THE 2007 PERSONAL INCOME TAX REFORM IN ITALY: EFFECTS ON POTENTIAL EQUITY, HORIZONTAL INEQUITY AND RE-RANKING

SIMONE PELLEGRINO, ACHILLE VERNIZZI

The 2007 Personal Income Tax Reform in Italy: Effects on Potential Equity, Horizontal Inequity and Re-ranking

Simone Pellegrino
Dipartimento di Scienze Economiche e Finanziarie "G. Prato"
Università degli Studi di Torino

Achille Vernizzi
Dipartimento di Scienze Economiche, Aziendali e Statistiche
Università degli Studi di Milano

June 15th, 2010

Abstract

According to Kakwani and Lambert (1998), an equitable income tax should respect three axioms related to each taxpayer's tax liability, average tax rate and post-tax income: whenever taxation determines unequal tax treatments among equals or modifies pre-tax ordering, it influences the potential vertical effect of the tax through three types of inequity. Following the authors' measurement system, we investigate changes in axiom violations due to the 2007 Italian personal income tax reform, that introduced significant changes in the tax structure. Our microsimulation model uses as input data those provided by the Bank of Italy in its Survey on Households Income and Wealth in the year 2006; estimates of the distribution of taxpayers are very close to the Ministry of Finance official statistics. The analysis considers both the individual and equivalent household gross income distribution and evaluates the decomposition with and without surtaxes. Main findings suggest that the 2007 reform enhanced (only a little) the overall redistributive effect of the tax as well as the potential redistributive effect that could be obtained without the three types of inequity. Moreover, it did not modify the composition of axiom violations only for equivalent households, whilst violations of the axiom requiring richer taxpayers must face higher tax rates than poorer ones substantially increased from 2006 to 2007. Finally, focusing on each decile of the income distribution, regressivities are concentrated in the bottom five deciles of the income distribution both for taxpayers and equivalent households.

JEL Codes: C81, H23; H24

Keywords: Personal Income Tax, Redistributive Effect, Horizontal Inequity, Reranking, Microsimulation Models

1. Introduction

The Italian Personal Income Tax (hereafter PIT) has been intensively modified in the last 15 years. Until 2002 tax progressivity was guaranteed by a system of piecewise decreasing tax credits and increasing marginal tax rates with 5 brackets. Then this system has been modified by consistent reforms in 2003, 2005 and 2007. The 2005 reform completed that of 2003. In particular, during the period 2005-2006 tax progressivity was focused on a system of income related tax deductions linearly decreasing with respect to gross income; from 2007 onwards, it is instead based on a system of income related tax credits linearly decreasing with respect to gross income. Moreover, the shift from the 2006 system to the 2007 system has enhanced the taxable income relevant for local governments for all households with dependent individuals. Finally, rate schedule has been modified by the 2007 reform: the number of brackets raised from 4 to 5, and the level of tax rate has been enhanced for higher incomes.

With regard to efficiency, the 2003 and 2005 tax system has been criticised as, due to the income related deduction system, the number and the level of the effective marginal tax rates were much higher than the tax code ones (Paladini, 2003; Galmarini, 2004; Pellegrino, 2007b); these unpleasant outcomes have been intensively reduced by the 2007 reform. On the equity ground, the 2007 reform has only enhanced the PIT redistributive effect (Pellegrino, 2007b) a little, so that another question arises: how do changes in the tax structure influence the PIT potential vertical effect and the horizontal inequity as well as the re-rankings?

In order to answer this question we apply the Kakwani and Lambert (1998) approach for the redistributive effect decomposition to the 2006 and 2007 PIT structure; both the individual gross income distribution and the equivalent household gross income distribution have been analysed. According to this methodology, an equitable income tax should respect three axioms related to each taxpayer's tax liability, average tax rate and post-tax income: whenever taxation determines unequal tax treatments among equals or modifies pre-tax ordering, it influences the potential vertical effect through three possible types of inequity.

The remainder of the paper is structured as follows. Section 2 describes the main characteristics of the tax structure in 2006 and 2007. Section 3 discusses the Kakwani

and Lambert (1998) approach for the redistributive effect decomposition. Section 4 describes the data and the microsimulation model used for simulations. Section 5 presents the results, whilst section 6 briefly summarises the paper.

