An Integrated Database to Measure Living Standards

Federico Perali (University of Verona, Italy), Martina Menon (University of Verona, Italy), and Elena Dalla Chiara (University of Verona, Italy)

Paper prepared for the 34th IARIW General Conference

Dresden, Germany, August 21-27, 2016

Session 3 (Plenary): Well-Being I

Time: Tuesday, August 23, 2016 [Morning]

An Integrated Database to Measure Living Standards

Elena Dalla Chiara[†], Martina Menon[‡] and Federico Perali[§]

Abstract: This study generates an integrated database to measure living standards in Italy using propensity score matching. We follow the recommendations of the Commission on the Measurement of Economic Performance and Social Progress proposing that income, consumption of market goods and non-market activities, and wealth, rather than production, should be evaluated jointly in order to appropriately measure material welfare. Our integrated database is similar in design to the one built for the US by the Levy Economics Institute to measure the multiple dimensions of well-being. In the United States, as is the case for Italy and most European countries, the State does not maintain a unified database to measure household economic well-being and data sources about income and employment surveys and other surveys on wealth and the use of time have to be statistically matched. The measure of well-being is therefore the result of a multidimensional evaluation process no longer associated with a single indicator as is usually the case when measuring gross domestic product. The estimation of individual and social welfare, multidimensional poverty and inequality does require an integrated living standard database where information about consumption, income, time and subjective well-being are jointly available. With this objective in mind, we combine information available in four different surveys: the European Union Statistics on Income and Living Conditions Survey, the Household Budget Survey, the Time Use Survey, and the Household Conditions and Social Capital Survey. We perform three different statistical matching procedures to link the relevant dimensions of living standards contained in each survey and report both the statistical and economic tests carried out to evaluate the quality of the procedure at a high level of detail.

Keywords: Propensity score, statistical matching, living standards, integrated data base.

JEL Classification: C81, I31, C55.

Acknowledgments: We would like to thank Nicola Tommasi for his helpful comments. Errors and omissions are the sole responsibility of the authors.

[†] University of Verona (Italy), Department of Economics, elena.dallachiara@univr.it
[‡] University of Verona (Italy), Department of Economics, martina.menon@univr.it
[§] University of Verona (Italy), Department of Economics and CHILD, federico.perali@univr.it

1. Introduction

In times of recession it is especially important to understand the multidimensional linkages between income, wealth and consumption and how costs and opportunities are distributed across social classes and territories. In France, the Fitoussi Commission (Stiglitz, Sen, Fitoussi 2010) set up by the French government to identify new tools to measure economic performance and social progress believes the times are ready to shift the attention from the measurement of economic production to the measurement of the well-being of people. To evaluate material welfare, the Commission proposes that income, consumption of both goods and time, and wealth, rather than production, are evaluated jointly with the aim of broadening the measures traditionally used for family support including the evaluation of non-market activities. Income or consumption alone cannot comprehensively describe household standard of livings though consumption inequality often mirrors income inequality (Attanasio, Hurst, and Pistaferri 2012). Consumption, defined by total household expenditure including possibly an imputed income from housing, differs from income because a household can borrow or save and should better reflect long-term standard of living and lifetime resources (Blundell and Preston 1996, Brewer and O'Dea 2012, Meyer and Sullivan 2011, Slesnick 1993).

The measure of well-being is therefore the result of a multidimensional evaluation process no longer associated with a single indicator as is usually the case when measuring gross domestic product. The standard of living of a person depends on multidimensional circumstances such as health status, equal access to education, the ability to develop personal relationships, to enjoy a clean environment and to invest in activities creating social capital. The estimation of individual and social welfare, multidimensional poverty and inequality requires an integrated living standard database where information about consumption, income, time and subjective well-being are jointly available.

Our aim is to create an integrated data set to measure living standards that combines information available from different data sources using Italian data as an empirical example. Our main contribution to the literature is to evaluate both the statistical and economic robustness of the fused data. To this end, we show how to perform robust economic tests based on the fundamental Engel relationship verifying the viability of the fused database for economic analysis. The matched data set contains information collected in four different surveys: the European Union Statistics on Income and Living Conditions survey (henceforth EUSILC), the Household Budget Survey carried out by the Italian National Statistical Institute (henceforth HBS), the Time Use Survey by the Italian National Statistical Institute (henceforth TUS), the Household Conditions and Social Capital survey of the International Center of Family Studies (henceforth CISF).

This architecture of integrated databases would be appropriate to identify the short and long-run actions guaranteeing the well-being of present and future generations as pursued, for example, by the Italian National Institute of Statistics (ISTAT) which, for the years 2013 and 2014, has produced a policy-relevant report on the Equitable and Sustainable Well-Being of the Italian people.

An integrated database with a design similar to the one described in the present study has been built for the US by the Levy Economics Institute to measure the multiple dimensions of well-being. In the United States, as in Italy and most European countries, the State does not collect a unified database to measure

household economic well-being, so data sources about income and employment surveys and other surveys on wealth and time use have to be statistically matched to form the Levy Institute Measure of Economic Well-being (LIMEW) database (Sharpe et al. 2011, Wolff et al. 2012).

The Living Standard Measurement Studies (LSMS) conducted by the World Bank in most developing countries, on the other hand, were designed to capture all the dimensions affecting well-being and quality of life and, in most cases, do not need such an articulated matching design. In a developing country context it is more cost and time efficient to carry out an integrated survey rather than a survey specific to each relevant dimension, as is done in most developed countries where a higher level of statistical precision is required.

Statistical matching techniques enable the integration of two or more data sources referring to the same target population and share a common set of variables. Matching combines information observed in a donor data set with units of a recipient data set with missing values for those variables. Usually, the recipient data set is the one used for statistical analysis and includes the largest number of observations because it gives more accurate results, while the donor data set is the database that contains the extra information. So statistical matching can be seen as a method of variable imputation from a donor to a recipient survey (D'Orazio *et al.* 2006, Donatiello *et al.* 2014, Kum and Masterson 2010, Rubin and Schenker 1986). The fundamental assumption behind the implementation of this procedure is that the processes generating the missing data are either missing completely at random (MCAR) or missing at random (MAR).

Integrated databases about living standards are also useful in epidemiological studies because they can serve as controls for case studies designed to capture all relevant quality of life dimensions aimed at understanding the causes of public health problems such as juvenile crime or public-health related aspects. The ecological framework, that is often used to explain why some groups in society are at a higher risk of exposure to public health problems, while others are protected, views public "disease" as the outcome of interactions between many factors at four levels - the individual, the relationship, the community, and the societal (Krug et al. 2002).

Figure A1 illustrates how consumption, time and social capital donor data sets have been linked to the income and wealth survey. The donor data sets include the extra information missing in the recipient database. The recipient data set contains the most detailed and accurate information about common variables gathered in all surveys. By combining these relevant dimensions of well-being, a "new" database is obtained, called the Italian Integrated Living Standard.

The rest of the paper is organized as follows. Section 2 describes the methodology to implement statistical matching using the propensity score approach. The single data sets are delineated in Section 3. Section 4 details the three statistical match procedures and analysis both the statistical and economic robustness of the outcomes. Section 5 concludes.

2. The Method

Statistical matching is a delicate exercise because of the dimensionality problem related to the high number of shared covariates, the number of possible values of categorical variables and the presence of continuous variables that can reflect many different values. Rosenbaum and Rubin (1983) proposed the use of *balancing scores* applied to the most relevant observed common variables. The balancing score $b(X)$ is a function of the observed covariates X such that the conditional distribution of X given $b(X)$ is independent $(\perp)$ of assignment in the treatment (D) $D \perp X \mid b(X)$. Originally, this technique was introduced to estimate causal effects between treated and control groups in non-randomized experiments. Throughout this study the treated group is the recipient data set, while the control group is the donor data set.

The propensity score is one possible balancing score that deals with the high dimensionality of the procedure reducing the problem to one-dimension. It is estimated using a logistic or probit regression specified on the selected set of covariates that are common to all questionnaires and its estimated score can be considered a synthetic indicator of the shared variables used in this function. The propensity score is the conditional probability of assignment to a particular treatment conditional on a set of observed covariates $p(X) = prob(D = 1 \mid X)$, where D is an indicator equal to 1 if an observation refers to treated group and 0 otherwise.

For a statistical robust application of the propensity score, the following two requirements must hold:

Conditional independence: given a set of common covariates which are not affected by treatment, the potential outcomes are independent of treatment assignment

$$D \perp Y_0, Y_1 \mid X \Rightarrow D \perp Y_0, Y_1 \mid p(X).$$

Common support: observations with the same covariate values have a positive probability of being both treated and untreated

$$Y_0, Y_1 \perp D \mid X.$$

The first requirement asserts that the outcome in the control group is independent of the treatment D conditional on the selected set of covariates. The second requirement states that the distribution of observed covariates is as similar as possible in both groups. This assumption ensures that there is an adequate overlap in the characteristics of treated and untreated observations to have potential matches in the untreated group.

The first step of the matching procedure chooses the best set of covariates observed in both data sets, called “matching variables”. A correct selection of variables allows control for differences within groups because the selected variables need to be independent of treatment assignment since it affects the outcome but not the exposure. The model specification involves a trade-off between the common support condition and the plausibility of the conditional independence assumption. A parsimonious specification may not affect common support, but may affect the plausibility of conditional independence, while a full specification may give rise to a support problem by affecting the common support condition (Black and Smith 2004, Caliendo

and Kopeinig 2008). The main purpose of the propensity score estimate is to balance all covariates, not to define the best selection into treatment (Augurzky and Schmidt 2001).

To inspect whether the common variables are independent of sample selection, we compare the marginal and joint distribution in the recipient and donor group by testing the similarity in distribution and calculating the between groups distance using both the absolute difference and Cramer's V test[1] (Leulescu and Agafitei 2013, Masterson 2010, Pacifico 2006, Sisto 2006). Before matching the common set of variables may have statistically different distributions, but after the implementation of the propensity score matching procedure, the common set of variables should be balanced within the strata.

The matching variables are used to estimate the propensity score value. As summarized by Lee (2013), to validate the result of the selected propensity score specification, four balancing tests are recommended: i) standardized differences proposed by Rosenbaum and Rubin (1985) for evaluating the bias reduction due to the success of the matching procedure, and consequently analysis of the distance in marginal distributions of the common variables; ii) t-tests to evaluate the equality of each covariate mean between the treatment and comparison groups (Rosenbaum and Rubin 1985); iii) stratification test for testing the mean differences within strata of the propensity score (Dehejia and Wahba 1999, 2002); iv) Hotelling test or F-test to verify the joint equality of covariate means between the treated and control groups (Smith and Todd 2005).

The standardized difference is computed as the percentage of the ratio between the difference of sample means in the recipient and donor subsamples and the square root of the average of sample variance in both groups.[2] Following Rosenbaum and Rubin (1985) a standardized difference is "large" if it is greater than 20. We also compute a t-test to verify if the mean of each common variable between the recipient and the donor database is not statistically different before and after the matching.

The stratification test is developed in two steps. In the first phase the observations are divided into strata. To determine the number of strata, the estimated propensity score is split into ranges provided its mean within each stratum is not statistically different in the recipient and donor group. In the second step, for each stratum a t-test is performed to test whether the common covariates present the same distribution in both groups (Caliendo and Kopeinig 2008, Dehejia and Wahba 2002, Garrido et al. 2014). If the t-test is rejected even in only one stratum, then the propensity score model is not well specified and the specification should be corrected until there are no significant differences between the two groups and the conditional independence assumption holds (Caliendo and Kopeinig 2008, Lee 2013).

The Hotelling test is used to jointly test the equality of the means in all covariates used in propensity score specification, between the recipient and donor data set. If the null hypothesis is rejected there is not balance in covariates between the two data sets. This test is adopted in multivariate tests of hypotheses and it is the generalization on the t-test used in univariate problems.

[1] Two distributions can be compared also with the Hellinger distance. This measure is always coherent and consistent with Cramer's V test, our selected test. Both the Hellinger distance and Cramer's V assume values between 0 and 1. A value close to 0 means that the relationship between the two distributions is weak. For Cramer's V test, the acceptance threshold of weak relationship is 0.15.

[2] Standardized difference is computed as $\frac{(\bar{x}_1-\bar{x}_0)}{\sqrt{0.5\cdot(\sigma_1^2+\sigma_0^2)}}\cdot 100$ where $\bar{x}_1$ and $\bar{x}_0$ denote the sample mean in the recipient and in the donor data set respectively, while σ_1^2 and σ_0^2 denote the sample variances in the recipient and in the donor data set.

To assess whether the characteristics observed in the recipient group are also observed in the control group consists in verifying the overlap and the region of common support of the propensity score value between these two groups (Lechner 2008). This control is important because the lack of common support may lead to biased results since the donor group may not be sufficiently similar to the recipient one. A graphical analysis of the density distributions of the propensity score in the recipient and donor group permits a visual inspection of the range and shape of the propensity score distributions (Caliendo and Kopeing 2008).

The estimated propensity score is then used to match each individual in the recipient group to an individual in the donor group. The next step is to choose the matching algorithm, implementing it with or without replacement, and the number of comparison units. The principal matching algorithms are nearest neighbor, caliper and radius, stratification and interval, kernel and local linear, and weighting (Caliendo and Kopeinig 2008, Chen and Shao 2000, Kum and Masterson 2010). The choice about performing a matching with or without replacement and about the number of comparison units involves a trade-off between bias and variance. The two aspects are inter-related because, for example, a matching with replacement and a smaller number of comparison units reduces both the bias and the precision (Dehejia and Wahba 2002). Our choice is the nearest neighbor algorithm with replacement and one comparison unit. For each individual of the recipient database we select the individual in the donor database with the closest distance in terms of propensity score.

The matching algorithm imputes the missing values of the recipient sample using the information from the donor sample. Then it is crucial to assess the quality of the matching outcome. Rässler (2004) describes four levels of validity to evaluate a matching procedure: preserving individual values, preserving joint distributions, preserving correlation structures, and preserving marginal distributions. In most cases, only the last level can be verified. Statistical matching can be considered successful if the marginal and the joint distribution of the covariates and the imputed information show similar trends in the original and the synthetic databases. We assess the matching procedure both inspecting the distributions of the extra information in the two databases, and comparing the distribution of the imputed covariates by the set of common variables used in the propensity function, computing the ratio of mean (Kum and Masterson 2008). The ratio of mean is calculated as the ratio between the mean of the recipient data set and the mean of the donor data set. To demonstrate whether the two groups are different on average, the distance of the ratio from 100 is calculated, 100 being the value that represents the perfect similarity in the means of the two groups, irrespective of whether the ratio is lower or higher than 100. There is no defined threshold to establish if the imputed information in the two samples can be considered comparable, but the closer the ratio to 100, the greater the similarity of the extra information.

We summarize the steps adopted to implement our propensity score based statistical matching as follows:

1. Choose a set of common target variables X having a significant relationship with variables of interest.

2. Compare the distribution of X in the recipient and control group.
3. Estimate the propensity score using the selected explanatory variables.
4. Validate the propensity score procedure by:
   4.1 computing balancing tests
   4.2 checking the overlap and region of common support between the two groups.
5. Choose the matching algorithm and match each observation of the recipient group to the observation in the control group using the propensity score value.
6. Assess the statistical matching quality by:
   6.1 inspecting distributions of the extra information in the two databases
   6.2 analyzing the trend of the imputed variables by the set of X covariates comparing the ratio of mean in the two groups.
7. Assess the economic matching quality using Engel curve analysis.

In the following section, we briefly describe the four surveys used in this work. Subsequently, we analyze the characteristics and properties of each statistical matching performed.

3. Data Sets Description

3.1 European Union Statistics on the Income and Living Conditions Survey (EUSILC): the recipient survey

EUSILC is an annual statistical survey that gathers comparable cross-sectional and longitudinal data for all 27 EU Member States. In Italy, the National Statistical Institute (ISTAT) conducts the survey. We use the 2010 sample of 19,147 households corresponding to 47,551 individuals. The sampled households are selected with a rotational design where a fraction of the sample of the previous survey is dropped and replaced with a new sample of equal size maintaining the same representativeness of the whole population. The survey collects information on incomes, wealth and living conditions both at the household and individual levels. EUSILC also gives accurate information on socio-demographic characteristics, housing conditions, health and education, employment status, economic activity and other firm-specific attributes.

