10.0 | 9.7 | 8.0 | 7.2 |
| II | 10.0 | 9.9 | 9.7 | 9.2 |
| III | 10.0 | 10.0 | 10.6 | 9.8 |
| IV | 10.0 | 9.6 | 9.6 | 10.1 |
| V | 10.0 | 10.1 | 10.7 | 10.7 |
| VI | 10.0 | 10.1 | 10.1 | 9.8 |
| VII | 10.0 | 10.0 | 10.4 | 10.3 |
| VIII | 10.0 | 10.3 | 10.4 | 10.5 |
| IX | 10.0 | 10.2 | 10.8 | 10.4 |
| X | 10.0 | 10.0 | 9.8 | 11.0 |
| **TOTAL** | 100.0 | 100.0 | 100 | 100.0 |

*Source: Ceccarelli, C. and Cutillo, A. (2016),* *Representativeness of the 2014 NHBS and 2013 HBS samples in comparison to the universe of households residing in Italy using fiscal tax income data. Unpublished paper.*

There is evidence that the theoretical sample of the *New HBS* is representative of the reference population, whereas the same conclusion cannot be reached for the final sample. However, the bias in the *New HBS*, at least in terms of income/expenditures levels, is even smaller than in the *Former HBS*. The higher levels of consumption expenditures in *New HBS* in comparison to *Former HBS* must therefore be justified by other aspects.

**4. The impact of innovations on consumption expenditure, inequality and poverty estimates**

One of the main differences between the two HBSs is represented by the reference periods, which have been extended in the *New HBS*. To “simulate” the effect of this extension, due to the availability of the information on purchasing month in the *New HBS* data, we have estimated the average monthly consumption expenditure only considering the expenditures in the *New HBS* made during the *Former HBS* reference period. The average monthly consumption expenditure passes from 2,471 to 2,501 euros (Table 3), as a result of two possible effects: using shorter periods may imply the so called “forward telescoping effect”; using larger periods implies the so called “memory effect” (Neter and Waksberg, 2012).

It must be noted that, while in the *Former HBS* no controls were made for forward telescoping effects, in the *New* some strategies were adopted to reduce memory effects. Besides precise anchoring of the time frame and precise definitions, we introduced an easier to answer set of questions related to the event of interest (the so called “warming-up” questions). In particular, we introduced questions on purchasing event, month and also on purchasing place. By using at least one of these answers we have been able also to impute the missing expenditures values. If we simulate the exclusion of all these expenditures from the *New HBS* estimates and we cumulate this effect with that produced by the reference periods, the average expenditure is estimated as 2,460 euros (Table 3).

Moreover, also a greater detail on expenditure items helps respondents to remember expenses that would otherwise be forgotten. The number of expenditure items in the *New HBS* almost doubled. For not identical items, we have calculated 159 aggregates obtained by summing up different items that can be directly compared. Through the comparison of these aggregates we can estimate the effect of items split. This effect, cumulated with the previous ones, leads the average consumption expenditure to 2,404 euros.

The results obtained in terms of the effect of items detail on consumption expenditure estimates are perfectly in line with the analysis conducted by Cifaldi and Neri (2013). They show how the underreporting of household expenditure in SHIW (assessed by comparing to National Account estimation) is linked to the use of a single recall question for non-durable expenditures and it is about 35%. Moreover it reduces to about 25% in the *Former HBS* and, if we consider the *New HBS* data, the underestimation, in comparison to National Account estimation, reduces to around 20%.

**Table 3 - Simulation of the innovations effects on average consumption expenditure, inequality and poverty incidences. Year 2013**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Aggregate** | **Average monthly consumption expenditure**  **(in Euros)** | **Inequality index (S80/S20)** | **Relative poverty incidence (%)** | **Absolute poverty incidence (%)** |
| **Former HBS** | **2359.10** | **7.0** | **12.6** | **7.9** |
| **New HBS** | **2471.10** | **6.3** | **10.4** | **6.3** |
| *New HBS with Former HBS reference periods* | *2501.37* | *6.8* | *11.7* | *7.2* |
| *New HBS with Former HBS reference periods and without imputed expenditures* | *2459.50* | *7.0* | *12.5* | *8.7* |
| *New HBS with Former HBS reference periods, without imputed expenditures and without splitting effect* | *2403.50* | *7.0* | *12.1* | *9.3* |
| *New HBS with Former HBS reference periods, without imputed expenditures, without splitting effect and without new items* | *2284.94* | *6.8* | *11.9* | *9.4* |
| **New HBS reported to the Former HBS methodology**  (with Former HBS reference periods, without imputed expenditures, without splitting effect, , without new items and with the old weighting system ) | **2388.05** | **7.1** | ***12.6*** | ***8.4*** |

*Source: own calculations based on Former HBS and New HBS data*

We have also simulated the change due to the introduction of items not considered in the *Former HBS*, as a result of the 2013 Coicop classification: they are 43 items, referring to new goods and services recently introduced into the market. This effect produced a reduction of the monthly expenditure estimate to 2,285 euros.

Finally, we have considered the effect due to the change in the post-stratification constraints for the weighting system. If we use the old weighting system (adopted in the *Former HBS*), the consumption expenditure passes from 2,285 to 2,388 euros. It means that the net effect of the new weighting system (that uses municipality typology, citizenship, employment status and month of participation as post-stratification constraints) reduces the consumption expenditure levels, probably because it guarantees a better representation of foreign population but also of low paid workers or rural households.

If we take into account the relative sampling errors (0.6% in the *Former HBS* and 0.5% in the *New HBS*), the estimation obtained by the data coming from the *New HBS reported to the Former HBS methodology* is statistically identical to the amount estimated by the *Former HBS* data. In other words, the innovations introduced in the *New HBS* seem to completely justify the increased level of consumption expenditure.

