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Self-Employment Incomes in the Italian EU SILC
Measurement and International Comparability

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ABSTRACT

The paper discusses some conceptual and empirical issues related to the international comparability of microdata on incomes. Firstly, it proposes a definition of comparability as '*meaningful accuracy*' at the micro level and, in its second part, illustrates the methods adopted in order to minimise the underestimation of self-employment incomes in the Italian EU SILC, the most critical threat to the international comparability of the Italian data. For what specifically concerns the collection of income data from households and/or individuals, data comparability requires the comparability of statistical units within and across countries (micro comparability). Micro comparability, on its turn, essentially coincides with *meaningful* accuracy. That is to say, with arithmetical accuracy together with semantic consistency (including the comprehensiveness) of the income definitions. In the Italian EU SILC, disposable self-employment income is set as the maximum value between the net income reported in the survey questionnaire and the net *taxable* income displayed in the tax return. Under the assumption that no individual over-reports her/his income, the rule minimises underestimation either in the administrative or in the survey data, depending on which of the two is larger. With respect to the exclusive use of survey data, the linkage with administrative data has increased substantially the number of percipients (+15,6 %) and the average self-employment income (+11,9 %).

CONTENTS [1]

1. INTERNATIONAL COMPARABILITY: AN OUTSTANDING CHALLENGE FOR THE EU SILC PROJECT

The Framework Regulation of the EU SILC project states, in its first article, that international comparability is a *fundamental aim*, to be pursued through *methodological studies*, carried out in close co-operation between Member States and Eurostat[2]. The Framework Regulation reflects the awareness of the insufficiency of the best practices relating to this important aspect. Therefore, the EU SILC project has been started with two ambitious purposes: (i) to provide a set of *harmonised* statistics on incomes and living conditions *following the best practices established by past experience* and (ii) to launch a *co-ordinated experiment in improving the state of the art* in the collection/measurement of incomes and living conditions. Given the general scope of the project, it is not surprising that international comparability stands out as one of its most important methodological challenges.

However, the concept of international comparability is not self-evident. According to Verma (2002), comparability of survey data:

> "[…] *may defy precise definition* […] *we mean that data (estimates) for different populations can be legitimately (i.e. in a statistical valid way) put together (aggregated), compared (differenced), and interpreted (given meaning) in relation to each other and/or against some common standard. Comparability is a relative concept: we can only have 'degrees of comparability', not absolute comparability'.*"

The explanation has the advantage of encompassing two crucial aspects of comparability. The first relates to the *multiple facets* of comparability ('what is comparability made of?'). Comparability is, at the same time, a property of the *data*, of the *statistics* used to aggregate the data and, finally, of the *interpretations* attached to the summary statistics taken from the data. The second important aspect of comparability is its *relativeness*: we should primarily seek for *ordinal* measures of comparability, based on assessments like: 'the dataset (the statistic, the interpretation) A is more suitable for international comparisons than B'. Such ordinal assessments are the only way to evaluate the success of the endeavours to produce datasets (indicators, analyses) *harmonised* at the international level, being comparability the ultimate aim of harmonisation.

This paper discusses some conceptual and empirical issues related to the international comparability of microdata on incomes, being an exhaustive study of the subject beyond its scope[3]. In fact, the paper proposes a compact definition of comparability as '*meaningful accuracy*' at the micro level and, also, illustrates the

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[1] The opinions reported in this paper are those of the author and do not necessarily involve the responsibility of the Istat.
[2] The achievement of international comparability through methodological studies is now also endorsed as a leading principle in the European Statistics Code of Practice (EUROSTAT, 2005).
[3] The international comparability of the other non-monetary information encompassed in the EU SILC project (living conditions, deprivation indicators etc.), though important, is not addressed in this paper.

methods adopted for the Italian EU SILC in order to minimise the underestimation of self-employment incomes. The latter problem is, by far, the most critical threat to the international comparability of the Italian income data[4]. The Italian experience may (hopefully) provide some useful insights on the definition and measurement of self-employment incomes when both survey and administrative data are available (Istat 2005, 2006).

2. COMPARABILITY: WHAT DOES IT MEAN?

Whilst the concept of international comparability of survey *statistics* has been explored at length by Vijay Verma[5], the focus here will be on the comparability of income data collected from *statistical units* belonging to different countries (*micro* comparability). Comparability at the micro level, *i.e.* between the incomes of *any* couple of households/individuals each living in *any* of the countries, is a necessary condition for meaningful welfare comparisons at the aggregated level. When the international comparisons are made at the aggregated level, *e.g* on the basis of National Accounts statistics, the comparability of statistical units may be somewhat overlooked (*i.e.* it does not necessarily play a central role). This practice may be accepted for those large-scale, broad-ranging overviews that consider each different country as a 'one consumer equivalent' economy. However, within such a stylized framework, nothing can be said about the inequality of incomes. In fact, distributional analyses require comparability between statistical units. A preliminary unavoidable step for the correct computation of most well-known inequality indexes consists in ranking the statistical units from the poorest to the richest (*Pen's Parade*). Clearly, in order to sort the statistical units of a given country in such a way, any couple of them must be comparable.

A distinction can be made between micro comparability '*within country*' ("any couple of statistical units of country A can be compared") and '*across countries*' ("any statistical unit of country A can be compared to any statistical unit of country B"). Both are required for the international comparability. Micro comparability within a country, as already noticed, is a necessary (though not always sufficient) condition for the international comparisons of national inequality indexes. Micro comparability across countries is required whenever a group of countries is compared against a common benchmark, such as a European Poverty Line.

In order to define comparability more precisely, it may be useful to distinguish between *data comparability*, on the one hand, and the comparability of summary statistics and interpretations (*welfare comparability*), on the other hand[6]. Whilst the former lies under the responsibility of data producers, the latter mainly concerns theoretical research and *ex-post* empirical investigations of the available data.