2. The Personal Income Tax in Italy: institutional and technical details

The 2006 tax structure

Let x_i be the personal gross income. The tax law considers four different deductions: $d_i^1\left(x_i^{MR}\right)$ is the income-related deduction for earned income; $d_i^2\left(x_i^{MR}\right)$ is the income-related deduction for dependent children and spouse as well as other individuals; d_i^3 is deduction for the main residence cadastral income; d_i^4 is a group of deductions for items of expenditure; $x_i^{MR} = x_i - d_i^3$. The taxable income relevant for the central government y_i^{CG} is evaluated as

$$y_i^{CG} = \begin{cases} x_i - d_i^1\left(x_i^{MR}\right) - d_i^2\left(x_i^{MR}\right) - d_i^3 - d_i^4 & if \quad d_i^1\left(x_i^{MR}\right) + d_i^2\left(x_i^{MR}\right) + d_i^3 + d_i^4 < x_i \\ 0 & if \quad d_i^1\left(x_i^{MR}\right) + d_i^2\left(x_i^{MR}\right) + d_i^3 + d_i^4 \geq x_i \end{cases}$$

In particular,

$$d_i^1\left(x_i^{MR}\right) = \begin{cases} d_i^{1p} & if \quad \dfrac{h + d_i^{1p} - x_i^{MR}}{h} \geq 1 \\ d_i^{1p}\,\dfrac{h + d_i^{1p} - x_i^{MR}}{h} & if \quad 0 < \dfrac{h + d_i^{1p} - x_i^{MR}}{h} < 1 \\ 0 & if \quad \dfrac{h + d_i^{1p} - x_i^{MR}}{h} \leq 0 \end{cases}$$

where h is equal to 26,000 euro, and d_i^{1p} is the corresponding potential deduction (differentiated by the kind of earned income: 7,500 euro for employees, 7,000 for pensioners, 4,500 for self-employed and 3,000 for other taxpayers);

$$d_i^2\left(x_i^{MR}\right)=\begin{cases} d_i^{2p} & if \quad \dfrac{f+d_i^{2p}-x_i^{MR}}{f}\geq 1 \\ d_i^{2p}\,\dfrac{f+d_i^{2p}-x_i^{MR}}{f} & if \quad 0<\dfrac{f+d_i^{2p}-x_i^{MR}}{f}<1 \\ 0 & if \quad \dfrac{f+d_i^{2p}-x_i^{MR}}{f}\leq 0 \end{cases}$$

where f is equal to 78,000 euro, and d_i^{2p} is the corresponding potential deduction for dependent persons within the household (3,200 for dependent spouse, and 2,900 for each dependent child and other individuals).

Applying the rate schedule $S\left(y_i^{CG}\right)$ to the taxable income y_i^{CG}, the gross tax liability $GT_i = S\left(y_i^{CG}\right)$ is obtained (Table 1). In this tax period, tax law admits only tax credits for items of expenditure c_i^1 (other than those considered by d_i^4). As a consequence, the net tax liability is evaluated as

$$T_i^{CG}=\begin{cases} GT_i-c_i^1 & if \quad GT_i>c_i^1 \\ 0 & if \quad GT_i\leq c_i^1 \end{cases}$$

Moreover, a surtax on PIT is levied by the region *R* and by the municipality *M* in which the taxpayer lives. The taxable income relevant for local governments differs from that relevant for the central government:

$$y_i^R=y_i^M=\begin{cases} x_i-d_i^2\left(x_i^{MR}\right)-d_i^3-d_i^4 & if \quad d_i^2\left(x_i^{MR}\right)+d_i^3+d_i^4<x_i \quad and \quad T_i^{CG}>0 \\ 0 & if \quad d_i^2\left(x_i^{MR}\right)+d_i^3+d_i^4\geq x_i \quad or \quad T_i^{CG}\leq 0 \end{cases}$$

Tax rates are differentiated between regions and municipalities. At the regional level, the standard rate is .9 per cent, but regions can raise it up to 1.4 per cent; the systems adopted are also different: flat rate, progressive bracket-base rates and progressive class-base rates. At the municipality level, only the flat system is permitted, and up to 2006 the tax rate cannot exceed .5 per cent (.8 per cent from 2007). Then the post-tax income is equal to $z_i = x_i - T_i$, where $T_i = T_i^{CG} + T_i^R + T_i^M$ if the whole tax system is considered, and $z_i^{CG} = x_i - T_i^{CG}$ if only the central government tax debt is considered.

The 2007 tax structure

From 2007 onwards, the deduction for earned income $d_i^1\left(x_i^{MR}\right)$ and the deduction for type of relationship $d_i^2\left(x_i^{MR}\right)$ have been eliminated and corresponding tax credits have been introduced; then the taxable income is

$$y_i^{CG} = y_i^R = y_i^M = \begin{cases} x_i - d_i^3 - d_i^4 & if \quad d_i^3 + d_i^4 < x_i \\ 0 & if \quad d_i^3 + d_i^4 \geq x_i \end{cases}$$