3.2 Household Budget Survey (HBS)

The ISTAT consumption survey collects detailed information on household expenditure on goods and consumer services in different categories, such as foodstuffs, clothing, housing, transport, education, health and holidays. The main aim of this survey is to analyze and evaluate the trend in household expenditure in relation to the socio-demographic characteristics of family members. We use the data collected in 2009, including 23,005 households. The sample is drawn with a two-stage sampling design. The first stage units are municipalities and the second stage units are households.

3.3 Time Use Survey (TUS)

The Time Use Survey records the time employed in daily activities for each household member. The respondent has to fill in a diary reporting on the main activity undertaken, any other activity taking place at the same time, and the places in which the activities are carried out. Each family, selected according to a random procedure, has to compile a diary for either one day of the week, Saturday or Sunday according to the day of the visit. To implement the matching procedure, we first imputed the time spent on each activity for those days the household member did not have to fill in the diary. The Time Use survey also reports on socio-demographic characteristics, education, economic activity, housing, and health conditions. The sampling design is implemented in two-stages. The first stage units are municipalities and the second stage units are households. The interviewees are each family member of age three or more. The 2008-2009 cross-sectional wave interviewed 18,250 households and 44,606 individuals.

3.4 Household Conditions and Social Capital Survey (CISF)

The survey on household conditions and social capital was designed by the International Center of Family Studies (CISF) in 2009 with the aim of describing the well-being of Italian families and their stock of social capital. The survey was carried out through telephone interviews by COESIS. It collects household level data about socio-demographic characteristics, income and overall economic condition, and a detailed set of questions on social capital and relational well-being. The sampling design is stratified by geographic areas and family types. The sample includes 4,017 households and has both national and macro-regional representativeness. Unlike the others, the CISF survey is not scheduled with regular frequency. It is the only survey not implemented by the Italian National Statistical Institute (ISTAT) included in our integrated data set. To respect the temporal correspondence between income and related variables, we use the 2010 cross-sectional wave for the EUSILC survey because the information on income refers to the previous reference period. We use the 2009 cross-sectional wave for the Household Budget Survey and the 2008-2009 wave for the Time Use Survey.

In the next section we describe the features of each one-to-one matching implemented following the sequential representation of Figure A1 and evaluate the statistical quality of the linking procedure.

4. **Results of the Statistical Matching Procedures**

We implemented three different statistical matching procedures using the EUSILC data set as the recipient sample because this survey includes the most detailed information regarding socio-demographic characteristics, household conditions, occupational status, income, wealth, health and education.

In sequence, the first linking procedure performs the data fusion between the EUSILC and HBS data set to impute the information related to household consumption. The second statistical matching associates the information about household time use with the EUSILC data set. The third matching fills in the missing values of the EUSILC data for social capital, family relationships and family well-being, using the CISF survey.

The three data fusions are implemented using the method outlined above. For all matching procedures EUSILC-HBS, EUSILC-TUS and EUSILC-CISF we report a) the alignment of common variables, b) their frequency distributions, c) the standardized differences and *t* balancing tests, d) the distribution of propensity score, e) the distribution of the extra information imputed with the propensity score procedure, in the original and matched data sets, and f) their ratio of mean by covariates. For illustrative convenience we report the results of all the standardized differences, the stratification, the Hotelling and *t* balancing tests for the EUSILC-HBS match only. For this matching we also implement an economic evaluation of the statistical procedure.

4.1 Data fusion between the EUSILC and Household Budget Surveys (HBS)

The EUSILC database does not record data about family consumption that is typically collected in Household Budget Surveys. As shown in Figure A1, we intend to add household consumption to the former survey. We aggregate detailed household expenditures into nine categories: cereals; meat, fish and dairy products; fruit and vegetables; other food products; clothing; housing; transport and communication; recreation and education; health and hygiene.

The two basic conditions to implement the statistical matching are satisfied. Both samples refer to the same target population and share a set of covariates related to socio-demographic characteristics, household characteristics and working status conditions. The common variables are defined in the same way. Table A1 documents how we harmonize and aggregate the variables of major interest omitting trivial reclassifications.

The adopted propensity score specification includes: region of residence (five dummies coded as North-West, North-East, Center, South, Islands), dummy variable to indicate the presence in the family of children between 0-5 years old, and between 6-14 years old, a dummy variable to reveal the presence in the family of at least a self-employed worker, single-parent dummy, homeownership (dummy variable equal to 1 if the household head is a homeowner), average family education (five dummies coded as Primary, Middle, Middle-High, High, University) and total disposable household income.

Table A2 shows the frequency distribution of the variables used in the propensity score specification. Geographical area includes the largest absolute differences. The value of Cramer's V test, however, does not support the existence of a significant relationship between the two samples. Therefore, considering a threshold of 0.15 associated with a weak relationship, we can conclude that all these variables are independent of treatment assignment. This statement is generally supported by the evidence presented in Table A3. Before matching, all standardized differences between recipient and donor groups are less than 20 percent, indicating that the two data sets are similar. The magnitude of these differences decreased after matching, becoming very close to zero. Table A3 also shows the p-values of the t-test to verify whether the means of two populations are equal. Before matching there are many covariates that do not have the same proportion, but after matching the proportions in the recipient and donor groups become equal. The only exception is represented by the "Primary" category of education, balanced before matching but after

matching without the same mean in the two samples. The Hotelling test also confirms that the covariates are balanced between the two groups. The null hypothesis of joint equality of the means is not rejected (Table A4).

These statements are supported by the evidence presented in Table A5. Conditioning on the propensity score, all variables are balanced within the two samples. The upper part of the table shows t-test values verifying whether the density distributions of the propensity score are equal in the two selected samples within each stratum. The lower part shows the t-test values carried out to examine whether the common covariates have the same distributions in the two data sets. The first stratum is not shown because the propensity score takes values higher than the first quintile into which the sample was initially divided. Considering a 0.01 significance level, the propensity score and the common covariates have the same distribution in the two samples.

We also perform a preliminary test to investigate the region of common support of the propensity score value. As shown in Figure A2, the estimated propensity score takes values in a similar range and displays comparable density distributions. Therefore the observations have the same probability of belonging to the recipient or the donor group.

To match the two sources we apply the nearest neighbor algorithm with replacement and one comparison unit. To verify the matching quality we analyze the distribution of the extra information transferred from the donor to the recipient. We test whether the extra information in the matched data set preserves the same distribution as the original data set. We also compare the means of the covariates used in the propensity score specification by computing the ratio of mean. This is calculated as the ratio between the mean of the recipient group and the mean of the donor group. As shown in Figures A3a-A3e, the distributions of all categories of expenditure are very close to each other, showing that the matching procedure has reproduced the same distribution as the original data set. This is not sufficient to completely characterize the quality of the matching outcome. It is also necessary to inspect the marginal distribution of imputed variables by variables used to estimate the propensity score value and to compute the matching algorithm. These results are presented in Tables A6a-A6i where we indicate the means of the extra information in the integrated and in the donor data sets and the ratio of the mean by the covariates used to estimate these values. With the exception of expenditure on “recreation and education” (Table A6h), the other tables show that the original and matched groups are statistically similar. The lowest income category records the higher difference in mean between the two samples. Further, the synthetic data set has higher values for all extra information. Other discrepancies arise in the presence of children 0-5 or 6-14 years old and where a member of the family is self-employed. When considering children, for example, the divergence could be due to the number of children in each age group, rather than simply their presence.

In the next section we study the economic robustness of the matching by investigating the Engel relationship linking the food share, an approximate indicator of well-being (Perali 2003, Perali 2008), and the logarithm of total expenditure. This is a fundamental empirical relation that is stable independently of the society that is analyzed and the time period considered.

4.1.1 Economic Robustness of the Matched Data: the Engel Relationship and Material Well-being

An immediate check of the economic robustness of the matched data is the comparison of income in the recipient EUSILC database and consumption from the HBS donor data set. Table B1 shows the number of households per income-expenditure cell and row frequencies of quintiles of household income and total expenditure grouped by the same classes of income quintiles. The marginal column of Table B1 shows that in the lowest quintiles total expenditure exceeds income for almost 72% of the families, suggesting under-reporting of income (Meyer and Sullivan 2011). On the other hand, most families in the upper income quintiles have positive savings.

In Table B2 we focus on the relationship between total expenditure and specific expenditure items in the fused and donor data set. As shown in Table B2, all budget shares have a similar magnitude and pattern in both data sets. "Food", "clothing" and "housing" shares decrease as total expenditure increases typical of necessity goods. On the other hand, the budget share of "transport and communication" and "recreation and education" increase as total consumption increases.

We further concentrate on the relationship between the food category and total expenditure because it is a robust relation whose main features should be maintained in the integrated data base. Food expenditure and total expenditure have a similar distribution shape in the original and fused data set both in the bottom and upper tail (Figure B1). This aggregate picture may hide significant differences, especially in the bottom and top five percent of the distribution. This is apparent when we compare the quantiles of the synthetic data set against the quantiles of the donor data set, as shown in the Q-Q Plot of Figure B2 referring to the whole sample. If the two groups come from a population with the same distribution, the point should fall along the 45-degree reference line. Figure B2 shows a different pattern between the two samples for both food and total expenditure, only in the upper tail of the distribution. However, if we zoom in to the bottom and top five percent of the distribution, as shown in Figures B3 and B4, a similar departure in the lower tails can be seen, representing less than five percent of the sample.

In order to describe the shape of the food and total expenditure distributions at the tail, as shown in Tables B3a and B3b, we test the statistical difference of the computed ratios of the 90 and 10 percentile (the level of food or total expenditure that 90% of the population fall below and 10% of the population rise above, divided by the level of food or total expenditure at the 10th percentile) describing how much larger food or total consumption is at the top compared to the bottom 10 percentile of both the donor (HBS) and matched (IILS) population. As shown in tables B3a and B3b, we also summarize the dispersion of the food and total expenditure with the Gini inequality index and test their difference. Table B3b also illustrate the Foster-Greer-Thorbecke (FGT)[3] poverty measures and the associated statistics testing for the difference of the poverty measures in the donor and fused samples. With the exception of the percentile ratio for total expenditure, for all other comparisons we cannot reject that the estimates in the donor and matched data sets

[3] The Foster-Greer-Thorbecke indices are computed by substituting different values of the parameter α in the equation $FGT_\alpha = \frac{1}{N}\sum_{i=1}^{H}\left(\frac{z-y_i}{z}\right)^\alpha$, where z is the poverty threshold equal to 60% of the median of total expenditure, N is the sample size, H is the number of poor (those with total expenditure at or below z and y_i is total expenditure of each individual i. With $\alpha = 0$, FGT_0 is the *headcount ratio*, the proportion of population that lives below the poverty line. With $\alpha = 1$ FGT_1 represents the *poverty gap index*, that summarizes the extent to which individuals fall below the poverty line. With $\alpha = 2$ FGT_2 measures the *squared poverty gap ("poverty severity") index* that puts stronger emphasis on the poverty of the poorest individuals.

are the same. On the basis of this evidence we conclude that the outcome of the matching is both statistically and economically robust.

To further verify the economic robustness of the matched distribution in a welfare measurement context we estimate the Engel relationship linking the food share, a reliable proxy for well-being (Perali 2003, 2008), and the logarithm of total expenditure, as shown in Figure B5, plotting the inverse relationship between the food share and the logarithm of total expenditure. As the level of total expenditure increases, the food share, and the associated level of household well-being, decreases in a similar fashion in both the recipient and donor distribution.

To also investigate the shape of the conditional distribution of food expenditure with the logarithm of total expenditure in the lower and upper tails where there is higher statistical noise, we estimate the Engel relation by also using also a quantile regression for each distribution quantile that is not influenced by extreme values. We estimate five quantile regressions for the quantiles 0.10, 0.25, 0.50, 0.75, and 0.90. Figure B6a shows the estimated quantile coefficients with the associated confidence intervals (solid line) and the least squares coefficients (dashed line) that, by construction, do not vary by quantile. OLS estimates underestimate especially in the lower tails in both the matched IILS data set and the donor HBS dataset. The underestimation is larger in the integrated data set. Figure B6b shows the estimated quantile and OLS coefficients in the same graph. The distance between the estimated OLS coefficients in the integrated and donor dataset and by quantile is not economically significant though slightly larger in the lowest quintiles. This evidence shows that in the fused data set the economic information is robustly maintained along all the relevant portions of the income distribution.

4.2 Data fusion between EUSILC and Time Use Surveys

The EUSILC survey does not collect information about how Italians spend their time. These detailed data are traditionally gathered within specifically designed Time Use surveys. Both samples constructed by ISTAT are drawn from the same population with the same sampling design. They share a large set of common variables. Both fundamental conditions are satisfied so we can reliably perform the statistical matching technique.

We used the same covariates to match the activities on a weekday, Saturday and Sunday. We obtain the same conclusion for the time spent on a weekday, on Saturday and on Sunday, so we only present the results for the time spent on main activities on a weekday.

Table A7 describes the harmonization of the common covariates used in the specification of the propensity score model. This model includes the region of residence (three dummies coded as North, Center, South), age (nine dummies for the age classes 3-5, 6-14, 15-19, 20-26, 27-36, 37-46, 47-56, 57-66, and older than 66), gender (1 if the individual is male), the presence in the family of worker (1 if there is at least one working component), the presence of students (1 if there is at last one student in the family), the presence of children by age classes (0-5, 6-13 and 14-18 years of age), single-parent family (1 if there is a mother or

father without partner, 0 otherwise) and the educational level attained (1 if the highest education level is high school or more, 0 otherwise).

The distributions of these variables do not show any significant relationship between the two samples (Table A8). The largest absolute differences are recorded for geographical area but, as highlighted by Cramer's V test, these differences are not statistically different. We also test the equal distribution of the covariates before and after matching (Table A9). As described in the previous table, the largest standardized differences before matching are observed between the categories that refer to the geographical area. These differences disappear after matching. The p-values highlight the equality of means of covariates after matching. The covariates that reject the null hypothesis of equality of means before matching are the same covariates recording higher standardized difference.

The estimated propensity score shows a similar density distribution and its values show a common support in the recipient and donor databases. Observations have the same probability of belonging to one of the two samples (Figure A4) and we can be confident about obtaining unbiased results after implementing the matching algorithm to impute the missing values in the recipient database. To lend further support to this assertion, we investigated the matching quality for the variables we are most interested in, such as rest, work, study and mobility (Tables A10a-A10d). These figures describe the differences in the original and matched database and in the ratio of the means by each covariate used in the propensity score specification. Almost all ratios are close to 100. This implies that the average in the two groups is similar. Marked deviations from 100 are explained by the presence of few outliers in the donor data set that are not used to "impute" the missing values in the integrated database[4] as shown by the heavy upper tails apparent in Figures A5a-A5b.

4.3 Data fusion between EUSILC and CISF Surveys

This matching involves the EUSILC survey, which does not present information about social capital, and the CISF survey, which collects detailed information on both bridging and bonding social capital and relational well-being (Menon, Pendakur, Perali 2014) .

To link these data sets we implement two different propensity score specifications because some variables about family relationships are pertinent only for some types of family. One propensity score specification concerns questions about family relations and the relationship with children. As a consequence, this specification relates to a subsample of the EUSILC and CISF data set that does not include singles. We also exclude the families defined as "other types of family" because this typology is not defined in the same way in the two questionnaires and comparison is impossible with the available information. The other specification, on the other hand, analyzes the whole sample because the questions of interest are not related to family composition.

Statistical matching between these two questionnaires can be applied because the surveys refer to the same target population and share a set of common covariates with the same definition. Some variables are

[4] This problem can be solved by computing the ratio of medians that gives statistical values not influenced by outliers. Note that it is not possible to use the ratio of medians because in most cases the median is equal to 0 and therefore the ratio cannot be calculated. In fact, the time spent on a particular activity does not depend only on one socio-demographic variable as represented in the tables, i.e. work time should be compared jointly in relation to age and working status.

used in both specifications. We describe both because the sample size differs and this may affect the shape of the distribution. The alignment of the common covariates is presented in Table A11.