Obviously, aggregate income statistics from different countries (regions, sub-populations) can be meaningfully compared and interpreted when they are computed from comparable data. Therefore, the two aspects can be ordered hierarchically: data comparability may be regarded as a necessary condition for welfare comparability. However, the condition is not always sufficient. For example, even though monetary incomes were measured with no errors, there will still be problems in comparing the welfare levels of households (individuals) living in different countries. The purchasing power of monetary incomes in different countries depends on the price levels and, therefore, a suitable set of purchasing power parities is an important tool for the comparative analysis of the households' economic conditions. Nevertheless, for what concerns the domain of data production processes, the need of an appropriate set of PPP's does not imply departures from the basic requirement of accuracy in the measurement of monetary incomes. Similarly, the use of equiva-

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[4] A detailed analysis of the reasons for the underreporting of self-employment incomes in Italian households surveys may be found in Brandolini (1999).

[5] See, for example, Verma (2002, 2006).

[6] The term 'welfare comparability' is used just to remind that a large amount of theoretical and empirical literature about the distribution of incomes is deeply rooted in the *welfarist* (or *utilitarian*) tradition. Despite its limitations, welfarism is still the underlying theoretical framework for the invention and interpretation of most measures of inequality. Within such a theoretical context, income is used as a *proxy* for utility. On the underpinnings of the welfarist approach for what concerns utility measurement and the interpersonal comparison of utilities see, *e.g.*, Sen (1979) and Atkinson (1999).

lence scales also entails comparability problems that, at least at first sight, do not immediately require a particular methodology in the measurement of incomes[7].

Conversely, under-estimation calls for improvements in measurement accuracy and the presence of non-monetary components of income (self-production, imputed rents, social transfers in kind) necessitate a more comprehensive definition of income. Finally, for what concerns the recent developments in the debate about the multidimensional nature of well-being, they do only need additional information about living conditions. Thus, it turns out that data comparability may be also a sufficient condition for welfare comparability *on the condition that* the data production process (and/or external data) conveys all the information which is considered relevant to this end.

Together with accuracy, of course, what is needed for international comparability is the *semantic consistency* of the income definitions (*comprehensiveness* included). Another important requirement, already mentioned in the previous paragraph, is the comparability of statistical units (*micro* comparability). Yet, comparability is still missing a definition for its own. A tentative definition could be initially expressed as follows:

> Comparability of income data is a *property* (a set of properties) of the data production processes (inputs, techniques and outputs) that permits *meaningful* comparisons, within and across countries (regions, sub-groups), between any couple of statistical units.

The proposed definition 'locates' comparability in the data production processes, as suggested by Verma (2006):

> *"In order to assess the degree to which different bodies of data are 'comparable', it is necessary to examine* […] *the methodology and implementation of the process of production of the data sets"*

Nevertheless, the definition is circular, as it describes comparability in terms of (meaningful) *comparisons*. Thus, the term 'comparison' must be explained. In mathematics, comparability of a set of objects is the property that a given relation is defined (*i.e.* exists) between any pair of them. For example, the elements of a set are comparable if, for any couple of elements x and y of the set, there exist a relation R such that at least one of the two following statements is true:

$$x \, R \, y \qquad ; \qquad y \, R \, x$$

Each one of the preceding statements (as well as their logical union) is a comparison. For the income variable, an obvious choice for the relation is the 'greater than or equal' assessment, since it permits to rank the statistical units from the poorest to the richest. Thus, in the case of income, it turns out that accuracy lies at the conceptual core of data comparability. Furthermore, coupled with proper qualifications about the interpretation of the results ('which comparisons are *meaningful*?'), accuracy is all we need for welfare comparability, too. In its obviousness, it is an encouraging conclusion if it is considered that, at first sight, international comparability appears to be an elusive multidimensional concept. Incidentally, it may be noted that conceptual vagueness disappears as soon as *micro* comparability is considered.

The request of *meaningful* comparisons corresponds to the requirement of *semantic consistency* and sets a bridge from data comparability to welfare comparability: the comparisons may be correctly interpreted (*i.e.* are meaningful) if they are suitable for welfare analysis. To this end, the already mentioned principle of *comprehensiveness* may be stated again as:

> For any couple of statistical units, the relation "$\geq$" between their incomes can be correctly established if the definition of income is *comprehensive, i.e.* if it includes all the components relevant for welfare comparability.

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[7] In presence of negative incomes, however, the equivalence scales cannot be applied and it may be advisable to recode the income variable to a low positive number (*bottom coding*). See the Appendix for an appraisal of the problem.

For the sake of comprehensiveness, the possible *trade-offs* between the mere 'arithmetic' accuracy and welfare comparability should not be decided at the expense of welfare comparability, for this would lead to *meaningless accuracy*. In the light of the definition of comparability as 'meaningful accuracy', an even stronger argument can be made: no *trade-offs* may occur between meaningful accuracy and comparability, since they are essentially different ways to express the same concept. Arithmetic accuracy and comprehensiveness of the income definition should be simultaneously pursued.

The whole discussion about comparability of incomes may be condensed in a short proposition:

> For what concerns the collection of income data from households and/or individuals, data comparability requires the comparability of statistical units within and across countries (micro comparability). Micro comparability, on its turn, essentially coincides with *meaningful* accuracy. That is to say, with arithmetical accuracy together with semantic consistency of the income definitions adopted in the various countries (regions, sub-groups). If an acceptable degree of meaningful accuracy is attained by the data production processes, micro comparability is also a sufficient condition for the *appropriate use* of income data in welfare comparisons (welfare comparability).