The HBS in Italy represents the source of data for two official measures of poverty[[3]](#footnote-3). Following the changes in consumption expenditure estimate, already discussed in this section, the monthly relative poverty line for a one member household was 584 euros in the *Former HBS*, compared to 619 euros in the *New HBS*.

The incidence of relative poverty was estimated at 12.6% and 10.4% (at 16.6% and 13% among individuals) respectively and the difference resulted statistically significant (the relative sampling errors are 2.7% in the Former HBS and 2.6% in the New HBS). Similarly, the change in absolute poverty incidence, from 7.9% to 6.3% (from 9.9% to 7.3%), resulted statistically significant, the relative sampling errors being 3.9% and 3.8%, respectively.

By considering all the simulations already analysed for consumption expenditure (Table 3) and taking into account the sampling errors, the poverty estimates obtained by *Former HBS* data and by *New HBS reported to the Former HBS methodology* are statistically identical.

Moreover also the level of inequality[[4]](#footnote-4) resulting from the *New HBS reported to the Former HBS methodology* is not statistically different from the one observed in the *Former HBS*. The largest effect on inequality is observed for the reference periods simulation. By comparing the estimates obtained by *New HBS* data and *New HBS* data with *Former HBS* periods, we observe an increase in inequality and in average consumption expenditure. It must be noted that the consumption expenditure increase, on average, is a composite effect of the decrease in the medium-low part of the consumption expenditure distribution and of the increase in the medium-high part, which results in an increase of inequality. This evidence, however, is not linked to stronger memory effects among the richest households, because the increase observed between Former and *New HBS* in captured expenditure events is equally distributed across deciles, even higher in the last three deciles than in the first three.

The observed increase in inequality is rather due to the higher impact of micro monthly estimation. For items with a reference period larger than one month, the monthly expenditure at the household level is obtained by dividing the spent amount by the number of months in the reference period. This implies that, given the larger reference periods in the *New HBS*, the monthly expenditure for the item is always lower than in the *Former HBS* -inducing lower values for the highest deciles; furthermore, the probability of capturing the expenditure event is always higher, reducing the proportion of households with no expenditures and producing higher values for the lowest deciles. Apart from possible memory effects, longer reference periods allow a better approximation of the household consumption expenditure behaviour.

**5. Final remarks**

In table 4 our findings are summarised. Imputing zero expenditures, splitting items of consumption and introducing new items determine, as expected, an increase of the estimated consumption expenditures, which is in line with the specific literature (Carroll and Crossley, 2015). Moreover, the increase due to all these innovations more than compensates the decrease of the consumption expenditure due to the new weighting system, with specific reference to the introduction of post-stratification constraints for citizenship and professional condition, and to the extension of reference periods.

Inequality and relative poverty measures change in a concordant way and both decrease when the effect of all the innovations are considered. For the absolute poverty measure the single effects act in a different way, following the exogenous nature of the poverty lines, even if the global effect is again a reduction in the measure. When new and split items are introduced, some households remember and declare expenditures that in the *Former HBS* were not considered or were forgotten given their aggregation with other items. Therefore, the inequality and the relative poverty increase (following the increase in the relative poverty line value), while the absolute poverty decreases, because some households overpass the absolute poverty line which does not change.

**Table 4 Innovations effect on average consumption expenditure, inequality and poverty measures. Year 2013 (sign of variation)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Aggregate** | | | | |
| **Innovation** | **Average consumption expenditure** | | **Inequality index** | **Relative poverty incidence** | **Absolute poverty incidence** |
| *Extending reference periods* | *-* | *-* | | *-* | *-* |
| *Imputing zero expenditures* | *+* | *-* | | *-* | *-* |
| *Splitting expenditure items* | *+* | *+* | | *+* | *-* |
| *Introducing new items* | *+* | *+* | | *+* | *-* |
| *Adopting the new weighting system* | - | - | | *-* | *+* |
| ***Global effect*** | **+** | **-** | | ***-*** | ***-*** |

When the new weighting system is introduced, more weight is given to the population with low levels of consumption expenditure. This entails a reduction in levels, inequality and relative poverty (also the relative poverty line value decreases) and an increase in the absolute poverty, because the households with expenditure levels lower than the absolute poverty line are more heavily weighted.

When the reference period is extended, the reduction in the average consumption expenditure goes together with the reduction in inequality and poverty estimates because, as already pointed out, larger reference periods induce lower values for the highest deciles - of the consumption expenditure distribution - and higher values for the lowest ones.

**5. References**

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1. The equivalence scale used in this paper is known as Carbonaro scale (Dagum C. and Ferrari G., eds. 2012, Household Behaviour, Equivalence Scales, Welfare and Poverty, Springer Science & Business Media). [↑](#footnote-ref-1)
2. This validation has been possible only in the aftermath of estimates production, because the fiscal income information becomes available at one year’s distance and therefore it can be used neither as a stratification nor as a post-stratification variable. [↑](#footnote-ref-2)
3. For the relative measure, households and their members are classified as relatively poor if their equivalent total consumption expenditure is not higher than 60% of the per-capita mean of the total consumption expenditure. For the absolute measure of poverty, households and their members are poor if their consumption expenditure is equal to or below the reference poverty threshold represented by the monetary value of a basket of basic needs (including adequate nurrishment, adequate accomodation and minimum availability of goods and services to dress, communicate, learn, move within the territory, educate oneself and maintain good health) defined by household types, size of municipality and geographical area of residence (accounting for differences in market offers and prices). [↑](#footnote-ref-3)
4. The inequality is measured by the S80/S20 index, that is the ratio between the share of all expenditures made by the top quintile and the share of expenditures made by the bottom quintile. [↑](#footnote-ref-4)