The Redistributive Effects of Tax Evasion: A Comparison between Conventional and Multi-Criteria Perspectives

Roberto Galbiati and Alberto Zanardi

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Roberto Galbiati
Bocconi University

and

Alberto Zanardi
University of Bologna
Econpubblica – Bocconi University

Corresponding author:
Alberto Zanardi
Econpubblica - Università Bocconi
via Sarfatti, 25
20136 Milano – Italy
tel: ++39 02 58365337
fax: ++39 02 58365318
email: alberto.zanardi@uni-bocconi.it
Abstract

The first part of the paper extends the approach developed by Lambert and Ramos (1997) for the measurement of the redistributive effects of a personal income tax to include tax evasion. Particular attention is paid to the concept and measurement of horizontal equity. We show that the criteria adopted to identify the equals are critical in order to evaluate the fairness of income taxation. In particular, we compare the traditional criterion, when income alone is considered (what we call conventional perspective), with a criterion based on a composite set of socio-economic features (multi-criteria perspective). Secondly, this framework is applied to the measurement of the redistributive effects of tax evasion in Italian income tax. The empirical analysis shows that in the tax-payers perspective, taxation improves the horizontal equity of pre-tax income distribution while, if the sole income is assumed as criterion of equity, income tax determines horizontal inequity.

Keywords: income tax, tax evasion, horizontal equity
1. Introduction

The theoretical and empirical literature on tax evasion available has devoted little attention to the analysis of the effects of fiscal non-compliance on the distribution of incomes and tax burdens. This is relatively surprising considering the importance placed on redistributive fairness in the tax system. This limited attention can be explained by considering that, on methodological grounds, no clear indications seem to emerge on how to measure the impact of tax evasion on income distribution, while problems in data availability have hampered empirical studies on these topics.

A critical point is that an adequate analysis of the (in)equity generated by tax evasion requires us to consider the different impacts on vertical equity (progressivity) and on horizontal equity of income distribution. Up to now, most studies have focused mainly on vertical equity issues, leaving largely unexplored the horizontal equity profiles. Even in this restricted vision, however, the analysis gives ambiguous results with respect to the direction of the effects of tax evasion on progressivity, unless strong restrictions on individual risk aversion and/or the fiscal system structure are introduced (Kakwani (1978), Personn and Wissen (1984), Bayer and Frank (1987), Roth et al. (1989)).

The emphasis on vertical equity criterion derives immediately from the theoretical framework on which these studies are based, that is the classical expected utility approach to income tax evasion developed by Allingham and Sandmo (1972). Consistent with a welfare approach, this model focuses on the comparison between income distributions. As a consequence, the vertical equity criterion can be easily applied. On the contrary, this approach does not place emphasis on the individual identity of those who shares different income levels in the distributions under comparison, and, therefore, horizontal equity issues (that is the claim for the equal treatment of equals) can hardly be addressed (Stiglitz (1982)).

Nevertheless, as suggested by Cowell (1987), horizontal (in)equity effects generated by tax evasion are particularly relevant because they are closely connected to the fairness in the tax treatment of individuals and may compromise the fiscal relationship between tax authorities and tax-payers.

This concern has spurred more recent studies (Bishop et al. (1994), Bernasconi and Marenzi (1999) and Bishop et al. (2000)) to try to capture both vertical and horizontal effects generated by tax evasion. In order to grasp these effects, they adopt the traditional definition of equals (“equals are those having the same pre-tax income”) and use standard measures in the analysis of income distribution such as Lorenz curve and Gini index.
The aim of this work is to extend the analysis of the redistributive effects of tax evasion both on methodological and empirical grounds, paying particular attention to the concept and measurement of horizontal equity. In the first part of our analysis, we extend the approach developed by Lambert and Ramos (1997) for the measurement of the redistributive (vertical and horizontal) effects of personal income tax in order to include tax evasion.