The last phrase in the proposition should not be understood as a claim for the sufficiency of the observed incomes for welfare analysis. What is meant is that the further possible corrections and additions needed for welfare comparisons (such as PPP's, equivalence scales, living conditions etc.) do not concern the collection of income data from households and/or individuals, which is the issue at hand. Thus, in order to assess (establish, improve) comparability of the income data, it is necessary and sufficient to take a closer look at the data production processes, looking for 'meaningful accuracy'[8].

In the following of this paper, the focus will be restricted on one of the most challenging methodological problems related to comparability, namely the underestimation of some income components, such as the revenues from self-employment. On the one hand, the inclusion of the underestimated income components reduces 'arithmetical' accuracy and, therefore, comparability. On the other hand, the exclusion of the underestimated incomes violates the principle of comprehensiveness and diminishes comparability, too. In principle, since it affects *anyway* comparability, underestimation of incomes should be tackled neither by altering the definition of income nor by tolerating less accurate measurements.

In practice, many researchers and data producers are doomed to accept a certain, usually unknown, degree of underestimation[9]. It is important to notice, at this stage of the argument, that the unspoken (also widespread?) belief that datasets affected by similar degrees of underestimation are 'somewhat' comparable is untenable, at least insofar as micro comparability is concerned. It may well be that some comparisons at the aggregated level can be made by applying suitable, or even approximate, correction factors. Unfortunately, being unreported income unevenly distributed among statistical units, an analogous simplified procedure cannot be applied at the micro level. Only if *all* the incomes in a country were underestimated by a known (or suitably estimated) parameter α, then there will be no problems for micro comparability[10]. This shows that underestimation is a major problem just because it hampers micro comparability and, as a consequence, welfare comparability, too. As difficult as it may be, underestimation should be minimised, setting in each country the true national income (at the micro level) as the *comparable benchmark*.

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[8] This is indeed the scope of two recent papers about the comparability of income surveys (Verma, 2006) and of business statistics (Struijs, 2006).

[9] Two clear-cut statements, taken from the "Canberra Handbook", depict the state of the art for what concerns the measurement of self-employment incomes in household surveys: "*Income data for the self-employed are also generally regarded as unreliable as a guide to living standards*"; "*Household surveys are notoriously bad at measuring income from capital and self-employment income*" (Canberra Group, 2001).

[10] The correction needed in such a hypothetical case would be exactly equivalent to the application of an exchange rate to the underestimated incomes, 'as if' they were measured with a different currency unit.

2. SELF-EMPLOYMENT INCOMES IN THE ITALIAN EU SILC [11]

To cope with the demanding aim of the EU SILC project, the Italian national statistical institute set up a mixed data collection strategy, based on a *paper and pencil* face-to-face interview and on the *linkage* of administrative with survey data. A first *semantic* issue concerns the definition of self-employment incomes. Economic, accounting and administrative definitions of self-employment incomes do not necessarily match and could raise problems of reliability and comparability. Moreover, the different definitions have an influence on the subjective understanding of the term 'income' by the respondents.

Figure 1 below shows, in a simplified sketch, the problem of collecting self-employment incomes when either survey or administrative data are available: the shaded areas correspond to the income available to an individual for his/her personal use.

Figure 1 Personal gross, taxable, reported and disposable income

(administrative data)   *(survey data)*
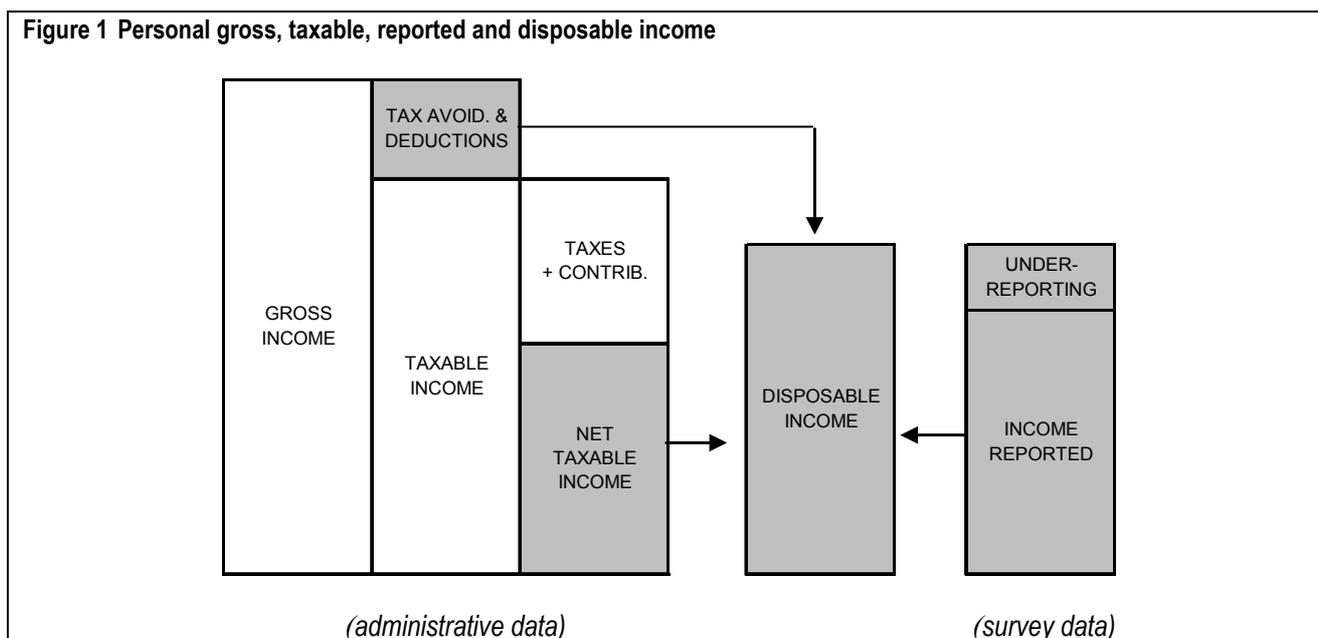
The alternative sources of microdata on earnings from self-employment may not contain the item 'disposable income' as such. Survey data may be affected by *underreporting*. Administrative data gathering the individual tax returns do not take account, of course, of illegal tax evasion and may not display all the authorized deductions allowed in the calculation of taxable income (tax avoidance)[12]. The accounting books, on their turn, usually report about the taxes paid by the company as a juridical entity and do not contain information on the personal taxes levied from the owners' profits. However, ignoring tax evasion, the accounting profits, net of company taxes, can be viewed as a measure of gross personal income. Nonetheless, they could still be different from personal taxable income. Indeed, the tax authorities may allow special deductions for the profits retained and invested in the business, stipulate departures from accounting rules for depreciation costs *etc.* Some categories of taxpayers (*e.g.* small family business, farmers, starting-up companies…) may be subject to a preferential tax regime that grants them special benefits.