4.3.1 Propensity score specification excluding singles and other family types

In this propensity score specification, which excludes singles and other family types, we include the following variables: region of residence (five dummies coded as North-West, North-East, Center, South, Islands), age of the head (three dummies coded as less than 35, 35-64, older than 64), dummies for the presence of children by age class (0-5, 6-13 and 14-18 years of age), main activity of the head of the household (four dummies coded as Employee, Unemployed, Retired, Inactive person), woman's working status (dummy equal to 1 if the householder's wife/common-law wife works), single-parent family (1 if there is a mother or father without partner, 0 otherwise) and education level attained by the household head (four dummies coded as Primary, Middle, High, University).

Table A12 shows the distribution of these variables after their harmonization and aggregation. Only the different levels of education have relatively higher values of absolute differences, though they are not statistically different in the two groups as measured by Cramer's V test.

As shown in Table A13, the specification used in the propensity score model achieves the balance in observed covariates. Almost all values of standardized differences are reduced after matching and the p-values show that the means of the recipient and the donor database are not statistically different. Figure A6 also shows the similarity of the propensity score distribution in the same common support region, so we conclude that the observations have the same probability of being assigned to one of the two samples.

To judge the quality of the matching outcome we only show the main variables regarding the information about family and social capital relationships. The results presented in Tables A14a-A14d clearly show that the matching quality is high. The ratios of mean are close or very close to 100, revealing that the two groups have similar distributions. This evidence is coherently represented in Figures A7a and A7b representing the discrete distribution of the extra information in the original and synthetic data sets.

4.3.2 Propensity score specification for the whole sample

This specification involves the whole sample because the extra information is not related to family type but concerns the attitude on participation in social life and social framework that pertains to singles and families as well. The specification includes variables regarding family composition as well because the time spent in social events and voluntary activities also depends on family characteristics. We consider the region of residence (three dummies coded as North, Center, South), three dummies for the presence of children by age class (0-5, 6-13 and 14-18 years of age), two dummies describing man and woman's working status (1 if the man/woman is employee), single-parent family (1 if there is only the mother or the father without partner) and level of education of the head of the household (four categories coded as Primary, Middle, High, University).

The frequency distribution of these variables show a similar trend in the two samples (Table A15). The level of education of the head of the household displays the largest absolute differences between categories, but these differences are not statistically different as pointed out by the result of Cramer's V test.

This specification proves that the observed variables are balanced between the recipient and the donor database. After matching, the standardized differences of all covariates are close to 0 and the p-values of the t-tests do not reject the null hypothesis of equality of means in the two samples (Table A16). The distribution of the propensity score value shows that the observations with the same characteristics have the same probability of extraction from both the synthetic and original data set (Figure A8). For simplicity's sake we show the matching outcome for the variable "Take part in social activities or volunteer", which is one of the variables of keenest interest in the present matching design. Figure A9 and Table A17 show that the distribution is similar in the donor and integrated data set and that its ratios of mean are close to 100.

5. **Conclusions**

This study describes a procedure used to construct a data set integrating Italian consumption, time use, social capital and income surveys, adopting propensity score matching. Statistical matching can be seen as an imputation procedure for missing values from a donor data to a recipient data set. We use the propensity score value as a synthetic indicator of the common variables used in the specification model. This study gives detailed information on the matching variables and the statistical tests of the independence of the covariates playing special attention to the main data fusion between the EUSILC and BHS surveys. We also compare the distributions of the extra information in the original and synthetic database. For the imputed information we compute the ratio of mean between the two databases for the covariates used in the propensity score specification. We also tested the economic robustness of the related data set by the Engel relationship, often used as a benchmark measure for welfare measurement. The matched data set passed all statistical and economic tests.

We can conclude that the integrated database to measure living standards in Italy can be reliably used to implement multidimensional inequality and poverty analysis explicitly assessing the value of time and social capital and, in general, to measure individual, household and social welfare more thoroughly.

References

Attanasio, O., Hurst, E., Pistaferri, L. (2012): "The Evolution of Income, Consumption, and Leisure Inequality in the US, 1980-2010". Working paper n. 17982, National Bureau of Economic Research.

Augurzy, B., Schmidt, C. M. (2001): "The propensity score: A means to an end". Discussion paper n. 271 IZA – Institute for the Study of Labor.

Black, D. A., Smith, J. A. (2004): "How robust is the evidence on the effects of college quality? Evidence from matching". *Journal of Econometrics*, 121: 99-124.

Blundell, R., Preston, I. (1996): "Income, expenditure and the living standards of UK households", *Fiscal Studies*, 16(3): 40-54.

Brewer, M., O'Dea, C. (2012): "Measuring living standards with income and consumption: evidence from the UK. Working paper n. 2012-05, Institute for Social and Economic Research, University of Essex and Institute for Fiscal Studies.

Caliendo, M, Kopeinig, S. (2008): "Some Practical Guidance for the Implementation of Propensity Score Matching". *Journal of Economic Surveys*, 22(1): 31-72

Chen, J., Shao, J. (2000). "Nearest Neighbor Imputation for Survey Data". *Journal of Official Statistics*, 16(2): 113-131.

Dehejia, R. H., Wahba, S. (1999): "Casual Effects in Nonexperimental Studies: Revaluating the Evaluation of Training Programs". *Journal of the American Statistical Association*, 94: 1053-1062.

Dehejia, R. H., Wahba, S. (2002): "Propensity Score Matching Methods for Non-Experimental Causal Studies". *Review of Economics and Statistics*, 84(1): 151-161.

D'Orazio, M., Di Zio, M., Scanu, M. (2006): Statistical Matching: Theory and Practice, Wiley, New York.

Donatiello, G., D'Orazio, M., Frattarola, D., Rizzi, A., Scanu, M., Spaziani, M. (2014) "Statistical Matching of Income and Consumption expenditures". *International Journal of Economic Science*, Vol. III (3): 50-65.

Garrido, M. M., Kelly, A. S., Paris, J., Roza, K., Meier, D. E., Morrison, R. S., Aldridge, M. D. (2014): "Methods for Constructing and Assessing Propensity Score". *Health Services Research*, 49(5): 1701-1720.

ISTAT (2013): "Rapporto Bes 2013: il benessere equo e sostenibile in Italia." ISTAT, Rome.

ISTAT (2014): "Rapporto Bes 2014: il benessere equo e sostenibile in Italia." ISTAT, Rome.

Krug, E. G., Dahlberg, L. L., Mercy, J. A., Zwi, A. B., Lozano, R. (2002): World report on violence and health. World Health Organization, Geneva.

Kum, H., Masterson, T. N. (2010): "Statistical matching using propensity score: Theory and application to the analysis of the distribution of income and wealth". *Journal of Economic and Social Measurement*, 35: 177-196.

Lechner, M. (2008): "A note on the common support problem in applied evaluation studies". *Annales d'Economie et de Statistique*, 91/92: 217-235.

Lee, W. S. (2013): "Propensity Score Matching and Variations on the Balancing Test". *Empirical Economics*, 44(1): 47-80.

Leulescu, A., Agafitei, M. (2013): "Statistical matching: a model based approach for data integration". Eurostat, European Commission, Luxembourg.

Masterson, T. (2010): "Quality of Match for Statistical Matches Used in the 1999 and 2005 LIMEW Estimates for Canada". Working paper n. 615, Levy Economics Institute.

Menon, M., Pendakur, R., Perali, F. (2014): "All in the family: How Do Social Capital and Material Wellbeing Affect Relational Wellbeing?". *Social Indicators Research*, 1: 1-22.

Meyer, B., Sullivan, J. (2011): "Further Results on Measuring the Well-being of the Poor Using Income and Consumption". *Canadian Journal of Economics*, 44(1): 52-87.

Pacifico, D. (2006): "Propensity Score Matching tra il database Bankitalia sui Bilanci delle famiglie italiane e il database Multiscopo Istat sulle condizioni di salute e il ricorso ai servizi sanitari. Università di Modena e Reggio Emilia.

Perali, F. (2003): The Behavioral and Welfare Analysis of Consumption. Dordrecht, Kluwer Academic Publishers.

Perali, F. (2008): "The Second Engel Law: Is it a Paradox?". *European Economic Review*, 52(8): 1353-1377.

Rässler, S. (2002): Statistical matching: A Frequentist Theory, Practical Applications, and Alternative Bayesian Approaches. Lecture Notes in Statistics, 168, Springer, New York.

Rosenbaum, P. R., Rubin, D. B. (1983): "The Central Role of the Propensity Score in Observational Studies for Casual Effects". *Biometrika*, 70: 41-55.

Rosenbaum, P. R., Rubin, D. B. (1985): "Constructing a control group using multivariate matched sampling methods that incorporate the propensity score". *The American Statistician*, 39, 33-38.
Rubin, D. B., Schenker, N. (1986): "Multiple Imputation for Interval Estimation from Simple Random Samples with Ignorable Nonresponse". *Journal of the American Statistical Association*, 81: 366-374.
Sisto, A. (2006): "Propensity score matching: un'applicazione per la creazione di un database integrato ISTAT-Banca d'Italia". Working paper n. 63, Dipartimento di Politiche Pubbliche e Scelte Collettive – POLIS, Università del Piemonte orientale.
Sharpe, A., Murray, A., Evans, B., Hazell, E. (2011): "The Levy Institute Measure of Economic Well-Being: Estimates for Canada, 1999 and 2005". Working paper n. 680, Levy Economics Institute.
Slesnick, D. (1993): "Gaining ground: poverty in the postwar United States". *Journal of Political Economy*, 101: 1-38
Smith, J., Todd, P. (2005): "Rejoinder". *Journal of Econometrics*, 125: 365-375.
Stiglitz, E., Sen, A., Fitoussi, J. P. (2010): Report by the Commission on the Measurement of Economic Performance and Social Progress.
Tedeschi, S., Pisano, E. (2013): "Data Fusion Between Bank of Italy-SHIW and ISTAT-HBS". Working paper n. 51253, Munich Personal RePEc Archive (MPRA).
Wolff, E. N., Zacharias, A., Masterson, T., Eren, S., Sharpe, A., Hazell, E. (2012): "A comparison of Inequality and Living Standards in Canada and the United States Using an Expanded Measure of Economic Well-Being". Working paper n. 703, Levy Economics Institute.

Appendix A

Figure A1: The data sets used to create an integrated database

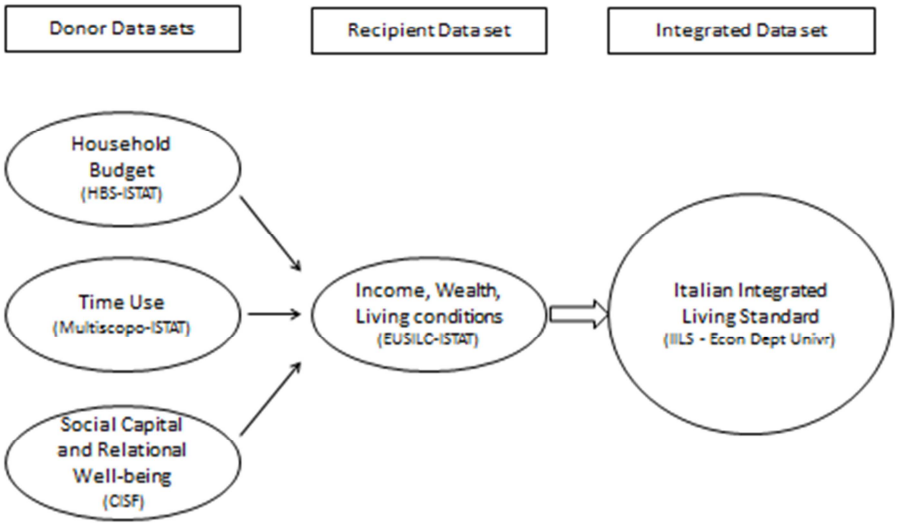

Table A1. Alignment of common variables in Eusilc – Household Budget match

Variable	Eusilc Survey	Household Budget Survey	Harmonized variable
Education	*istr_c* 1=unqualified, illiterate 2=unqualified, can read and write 3=primary school 4=first grade secondary school 5=second grade secondary school (2-3 years) 6=second grade secondary school (4-5 years) 7=certificate post-A levels 8=bachelor's degree or master's degree 9=superior graduate school 10=Ph.D.	*titstu* 1=Ph.D or superior graduate school 2=master's degree 3=bachelor's degree 4= second grade secondary school (4-5 years) 5= second grade secondary school (2-3 years) 6= first grade secondary school 7=primary school 8=unqualified	 1=unqualified 2=primary school 3= first grade secondary school 4= second grade secondary school (2-3 years) 5= second grade secondary school (4-5 years) or certificate post-A levels 6= bachelor's degree or master's degree 7= superior graduate school or Ph.D.
Status in employment	*pl040* 1=self-employed with employees 2=self-employed without employees 3=employee 4=family worker	*posprof* 1=executive 2=manager 3=clerk 4=intermediate categories 5=foreman 6=other employee 7=trainee 8=homeworker 9=military force (armed force) 10=entrepreneur 11=self-employed 12=independent contractor 13=partner of cooperatives 14= assistant 15=project worker 16=occasional contractor (from code 1 to code 9 employee, from code 10 to code 16 self-employed)	 1=self-employed 0=other
Tenure status of the house	*hh020* 1=owner 2=tenant or subtenant paying rent at prevailing or market rate 3=accommodation is rented at a reduced rate (lower price that the market price) 4=accommodation is provided free	*tipoccup* 1=tenant or subtenant paying rate 2=owner 3=accommodation is in usufruct 4=accommodation is provided free by relatives or friends	 1=owner 0=other

Note: In italic the name of the variables in each survey.

Table A2. Comparison between frequency distribution for some common variables

	EUSILC	HBS	Absolute difference	Cramer's V *
Geographical area				0.094
North-West	23.03	23.58	0.55	
North-East	24.04	21.15	2.89	
Center	22.97	17.62	5.35	
South	21.36	26.61	5.25	
Islands	8.60	11.04	2.44	
Children 0-5 years old				0.020
No	88.53	89.75	1.22	
Yes	11.47	10.25	1.22	
Children 6-14 years old				0.011
No	84.01	83.18	0.83	
Yes	15.99	16.82	0.83	
Self-employed				0.005
No	80.51	80.15	0.36	
Yes	19.49	19.85	0.36	
Single-parent				0.025
No	91.41	92.78	1.37	
Yes	8.59	7.22	1.37	
Homeownership				0.009
No	25.50	24.72	0.78	
Yes	74.50	75.28	0.78	
Average family education				0.036
Primary	26.95	26.83	0.12	
Middle	24.28	27.24	2.96	
Middle-High	19.16	18.15	1.01	
High	23.16	21.48	1.68	
University	6.44	6.29	0.15	
Household income				0.025
1st quintile	19.51	20.41	0.90	
2nd quintile	19.48	20.44	0.96	
3rd quintile	20.17	19.85	0.32	
4th quintile	19.85	20.13	0.28	
5th quintile	20.99	19.17	1.82	

*The acceptance threshold of a weak relationship is 0.15

Table A3. Test for Standardized Differences and t-test on the equality of means

Variable	Test for Standardized Differences		T-test	
	Standardized difference before matching	Standardized difference after matching	P-value before matching	P-value after matching
Geographical area				
North-West	-1.30	0.00	0.1820	0.9750
North-East	6.90	-1.70	0.0000	0.1650
Center	13.30	2.00	0.0000	0.0880
South	-12.30	-0.20	0.0000	0.8980
Islands	-8.20	-0.20	0.0000	0.8510
Children 0-5 years old	3.90	-2.80	0.0000	0.0180
Children 6-14 years old	-2.30	-1.50	0.0220	0.1990
Self-employed	-0.90	-1.00	0.3560	0.3900
Single-parent	5.10	-0.80	0.0000	0.4930
Homeownership	-1.80	0.40	0.0640	0.7180
Average family education				
Primary	0.30	4.10	0.7790	0.0010
Middle	-6.80	-1.40	0.0000	0.2500
Middle-High	2.60	-1.80	0.0080	0.1240
High	4.00	-1.50	0.0000	0.2030
University	0.60	0.60	0.5280	0.6030
Household income	7.60	-1.60	0.0000	0.1850

Table A4. Hotelling test after matching

Variable	Mean of HBS	Mean of EUSILC
Geographical area		
North-West	0.230	0.230
North-East	0.248	0.240
Center	0.221	0.230
South	0.214	0.214
Islands	0.087	0.086
Children 0-5 years old	0.124	0.115
Children 6-14 years old	0.166	0.160
Self-employed	0.199	0.195
Single-parent	0.088	0.086
Homeownership	0.743	0.745
Average family education		
Primary	0.251	0.269
Middle	0.249	0.243
Middle-High	0.199	0.192
High	0.238	0.232
University	0.063	0.064
Household income	3.197	3.158
Hotelling p-value	0.069	