Furthermore, the concept of horizontal equity traditionally adopted (what we called *conventional perspective*) is brought into question; income alone seems to be too narrow a criterion to identify the equals. Moreover, many other socio-economic profiles seem to affect the perception of those people with regards to whom they perceive as an equal. As a consequence, a new criterion based on a composite set of socio-economic features (what we called *multi-criteria perspective*) is adopted in order to evaluate the vertical and horizontal effects of tax evasion. In particular we suggest that a discrepancy between the definition of a fair income taxation given by the conventional approach and that one given by tax-payers may emerge, and, therefore, the outcome of tax system perceived as horizontally equitable in the traditional perspective may be interpreted as unfair by the tax-payers. By the same token, the horizontal effect of tax evasion can be differently perceived when the adopted definitions of equals are divergent.

In the empirical section we apply this new framework to the measurement of the redistributive effects of tax evasion in the case of Italian personal income tax. In particular, data collected through the ordinary auditing activities carried out by Italian tax authorities on self-employed tax-payers (small business firms and professionals) are used here.

2. Measuring the redistributive effects of a personal income tax: the Lambert-Ramos framework

The redistributive performance of the personal income tax is usually evaluated with reference to the two basic principles of vertical redistribution and horizontal equity. Vertical redistribution demands that different individuals be taxed differently in order to reduce the inequality, while horizontal equity generally claims that like individuals be fiscally treated alike. In particular, in tax analysis, the individuals that share the same pre-tax income are usually considered as equals, and therefore the violation of horizontal equity is measured as *the post-tax inequality of those having the same pre-
In terms of vertical redistribution, income tax operates by reducing the post-tax differences among pre-tax groups of equals.

In fact there are different interpretations of the relationship between vertical redistribution and horizontal equity, and between their measures too\(^1\). In this paper we tackle this issue referring to the theoretical framework developed by Lambert and Ramos (1997). Following their approach, the overall redistributive effects \((RE)\) of a personal income tax can be decomposed into a horizontal inequity effect \((HI)\) and a vertical redistributive effect \((VR)\). In particular Lambert and Ramos show that horizontal inequity can be interpreted as a decrease in vertical performance of income tax due to the different treatment of equals by taxation. This result relies on the properties of the measurement they used to capture local horizontal inequity, that is the Mean Logarithmic Deviation\(^2\).

According to this framework, denoting \(S(x_j)\) the set of the tax-payers having the same pre-tax income \(x_j\), the inequality in \(S(x_j)\) for post-tax income \(y\) is measured by:

\[
J_{S(x_j)} = \sum_{i \in S(x_j)} \ln \left( \frac{\bar{y}_{S(x_j)}}{y_i} \right) \frac{1}{n_{S(x_j)}}
\]

(1)

Therefore aggregating \(J_{S(x_j)}\) by using the population shares \(p_j = \frac{n_{S(x_j)}}{n}\) as weights, the index \(HI\) that measures the horizontal inequity induced by taxation is given by:

\[
HI = \sum_j p_j J_{S(x_j)}
\]

(2)

The vertical redistribution \(VR\), that is the inequality reducing effect of taxation, is measured by:

\[
VR = J_{\text{pre}}^* - J_{\text{post}}^*
\]

(3)

where:

\[
J_{\text{pre}}^* = \sum_{i=1}^{n} \ln \left( \frac{\bar{x}}{x_i} \right) \frac{1}{n}
\]

(4)

\[
J_{\text{post}}^* = \sum_{i=1}^{n} \ln \left( \frac{\bar{y}}{y_{i \in S(x_j)}} \right) \frac{1}{n}
\]

(5)

\(J_{\text{post}}^*\) is obtained by substituting each post-tax income \(y_i\) of \(i \in S(x_j)\) with the mean of \(y_i\) of the individuals in \(j\)-th group.

Lambert and Ramos demonstrate that the overall redistributive effects of the personal income tax \(RE = J_{\text{pre}}^* - J_{\text{post}}^*\) are given by:

\[
RE = VR - HI
\]

(6)
2.1. The redistributive effects of tax evasion

One of the aims of this paper is to extend the Lambert and Ramos framework to include the measurement of the redistributive effects of tax evasion. In fact tax evasion is expected to have a considerable influence on the redistributive performance of income taxation. In order to measure this influence of tax evasion on the redistributive performance of the personal income tax, we denote with \( x_1, x_2, \ldots, x_n \) the distribution of \textit{pre-tax audited} incomes, with \( y_1, y_2, \ldots, y_n \) the distribution of \textit{post-tax audited} incomes, and with \( z_1, z_2, \ldots, z_n \) the distribution of \textit{post-tax actual} incomes, that is the difference between the pre-tax audited income and the reported tax.