Note that the 2007 taxable income relevant for local governments is greater than the 2006 one; this implies, *ceteris paribus*, a greater tax debt levied by the local government for all households with dependent individuals within the household. The 2007 rate schedule $S\left(y_i^{CG}\right)$ is reported in Table 2. From 2007 onwards, tax law admits three distinct kinds of tax credits. They are: tax credit for items of expenditure c_i^1; tax credit for earned income $c_i^2\left(x_i^{MR}\right)$; tax credit for dependent individuals within the household $c_i^3\left(x_i^{MR}\right)$. As a consequence, the net tax liability relevant for the central government is

$$T_i^{CG} = \begin{cases} GT_i - c_i^1 - c_i^2\left(x_i^{MR}\right) - c_i^3\left(x_i^{MR}\right) & if \quad GT_i > c_i^1 - c_i^2\left(x_i^{MR}\right) - c_i^3\left(x_i^{MR}\right) \\ 0 & if \quad GT_i \leq c_i^1 - c_i^2\left(x_i^{MR}\right) - c_i^3\left(x_i^{MR}\right) \end{cases}$$

In particular,

$$c_i^2(x_i^{MR}) = \begin{cases} tm & if \quad x_i^{MR} \leq m \\ (tm - a) + a\left(\dfrac{k - x_i^{MR}}{k - m}\right) & if \quad m < x_i^{MR} \leq k \\ (tm - a)\left(\dfrac{w - x_i^{MR}}{w - k}\right) + b & if \quad k < x_i^{MR} \leq w \\ 0 & if \quad x_i^{MR} > w \end{cases}$$

where *t* is the lowest marginal tax rate (23 per cent); *m* is equal to 8,000 euro for employees, 7,500 for pensioners younger than 75, 7,750 for pensioners older than 75, 4,800 for the self-employed, and zero for non working taxpayers; *k* is equal to 15,000 euro for employees and pensioners, whilst it is equal to *w* for the self-employed; *w* is equal to 55,000 euro for all taxpayers; *a* is equal to 502 euro for employees, 470 for pensioners younger than 75, 486 for pensioners older than 75, zero for self-employed

and non working taxpayers; *b*, that ranges from 10 to 40 euro in the bandwidth 23-28 thousands euro, is applied only to employees.

There are three different tax credits for type of relationship: tax credit for dependent children $c_i^{3C}\left(x_i^{MR}\right)$, for dependent spouse $c_i^{3S}\left(x_i^{MR}\right)$, and for other household components $c_i^{3O}\left(x_i^{MR}\right)$. The overall value for $c_i^{3}\left(x_i^{MR}\right)$ is then $c_i^{3}\left(x_i^{MR}\right)=c_i^{3C}\left(x_i^{MR}\right)+c_i^{3S}\left(x_i^{MR}\right)+c_i^{3O}\left(x_i^{MR}\right)$.

In particular,

$$c_i^{3C}\left(x_i^{MR}\right)=\begin{cases} c_i^{3Cp}\left(x_i^{MR}\right)\dfrac{q+(n-1)e-x_i^{MR}}{q+(n-1)e} & if\ \ 0<x_i^{MR}\le q+(n-1)e \\ 0 & if\ \ x_i^{MR}>q+(n-1)e \end{cases}$$

where *n* is the number of dependent children, *e* is equal to 15,000 euro and *q* is equal to 95,000; $c_i^{3Cp}\left(x_i^{MR}\right)$ is the corresponding potential tax credit: it is 800 and 900 euro if the dependent child is younger and older than 3 years, respectively, and the dependent children within the households are 3 or less; these corresponding potential tax credits are 200 euro higher whenever the dependent children within the households are more than 3.

Finally,

$$c_i^{3S}\left(x_i^{MR}\right)=\begin{cases} c_i^{3Sp}\left(x_i^{MR}\right)-u\dfrac{x_i^{MR}}{k} & if\ \ x_i^{MR}\le k \\ c_i^{3Sp}\left(x_i^{MR}\right) & if\ \ k<x_i^{MR}\le w-k \\ c_i^{3Sp}\left(x_i^{MR}\right)\dfrac{r-x_i^{MR}}{w-k} & if\ \ w-k<x_i^{MR}\le w \\ 0 & if\ \ x_i^{MR}>w \end{cases}$$

and

$$c_i^{2O}\left(x_i^{MR}\right)=\begin{cases} c_i^{2Op}\left(x_i^{MR}\right)\dfrac{r-x_i^{MR}}{r} & if\ \ x_i^{MR}\le 2(w-k) \\ 0 & if\ \ x_i^{MR}>2(w-k) \end{cases}$$

where *u* is equal to 110 euro, $c_i^{3Op}\left(x_i^{MR}\right)$ is equal to 750 euro and $c_i^{3Sp}\left(x_i^{MR}\right)$ is equal to 800 euro (or less for some income bandwidths).