*Table A5. Test statistic of t-test in each stratum **

	Stratum										
	2	3	4	5	6	7	8	9	10	11	12
Balance of propensity score distribution across treatment and comparison groups	-0.077	1.368	1.332	-0.076	-1.218	-2.238	-0.654	-0.425	-1.980	-0.593	-1.381
Balance of covariates across treatment and comparison groups											
Geographical area - ref. cat. "North-West"											
North-East	-1.287	-1.200	0.747	-1.346	0.336	0.681	2.501	0.279	1.127	-0.586	-0.775
Center	.	.	-0.984	0.576	-0.330	-0.104	-2.117	-0.254	-0.719	-0.840	-0.775
South	-0.987	2.089	-2.197	0.194	-1.116	-0.561	-2.189	.	-0.873	.	.
Islands	1.471	-1.586	-0.961	-0.169	-0.731	-0.589	0.033	.	-0.873	-0.622	.
Children between 0-5 years old	0.591	-0.539	-0.717	-0.429	0.036	0.884	0.483	-1.016	1.029	1.066	-0.775
Children between 6-14 years old	0.842	0.284	0.746	0.081	-0.563	0.813	-1.892	-1.766	0.331	-1.568	-0.775
Self-employed	1.210	0.907	0.343	1.842	-1.040	-0.768	-0.226	-2.346	-0.877	-1.031	.
Single-parent	-0.279	2.350	0.287	0.627	-1.750	-0.062	-0.050	0.357	-0.100	-0.048	.
Homeownership	1.121	-1.716	2.048	0.118	-1.077	2.482	-1.434	-0.905	-1.465	-2.269	.
Average family education -ref. cat. "Primary"											
Middle	-0.253	0.823	1.416	0.226	-0.529	1.156	0.550	-0.329	0.480	-1.090	.
Middle-High	-2.494	1.061	-0.595	1.186	0.733	-0.961	1.547	-0.014	-0.117	-0.992	-0.775
High	0.685	1.555	-1.714	1.661	-1.370	-0.612	0.042	0.601	-1.080	0.079	-1.549
University	-0.007	-2.082	-0.495	0.456	0.388	0.774	-0.636	0.276	1.533	0.798	.
Household income	2.326	1.124	-0.092	2.256	-0.981	0.050	-0.217	-1.203	-1.518	-0.508	-0.793

*Significance level equal to 0.01

Figure A2. Distribution of propensity score across recipient and donor data sets

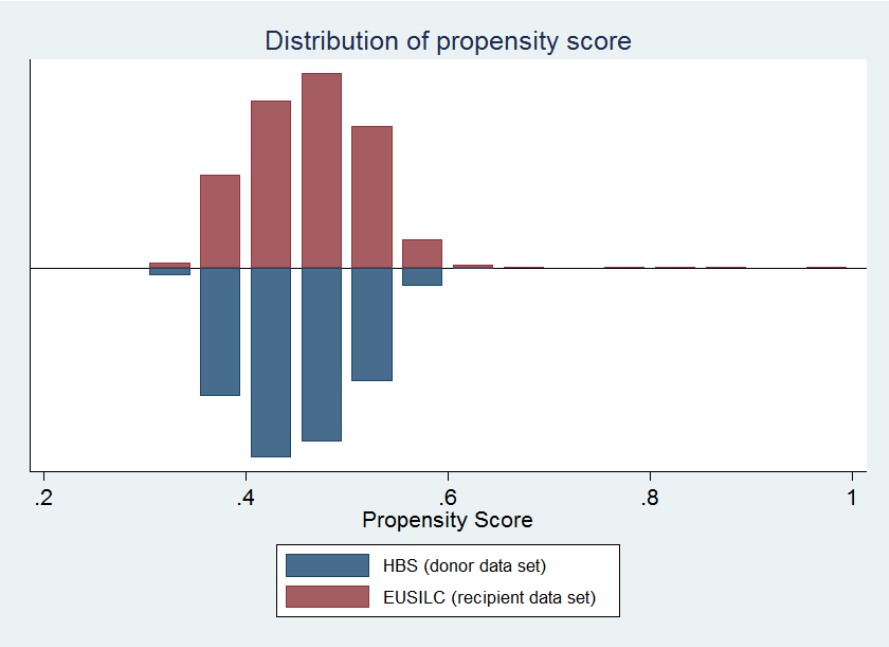

Figure A3a. Distribution of expenditure for "Cereals" and "Meat, fish and dairy products" in integrated and donor data sets

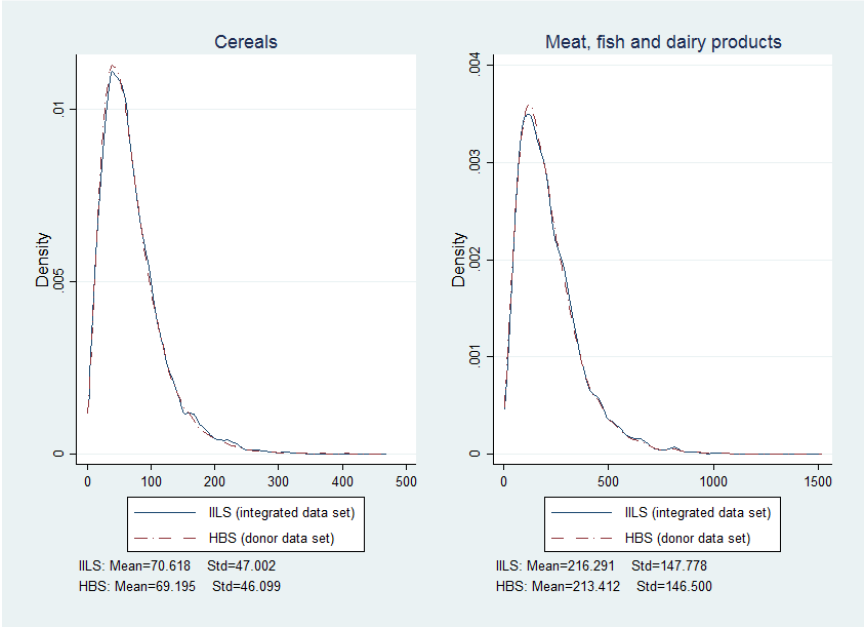

Figure A3b. Distribution of expenditure for "Fruits and vegetables" and "Other food products" in integrated and donor data sets

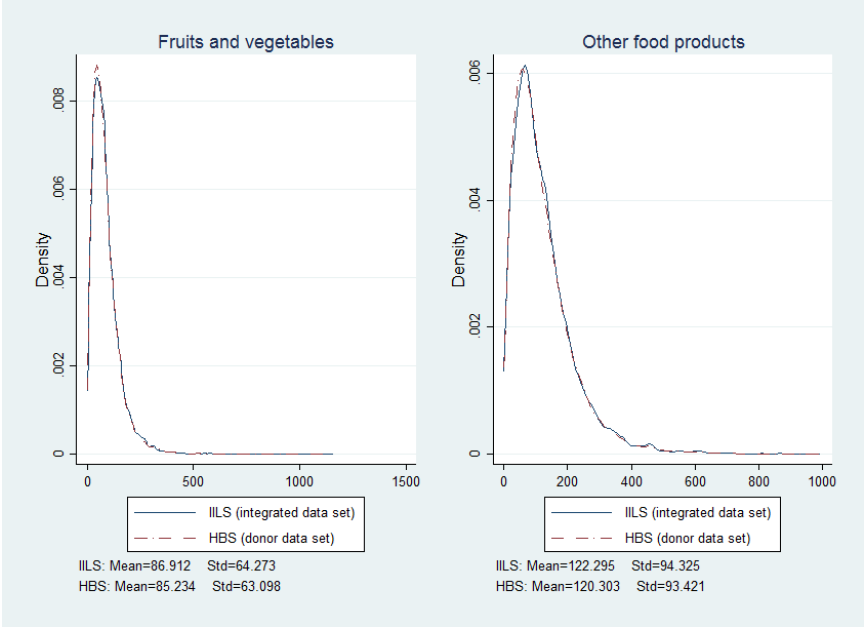

Figure A3c. Distribution of expenditure for "Clothing" and "Housing" in integrated and donor data sets

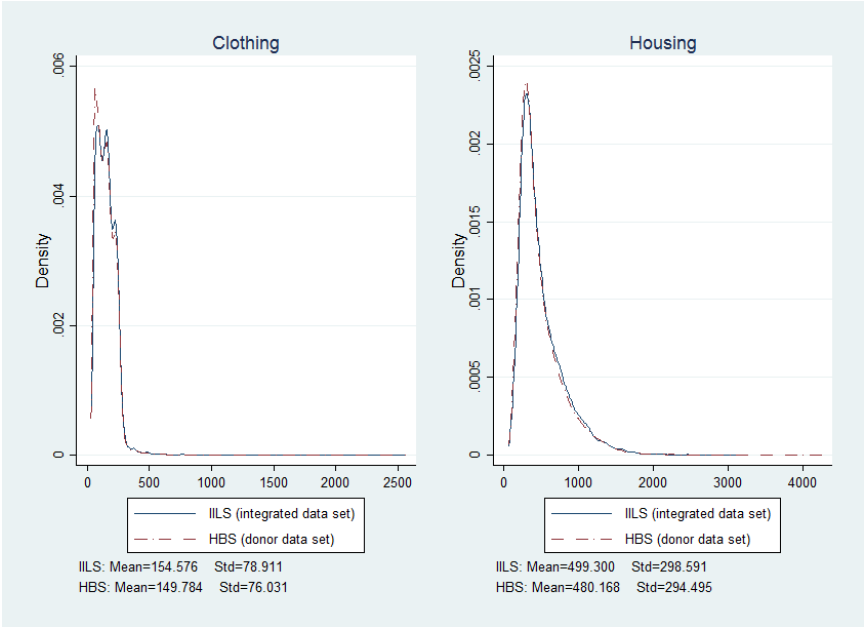

Figure A3d. Distribution of expenditure for "Transport and communication" and "Recreation and education" in integrated and donor data sets

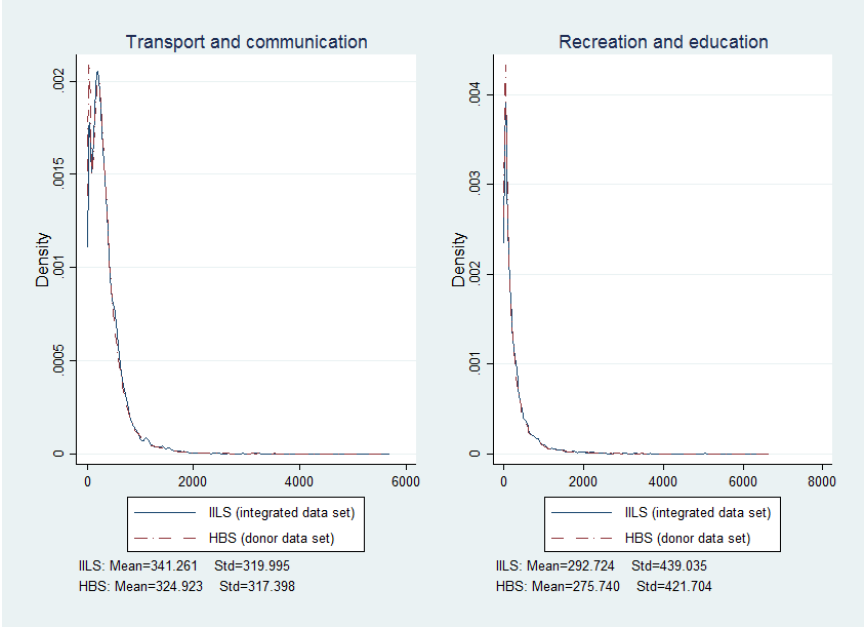

Figure A3e. Distribution of expenditure for "Health" in integrated and donor data sets

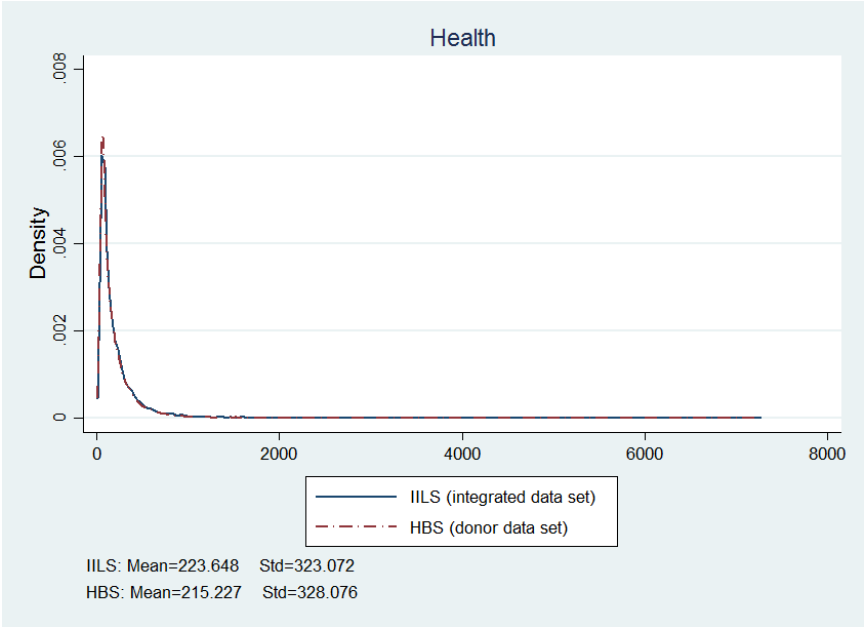

Table A6a. Cereals expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	71.23	71.05	99.74
North-East	70.04	70.73	100.97
Center	69.30	72.67	104.87
South	67.80	68.38	100.84
Islands	66.40	69.24	104.27
Children 0-5 years old			
No	67.63	70.35	104.03
Yes	82.88	72.65	87.66
Children 6-14 years old			
No	65.10	70.47	108.24
Yes	89.44	71.40	79.84
Self-employed			
No	65.89	70.46	106.94
Yes	82.54	71.25	86.32
Single-parent			
No	69.41	70.63	101.75
Yes	66.44	70.51	106.13
Homeownership			
No	64.02	70.48	110.09
Yes	70.89	70.66	99.68
Average family education			
Primary	59.70	69.63	116.64
Middle	72.84	71.19	97.73
Middle-High	78.90	71.47	90.59
High	70.58	70.95	100.52
University	61.17	68.86	112.56
Household income			
1st quintile	51.05	68.63	134.43
2nd quintile	62.65	69.72	111.29
3rd quintile	68.90	71.82	104.23
4th quintile	77.12	71.75	93.03
5th quintile	87.48	71.08	81.25

Table A6b. Meat, fish and dairy products expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	213.51	215.01	100.70
North-East	185.34	209.19	112.87
Center	227.35	218.80	96.24
South	231.22	220.99	95.58
Islands	201.82	221.18	109.59
Children 0-5 years old			
No	209.22	216.24	103.36
Yes	250.14	216.66	86.62
Children 6-14 years old			
No	203.18	216.31	106.46
Yes	264.01	216.21	81.89
Self-employed			
No	203.05	216.89	106.82
Yes	255.25	213.81	83.76
Single-parent			
No	214.31	216.17	100.87
Yes	201.83	217.60	107.81
Homeownership			
No	192.54	216.72	112.56
Yes	220.26	216.14	98.13
Average family education			
Primary	182.78	214.02	117.09
Middle	226.73	218.61	96.42
Middle-High	241.55	217.74	90.15
High	220.01	216.40	98.36
University	182.69	212.34	116.23
Household income			
1st quintile	155.40	212.01	136.43
2nd quintile	193.87	215.91	111.37
3rd quintile	214.18	222.33	103.80
4th quintile	239.99	212.49	88.54
5th quintile	267.31	218.42	81.71