Relying on the Lambert and Ramos approach, the redistribution in the case of \textit{complete honesty} is thus defined as:

\[
RE_{XY} = VR_{XY} - HI_{XY}
\]

while the \textit{actual redistribution}, in case of tax evasion, is given by:

\[
RE_{XZ} = VR_{XZ} - HI_{XZ}
\]

The difference between (8) and (7) measures the \textit{redistributive effects of tax evasion}, that is:

\[
REEV = RE_{XZ} - RE_{XY} = (VR_{XZ} - VR_{XY}) - (HI_{XZ} - HI_{XY}) = VREV - HIEV
\]

where \( VREV \) denotes the vertical redistribution and \( HIEV \) the horizontal inequity implied by tax evasion.

3. The \textit{multi-criteria perspective} in the analysis of the redistributive effects of income tax

The analysis of the redistributive effects of taxation and tax evasion developed above is based on the conventional view of horizontal equity. In this conventional perspective equals are those who share the same level of income. However, different criteria to identify groups of equals are conceivable. As suggested, for instance, by Sen (1973, 1992), individual well-being refers to a multidimensional set of features; income, wealth, opportunities, achievements, freedoms and rights. Therefore, in terms of horizontal equity, we may assume that tax-payers perceive themselves as equals not only with reference to income but also to a composite set of socio-economic features. As a consequence, the criteria adopted by tax-payers may be different from that one traditionally assumed and, therefore, a discrepancy between the definition of a fair income tax given by the conventional approach and that one given by tax-payers may emerge. Once a criterion of equality is assumed, when inside any group of equals a
rise in distance of their incomes with respect to the average value in the group occurs, this rise is perceived as a worsening in horizontal equity.

In order to measure the horizontal inequity perceived by tax-payers, we consider a set of \( m \) different features characterizing each tax-payer, \( Z = \{ Z_1, ..., Z_h, ..., Z_m \} \) where: \( Z_h = \{ z_{h1}, z_{h2}, ..., z_{hK_h} \} \) and define the group of equals \( S(c_i) \) (with \( l = 1, ..., K_1 \ast ... \ast K_m \)) as the set of tax-payers sharing the same \( l \)-th value assumed by the set \( Z \). Therefore, in the multi-criteria perspective the pre-tax horizontal inequity index in the group of equals \( S(c_i) \) is:

\[
J^{\text{pre}}_{s(c_i)} = \sum_{i \in S(c_i)} \ln \left( \frac{\bar{x}_{S(c_i)}}{x_i} \right) \frac{1}{n_{S(c_i)}}
\]

while the post-tax horizontal inequity index is given by:

\[
J^{\text{post}}_{s(c_i)} = \sum_{i \in S(c_i)} \ln \left( \frac{\bar{y}_{S(c_i)}}{y_i} \right) \frac{1}{n_{S(c_i)}}
\]

Aggregating \( J^{\text{pre}}_{s(c_i)} \) and \( J^{\text{post}}_{s(c_i)} \) by group of equals, we obtain respectively the total post-tax and pre-tax inequity index in the multi-criteria perspective:

\[
J^{\text{post}} = \sum_{l} P_l J^{\text{post}}_{s(c_i)}
\]

\[
J^{\text{pre}} = \sum_{l} P_l J^{\text{pre}}_{s(c_i)}
\]

where \( P_l = \frac{n_{S(c_i)}}{n} \)

The effects of income tax in terms of horizontal inequity in the in the multi-criteria perspective can be measured by:

\[
\text{HIC} = J^{\text{post}} - J^{\text{pre}}
\]