Another controversial semantic issue concerns the allotment of self-employment earnings between the categories of labour and capital incomes. At this regard, the naming and accounting conventions encompassed in the tax laws are not necessarily the most suitable for economic analysis and, moreover, may also hamper international comparability. The System of National Accounts opportunely sums up both components in the concept of 'mixed income', a convention that permits to analyse them as rewards for independent labour, often assisted by the worker's capital[13]. The Canberra Group (2001) and the ILO resolution on income surveys (2003) recommend to exclude from self-employment income the profits of unincorporated businesses

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[11] The present paragraph largely follows Consolini *et al.* (2006).

[12] This is in accordance with the conclusion reported in Byfuglien (2001), after a thorough analysis of the ECHP experience: "[…] *in no country administrative sources alone are sufficient for providing all necessary data for studying all specific aspects of poverty and social exclusion. A linked survey can also be necessary* […] *to identify non taxable income* […].

[13] Some self-employeds (*e.g.* subcontractors) do *not* use their own capital in production.

distributed to 'sleeping partners', an advice that clearly attaches more weight to the 'labour' component. Given the ambiguity of the definition of self-employment incomes in the tax laws, for the Italian EU SILC the tax source has been used with caution (substantially, to check and replace the underreported survey incomes). In fact, to avoid errors due to legal definitions, when the earnings of the self-employed have been reported in the tax data exclusively under the 'capital incomes' heading, the information has not been used (*i.e.* they have not been compared with the survey incomes, nor have they been loaded in the final dataset)[14].

In the EU SILC project, the standard procedure to measure net self-employment incomes requires to collect the amount of money drawn out of self-employment business only when the profit/loss from accounting books or the taxable self-employment income (net of corresponding taxes) are not available. For the Italian EU SILC, when both the administrative and the survey datasources report it, income from self-employment is set equal to the maximum value between: (i) the (net) self-employment income resulting from the tax return and: (ii) the (net) self-employment income reported by the interviewee. This departure from the standard definition is adopted in order to minimise either under-estimation due to tax avoidance/evasion in the administrative data or under-reporting in the survey data, depending on which of the two is larger. The procedure increases the degree of international comparability, under the assumption that self-employment income in the benchmark country is not under-estimated.

The two datasources do not perfectly overlap. In fact, some individuals report self-employment incomes in only one datasource. This is the case of some individuals whose professional status at the time of the interview is different from that of the income reference period and of many percipients of small and/or secondary self-employment incomes. The survey data include as self-employment incomes those small compensations for minor and informal services that are frequently unnoticed for tax purposes. For example, the earnings of baby-sitters. On the other hand, some minor self-employment incomes shown in the tax returns may be disregarded during the interview to ease the response burden.

In the survey questionnaire for the Italian EU SILC, the amount of self-employment income is asked after a reminder question, requesting YES/NO replies to a list of possible personal uses of earnings (consumption and saving). This sequence has been devised in order to suggest to the interviewee an interpretation as close as possible to the 'money drawn out' concept. In effect, for some self-employeds the literal translation into Italian of the question "Have you drawn out money from business for your personal use?" may evoke the idea of a deceitful behaviour like, for example, to withdraw money from the cash account without taking note in the books of the corresponding revenues (tax evasion).

For what concerns the amount of self-employment incomes, the instructions to the interviewers advise them to explain that "*self-employment activity has led to*:
- **earnings** *if the individual or her/his family has got from it an amount of money that has been used for personal/household expenses, saved, invested in the business or in financial activities, dwellings and other real estates;*
- **a loss** *if he/she has not obtained from it any money to pay for personal/household expenses or to save/invest and, also, has used incomes from other sources, borrowed money or sold assets to pay for the costs of the self-employment activity.*"

The reason for such a definition is quite simple: if positive earnings are 'money drawn out' from business, then losses should be understood as 'money put into' it.

During the pilot tests of the EU SILC questionnaire, most self-employed have proved to be much more confident with the simple logic of the preceding definition than with the concept of income entailed by the accounting rules (to say nothing of the complex computation of taxable income, a task which is usually left to tax consultants).

It was expected that, though the interviewees may show a certain degree of reticence, in the Italian context survey underreporting should have a more limited extent with respect to tax avoidance and evasion, as the

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[14] In these cases, the survey income is retained in the final dataset as it is.

answers to the survey questionnaire do not entail tax consequences[15]. Moreover, to minimise the percentage of missing answers to the income question, for those respondents who do not remember the exact amount of their self-employment income, a supplementary question asks for an approximate amount, to be selected out of a predetermined list.