Table A6c. Fruits and vegetables expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	86.96	87.23	100.31
North-East	83.23	86.23	103.59
Center	92.04	90.73	98.58
South	84.96	84.72	99.72
Islands	75.19	83.22	110.68
Children 0-5 years old			
No	84.76	86.55	102.11
Yes	89.41	89.73	100.36
Children 6-14 years old			
No	82.76	87.15	105.31
Yes	97.49	85.67	87.88
Self-employed			
No	81.81	86.95	106.29
Yes	99.06	86.74	87.56
Single-parent			
No	85.53	86.79	101.47
Yes	81.40	88.24	108.40
Homeownership			
No	77.92	86.91	111.53
Yes	87.64	86.91	99.18
Average family education			
Primary	74.40	85.05	114.31
Middle	87.26	87.27	100.00
Middle-High	94.77	87.13	91.94
High	89.62	88.47	98.71
University	80.18	87.15	108.69
Household income			
1st quintile	66.13	84.09	127.15
2nd quintile	77.01	86.88	112.81
3rd quintile	85.35	88.78	104.01
4th quintile	94.08	85.25	90.61
5th quintile	104.93	89.36	85.16

Table A6d. Other food products expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	124.84	122.61	98.21
North-East	117.46	121.33	103.29
Center	118.87	124.70	104.90
South	122.54	120.87	98.63
Islands	112.94	121.28	107.38
Children 0-5 years old			
No	118.71	122.15	102.90
Yes	134.24	123.39	91.91
Children 6-14 years old			
No	115.15	121.93	105.89
Yes	145.79	124.23	85.21
Self-employed			
No	113.07	122.46	108.30
Yes	149.51	121.63	81.35
Single-parent			
No	121.30	122.18	100.73
Yes	107.46	123.49	114.92
Homeownership			
No	108.97	122.78	112.67
Yes	124.02	122.13	98.47
Average family education			
Primary	92.90	119.91	129.07
Middle	128.55	124.39	96.76
Middle-High	143.37	122.38	85.36
High	127.65	122.81	96.21
University	109.80	122.31	111.39
Household income			
1st quintile	78.12	118.61	151.83
2nd quintile	103.99	122.40	117.71
3rd quintile	119.90	125.02	104.27
4th quintile	137.89	119.55	86.70
5th quintile	164.56	125.60	76.32

Table A6e. Clothing expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	144.10	150.50	104.44
North-East	152.56	154.41	101.21
Center	150.34	165.30	109.95
South	153.97	148.65	96.54
Islands	145.61	152.01	104.40
Children 0-5 years old			
No	141.89	153.51	108.19
Yes	218.92	162.83	74.38
Children 6-14 years old			
No	134.69	154.64	114.82
Yes	224.43	154.22	68.71
Self-employed			
No	138.62	153.60	110.81
Yes	194.88	158.59	81.38
Single-parent			
No	150.49	153.89	102.26
Yes	140.69	161.90	115.07
Homeownership			
No	143.90	156.06	108.45
Yes	151.71	154.07	101.55
Average family education			
Primary	101.78	148.86	146.25
Middle	153.10	153.05	99.96
Middle-High	182.39	158.95	87.15
High	173.84	159.28	91.63
University	163.87	154.30	94.16
Household income			
1st quintile	86.39	144.97	167.80
2nd quintile	124.63	149.16	119.68
3rd quintile	149.82	158.72	105.94
4th quintile	184.34	157.12	85.23
5th quintile	207.77	162.14	78.04

Table A6f. Housing expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	565.43	507.98	89.84
North-East	562.26	538.78	95.82
Center	479.48	558.14	116.41
South	385.88	417.76	108.26
Islands	369.23	411.01	111.31
Children 0-5 years old			
No	468.64	495.32	105.69
Yes	581.06	530.03	91.22
Children 6-14 years old			
No	462.82	501.09	108.27
Yes	565.95	489.91	86.56
Self-employed			
No	459.52	497.83	108.34
Yes	563.55	505.37	89.68
Single-parent			
No	480.66	493.91	102.76
Yes	473.85	556.67	117.48
Homeownership			
No	547.85	519.10	94.75
Yes	457.95	492.52	107.55
Average family education			
Primary	362.79	485.27	133.76
Middle	475.26	479.95	100.99
Middle-High	541.54	515.54	95.20
High	545.67	519.25	95.16
University	601.13	510.91	84.99
Household income			
1st quintile	335.47	463.83	138.26
2nd quintile	416.72	473.87	113.71
3rd quintile	486.29	502.31	103.29
4th quintile	542.40	514.16	94.79
5th quintile	630.20	538.94	85.52

Table A6g. Transport and communication expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	352.42	339.98	96.47
North-East	358.65	359.55	100.25
Center	338.33	379.45	112.15
South	289.23	301.28	104.17
Islands	266.24	290.85	109.24
Children 0-5 years old			
No	316.94	338.36	106.76
Yes	394.78	363.66	92.12
Children 6-14 years old			
No	307.99	344.28	111.78
Yes	408.67	325.41	79.63
Self-employed			
No	295.51	341.16	115.45
Yes	443.71	341.67	77.00
Single-parent			
No	326.19	338.95	103.91
Yes	308.58	365.80	118.54
Homeownership			
No	279.50	345.19	123.50
Yes	339.83	339.92	100.02
Average family education			
Primary	179.23	329.35	183.76
Middle	338.74	333.36	98.41
Middle-High	413.04	349.27	84.56
High	394.78	354.23	89.73
University	393.56	350.36	89.02
Household income			
1st quintile	141.17	310.85	220.19
2nd quintile	251.66	335.17	133.18
3rd quintile	317.83	349.71	110.03
4th quintile	416.39	336.00	80.69
5th quintile	509.98	372.05	72.95

Table A6h. Recreation and education expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	355.95	296.64	83.34
North-East	351.83	335.15	95.26
Center	273.78	340.90	124.51
South	197.13	222.13	112.68
Islands	151.34	210.25	138.93
Children 0-5 years old			
No	264.27	290.08	109.76
Yes	376.11	313.13	83.25
Children 6-14 years old			
No	252.22	295.02	116.97
Yes	392.06	280.64	71.58
Self-employed			
No	241.87	292.44	120.91
Yes	412.54	293.90	71.24
Single-parent			
No	275.91	289.75	105.02
Yes	273.58	324.32	118.55
Homeownership			
No	224.38	293.73	130.91
Yes	292.60	292.38	99.92
Average family education			
Primary	109.71	279.12	254.42
Middle	243.54	268.65	110.31
Middle-High	361.29	314.75	87.12
High	394.93	314.34	79.59
University	469.27	297.13	63.32
Household income			
1st quintile	112.93	261.18	231.29
2nd quintile	183.74	273.42	148.81
3rd quintile	258.39	303.73	117.55
4th quintile	355.05	300.14	84.53
5th quintile	481.86	322.38	66.90

Table A6i. Health and hygiene expenditure: Ratio of mean by covariates

	HBS	IILS	Ratio
Geographical area			
North-West	240.35	230.39	95.86
North-East	265.71	244.57	92.04
Center	217.74	246.45	113.18
South	172.35	182.14	105.68
Islands	164.21	189.27	115.26
Children 0-5 years old			
No	212.79	221.75	104.21
Yes	236.55	238.26	100.72
Children 6-14 years old			
No	212.33	224.66	105.81
Yes	229.57	218.31	95.09
Self-employed			
No	207.06	222.42	107.42
Yes	248.23	228.72	92.14
Single-parent			
No	216.02	220.94	102.28
Yes	205.05	252.41	123.10
Homeownership			
No	177.92	221.78	124.65
Yes	227.47	224.29	98.60
Average family education			
Primary	177.29	221.23	124.78
Middle	203.06	209.11	102.98
Middle-High	250.89	234.90	93.62
High	243.14	231.25	95.11
University	231.47	227.75	98.39
Household income			
1st quintile	155.22	205.83	132.60
2nd quintile	179.39	219.20	122.20
3rd quintile	214.10	229.84	107.35
4th quintile	239.16	215.60	90.15
5th quintile	293.36	246.01	83.86

Table A7. Alignment of common variables in Eusilc – Time Use match

Variable	Eusilc Survey	Time Use Survey	Harmonized variable
Education	*istr_c* 1=unqualified, illiterate 2= unqualified, can read and write 3=primary school 4=first grade secondary school 5=second grade secondary school (2-3 years) 6=second grade secondary school (4-5 years) 7=certificate post-A levels 8=bachelor's degree or master's degree 9=graduated studies 10=Ph.D.	*col.8* 1=Ph.D or graduated studies 2=degree (4 year or more) 3= master's degree 4=bachelor's degree 5=academic degree 6= certificate post-A levels 7= second grade secondary school (4-5 years) 8= second grade secondary school (2-3 years) 9= first grade secondary school 10=primary school 11= unqualified, can read and write 12= unqualified, illiterate	1=unqualified, illiterate 2=unqualified, can read and write 3=primary school 4=first grade secondary school 5=second grade secondary school (2-3 years) 6=second grade secondary school (4-5 years) 7=certificate post-A levels 8=bachelor's degree or master's degree 9=graduated studies or Ph.D
Economic status	*pl211a-pl211l* 1=working full time 2=working part-time 3=unemployed 4=pupil, student, further training, unpaid work experience 5=in retirement or in early retirement or has given up business 6=permanently disabled or/and unfit to work 7=in compulsory military community or service 8=fulfilling domestic tasks and care responsibilities 9=other inactive person (codes 1 and 2 employee; codes 7 and 9 other inactive person)	*col.9* 1=employee 2=looking for a new job 3=looking for first job 4=fulfilling domestic tasks 5=student 6=unfit to work 7=in retirement or in early retirement or has given up business 8=other (codes 2 and 3 unemployed)	1=employee 2=unemployed 3= pupil, student, further training, unpaid work experience 4=in retirement or in early retirement or has given up business 5=permanently disabled or/and unfit to work 6= fulfilling domestic tasks and care responsibilities 7=other inactive person

Note: In italic the name of the variables in each survey.

Table A8: Comparison between frequency distribution for some common variables

	EUSILC	TUS	Absolute difference	Cramer's V *
Geographical area				0.076
North	44.36	43.73	0.63	
Center	22.87	17.64	5.23	
South	32.77	38.64	5.87	
Age group				0.010
3-5	2.88	2.83	0.05	
6-14	8.73	8.75	0.02	
15-19	5.26	5.26	0.00	
20-26	7.50	7.34	0.16	
27-36	12.92	13.08	0.16	
37-46	16.26	16.39	0.13	
47-56	14.71	14.15	0.56	
57-66	12.75	12.68	0.07	
>66	19.00	19.51	0.51	
Gender				0.000
Female	51.84	51.82	0.02	
Male	48.16	48.18	0.02	
Presence of workers				0.015
No	61.60	60.09	1.51	
Yes	38.40	39.91	1.51	
Presence of students				0.008
No	83.34	83.96	0.62	
Yes	16.66	16.04	0.62	
Children 0-5 years old				0.001
No	86.60	86.56	0.04	
Yes	13.40	13.44	0.04	
Children 6-13 years old				0.004
No	77.96	77.63	0.33	
Yes	22.04	22.37	0.33	
Children 14-18 years old				0.002
No	82.78	82.65	0.13	
Yes	17.22	17.35	0.13	
Single-parent				0.000
No	91.67	91.67	0.00	
Yes	8.33	8.33	0.00	
High level of education				0.034
No	63.50	66.76	3.26	
Yes	36.50	33.24	3.26	

*The acceptance threshold of a weak relationship is 0.15

Table A9. Test for Standardized Differences and t-test on the equality of means

Variable	Test for Standardized Differences		T-test	
	Standardized difference before matching	Standardized difference after matching	P-value before matching	P-value after matching
Geographical area				
North	1.30	0.00	0.0600	0.9930
Center	13.00	-0.10	0.0000	0.9830
South	-12.30	0.00	0.0000	0.9920
Age	-0.50	0.00	0.4670	0.9890
Gender	0.00	0.20	0.9540	0.9570
Presence of workers	-3.10	-0.20	0.0000	0.9540
Presence of students	1.70	-0.20	0.0130	0.9440
Children 0-5 years old	-0.10	0.30	0.8390	0.9210
Children 6-13 years old	-0.80	0.00	0.2460	0.9900
Children 14-18 years old	-0.40	0.30	0.5990	0.9100
Single-parent	0.00	0.80	0.9940	0.7860
High level of education	6.90	-0.10	0.0000	0.9760

Figure A4. Distribution of propensity score across recipient and donor data sets

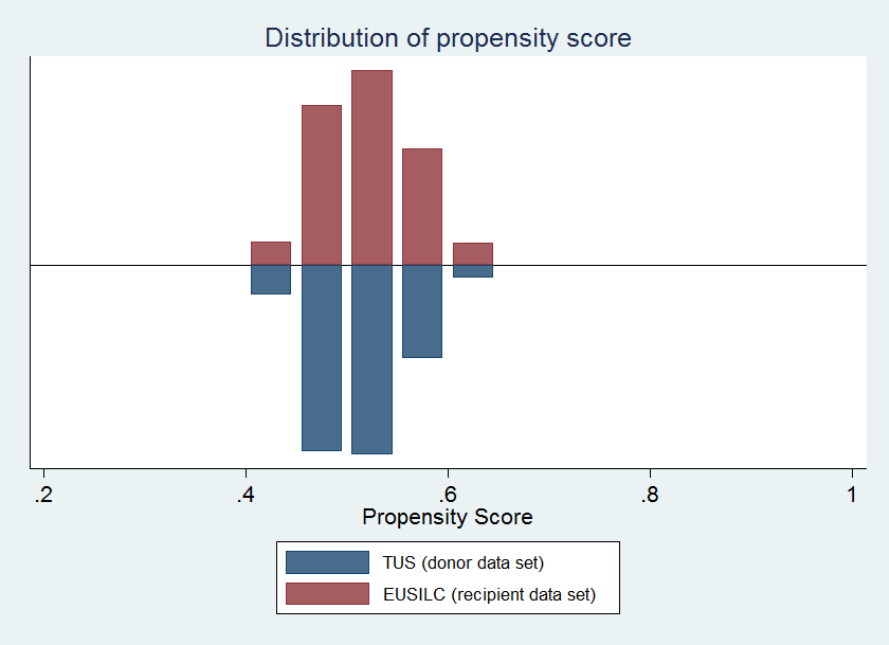

Figure A5a. Distribution of "rest time" and "work time" in integrated and donor data sets

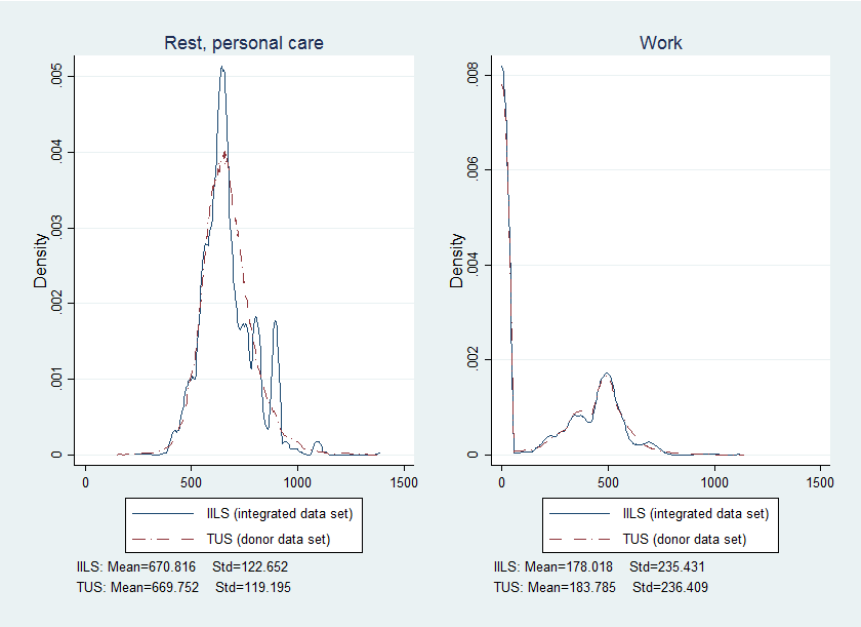

Figure A5b. Distribution of "study time" and "mobility time" in integrated and donor data sets