As seen before, in terms of vertical redistribution income tax acts by reducing the post-tax differences between pre-tax groups of equals. Substituting each pre-tax income \( x_i \) of \( i \in S(c_i) \) with the mean of \( X \) of the individuals in \( l \)-th group and each post-tax income \( y_i \) of \( i \in S(c_i) \) with the mean of \( Y \) of the individuals in \( l \)-th group, vertical redistribution is measured by:

\[
\text{VRC} = J^{\text{pre}*} - J^{\text{post}*}
\]

where:

\[
J^{\text{pre}*} = \sum_{i=1}^{n} \ln \left( \frac{\bar{x}}{x_{i \in S(c_i)}} \right) \frac{1}{n}
\]

\[
J^{\text{post}*} = \sum_{i=1}^{n} \ln \left( \frac{\bar{y}}{y_{i \in S(c_i)}} \right) \frac{1}{n}
\]
Analogously to Lambert and Ramos, we can demonstrate that in the multi-criteria perspective:

\[ \text{REC} = J^\text{pre} - J^\text{post} = \text{VRC} - \text{HIC} \] (18)

and that:

\[ \text{REC} = \text{RE} \] (19)

and therefore:

\[ \frac{\text{VRC} - \text{VR}}{\text{RESVR}} = \frac{\text{HIC} - \text{HI}}{\text{RESHI}} \] (20)

That is, the measure of overall redistributive effects is unchanged with respect to the Lambert and Ramos case as it is not affected by the criterion applied in order to identify the equals. On the contrary, the grouping rule affects the decomposition of \(RE\), that is the size of both vertical and horizontal effects.

This change in perspective also affects the perceived size of the redistributive effects of tax evasion. The redistributive effects of tax evasion as seen in the multi-criteria perspective are measured analogously to the conventional approach by:

\[ \text{REEV} = \text{REC}_{xz} - \text{REC}_{xy} = (\text{VRC}_{xz} - \text{VRC}_{xy}) - (\text{HIC}_{xz} - \text{HIC}_{xy}) = \text{VREVC} - \text{HIEVC} \] (21)

where \(\text{VREVC}\) denotes the vertical redistribution and \(\text{HIEVC}\) the horizontal inequity caused by tax evasion in the multi-criteria perspective.

Finally, to compare the redistributive effects due to tax-evasion between the two perspectives, we define:

\[ \text{RESEV} = \text{REEV} - \text{REE} = (\text{VREVC} - \text{HIEVC}) - (\text{VREV} - \text{HIEV}) = (\text{VREVC} - \text{VREV}) - (\text{HIEVC} - \text{HIEV}) = \text{RESEVVR} - \text{RESEVHI} \] (22)

Therefore the difference in the perception of overall redistributive effects due to tax evasion between the multi-criteria and the conventional perspectives (\(\text{RESEV}\)) can be decomposed into a vertical redistribution component (\(\text{RESEVVR}\)) and a horizontal inequity component (\(\text{RESEVHI}\)). It is worth noting that by construction \(\text{RESEV}\) is necessarily null but it derives from the composition of two effects that we would expect to be different.

4. Empirical Analysis

In this section we apply the theoretical framework previously developed to the analysis of Italian personal income tax (Imposta sul Reddito delle Persone Fisiche - IRPEF). Our analysis is based on data collected through ordinary auditing activities carried out by the Italian tax authorities. More specifically, the data set we use includes
personal and fiscal details of self-employed tax-payers (small business firms and professionals) whose reported incomes for the payment of IRPEF for the tax year 1987 were audited by the Italian tax authorities during the following seven years until December 1995.

This ‘set’ of ordinary auditing data, which includes more than 65,000 tax declarations, obviously does not provide an authentically random sample representative of the entire tax-payers population. This is because tax authorities choose tax-payers to be audited on the basis of their own selection criteria (which is not made public). As a consequence, the set of selected tax-payers suffers from an evident sample selection bias. In order to correct this distortion, we chose to rely on a purely statistical approach. The original data was post-stratified by a set of weights in order to align the structure of the sample to the entire population of tax-payers. We weighted each of the observations of the audited sample by the ratio between the relative frequency of each category of tax-payer in the audited sample and in the entire tax-payer population. The categories of tax-payers considered here were identified on the basis of a set of fundamental socio-economic characteristics which we would expect to have a remarkable influence on the formulation of the selection policies implemented by tax authorities. Specific reference was made to the joint distribution of self-employed tax-payers (audited and not audited) by the territorial areas of residence (the 20 Italian Regions), the level of reported income (6 classes), and the branch of economic activity (12 sectors). However, the data set remains affected by a series of evident drawbacks. On one hand, post-stratification cannot weigh those categories of tax-payers where no one was investigated (even if those categories, in reality, are few!). On the other hand, inaccuracies in the ordinary auditing activity, different from fiscal auditing programmes specifically implemented for analysis purposes (such as TCMP in the US), may jeopardise the reliability of the data.