3. The Kakwani and Lambert methodology for the redistributive effect decomposition

Let x_i and T_i be the pre-tax income and the tax debt of individual or household *i*, with $i = 1, 2, ..., N$. Then observation's *i* post-tax income is equal to $z_i = x_i - T_i$. In order to be classified as strictly progressive, an income tax should respect three axioms (Kakwani and Lambert, 1998).

Starting by considering all possible income unit pairs $\{i, j\}$ in the income distribution, the first axiom requires richer taxpayers to pay higher tax liabilities than poorer ones.

This implies:

$$x_i \geq x_j \Rightarrow T_i \geq T_j \quad (1)$$

This axiom requires the minimal progression: when gross income increases, tax liabilities cannot decrease; however, they can be equal, so that (1) can be satisfied in the so-called "no tax area", regarding poorest taxpayers with a zero tax debt.

The second axiom demands the average tax rate to be a non decreasing function with respect to the gross income:

$$x_i \geq x_j \text{ and } T_i \geq T_j \Rightarrow \frac{T_i}{x_i} \geq \frac{T_j}{x_j} \quad (2)$$

This axiom recalls the progressive principle: average tax rate for richer taxpayers should be greater (or at least equal) than those faced by poorer ones. It can be satisfied only whenever (1) holds; if this is not so, then $x_i \geq x_j$ and $T_i < T_j$, so that $\frac{T_i}{x_i} < \frac{T_j}{x_j}$. Note that (2) permits a proportional income tax as well as a tax characterised by a piecewise linear average tax function.

Finally, a progressive tax satisfying (1) and (2) with non confiscatory tax rates excludes the possibility that the tax causes re-ranking in the transition from the pre- to the post-tax income:

$$x_i \geq x_j \text{ and } T_i \geq T_j \text{ and } \frac{T_i}{x_i} \geq \frac{T_j}{x_j} \Rightarrow z_i \geq z_j \quad (3)$$

The non re-ranking requirement can be evaluated whenever (1) and (2) hold; if (1) does not hold, than re-ranking cannot occur: if $x_i \geq x_j$ and $T_i < T_j$, then $z_i \geq z_j$; similarly, if (1) holds and (2) does not, then $x_i \geq x_j$ and $\frac{T_i}{x_i} < \frac{T_j}{x_j}$, so that $z_i \geq z_j$.

Turning to the consideration of the whole income distribution, the three axioms can be summarised as follow. Let G_X, G_T, G_A and G_Z be the Gini coefficient for pre-tax incomes, tax liabilities, average tax rates and post-tax incomes, respectively; let the corresponding concentration coefficients be C_T, C_A and C_Z (tax debts, average tax rates and post-tax incomes are ordered according to the pre-tax income ordering). Finally, let define $R_T = G_T - C_T$, $R_A = G_A - C_A$ and $R_Z = G_Z - C_Z$.

The first axiom is violated whenever tax debts ordering differs from the pre-tax income one. It follows that (1) is not satisfied whenever the concentration coefficient for tax debts C_T is smaller than the corresponding Gini coefficient G_T: $R_T \geq 0$.

Focusing only on all income pairs $\{i,j\}$ for which (1) holds, the second axiom is violated whenever the tax rate ordering differs from the pre-tax ordering; Kakwani and Lambert (1998) suggest checking the second axiom by the difference $R_A - R_T$: "if zero [positive] this suggest that Axiom 2 is upheld [violated]". The authors observe that even if $R_A - R_T$ could go negative, they never found it negative in their extensive simulations.

Finally, focusing only on all income pairs $\{i,j\}$ for which (2) holds, the third axiom is violated whenever the post-tax ordering differs from the pre-tax one, that is whenever C_Z is smaller than the corresponding Gini coefficient G_Z: $R_Z \geq 0$.

If the three axiom violations are taken into account, let us now see the redistributive effect decomposition. The redistributive effect is $RE = G_X - G_Z$, while the Kakwani and Reynolds-Smolensky indexes are $K = C_T - G_T$ and $RS = G_X - C_Z$, respectively.

These three indexes are related by the overall average tax rate $\theta = \frac{\sum_{i=1}^{n} T_i}{\sum_{i=1}^{n} x_i}$ as follows:

$$RS = \frac{\theta}{1-\theta} K = RE + R_Z .$$

It is possible to verify (Kakwani and Lambert, 1998) that

$$RE = P^{RE} - S^1 - S^2 - S^3 \qquad (4)$$

where $P^{RE} = \frac{\theta}{1-\theta}(K + R_A)$ indicates the potential redistributive effect, that is the redistributive effect that might be obtained with no axiom violations, whilst $S^1 = \frac{\theta}{1-\theta} R_T$, $S^2 = \frac{\theta}{1-\theta}(R_A - R_T)$ and $S^3 = R_Z$ measure the violation of axiom 1, 2 and 3, respectively.