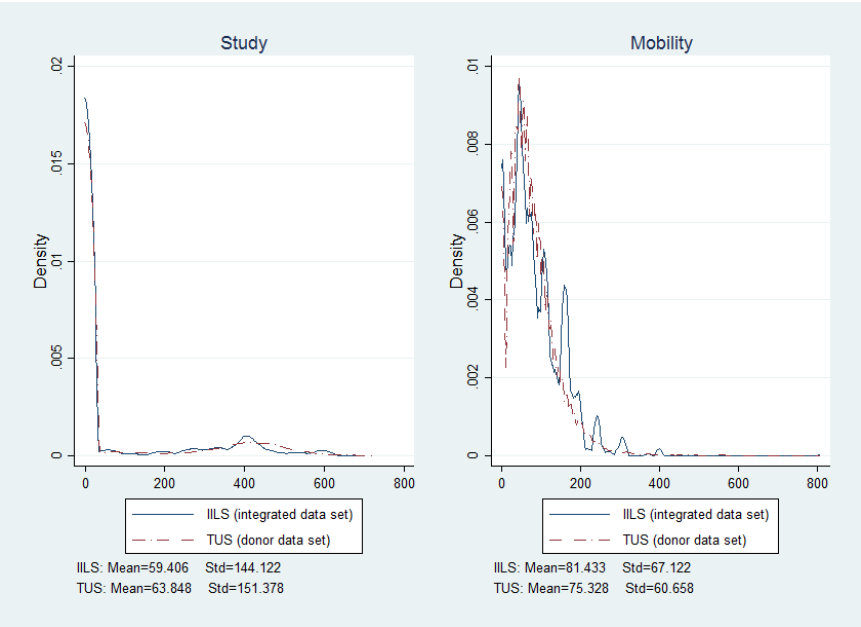

Table A10a. Rest and personal care time: Ratio of mean by covariates

	TUS	IILS	Ratio
Geographical area			
North	661.25	680.55	102.92
Center	671.30	656.98	97.87
South	678.68	667.29	98.32
Age group			
3-5	802.57	792.92	98.80
6-14	727.05	706.23	97.14
15-19	665.42	682.46	102.56
20-26	652.22	657.26	100.77
27-36	628.13	614.94	97.90
37-46	617.41	622.91	100.89
47-56	618.37	622.10	100.60
57-66	670.80	648.29	96.64
>66	740.99	770.00	103.91
Gender			
Female	671.83	677.02	100.77
Male	667.51	664.14	99.49
Presence of workers			
No	713.41	715.97	100.36
Yes			
Presence of students			
No	664.39	666.48	100.31
Yes	697.82	692.51	99.24
Children 0-5 years old			
No	669.22	670.72	100.22
Yes	673.16	671.41	99.74
Children 6-13 years old			
No	669.95	675.22	100.79
Yes	669.06	655.22	97.93
Children 14-18 years old			
No	674.19	675.75	100.23
Yes	648.60	647.11	99.77
Single-parent			
No	670.66	672.29	100.24
Yes	659.72	654.53	99.21
High level of education			
No	688.13	687.80	99.95
Yes	632.83	641.26	101.33

Table A10b. Work time: Ratio of mean by covariates

	TUS	IILS	Ratio
Geographical area			
North	204.75	190.26	92.93
Center	192.62	184.06	95.56
South	156.03	157.22	100.77
Age group			
3-5	0.00	2.05	-
6-14	0.05	0.57	1037.12
15-19	36.83	19.77	53.68
20-26	215.26	190.52	88.51
27-36	344.43	328.44	95.36
37-46	354.53	341.58	96.35
47-56	322.28	333.91	103.61
57-66	119.76	112.67	94.08
>66	10.76	5.99	55.69
Gender			
Female	127.43	121.24	95.14
Male	244.39	239.13	97.85
Presence of workers			
No	5.52	8.42	152.34
Yes	452.18	450.12	99.54
Presence of students			
No	218.31	212.53	97.35
Yes	3.12	5.45	174.80
Children 0-5 years old			
No	179.10	170.42	95.15
Yes	213.96	227.16	106.17
Children 6-13 years old			
No	185.70	180.36	97.12
Yes	177.13	169.73	95.82
Children 14-18 years old			
No	185.10	179.03	96.72
Yes	177.52	173.16	97.54
Single-parent			
No	183.65	178.15	97.01
Yes	185.30	176.54	95.27
High level of education			
No	132.14	120.58	91.25
Yes	287.52	277.93	96.67

Table A10c. Study time: Ratio of mean by covariates

	TUS	IILS	Ratio
Geographical area			
North	60.11	52.00	86.51
Center	58.06	56.21	96.81
South	70.72	71.65	101.33
Age group			
3-5	273.71	239.38	87.45
6-14	330.88	297.97	90.05
15-19	294.89	257.65	87.37
20-26	121.17	126.39	104.30
27-36	15.10	24.79	164.20
37-46	2.13	0.60	28.23
47-56	1.25	0.86	68.19
57-66	0.96	0.21	21.94
>66	0.49	0.09	18.13
Gender			
Female	61.10	63.01	103.13
Male	66.80	55.52	83.12
Presence of workers			
No	104.37	93.13	89.23
Yes	2.84	5.31	187.08
Presence of students			
No	14.30	14.40	100.70
Yes	323.09	284.45	88.04
Children 0-5 years old			
No	56.20	53.08	94.44
Yes	113.06	100.31	88.72
Children 6-13 years old			
No	37.91	35.40	93.36
Yes	153.88	144.34	93.80
Children 14-18 years old			
No	46.01	43.05	93.57
Yes	148.79	138.03	92.77
Single-parent			
No	61.63	57.21	92.83
Yes	88.25	83.55	94.67
High level of education			
No	78.59	71.54	91.04
Yes	34.24	38.30	111.83

Table A10d. Mobility time: Ratio of mean by covariates

	TUS	IILS	Ratio
Geographical area			
North	75.55	87.08	115.26
Center	75.09	80.86	107.69
South	75.18	74.19	98.68
Age group			
3-5	53.36	78.53	147.18
6-14	63.61	73.96	116.27
15-19	101.44	110.79	109.22
20-26	99.78	115.12	115.37
27-36	89.36	93.02	104.11
37-46	88.23	87.71	99.42
47-56	80.44	68.64	85.33
57-66	68.20	80.14	117.51
> 66	48.21	61.39	127.34
Gender			
Female	67.71	65.34	96.50
Male	83.52	98.75	118.24
Presence of workers			
No	64.57	75.71	117.26
Yes	91.53	90.61	99.00
Presence of students			
No	74.16	78.90	106.40
Yes	81.45	94.09	115.51
Children 0-5 years old			
No	75.17	81.51	108.44
Yes	76.36	80.96	106.01
Children 6-13 years old			
No	74.07	81.59	110.16
Yes	79.70	80.87	101.46
Children 14-18 years old			
No	72.53	78.93	108.84
Yes	88.67	93.44	105.38
Single-parent			
No	74.75	80.43	107.59
Yes	81.66	92.53	113.30
High level of education			
No	68.08	76.81	112.82
Yes	89.89	89.48	99.54

Table A11. Alignment of common variables in Eusilc – Cisf match

Variable	Eusilc Survey	Cisf Survey	Harmonized variable
Education	*istr_c* 1=unqualified, illiterate 2=unqualified, can read and write 3=primary school 4=first grade secondary school 5=second grade secondary school (2-3 years) 6=second grade secondary school (4-5 years) 7=certificate post-A levels 8=bachelor's degree or master's degree 9=graduated studies 10=Ph.D. (1,2,3=1 / 4,5 =2 / 6, 7=3 / 8,9,10=4)	*q_11* 1=unqualified, primary school 2=first grade secondary school 3=second grade secondary school 4=academic degree, degree, graduated studies	Same as Cisf survey
Economic status	*pl211a-pl211l* 1=employee working full-time 2=employee working part-time 3=self-employed working full-time 4=self-employed working part-time 5=unemployed 6=pupil, student, further training, unpaid work experience 7=in retirement or in early retirement or has given up business 8=permanently disabled or/and unfit to work 9=in compulsory military community or service 10=fulfilling domestic tasks and care responsibilities 11=other inactive person (codes 1, 2, 3, 4 employee)	*q_12* 1= in retirement or in early retirement 2= fulfilling domestic tasks and care responsibilities 3=pupil, student 4=civil or military service 5= unemployed 6=unemployed insurance/redundancy worker 7=looking for first job 8= permanently disabled or/and unfit to work 9=not working because wealthy 10=employee in private sector 11=employee in public sector 12=self-employed 13=uncharacteristic worker (codes 6, 10, 11, 12, 13 employee; codes 5, 7 unemployed; code 9 other inactive)	1=employee 2= unemployed 3=pupil, student, further training, unpaid work experience 4=in retirement or in early retirement or has given up business 5=permanently disabled or/and unfit to work 6=in compulsory military community or service 7=fulfilling domestic tasks and care responsibilities 8=other inactive person

Note: In italic the name of the variables in each survey.

Table A12. Comparison between frequency distribution for some common variables – No singles and other family types

	EUSILC	CISF	Absolute difference	Cramer's V *
Geographical area				0.066
North-West	22.17	27.41	5.24	
North-East	23.78	19.14	4.64	
Center	22.45	19.71	2.74	
South	22.59	22.62	0.03	
Islands	9.01	11.12	2.11	
Age of the household head				0.049
Less than 35	7.22	4.62	2.60	
35-64	63.40	68.54	5.14	
Older than 64	29.39	26.85	2.54	
Children 0-5 years old				0.045
No	84.75	88.85	4.10	
Yes	15.25	11.15	4.10	
Children 6-13 years old				0.023
No	79.67	77.27	2.40	
Yes	20.33	22.73	2.40	
Children 14-18 years old				0.028
No	84.50	81.85	2.65	
Yes	15.50	18.15	2.65	
Working status of the household head				0.051
Employes	56.21	56.07	0.14	
Unemployed	3.07	2.45	0.62	
Retired	32.92	36.61	3.69	
Other inactive	7.80	4.87	2.93	
Wife/common-law wife employed				0.021
No	61.94	64.60	2.66	
Yes	38.06	35.40	2.66	
Single-parent				0.005
No	87.07	87.46	0.39	
Yes	12.93	12.54	0.39	
Education of the household head				0.102
Primary	25.03	16.41	8.62	
Middle	36.23	33.17	3.06	
High	28.47	38.35	9.88	
University	10.26	12.07	1.81	

*The acceptance threshold of a weak relationship is 0.15

Figure A6. Distribution of propensity score across recipient and donor data sets – No singles and other family types

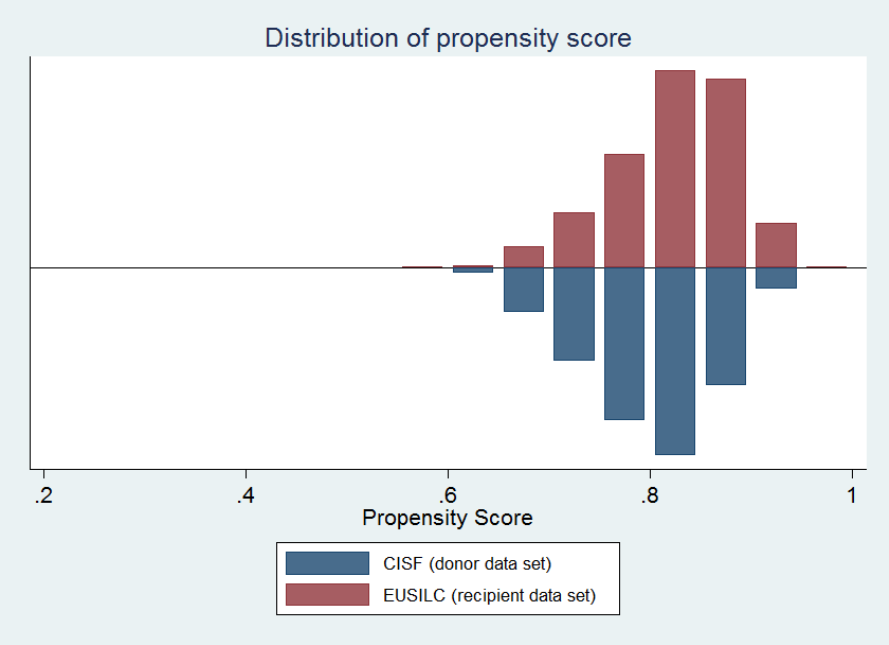

Table A13. Test for Standardized Differences and t-test on the equality of means – No singles and other family types

Variable	Test for Standardized Differences		T-test	
	Standardized difference before matching	Standardized difference after matching	P-value before matching	P-value after matching
Geographical area				
North-West	-12.20	2.20	0.00	0.64
North-East	11.30	-0.40	0.00	0.94
Center	6.70	-2.70	0.00	0.55
South	-0.10	-0.80	0.97	0.86
Islands	-7.00	2.60	0.00	0.57
Age of the household head	-0.10	-6.70	0.96	0.15
Children 0-5 years old	12.10	-2.40	0.00	0.58
Children 6-13 years old	-5.80	-3.60	0.00	0.41
Children 14-18 years old	-7.10	-3.60	0.00	0.42
Working status of the household head				
Employee	0.30	-2.80	0.89	0.54
Unemployed	3.80	4.50	0.08	0.35
Retired	-7.80	-1.80	0.00	0.68
Other inactive	12.10	5.90	0.00	0.21
Wife/common-law wife employed	5.50	2.40	0.01	0.60
Single-parent	1.20	-2.80	0.57	0.54
Education of the household head				
Primary	21.40	0.10	0.00	0.97
Middle	6.40	-2.70	0.00	0.55
High	-21.10	2.40	0.00	0.60
University	-5.70	0.50	0.00	0.91

Figure A7a. Distribution of "Trust in family members for daily necessities" and "Trust in friends of family members" in integrated and donor data sets

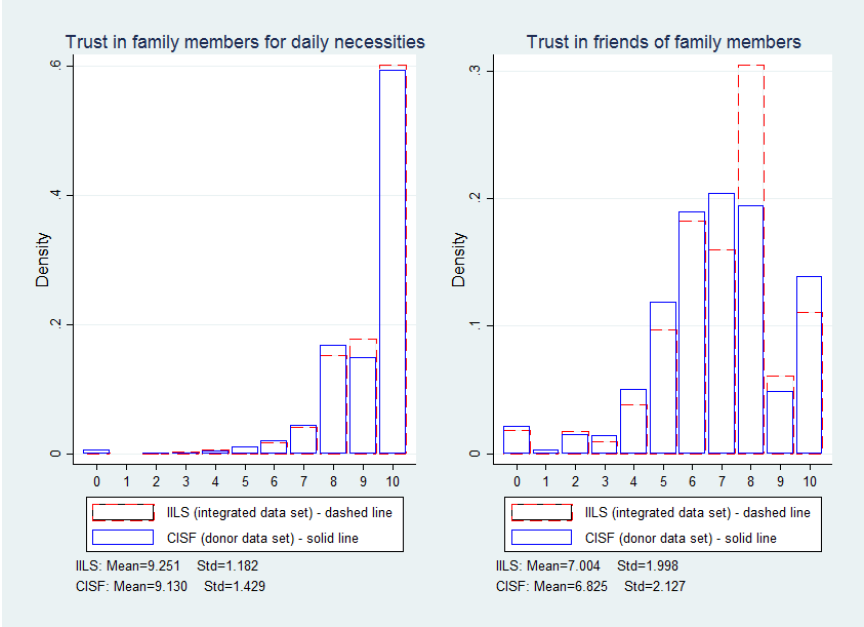

Figure A7b. Distribution of "Satisfaction about the relationship with children" and "Satisfaction about the time spent together" in integrated and donor data sets

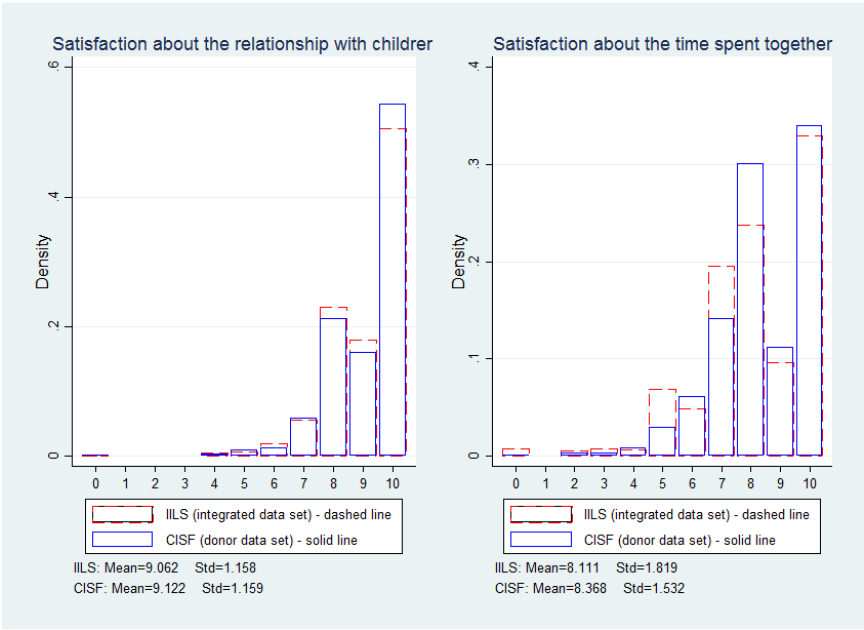

Table A14a. Trust in family members for daily necessities: Ratio of mean by covariates