Table 1 provides some summary statistics of the data used. Tax evasion turns out to be remarkably high among those Italians who are self employed; the average gross evaded income of the entire population is 88% of reported incomes (47% of the average audited income). However, the data shows considerable variability in fiscal non-compliance among different categories of tax-payers with relation to sectors of economic activity, territorial areas of residence and post-tax audited income deciles. Consistently with other analyses of Italian tax evasion (Bernardi and Bernasconi (1996); Cannari et al. (1995)), “Professionals” and “Finance and insurance” sectors show lower levels of fiscal non-compliance, while tax evasion increases from northern to southern regions and moving from bottom to top income deciles.
The overall redistributive effects of IRPEF and their decomposition into vertical redistribution and horizontal inequity components are reported in Table 2. The upper section (Reported incomes, column single obs) gives a picture of the apparent redistributive effects of the personal income tax as measured by applying the indices introduced in Section 2 to reported incomes. IRPEF shows a prominent overall redistributive effect (larger than, for example, the Spanish case reported in Lambert and Ramos (1997)), mainly due to a strong vertical effect, while the contribution of horizontal inequity is almost insignificant.

However, reported incomes are affected by tax evasion and therefore the indexes just introduced do not measure the potential redistributive performance of IRPEF in the case when all tax-payers behave honestly. Therefore the second section of Table 2 (Audited incomes, single obs column) evaluates the redistributive effects of IRPEF on audited incomes, on the basis of the assumption that true income is adequately recorded by tax authorities through their auditing activities. Comparing reported to audited incomes, the redistributive effects decrease to some extent. This result suggests that the representation offered by official fiscal statistics (based on reported incomes) overestimates the potential redistributive performance of personal income tax providing an unreliable picture of the distributional outcome. Moreover, by decomposing the overall redistribution into vertical and horizontal effects, the lower redistributive performance of IRPEF can be ascribed to a relevant underestimation of horizontal inequity implied by taxation. In brief, according to fiscal statistics, the redistributive performance of IRPEF appears stronger and very much more horizontally equitable than in the case where fiscal rules were fully respected.

However, neither reported nor audited incomes make it possible to assess the actual redistributive effects of IRPEF. In the presence of tax evasion, the actual redistributive performance can be grasped only by focusing on the incomes actually disposable to tax-payers after taxes corresponding to reported income have been paid (see Actual incomes section of Table 2, single obs column). Moreover, by comparing audited incomes to actual incomes, the redistributive effects of tax evasion can be measured. As shown in the lower section of Table 2 (Tax evasion effects, single obs column), tax evasion causes a significant fall in total redistributive effects (REEV). This outcome can be ascribed both to a weakening of vertical effects (VREV), since tax evasion is strongly concentrated in the upper deciles of audited incomes (see Table 1), and to a raise of horizontal inequity (HIEV), as in fact tax-payers having the same pre-tax income have different opportunities, motivations and aims for evasion.