The interviewers were repeatedly advised not to compel persons visibly embarrassed or bothered, as they could provide false answers. As a general principle, missing answers were always preferred to false ones. In addition, interviewers were also asked to directly provide their own assessment, after the interview, of the reliability of the reported incomes. The whole approach to the collection of self-employment incomes through personal interviews aims at minimising reporting errors and, at the same time, at devising suitable imputation procedures for the missing values. The setup of the imputation procedures has been eased, on the one hand, by the rich qualitative information available in the survey and, on the other hand, by the reduction of the bias due to the unreliable answers retained among the valid cases. These latter have been minimised by the systematic preference for missing with respect to false answers and by the removal of the unreliable amounts.

With respect to the exclusive use of survey data, the linkage with administrative data has increased substantially the number of percipients (+15,6 %) and the average self-employment income (+11,9 %). Among the individuals for which both sources contain self-employment incomes, the record linkage reveals that underestimation is more frequently observed in the tax data than in the survey data[16]. The use of administrative data has also slightly changed the distribution of self-employment incomes (Figure 2). Indeed, with respect to the survey data, the final (*i.e.* integrated) dataset contains a lower percentage of self-employment incomes in the range 2,000 - 12,000 euros per year and an higher proportion of percipients with incomes greater than 20,000 euros.

Figure 2 **Distribution of self-employment incomes in the survey and in the final dataset** *(all percipients)*
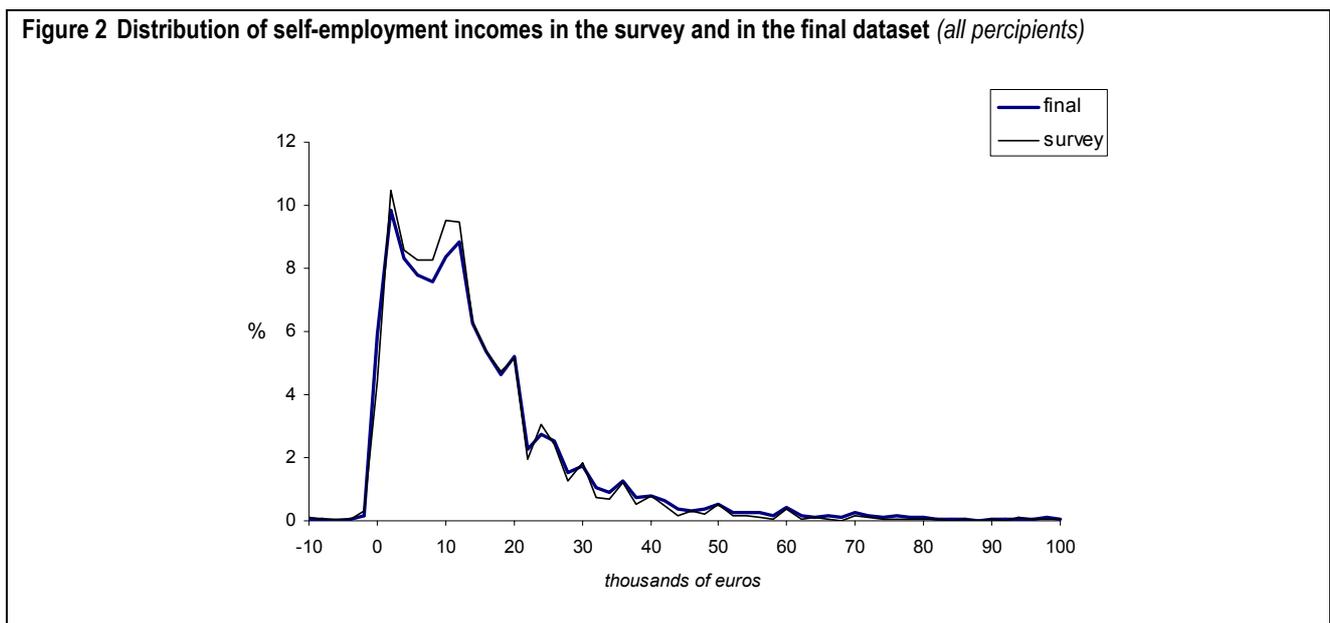
The concentration of self-employment income is different, too (Table 1). The Gini index shows that survey data are characterised by much less inequality (0.48) than the tax data (0.59). In the final dataset the Gini measure of inequality of self-employment incomes amounts to 0.50. The decomposition of the Gini index by sub-groups of percipients, precisely by their professional status at the time of the interview, reveals that the final data encompass an higher degree of inequality 'between groups' than the two datasources taken sepa-

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[15] Needless to say, a special effort has been made to persuade the interviewees that, according to the Italian laws, their answers are collected solely for statistical purposes and will never be transmitted to the tax authorities.

[16] A similar result for what seems to be an Italian peculiarity, would be obtained by comparing the aggregate amounts of taxable self-employment incomes with the corresponding statistics computed from the Bank of Italy Survey on Household Incomes and Wealth (Brandolini, 1999).

rately. Moreover, after the integration, the 'between groups' component has an higher importance in explaining overall inequality.