	CISF	IILS	Ratio
Geographical area			
North-West	9.13	9.40	102.93
North-East	9.22	9.13	99.03
Center	9.20	9.25	100.49
South	9.02	9.20	102.07
Islands	9.07	9.34	102.97
Age group of the household head			
Less then 35	9.25	8.69	93.93
35-64	9.15	9.21	100.64
Older than 64	9.05	9.47	104.71
Children 0-5 years old			
No	9.11	9.27	101.73
Yes	9.29	9.17	98.63
Children 6-13 years old			
No	9.09	9.26	101.90
Yes	9.27	9.21	99.37
Children 14-18 years old			
No	9.13	9.26	101.42
Yes	9.15	9.23	100.89
Working status of the household head			
Employee	9.22	9.19	99.69
Unemployed	8.99	9.12	101.44
Retired	9.04	9.45	104.49
Other inactive	8.82	8.91	101.00
Wife/common-law wife employed			
No	9.13	9.35	102.42
Yes	9.13	9.09	99.57
Single-parent			
No	9.17	9.30	101.34
Yes	8.82	8.95	101.46
Education of the household head			
Primary	8.92	9.43	105.76
Middle	9.07	9.09	100.22
High	9.23	9.38	101.72
University	9.27	9.01	97.16

Table A14b. Trust in friends of family members: Ratio of mean by covariates

	CISF	IILS	Ratio
Geographical area			
North-West	7.04	7.19	102.09
North-East	6.88	7.21	104.83
Center	6.84	6.85	100.24
South	6.58	6.74	102.31
Islands	6.67	7.05	105.69
Age group of the household head			
Less then 35	6.97	6.27	89.97
35-64	6.86	6.92	100.93
Older than 64	6.71	7.36	109.65
Children 0-5 years old			
No	6.82	7.05	103.39
Yes	6.84	6.73	98.30
Children 6-13 years old			
No	6.81	7.02	103.09
Yes	6.86	6.92	100.88
Children 14-18 years old			
No	6.81	7.05	103.52
Yes	6.90	6.76	98.00
Working status of the household head			
Employee	6.88	6.87	99.90
Unemployed	6.19	6.39	103.24
Retired	6.78	7.38	108.88
Other inactive	6.87	6.60	96.19
Wife/common-law wife employed			
No	6.77	6.96	102.86
Yes	6.92	7.07	102.09
Single-parent			
No	6.83	7.06	103.33
Yes	6.76	6.62	97.82
Education of the household head			
Primary	6.51	7.25	111.47
Middle	6.73	6.67	99.07
High	6.92	7.10	102.67
University	7.23	7.32	101.26

Table A14c. Satisfaction about the relationship with children: Ratio of mean by covariates

	CISF	IILS	Ratio
Geographical area			
North-West	9.17	9.17	99.95
North-East	9.02	9.02	100.02
Center	9.06	9.13	100.74
South	9.12	8.89	97.42
Islands	9.26	9.21	99.47
Age group of the household head			
Less then 35	9.25	9.15	98.89
35-64	9.14	9.07	99.20
Older than 64	8.98	8.99	100.13
Children 0-5 years old			
No	9.05	8.98	99.18
Yes	9.46	9.35	98.89
Children 6-13 years old			
No	9.06	9.04	99.82
Yes	9.25	9.11	98.58
Children 14-18 years old			
No	9.14	9.14	99.94
Yes	9.07	8.81	97.12
Working status of the household head			
Employee	9.19	9.10	99.06
Unemployed	9.18	8.97	97.67
Retired	8.94	8.99	100.58
Other inactive	8.98	8.93	99.42
Wife/common-law wife employed			
No	9.13	9.13	99.95
Yes	9.11	8.98	98.58
Single-parent			
No	9.17	9.10	99.28
Yes	8.86	8.89	100.29
Education of the household head			
Primary	8.94	9.01	100.75
Middle	9.18	9.11	99.23
High	9.12	9.05	99.30
University	9.14	9.02	98.66

Table A14d. Satisfaction about the time spent together: Ratio of mean by covariates

	CISF	IILS	Ratio
Geographical area			
North-West	8.40	8.28	98.60
North-East	8.40	8.18	97.39
Center	8.30	7.93	95.56
South	8.32	7.90	94.92
Islands	8.45	8.49	100.38
Age group of the household head			
Less then 35	8.15	8.00	98.18
35-64	8.34	8.17	97.92
Older than 64	8.47	8.01	94.60
Children 0-5 years old			
No	8.35	8.10	97.02
Yes	8.53	8.18	95.88
Children 6-13 years old			
No	8.36	8.10	96.89
Yes	8.39	8.14	97.08
Children 14-18 years old			
No	8.36	8.12	97.15
Yes	8.41	8.06	95.81
Working status of the household head			
Employee	8.28	8.15	98.41
Unemployed	8.55	7.99	93.41
Retired	8.51	8.28	97.31
Other inactive	8.23	7.18	87.16
Wife/common-law wife employed			
No	8.45	8.17	96.63
Yes	8.21	8.01	97.62
Single-parent			
No	8.40	8.14	96.94
Yes	8.15	7.90	96.94
Education of the household head			
Primary	8.44	8.05	95.46
Middle	8.40	8.01	95.35
High	8.31	8.38	100.79
University	8.36	7.86	94.07

Table A15. Comparison between frequency distribution for some common variables – Whole sample

	EUSILC	CISF	Absolute difference	Cramer's V *
Geographical area				0.031
North	47.07	48.00	0.93	
Center	22.97	19.72	3.25	
South	29.96	32.29	2.33	
Children 0-5 years old				0.033
No	89.47	92.06	2.59	
Yes	10.53	7.94	2.59	
Children 6-13 years old				0.023
No	86.07	83.92	2.15	
Yes	13.93	16.08	2.15	
Children14-18 years old				0.026
No	89.37	87.23	2.14	
Yes	10.63	12.77	2.14	
Housband/common-law housband employed				0.001
No	63.49	63.33	0.16	
Yes	36.51	36.67	0.16	
Wife/common-law wife employed				0.013
No	73.19	74.71	1.52	
Yes	26.81	25.29	1.52	
Single-parent				0.003
No	91.41	91.21	0.20	
Yes	8.59	8.79	0.20	
Education of the household head				0.077
Primary	29.48	22.75	6.73	
Middle	33.26	30.72	2.54	
High	27.24	35.08	7.84	
University	10.01	11.45	1.44	

*The acceptance threshold of a weak relationship is 0.15

Figure A8. Distribution of propensity score across recipient and donor data sets – Whole sample

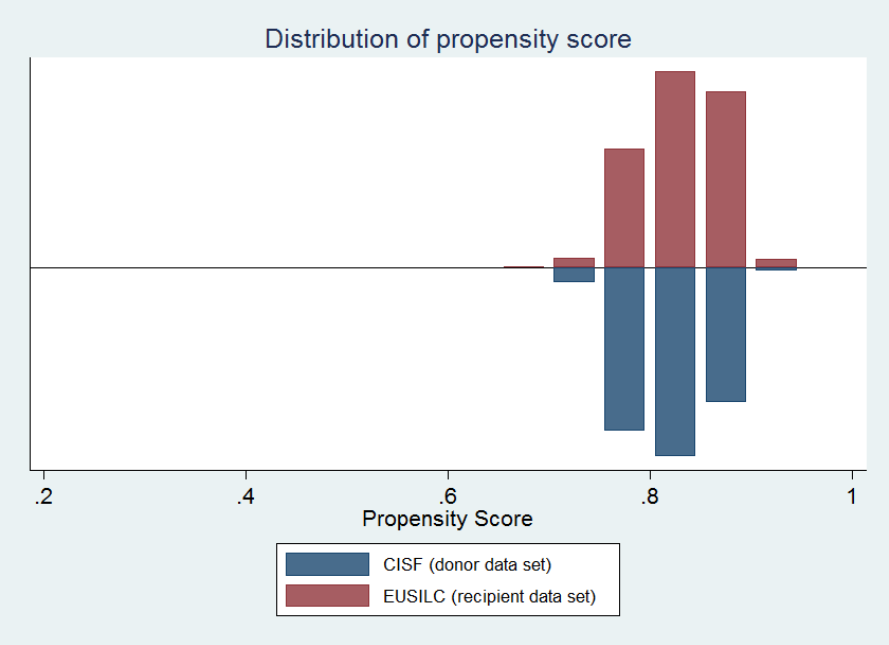

Table A16. Test for Standardized Differences and t-test on the equality of means – Whole sample

Variable	Test for Standardized Differences		T-test	
	Standardized difference before matching	Standardized difference after matching	P-value before matching	P-value after matching
Geographical area				
North	-1.90	1.00	0.2840	0.8720
Center	8.00	-1.00	0.0000	0.8680
South	-5.00	-0.10	0.0030	0.9820
Children 0-5 years old	8.90	1.90	0.0000	0.7470
Children 6-13 years old	-6.00	2.00	0.0000	0.7330
Children 14-18 years old	-6.70	-0.20	0.0000	0.9700
Housband/common-law housband employed	-0.30	-0.60	0.8510	0.9240
Wife/common-law wife employed	3.50	0.30	0.0480	0.9560
Single-parent	-0.70	2.40	0.6870	0.6840
Education of the household head				
Primary	15.40	0.10	0.0000	0.9860
Middle	5.50	-0.30	0.0020	0.9570
High	-17.00	0.20	0.0000	0.9730
University	-4.70	0.10	0.0060	0.9930

Figure A9. Distribution of "Take part in social activities or volunteer" in integrated and donor data sets

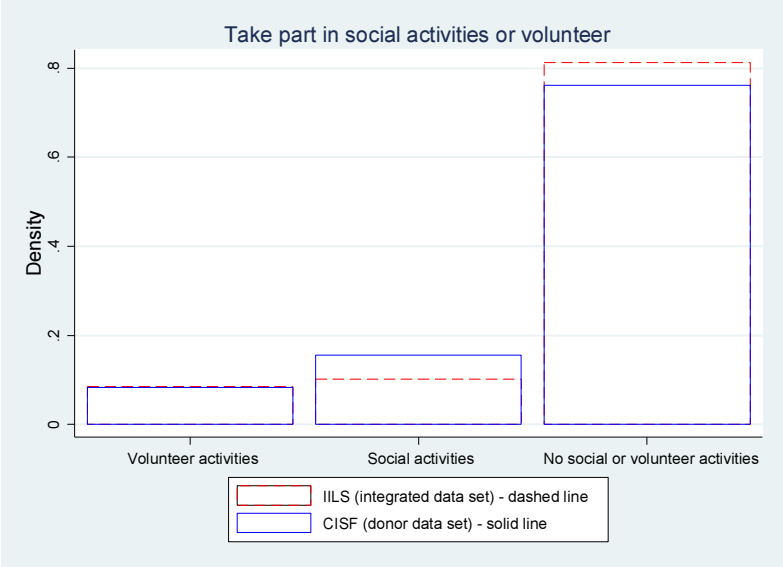

Table A17. Take part in social activities or volunteer: Ratio of mean by covariates

	CISF	IILS	Ratio
Geographical area			
North	2.64	2.80	106.01
Center	2.69	2.43	90.52
South	2.73	2.84	104.11
Children 0-5 years old			
No	2.67	2.73	102.08
Yes	2.76	2.73	99.02
Children 6-13 years old			
No	2.67	2.73	102.05
Yes	2.71	2.73	100.77
Children 14-18 years old			
No	2.68	2.72	101.60
Yes	2.66	2.75	103.68
Husband/common-law husband employed			
No	2.68	2.74	102.17
Yes	2.68	2.71	101.24
Wife/common-law wife employed			
No	2.69	2.76	102.66
Yes	2.65	2.64	99.64
Single-parent			
No	2.68	2.74	102.02
Yes	2.65	2.65	99.78
Education of the household head			
Primary	2.76	2.56	92.59
Middle	2.74	2.81	102.45
High	2.64	2.80	106.18
University	2.47	2.76	111.99

Appendix B

Table B1. Conditional frequencies by income quintiles

Quintiles of household income (Y)	Total expenditure (X)						Average savings (Y-X)
	<= 1199	1199 -| 1788	1788 -| 2545	2545 -| 3662	>3662	Total	
<= 1199	1060 28.37	1026 27.46	912 24.41	501 13.41	237 6.34	3736 100.00	-1098.86
1199 -| 1788	937 25.12	1068 28.63	895 23.99	558 14.96	272 7.29	3730 100.00	-450.12
1788 -| 2545	754 19.52	1095 28.35	1098 28.43	616 15.95	299 7.74	3862 100.00	94.42
2545 -| 3662	807 21.23	1058 27.83	1055 27.76	608 16.00	273 7.18	3801 100.00	1046.40
>3662	702 17.47	1092 27.18	1165 28.99	703 17.50	356 8.86	4018 100.00	3330.52
Total	4260 22.25	5339 27.88	5125 26.77	2986 15.60	1437 7.51	19147 100.00	

Table B2. Average budget share by quintile group of total expenditure

Category of expenditure		Quintiles of Total expenditure				
		1	2	3	4	5
Food	IILS	0.293	0.278	0.260	0.252	0.225
	HBS	0.301	0.280	0.272	0.257	0.226
Clothing	IILS	0.108	0.098	0.092	0.080	0.059
	HBS	0.107	0.098	0.092	0.079	0.058
Housing	IILS	0.327	0.293	0.274	0.255	0.212
	HBS	0.326	0.290	0.266	0.253	0.211
Transport and communication	IILS	0.103	0.151	0.166	0.178	0.185
	HBS	0.098	0.151	0.168	0.177	0.184
Recreation and education	IILS	0.058	0.083	0.107	0.134	0.198
	HBS	0.058	0.084	0.105	0.133	0.199
Health	IILS	0.110	0.096	0.101	0.102	0.121
	HBS	0.111	0.098	0.097	0.101	0.123

Figure B1. Distribution of "Food Expenditure" and "Total Expenditure" in integrated and donor data sets