Nevertheless, the empirical application of the horizontal equity criterion generally suffers an identification problem, well discussed in Lambert and Ramos (1997), that
implies an incorrect evaluation of both vertical and horizontal effects. Indeed, when people having exactly the same pre-tax income are assumed as equals (see Tab. 2, single obs column), an excessively high number of single-component groups emerges, consequently excluding a large proportion of tax-payers population from the evaluation of horizontal inequity. Following Lambert and Ramos, we tried to address this issue by banding the pre-tax income distribution in order to identify groups of "close equals". In the empirical application, we divided the domain of pre-tax incomes distributions (respectively reported and audited) into 100 bands of equal width and considered as "close equals" those taxpayers belonging to the same band. We then repeated this procedure by considering two other groupings characterized by a narrower banding (500 and 1,000 bands respectively). Corresponding to each grouping, a series of indexes of pseudo-vertical and pseudo-horizontal effects were determined (see Table 2, columns group by income bands). However, if income banding makes it possible to overcome, at least partially, the identification problem, this approach makes more difficult to draw a clear-cut distinction between horizontal and vertical effects with the consequence that the measure of pseudo-horizontal effect erroneously includes a part of vertical redistribution. Moreover, as bands of increasingly narrow dimension are adopted, this measurement error becomes less and less relevant even if, correspondingly, the number of single-component groups rises, thus posing a trade-off that must be accurately evaluated.

Table 3 compares the conventional perspective (when income alone is considered to identify the equals) with the multi-criteria perspective in the evaluation of the redistributive effects of IRPEF and tax evasion. As discussed in the theoretical section, the horizontal equity criterion in the tax-payers perspective is assumed to refer to a broader set of socio-economic characteristics in addition to income. Restrictions in the availability of information in the data-set compelled us to resort to a simplified approach in the identification of groups of equals. In particular, the tax-payers who share the same features in terms of geographical area of residence, economic activity and income decile were regarded as belonging to the same group. As such, using the categories reported in Table 1, 2,400 different groups of equals were identified.

In the case of audited incomes the vertical redistribution in the multi-criteria perspective ($VRC$) is lower than in the conventional perspective ($VR$). This means that, from the tax-payers point of view, fiscal compliance would entail a weaker vertical redistribution. On the contrary, again in the multi-criteria perspective, taxation implies an improvement in horizontal equity (that is, a reduction of relative differences among the post-tax incomes with respect to those among pre-tax incomes within the groups of equals), as proved by the negative value of horizontal inequity index ($HIC$). This
outcome is contrary to what is perceived in the conventional perspective (III) that, as shown previously, recognizes taxation as a source of horizontal inequity.

In the analysis of actual incomes, that is when tax evasion is considered, the comparison between the two perspectives leads to results which are analogous to those just highlighted in the case of audited incomes. That is, even when taxation is affected by evasion, from the tax-payers point of view \textit{IRPEF} turns out to be less vertically redistributive and more horizontally equitable than in the conventional perspective.

In the in the lower section of Table 3, the redistributive effects of tax evasion as perceived respectively by the multi-criteria and the conventional perspectives are compared. In both cases, tax evasion produces a fall in vertical redistribution (see $V_{REV}$ and $V_{REVC}$), but this effect is much higher for tax-payers than what is traditionally perceived (see $RESEV_{VR}$). However, the main result here is that under the multi-criteria perspective, tax evasion has the opposite effect in terms of horizontal equity ($H_{IEVC}$) with respect to those under the conventional perspective ($H_{IEV}$). While conventionally tax evasion is seen as a source of horizontal inequity, for tax-payers non-compliance greatly contributes to raise horizontal equity. This means that tax-payers look at tax-evasion as a mean to increase the equality among their equals, while in the conventional perception tax evasion violates the fairness of the tax rules.

5. Concluding remarks

This paper extends the analysis of redistributive effects of income tax proposed by Lambert and Ramos (1997) to the consideration of tax evasion, and consequently proposes a new approach to investigate redistribution caused by tax evasion. Particular attention has been paid to the concept and measurement of horizontal equity. Our analysis has been driven by the choice to measure local horizontal inequity as an increase in post-tax income inequality among pre-tax equals. We show that the criteria adopted to identify the equals are critical in order to evaluate the fairness of income taxation. In particular, we compare the conventional criterion, when the sole income is considered, with a criterion based on a composite set of socio-economic features.

The empirical analysis of Italian income tax shows that in the multi-criteria perspective taxation improves the horizontal equity of pre-tax income distribution, while, if income alone is assumed on the basis of distributive evaluations, \textit{IRPEF} determines horizontal inequality. Moreover, when tax evasion is considered, the
opposite outcome in terms of perception of horizontal inequity between the two perspectives turns out to be greatly emphasized.