In order to study the dimension of axiom violations within the income distribution, as Gini and concentration coefficients derive from the Lorenz and concentration curves, it is possible to decompose the redistributive effect also by income deciles.

Let $L_{XX}(p)$, $L_{TT}(p)$, $L_{AA}(p)$ and $L_{ZZ}(p)$ be the Lorenz curves for pre-tax incomes, tax liabilities, average tax rates and post-tax incomes, respectively. We label the corresponding concentration curves, when the ordering is assigned by pre-tax incomes ranking, as $L_{TX}(p)$, $L_{AX}(p)$ and $L_{ZX}(p)$.

Then, the following decomposition holds:

$$\begin{aligned} L_{ZZ}(p) - L_{XX}(p) = & \frac{\theta}{1-\theta}\left[L_{XX}(p) - L_{TX}(p) + L_{AX}(p) - L_{AA}(p)\right] + \\ & - \frac{\theta}{1-\theta}\left[L_{TX}(p) - L_{TT}(p)\right] + \\ & - \frac{\theta}{1-\theta}\left[L_{AX}(p) - L_{AA}(p) - L_{TX}(p) + L_{TT}(p)\right] + \\ & - \left[L_{ZX}(p) - L_{ZZ}(p)\right] \end{aligned} \qquad (5)$$

Multiplying (5) by 2 and integrating (5) from $p = 0$ to $p = 1$, equation (4) is obtained (Kakwani and Lambert, 1998). The first term measures the potential redistributive effect, while the other three terms, as previously discussed, the violation of axiom 1, 2 and 3, respectively.

4. Data and main feature of the microsimulation model

As input data, we make use of the Bank of Italy Survey on Household Income and Wealth (hereafter SHIW) published in 2008. It contains information on household post-tax income and wealth in the year 2006, covering 7,768 households, and 19,848 individuals. According to definition in the survey, "*a household is a group of persons living together, whether related by kinship or not, who fulfill their needs by pooling all or part of the income earned by the members*"; …"*the head of the household is defined as the person earning the highest income (excluding property income)*" (Bank of Italy, 2008). The sample is representative of the Italian population, composed of about 23,5 million households and 60 million individuals. For further details on the sample selection and aggregate statistics see Brandolini (1999) and Bank of Italy (2008).

The microsimulation model employed for this paper estimates all the most important taxes and contributions characterising the Italian fiscal system. Here we focus only on the PIT module of the microsimulation. Additional details on the algorithm used in the transition from the post- to the pre-tax income of each taxpayer are given in Pellegrino (2007a).

Results concerning the PIT gross income distribution are very close to the Ministry of Finance (2008) official statistics both considering the composition of PIT taxpayers by work status as well as by their mean gross income and the gross income distribution by income classes (see Pellegrino *et. al.* 2010 for further details).

Once each individual gross and net money incomes have been simulated, we evaluate them also at household level. In order to obtain equivalent incomes, we divided household money income by the Cutler Scale (*CS*), defined as:

$$CS = \left(N_A + \alpha N_C\right)^{\beta}$$

where N_A and N_C are, respectively, the number of adults and children (individual within the household aged 17 or less) within each household and $0 \le \alpha \le 1$ and $0 \le \beta \le 1$ are parameters: the first one assigns a different weight to children with respect to adults, whilst the latter indicates the economies of scale attached to the equivalence scale. Following van de Ven *et al*. (2003), we choose the equivalence scale parameters that minimise the re-ranking index (Figure 1): α is equal to .31, .29, .39 and .34 in

2006 and 2007, without and with surtaxes, respectively; corresponding values for β are .77, .70, .76 and .70.

Table 3 shows the inequality indexes both for individuals and equivalent households. We consider separately the tax levied by the central government, so that $z_i^{CG} = x_i - T_i^{CG}$, and the overall PIT, so that $z_i = x_i - T_i$.

Focusing on taxpayers, the pre- and post-tax Gini coefficient are 44.14 and 38.79 (39.00 without surtaxes), respectively. The overall redistributive effect *RE* is then 5.35 (5.14) in 2006 and 5.57 (5.34) in 2007: this raise is due to the increase of both the overall average tax rate and the Kakwani index; as expected, including surtaxes, *RE* and the average tax rate are higher, whilst *K* is smaller than those observed without surtaxes. Note that tax modifications enhanced the Atkinson-Plotnick-Kakwani re-ranking index from 0.07 to 0.08 without surtaxes and from .008 to .009 with surtaxes. A similar picture emerges whenever equivalent households are considered: the overall redistributive effect *RE* is 5.26 (5.06 without surtaxes) in 2006 and 5.53 (5.32) in 2007.