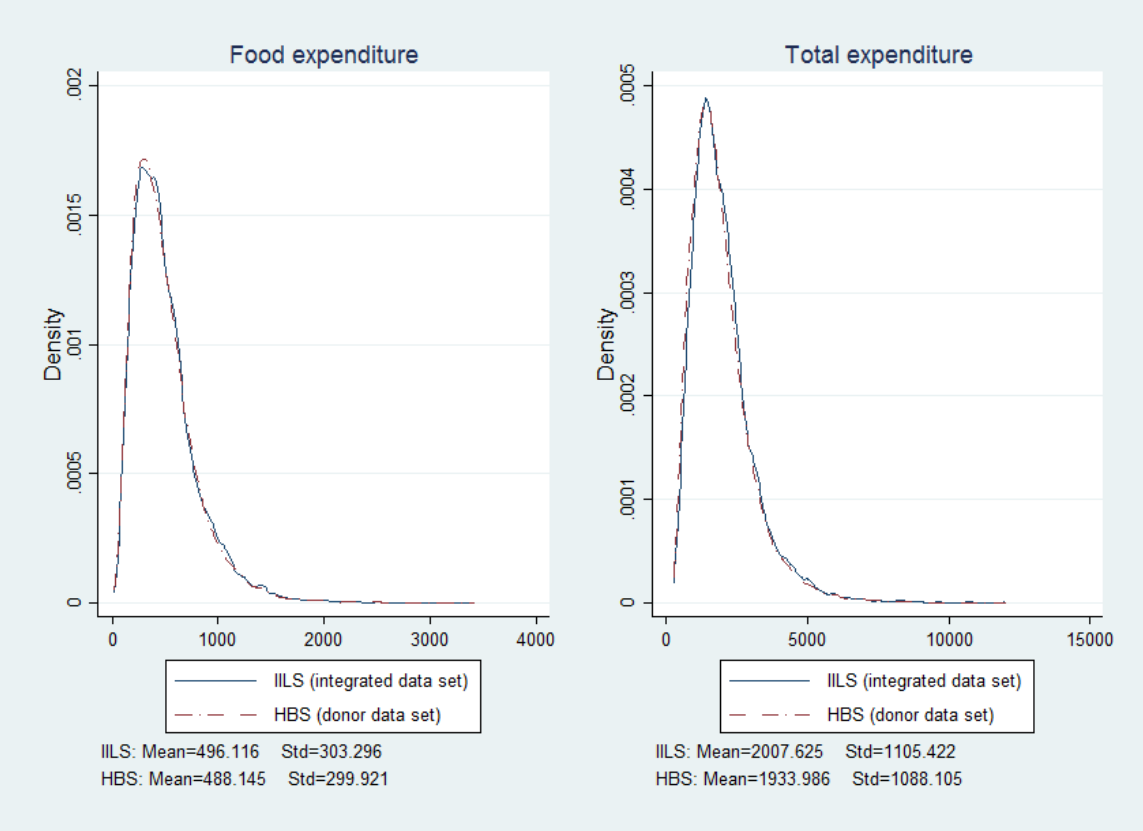

Figure B2. Q-Q Plot of Food Expenditure and Total Expenditure

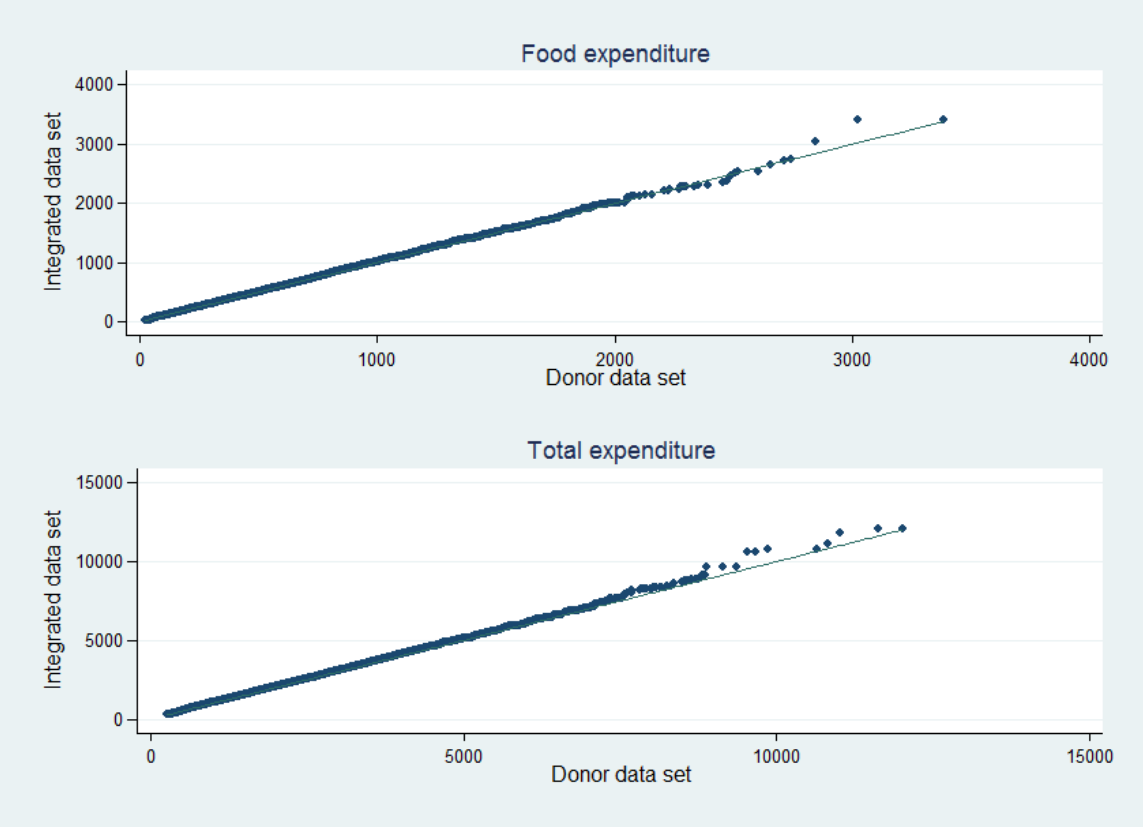

Figure B3. Q-Q Plot of Food Expenditure: focus on the tails

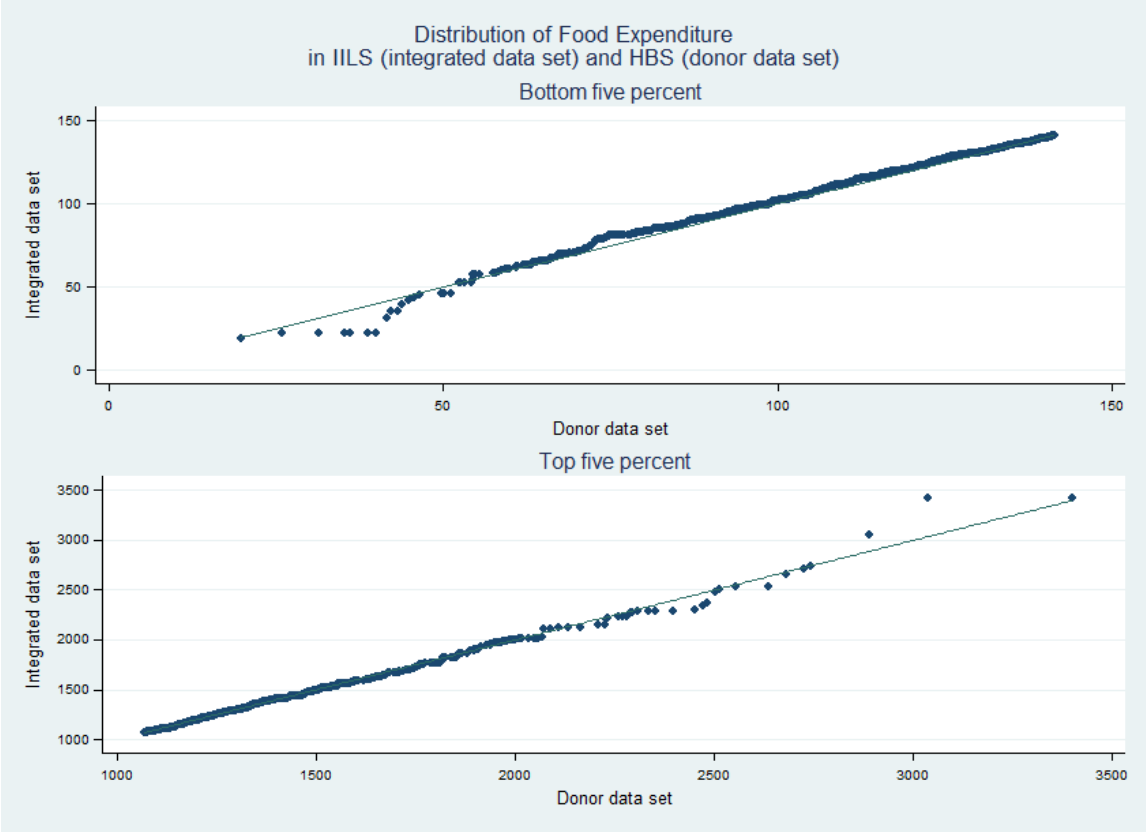

Figure B4. Q-Q Plot of Total Expenditure: focus on the tails

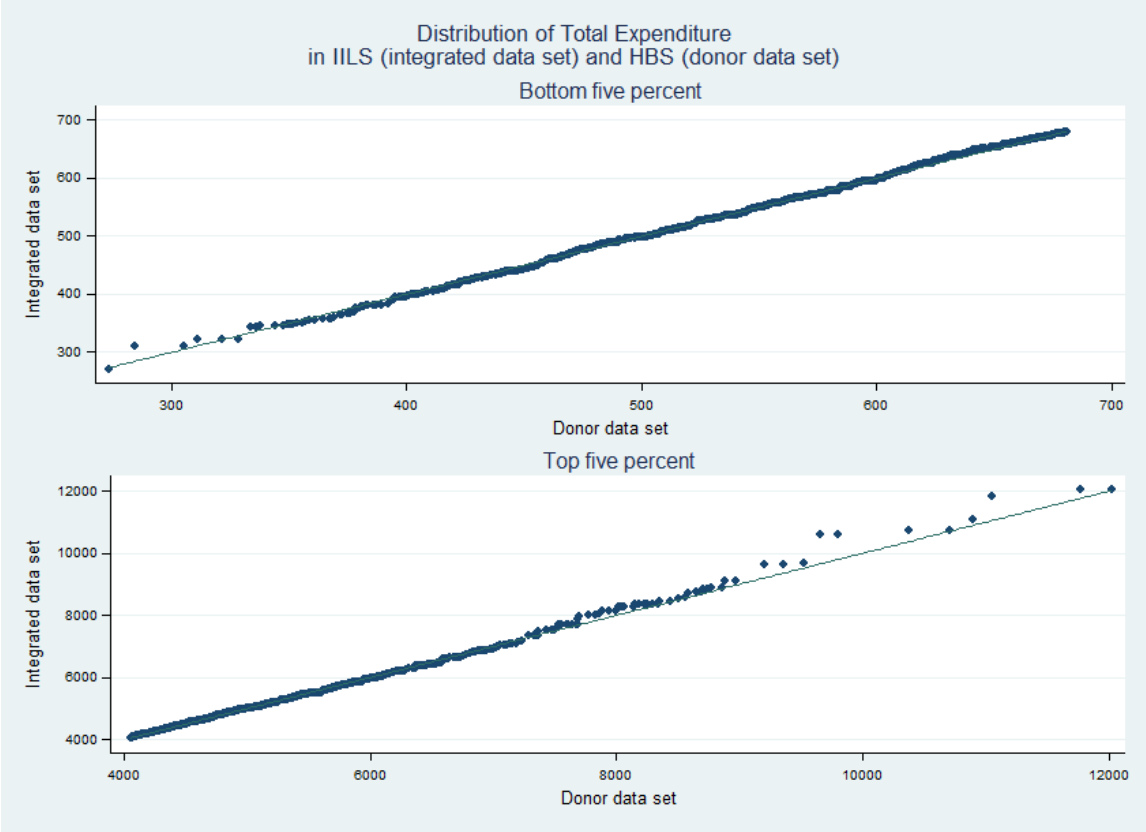

Table B3a. Dispersion indexes for Food Expenditure

		p90/p10	Gini coefficient
IILS (integrated data set)		4.7902	0.3189
HBS (donor data set)		4.7309	0.3206
DIFFERENCE		-0.0592	0.0017
	std. err.	*0.0339*	*0.0022*
	*p-value**	*0.0802*	*0.4474*

* If the p-value is greater than the chosen significance level (by convention equal to 0.05 or 0.01) the null hypothesis cannot be reject.

Table B3b. Inequality and poverty indexes for Total Expenditure

	p90/p10	Gini coefficient	FGTα poverty index**		
			α=0	α=1	α=2
IILS (integrated data set)	3.6310	0.2766	0.1568	0.0334	0.0101
HBS (donor data set)	3.7593	0.2816	0.1658	0.0354	0.0106
DIFFERENCE	0.1283	0.0050	0.0090	0.0020	0.0005
std. err.	*0.0218*	*0.0021*	*0.0035*	*0.0012*	*0.0006*
*p-value**	*0.0000*	*0.0175*	*0.0103*	*0.1004*	*0.3832*

* If the p-value is greater than the chosen significance level (by convention equal to 0.05 or 0.01) the null hypothesis cannot be reject.

** α=0: headcount ratio, α=1: poverty gap index, α=2: squared poverty gap index.

Figure B5. Engel Curve in integrated and donor data sets

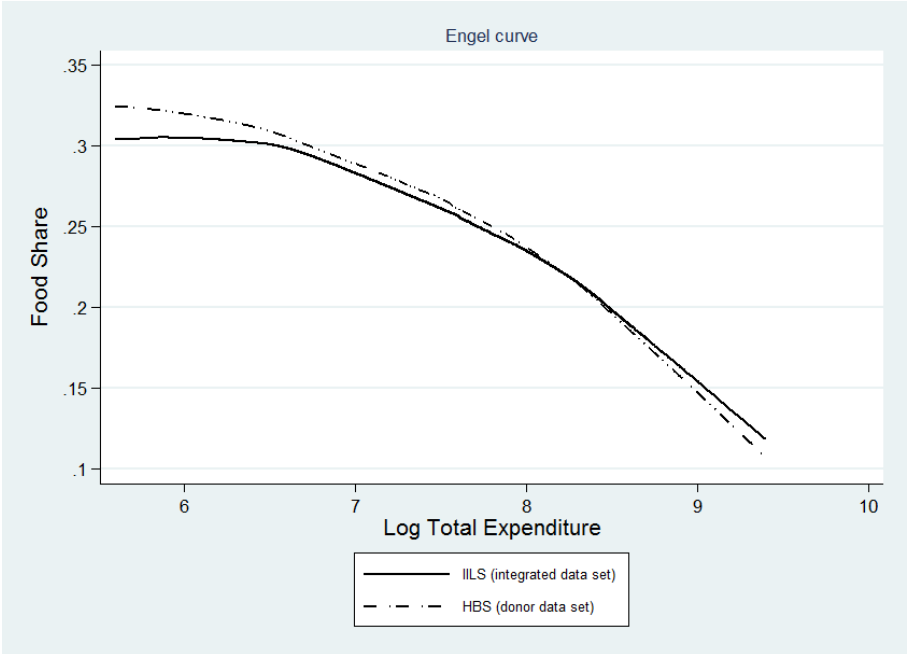

Figure B6a. Estimated coefficient of Total Expenditure with OLS regression and quantile regression

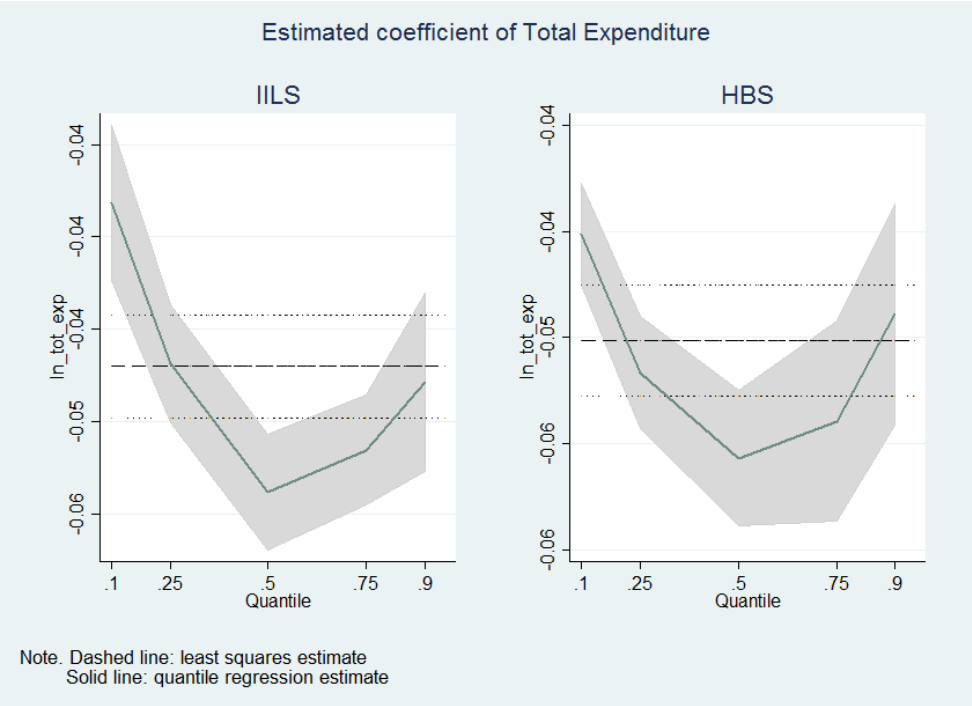

Figure B6b. Estimated coefficient of Total Expenditure with OLS regression and quantile regression