These results are consistent with the idea that each tax-payer decides how much to evade in order to minimize the distance between his own post-tax disposable income and the average income of other people belonging to the same group of equals, since that income is perceived as fair. As a consequence, within each group of tax-payers having the same socio-economic features, tax evasion reduces the overall relative distance from the average income, and a reduction such as this is perceived by tax-payers as an increase in horizontal equity.

This idea recalls the approach proposed by Bernasconi and Zanardi (2000) for the analysis of individual tax evasion behavior. Building on Cumulative Prospect Theory (Tversky and Kahneman, 1992), they show that a taxpayer’s behavior may change depending on whether the disposable income he would obtain if he paid all his tax liability is higher or lower than his own reference income. If it is higher, we show that the taxpayer behaves as in the standard expected utility model. If, on the other hand, it is lower, the taxpayer’s decision is mainly motivated by the desire to obtain a disposable income at least equal to the reference income (if he is not caught out).

Finally, some relevant policy implications seem to follow from the results obtained here. Literature thus far has recognized in tax evasion a remarkable source of horizontal inequity and, as a consequence, the policies to combat tax evasion have been justified not only in order to assure fiscal yield for the government but also for reasons of fairness in taxation. Our work shows that this result is not straightforward when different criteria of equality are assumed, and therefore the measures adopted to contrast tax evasion could find a weaker justification at least on the basis of equity considerations.
References


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1 See Atkinson and Stiglitz (1980) and Kaplow (1989).

2 The Mean Logarithmic Deviation is an additively decomposable measure of an income distribution \( \{y_1, y_2, \ldots, y_n\} \) defined as:

\[
J = \sum_{i=1}^{n} \ln \left( \frac{\bar{y}}{n_i} \right) \frac{1}{n}
\]

where \( \bar{y} \) is the mean of \( y \).

3 It is worth noting that in this case the horizontal inequity component includes that part of vertical redistribution which is carried out within each group of equals. While these effects are viewed as vertical ones in the traditional framework, they are correctly interpreted as a horizontal outcome by tax-payers.

4 The unitary group ratio shown in Table 2 is computed as the number of groups of equals with a single component divided by the total number groups of equals.
## Tab. 1 Weighted sample descriptive statistics (fiscal year 1987) - average values

<table>
<thead>
<tr>
<th>Economic activities</th>
<th>n obs</th>
<th>pre-tax reported income*</th>
<th>pre-tax reported income**</th>
<th>post-tax reported income**</th>
<th>pre-tax audited income**</th>
<th>post-tax audited income**</th>
<th>post-tax actual income**</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complete sample</strong></td>
<td>65055</td>
<td>10112</td>
<td>100.0</td>
<td>81.6</td>
<td>187.9</td>
<td>131.7</td>
<td>169.5</td>
</tr>
<tr>
<td><strong>Agriculture</strong></td>
<td>330</td>
<td>4429</td>
<td>43.8</td>
<td>40.3</td>
<td>113.7</td>
<td>85.8</td>
<td>110.2</td>
</tr>
<tr>
<td><strong>Handicraft – Foodstuffs</strong></td>
<td>393</td>
<td>7279</td>
<td>72.0</td>
<td>63.6</td>
<td>308.6</td>
<td>183.0</td>
<td>300.2</td>
</tr>
<tr>
<td><strong>Handicraft – Mining</strong></td>
<td>180</td>
<td>8507</td>
<td>84.1</td>
<td>73.1</td>
<td>287.9</td>
<td>176.4</td>
<td>276.9</td>
</tr>
<tr>
<td><strong>Handicraft – Manufacture</strong></td>
<td>15404</td>
<td>7462</td>
<td>73.8</td>
<td>64.5</td>
<td>191.9</td>
<td>129.9</td>
<td>182.7</td>
</tr>
<tr>
<td><strong>Wholesale trade</strong></td>
<td>1424</td>
<td>10080</td>
<td>99.7</td>
<td>85.2</td>
<td>353.2</td>
<td>215.1</td>
<td>338.7</td>
</tr>
<tr>
<td><strong>Retail trade</strong></td>
<td>12211</td>
<td>7843</td>
<td>77.6</td>
<td>67.4</td>
<td>167.7</td>
<td>122.5</td>
<td>157.6</td>
</tr>
<tr>
<td><strong>Other commercial activities</strong></td>
<td>10308</td>
<td>8828</td>
<td>87.3</td>
<td>74.6</td>
<td>156.7</td>
<td>116.9</td>
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### Post-tax audited income deciles