5. Results

We start by analysing the *RE* decomposition for taxpayers. The 2007 reform has substantially increased the potential redistributive effect: in 2006 $\frac{P^{RE}}{RE}\%$ is equal to 115.45 with surtaxes and to 114.73 without surtaxes (Table 4 and 5); in 2007 the corresponding values are 129.91 and 130.07, respectively (Table 6 and 7). These results imply that axiom violations played a more important role in 2007 with respect to 2006. In particular, it is the second axiom that presents the most remarkable difference in the overall violation. Moreover, tax reform modified their composition: $\frac{\left(\frac{S^2}{RE}\right)}{\left(\frac{P^{RE}}{RE}-1\right)}\%$ raised

from 64 per cent in 2006 to 79 per cent in 2007, whilst $\frac{\left(\frac{S^1}{RE}\right)}{\left(\frac{P^{RE}}{RE}-1\right)}\%$ and $\frac{\left(\frac{S^3}{RE}\right)}{\left(\frac{P^{RE}}{RE}-1\right)}\%$ fall from 27 per cent to 16 per cent and from 9 to 5, respectively.

Tables 4-7 report also each decile gross and net income share with respect to the overall incomes as well as the *RE* decomposition: in both years considered, the net income share is bigger than the gross one for the first 8 deciles, whilst it is smaller for the last two. In particular, the regressivities are detected in the first four income deciles; for the remaining upper deciles the actual income share is greater than the one that should be obtained without axiom violations. Note that in 2006 no regressivities are registered in the first decile. This result has a technical explanation: in contrast to the 2007 tax code, in 2006 the income-related deduction for earned income $d_i^1\left(x_i^{MR}\right)$ was applied to all taxpayers, also to non workers; as a consequence, almost all taxpayers in the first decile have no tax debt, so that no inequity can be observed. This is the reason why we observe a singificant negative value in the first decile of 2007 taxpayers (−0.62 in Table 6, −0.58 in Table 7), quite higher, in absolute terms, than the figure observed for the other nine deciles: this is what makes S^2 overall violation much greater in 2007 than in 2006.

Turning to equivalent households, results are presented in Tables 8-11. The increase of the potential redistributive effect is less extensive than that observed for taxpayers: in 2006 $\frac{P^{RE}}{RE}\%$ is equal to 109.31 with surtaxes and to 109.53 without surtaxes; in 2007 the corresponding values are 112.24 and 112.21, respectively. The composition of regressivities has not been substantially modified by the reform: violations of axiom 2 explain 65 per cent of $\left(\frac{P^{RE}}{RE}-1\right)\%$ in 2006 and 68 per cent in 2007; corresponding values for axiom 1 are 25 and 23, respectively, whilst violations of axiom 3 are equal in the two years considered.

This depends on the application of the equivalence scale, evaluated in order to minimize re-ranking. Turning to decile decomposition, a similar picture with respect to taxpayers

emerges. It is worth stressing that, after having applied the equivalence scale, the reduction in the violation of S^2 is much greater in 2007 than in 2006: this effect is mainly originated by the first decile. As underlined before, in 2007 tax system the implicit no tax area is applied only to work incomes, which makes axiom 2 violation particularly remarkable: in the first decile, due to low incomes, tax credits for family charges succeed by themselves in reducing dissimilarities in tax liability among families, even with personal tax credits that are quite different.

6. Concluding remarks

Since the Italian personal income tax has been intensively modified by the 2007 reform, in this paper we study how these changes influenced the potential redistributive effect and the importance of the three axiom violations according to the Kakwani and Lambert (1998) methodology.

Main findings suggest that the 2007 reform enhanced the redistributive effect of the personal income tax only a little; it substantially enhanced the potential redistributive effect that could be obtained without axiom violations. Moreover, this reform did not modify the composition of axiom violations only for equivalent households, whilst for taxpayers it enhanced violations of the axiom requiring richer taxpayers to face higher average tax rates and reduces the importance of the other two axiom violations. Finally, focusing on each decile of the income distribution, regressivities are concentrated in the bottom five deciles of the income distribution.

References

Bank of Italy (2008), *Household Income and Wealth in 2006*, Supplements to the Statistical Bulletin, Vol. XVIII, no. 7.

Brandolini A. (1999), *The Distribution of Personal Income in Post-War Italy: Source Description, Data Quality, and the Time Pattern of Income Inequality*, Banca d'Italia, Temi di discussione, n. 350.

Galmarini U., (2004), *La moltiplicazione delle aliquote*, lavoce.info, December 4th.

Kakwani N. and Lambert P. J., (1998), On measuring inequality in taxation: a new approach, *European journal of political economy*, vol. 14, pp. 369-380.

Lambert P. J., (2001), *The distribution and redistribution of income*, Manchester University Press, Third Edition.

Ministry of Economy and Finance, Department of Finance, *Statistical Reports*, 2008.