Table 1   Gini index decomposed by subgroups of percipients of self-employment income
(all the self-employment incomes available in each source)

	SURVEY DATA			TAX DATA			FINAL DATA		
Overall Gini	0.48		*100%*	0.59		*100%*	0.50		*100%*
- between groups	0.17		*36%*	0.18		*30%*	0.21		*41%*
- within groups	0.10		*22%*	0.12		*21%*	0.09		*18%*
- crossover	0.20		*42%*	0.28		*49%*	0.21		*41%*
	group specific Gini	share of population	share of income	group specific Gini	share of population	share of income	group specific Gini	share of population	share of income
Employees	0.59	4.6%	2.4%	0.69	11.6%	7.7%	0.61	9.6%	5.6%
Enterpreneurs	0.45	7.8%	12.2%	0.60	6.0%	9.5%	0.46	6.7%	11.6%
Professionals	0.43	16.4%	24.8%	0.54	17.5%	27.4%	0.45	14.2%	23.4%
Artisans/shopkeepers...	0.43	42.8%	40.3%	0.52	40.4%	38.0%	0.41	37.1%	37.4%
Co-helpers	0.49	7.7%	5.8%	0.52	4.6%	3.8%	0.48	6.7%	5.1%
Coop. stockholders	0.41	2.5%	2.3%	0.53	1.1%	0.9%	0.42	2.2%	1.9%
Co.co.co.	0.47	12.8%	9.2%	0.61	2.6%	2.1%	0.47	11.1%	7.6%
Unemployeds	0.64	1.4%	0.7%	0.67	2.5%	1.0%	0.57	2.2%	1.0%
Other inactive	0.59	4.0%	2.4%	0.63	13.8%	9.6%	0.60	10.2%	6.4%

In fact, with respect to the survey data, the tax file includes an higher proportion of percipients of secondary ('employees') and of marginal/temporary ('unemployeds', 'other inactive') self-employment incomes, as well as larger shares of the corresponding incomes. Furthermore, in both sources (and in the final data as well), these sub-groups are the ones with the highest degree of inequality. In the final data, the majority of retained records for these sub-groups made of 'employees', 'unemployeds' and 'other inactive' come from the tax datasource, while the opposite is true for all the other categories of percipients, namely for those who are self-employed at the time of the interview (Table 2). More generally, the self-employment incomes of all the sub-groups of percipients are more unequally distributed in the tax datasource than in the survey.

Table 2   Sources of self-employment incomes in the final dataset, by subgroups of percipients
(all the percipients of self-employment incomes in the final dataset)

	survey	tax	all
Employees	36.4	63.6	100.0
Enterpreneurs	79.3	20.7	100.0
Professionals	71.2	28.8	100.0
Artisans/shopkeepers...	73.9	26.1	100.0
Co-helpers	84.6	15.4	100.0
Coop. stockholders	88.0	12.0	100.0
Co.co.co.	94.3	5.7	100.0
Unemployeds	44.7	55.3	100.0
Other inactive	28.3	71.7	100.0
All	**68.2**	**31.8**	**100.0**

A closer look at the results permits to conclude that both datasources miss a substantial amount of information. Of all the percipients of self-employment incomes in the integrated dataset, the 40.9% would have been ignored (or misclassified as percipients of pure capital incomes) by using exclusively the available tax records. At the same time, the 13.5% do not reveal themselves as percipients of self-employment incomes in the survey (Table 3).

Table 3 Percipients of self-employment incomes in the integrated dataset, by content of the two datasources
(all percipients in the final dataset [a])

	TAX DATA		SURVEY DATA			FINAL DATA
	reported	not reported	observed	missing (imputed)	NO to S.E. question	
Employees	71.0	29.0	26.9	14.5	58.6	100.0
Enterpreneurs	53.0	47.0	79.8	20.2	none	100.0
Professionals	73.1	26.9	80.0	20.0	none	100.0
Artisans/shopkeepers...	64.3	35.7	76.1	23.9	0.1	100.0
Co-helpers	40.3	59.7	49.6	50.4	none	100.0
Coop. stockholders	28.8	71.2	54.5	45.5	none	100.0
Co.co.co.	14.1	85.9	50.3	49.4	0.3	100.0
Unemployeds	66.0	34.0	32.5	21.3	46.2	100.0
Other inactive	79.5	20.5	21.8	11.8	66.4	100.0
All	**59.1**	**40.9**	**60.5**	**26.0**	**13.5**	**100.0**

[a] In the panel for survey data, the first two columns regard persons who answered 'YES' to the question about self-employment.

APPENDIX: 'NEGATIVE INCOMES'

The definition of income in surveys: can households have negative incomes?

Gross *monetary* household income GY can be spent on consumption C, transferred to the public administration (taxes and social security contributions), *given* to other households (alimonies etc…) or added to wealth (*i.e.* saved)[17]:

$$[1] \qquad GY = C + TAX + TR^{OUT} + S$$

At the same time, gross income can be viewed as the sum of gross earnings from various sources $\Sigma_i\, GY_i$, of public transfers P and of private transfers TR^{IN} *received* from other households:

$$[2] \qquad GY = \Sigma_i\, GY_i + P + TR^{IN}$$

Thus, it must be true that:

$$[3] \qquad \Sigma_i\, GY_i + P + TR^{IN} = C + TAX + TR^{OUT} + S$$

Household disposable income Y may be defined as: $GY - TAX - TR^{OUT}$. Subtracting taxes, social security contributions and transfers to other households from both sides of expression [3], it turns out that disposable income equals the sum of the gross income components and pensions *minus* taxes and net private transfers $TR^{OUT} - TR^{IN}$ (or, alternatively, the sum of consumption and saving):

$$[4] \qquad \Sigma_i\, GY_i + P - TAX - TR = C + S$$

In the EU-SILC project, as in many other surveys on income, for analytical purposes gross and disposable incomes are measured by observing the left hand sides of identities [3] and [4]. However, since consumption must be strictly positive and both TAX and TR^{OUT} must be non-negative, expressions [3] and [4] imply that gross and disposable income must be strictly positive when saving is non-negative[18]. Furthermore, gross self-employment income is the only component in the left hand side of expression [3] that may take a negative value. Therefore, when saving is non-negative, gross self-employment income must be strictly positive when it is the only source of current income (*i.e.* if P, TR^{IN} and all other earnings except self-employment are zero).