| Bottom | 6508  | 2076 | 20.5 | 20.0 | 23.9 | 17.1 | 23.4 |
| 2      | 6506  | 3684 | 36.4 | 34.1 | 46.2 | 40.6 | 43.9 |
| 3      | 6513  | 5025 | 49.7 | 45.4 | 66.5 | 57.9 | 62.2 |
| 4      | 6498  | 6610 | 65.4 | 58.3 | 87.8 | 75.0 | 80.8 |
| 5      | 6509  | 8175 | 80.8 | 70.8 | 112.6| 94.4 | 102.6|
| 6      | 6499  | 10248| 101.3| 86.8 | 144.2| 118.2| 129.6|
| 7      | 6506  | 12537| 124.0| 104.1|189.8 |150.9 |169.9 |
| 8      | 6505  | 16761| 165.8|133.9|259.7|198.2|227.8|
| 9      | 6344  | 14419| 142.6|117.8|832.3|477.0|807.5|
| **Top**| 6505  | 37447| 370.3|256.7|1267.5|690.7|1152.9|

* euro  
** 100 = mean on the whole population of pre-tax reported income
## Tab. 2 Redistributive effects of personal income tax (fiscal year 1987)

### Reported incomes*

<table>
<thead>
<tr>
<th>unitary group ratio</th>
<th>groups by income bands</th>
<th>100</th>
<th>500</th>
<th>1000</th>
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<tr>
<td></td>
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<td>0.43</td>
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<td>0.1565 100.00</td>
<td>0.1565 100.00</td>
<td>0.1565 100.00</td>
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<td>VR</td>
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<td>0.0997 63.73</td>
<td>0.1436 91.79</td>
<td>0.1436 91.79</td>
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<td>HI</td>
<td>0.0057 3.62</td>
<td>-0.0568 -36.27</td>
<td>-0.0128 -8.21</td>
<td>-0.0055 -3.51</td>
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</table>

### Audited incomes**

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<th>groups by income bands</th>
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<th>500</th>
<th>1000</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0.46</td>
<td>0.24</td>
<td>0.32</td>
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<tr>
<td>RE</td>
<td>0.1430 100.00</td>
<td>0.1430 100.00</td>
<td>0.1430 100.00</td>
<td>0.1430 100.00</td>
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<tr>
<td>VR</td>
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<td>0.1517 106.05</td>
<td>0.1605 112.22</td>
<td>0.1644 114.92</td>
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<tr>
<td>HI</td>
<td>0.0221 15.43</td>
<td>0.0087 6.05</td>
<td>0.0175 12.22</td>
<td>0.0213 14.92</td>
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### Actual incomes**

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<td>0.32</td>
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<tr>
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<td>0.1323 100.00</td>
<td>0.1323 100.00</td>
<td>0.1323 100.00</td>
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### Tax evasion effects**

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* grouping by pre-tax reported income

** grouping by pre-tax audited income

Actual incomes: pre-tax audited income vs. post-tax disposable income

In italics: percentage decomposition of total redistributive effects
Tab.3  Tax evasion effects - conventional vs multi-criteria perspective (fiscal year 1987)

<table>
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<th>Actual incomes</th>
<th>Tax evasion effects</th>
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Actual income: pre-tax audited income vs. post-tax disposable income

\[
VREV = VR_{\text{actual}} - VR_{\text{audited}}
\]
\[
VREVC = VRC_{\text{actual}} - VRC_{\text{audited}}
\]
\[
RESEVVR = VREVC - VREV
\]
\[
HIEV = HI_{\text{actual}} - HI_{\text{audited}}
\]
\[
HIEVC = HIC_{\text{actual}} - HIC_{\text{audited}}
\]
\[
RESEVHI = HIEVC - HIEV
\]