Paladini R., (2003), *L'imposta progressiva e la finanziaria 2003*, Università degli studi di Siena, Dipartimento di Economia Politica, Quaderni, n. 383.

Pellegrino S., (2007a), *Il Modello di microsimulazione IRPEF 2004*, SIEP, Italian Society of Public Economics, WP 583/07.

Pellegrino S., (2007b), IRPEF 2007: una redistribuzione (quasi) irrilevante?, *Rivista di diritto finanziario e scienza delle finanze*, anno LXVI, fasc. 1, 2007, pp. 24-43.

Pellegrino S., Piacenza M. and Turati G., (2010), *Developing a static microsimulation model for the analysis of housing taxation in Italy*, mimeo.

van de Ven J. and Creedy J., (2003), *Taxation, re-ranking and equivalence scales*, New Zealand Treasury, WP 3/11.

Table 1: Central Government marginal tax rates before the 2007 reform

Tax base (euro)				Tax rate (%)
		up to	26.000	23
from	26.000	up to	33.500	33
from	33.500	up to	100.000	39
above	100.000			43

Source: Ministry of Finance, 2007.

Table 2: Central Government marginal tax rates after the 2007 reform

Tax base (euro)				Tax rate (%)
		up to	15.000	23
from	15.000	up to	28.000	27
from	28.000	up to	55.000	38
from	55.000	up to	75.000	41
above	75.000			43

Source: Ministry of Finance, 2007.

Table 3: Inequality indexes

	Taxpayers				Equivalent households			
	Without surtaxes		With surtaxes		Without surtaxes		With surtaxes	
Indexes	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**
Average tax rate (%)	**18.51**	**18.44**	**19.72**	**19.78**	**18.66**	**18.56**	**19.88**	**19.90**
Gini coefficient for the gross income	**44.14**	**44.14**	**44.14**	**44.14**	**39.34**	**39.25**	**39.36**	**39.26**
Gini coefficient for the net income	**39.00**	**38.80**	**38.79**	**38.57**	**34.28**	**33.93**	**34.09**	**33.73**
Gini coefficient for the tax	**67.94**	**69.21**	**67.12**	**68.14**	**62.11**	**63.51**	**61.25**	**62.38**
Redistributive effect	**5.14**	**5.34**	**5.35**	**5.57**	**5.06**	**5.32**	**5.26**	**5.53**
Concentration index for the net income	**38.93**	**38.72**	**38.71**	**38.48**	**34.24**	**33.88**	**34.04**	**33.67**
Concentration index for the tax	**67.04**	**68.08**	**66.22**	**67.08**	**61.58**	**62.85**	**60.76**	**61.77**
Kakwani index	**22.91**	**23.94**	**22.09**	**22.94**	**22.24**	**23.59**	**21.41**	**22.51**
Reynolds-Smolensky index	**5.20**	**5.41**	**5.43**	**5.65**	**5.10**	**5.38**	**5.31**	**5.59**
Atkinson-Plotnick-Kakwani index	**0.07**	**0.08**	**0.08**	**0.09**	**0.04**	**0.05**	**0.05**	**0.06**

Source: Own elaborations on SHIW.