An useful additional information to the EU-SILC database could be provided by a question about the occurrence of positive savings in the income reference period T, as the answer could be used to check for the reliability of negative incomes[19]:

"Have you been able to save a part (or all) of the income you have earned/received in T?"
(excluding wealth increases due to lottery wins, inheritances, occasional lump-sum transfers…)

Yes, more than in T – 1	☐ 1
Yes, more or less like in T – 1	☐ 2
Yes, though less than in T – 1	☐ 3
No saving in year T	☐ 4

The rationale to exclude the unspent occasional increases in wealth is to reflect as closely as possible the theoretical definition of saving as a *flow* from current income. Indeed, provided that respondents understand correctly the question, zero or negative incomes should be considered as measurement errors when strictly positive savings are reported for the same time period.

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[17] For simplicity, self-production of goods and services, transfers in kind and other *non-monetary* components of income are not explicitly considered.

[18] A negative income tax should be recorded as a cash transfer *received* when it gives a benefit to the taxpayer. For example, if the negative income tax is computed as $\tau(GY) - A$, then it should be encompassed in the (public) transfers *received* whenever A is greater than $\tau(GY)$. Otherwise, of course, it should be considered as a genuine tax.

[19] Moreover, the answer would be in itself an interesting indicator of the financial situation of the household.

People may also finance expenses by dissaving, that is by selling assets or borrowing money. Thus, in case of no saving, another useful question could be:

"Has your wealth been reduced in T by…"

Selling financial assets or real estates	☐	1
Selling goods on second-hand markets (e.g. cars)	☐	2
Selling jewels, paintings etc.	☐	3
Borrowing money from a bank, financial company or other sources	☐	4
No changes in wealth	☐	5

When saving is negative, a check on the reliability of negative or zero incomes requires additional information on the exact amount of dissaving, which is not the case of the EU-SILC project (and of many other income surveys). Negative or zero gross incomes cannot be ruled out when saving is negative and its absolute value is greater or equal to the sum of consumption, taxes and transfers to other households:

$$[5] \qquad |S| \geq C + TAX + TR^{OUT} \qquad , S<0$$

In fact, gross income may be zero or negative because dissaving may be used to finance self-employment losses, too. At the same time, when saving is negative, disposable income is negative or zero if:

$$[6] \qquad |S| \geq C \qquad , S<0$$

In the EU-SILC project, self-employment earnings/losses may be collected from different accessible sources. When accounting profits or tax records are not available, the respondents are invited to report the amount of money drawn out from business for personal purposes. It is important to note that even the latter approach can lead to negative incomes. In fact, self-employment gives rise to earnings if the individual or her/his family gets from it an amount of money that is used for personal and household expenses or saved/invested in the business (or in financial activities, dwellings, other real estates…). On the other hand, a loss occurs if the self-employed does not obtain any money to pay for personal/household purposes (or to save/invest) and, also, makes use of incomes from other sources, borrows money or sells assets to pay for business costs. In other words, the 'money drawn out' approach should include the 'money put into' state of affairs as a particular case.

A tightly related issue concerns those changes in net wealth not included in the income definition and, thus, not observed in the income surveys. In fact, self-employment losses, consumption, taxes and transfers to other households can be financed also by inheritances, lottery wins, realised capital gains and occasional lump-sum transfers. These 'sudden jumps in wealth' ΔW are not considered as a part of the flow of current saving and, thus, not included in the measure of income. This convention about instantaneous changes in wealth could perhaps be different from the ordinary usage of the word 'saving' and a great attention should be paid to the wording of the questions, as already noticed.

However, if the questions about saving and dissaving are correctly understood by the respondents, then a negative or zero value of income would still be inconsistent with a strictly positive flow of savings, whatever the level of ΔW. When S<0, on the other hand, zero or negative incomes cannot be ruled out even though $\Delta W>0$. This may be the case, in effect, when the positive change in wealth is not sufficient to finance all the expenses and/or the self-employment losses, so that a household has to sell its assets or to borrow money anyway. Thus, the existence of unobserved variations in wealth does not affect substantially the arguments previously made about the possibility of zero or negative incomes[20].

In conclusion, it seems advisable to make a clear distinction between, on the one hand, the case of positive saving when, in principle, negative incomes should be considered as *measurement errors* (and, if possible,

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[20] For what concerns instantaneous decreases in wealth (*i.e.* $\Delta W<0$), zero or negative incomes would be, again, inconsistent with $S \geq 0$ and, on the other hand, cannot be ruled out for S<0.

substituted by imputed values) and, on the other hand, *admissible* negative values. Additional YES/NO questions about saving, dissaving and instantaneous changes in wealth (at least, in liabilities) could provide valuable information to set up a suitable strategy for detecting *false* negative incomes[21].

Can negative and zero incomes be used for welfare analysis?

The use of negative incomes in the analysis of the households' welfare should be avoided for theoretical as well as for practical reasons[22]. On theoretical grounds, since income is most often used as a *proxy* for utility, negative values do not have a straightforward interpretation. Indeed, a negative value is due to the selection of one out of many possible cardinalisation of utility (an *ordinal* concept), namely of a measurement based on a scale with a negative origin. Keeping in mind that utility is an ordinal concept, it is impossible to attach any meaningful interpretation to its negative values. On the other hand, a negative level of utility inevitably suggests the idea of something 'bad'. From the previous discussion about negative income, it turns out that it may correspond to a loss of either *present* utility (when it is related to a lower level of present consumption) or, notably in case of dissaving, of *future* utility[23]. More importantly, since the instantaneous jumps in wealth are ignored, a negative income may well be a symptom of *unobserved* utility (*e.g.* consumption financed by capital gains). To sum up, on the one hand an interpretation of negative incomes is definitely out of the scope of the ordinal approach to utility and, on the other hand, they cannot be given an unambiguous meaning in the context of the specific cardinalisation that uses income as a proxy for utility.

In practice, negative incomes are disturbing for two main reasons:

- a first empirical problem concerns the equivalisation of negative incomes. The application of the standard procedure (*i.e.* dividing income for a strictly positive equivalence parameter) entails an asymmetrical treatment of positive vs. negative incomes. In fact, while for equal positive incomes larger households are the *worse-off* ones, among households with equal amounts of negative income, after equivalisation, the opposite conclusion holds: the larger the better. It would be difficult to provide a sound rationale for such an asymmetrical treatment of negative incomes. Indeed, the asymmetry seems intrinsically inconsistent with the purpose of equivalisation: other things being equal, to attain a given level of utility larger households need more income.

- some well-known inequality indexes cannot be applied to microdata containing some negative or zero incomes[24]. For example, two widely-used indexes of inequality, the MLD (Mean Log Deviation) and the Theil Index cannot be computed on negative or zero incomes because of the logarithmic terms in their formulas[25]:

$$MLD = \frac{1}{n} \sum_{i=1}^{n} \ln\left(\frac{\bar{y}}{y_i}\right)$$

$$Theil = \frac{1}{n} \sum_{i=1}^{n} \frac{y_i}{\bar{y}} \ln \frac{y_i}{\bar{y}}$$

Both the MLD and the Theil are members of the class of Generalised Entropy inequality indexes:

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[21] To this end, the non-monetary indicators of the households' well-being would lead to a less accurate check. Indeed, because of unobserved dissaving, any set of well-being indicators is theoretically consistent with negative incomes. Nonetheless, the non-monetary indicators may be used to identify *potential* errors. When a household truly has negative incomes, at least some symptoms of economic stress should reasonably be present. After all, can a household make ends meet easily when coping with a serious loss?

[22] The discussion in this section concerns solely the treatment of *genuine* negative incomes. In principle, *false* negative incomes should be detected and corrected.

[23] The distinction is purely theoretical. In practice, the two situations may overlap: a household facing financial troubles may experience less consumption and more debts (or lower stock of assets) at the same time.

[24] There is not much literature on inequality measurement when negative incomes are present. The issue, however, is reviewed (with bibliographic references) in: Stich (1996) and in Cowell (2000).

[25] Actually, the MLD can be computed with non-negative values. However, a single zero income is sufficient for the MLD to attain its maximum value ($+\infty$).

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha} \left[\frac{1}{n} \sum_{i=1}^{n} \left(\frac{y_i}{\bar{y}} \right)^{\alpha} - 1 \right]$$

Indeed, GE(0) = MLD and GE(1) = Theil. The parameter α reflects the importance attributed to different parts of the distribution of incomes. By using MLD (*i.e.* by setting α = 0), the differences among the lowest incomes are of utmost importance in the assessment of overall inequality. The Theil Index (α = 1) attaches equal weights to all differences in incomes and, finally, the GE indexes with α > 1 give more significance to the differences among the higher incomes. In fact, the presence of zero or negative incomes restricts the choice of α to values greater than one, ruling out those GE measures that imply an equal (or higher) weight to the lowest part of the distribution. Moreover, for values of α > 2, the GE inequality measures may become very sensitive to a few high incomes. In practice, when zero or negative incomes are present, the choice is limited to GE(2) = CV:

$$CV = \frac{1}{\bar{y}} \left[\frac{1}{n} \sum_{i=1}^{n} (y_i - \bar{y})^2 \right]^{1/2}$$

The Gini index can be computed even though zero or negative incomes are present. However, if some households report very large negative values, the Gini may exceed one, thus giving an excessive weight to a few negative values. In general, it may be agreed that: "*Many standard aggregative inequality measures are undefined for negative incomes, and a substantial class of these measures will not work even for zero incomes, in the sense that they are either undefined, or are unbounded, or attain their maximum value at any income distribution that has one or more zero incomes.*"[26]

Two possible practical solutions to the problem of zero and negative incomes are[27]:
- cases with negative or zero incomes are simply dropped before the computations of indexes
- negative and zero incomes are recoded to a positive value ε, equal to a minimum subsistence level or to a very small (say 10^{-10}) positive number[28].

The first solution is, in effect, very rough and may only be justified when *all* negative incomes are known to be measurement errors. However, for the producer of an income survey, it would be questionable to allow for the presence of false negative incomes in a dataset while keeping them out when computing inequality indexes. After all, why false negative incomes should affect mean income? As already mentioned, false negative incomes should rather be eliminated at an earlier stage of the data production process.

The choice of a minimum subsistence level instead of *genuine* negative values could be justified by remembering that, in the calculation of inequality indexes, income is used as a *proxy* for utility. The proposed conventional treatment of zero and/or negative incomes accounts for the fact that a basic level of *present* utility is inevitably attained by any household. Indeed, even though it has a negative monetary income, an household cannot survive without a minimal level of current consumption.

On the other hand, the bottom-coding to ε>0 changes the representation of the lowest tail of the distribution of incomes. Indeed, the ranking of households with incomes lower than ε is not preserved (all have the same rank in the Pen's Parade). Moreover, for these households the relative distances with respect to the poverty line are lost and this has an influence on the calculation of the Poverty Gap Index. The same 'good old' Gini index indicates less inequality. These differences can be minimised by setting ε ≤ 1. However, under the assumption that a basic level of utility is attained anyway, an income of (say) 1 euro is just as 'strange' as a zero value (that is, it would be better to set an higher value for ε). A careful empirical investigation of the consequences on the main inequality indexes may help to find the best conventional value for ε.

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[26] Amiel, Cowell, Polovin (1996).

[27] In what follows, the translation of the origin to give only positive values is ignored, since it is neither mean nor median preserving.

[28] Another solution, similar to setting ε = 10^{-10}, would be to set all negative or zero incomes to one. In this way, the logarithmic terms in the MLD and Theil indexes would all be 0's.

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