Figure 1: Cutler scale parameters and *R/RE* minimisation in 2006

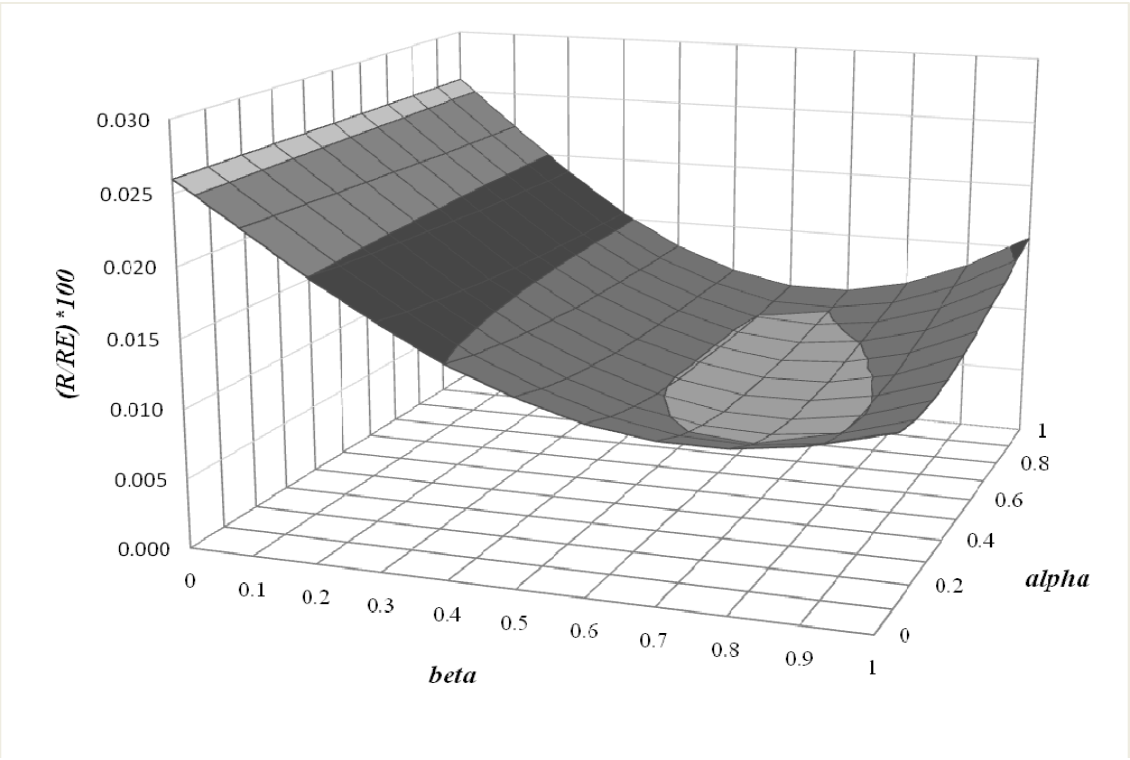

Table 4: *RE* decomposition for taxpayers in 2006 with surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	0.52	0.65	0.13	0.13	0.00	0.00	0.00	0.00
2	2.80	3.44	0.65	0.82	-0.03	-0.14	-0.01	-0.17
3	4.32	5.16	0.84	1.34	-0.13	-0.35	-0.01	-0.50
4	6.00	6.81	0.81	0.98	-0.07	-0.08	-0.03	-0.17
5	7.53	8.28	0.75	0.68	0.01	0.07	-0.02	0.07
6	8.94	9.55	0.61	0.50	0.03	0.10	-0.01	0.12
7	10.32	10.81	0.49	0.32	0.04	0.11	0.02	0.17
8	12.10	12.41	0.31	0.09	0.06	0.14	0.01	0.22
9	15.14	15.02	-0.12	-0.30	0.04	0.11	0.03	0.18
10	32.33	27.86	-4.47	-4.56	0.04	0.03	0.02	0.09
Total	44.14	38.79	5.35	6.17	-0.22	-0.53	-0.08	-0.83
%	-	-	100.00	115.45	-4.11	-9.87	-1.48	-15.45

Source: Own elaborations on SHIW.

Table 5: *RE* decomposition for taxpayers in 2006 without surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	0.52	0.64	0.12	0.12	0.00	0.00	0.00	0.00
2	2.80	3.40	0.60	0.75	-0.02	-0.11	-0.01	-0.14
3	4.32	5.13	0.81	1.26	-0.12	-0.32	-0.01	-0.45
4	6.00	6.79	0.79	0.98	-0.07	-0.09	-0.03	-0.19
5	7.53	8.26	0.73	0.67	0.01	0.06	-0.01	0.06
6	8.94	9.54	0.60	0.49	0.03	0.09	-0.01	0.11
7	10.32	10.80	0.48	0.32	0.04	0.10	0.02	0.16
8	12.10	12.41	0.30	0.10	0.06	0.13	0.01	0.20
9	15.14	15.03	-0.11	-0.28	0.04	0.10	0.02	0.17
10	32.33	28.00	-4.33	-4.41	0.03	0.03	0.02	0.08
Total	44.14	39.00	5.14	5.89	-0.20	-0.48	-0.07	-0.76
%	-	-	100.00	114.73	-3.98	-9.43	-1.33	-14.73

Source: Own elaborations on SHIW.

Table 6: *RE* decomposition for taxpayers in 2007 with surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	0.52	0.63	0.11	0.75	-0.02	-0.62	0.00	-0.64
2	2.80	3.42	0.62	0.96	-0.05	-0.27	-0.01	-0.34
3	4.32	5.19	0.87	1.24	-0.12	-0.24	-0.01	-0.37
4	6.00	6.87	0.88	0.88	-0.06	0.08	-0.02	-0.01
5	7.53	8.36	0.82	0.65	0.02	0.16	-0.02	0.17
6	8.94	9.62	0.69	0.50	0.04	0.17	-0.01	0.19
7	10.32	10.87	0.55	0.31	0.04	0.18	0.02	0.24
8	12.10	12.46	0.36	0.05	0.06	0.23	0.01	0.31
9	15.14	15.05	-0.09	-0.45	0.06	0.27	0.03	0.37
10	32.33	27.53	-4.80	-4.89	0.03	0.04	0.02	0.09
Total	44.14	38.57	5.57	7.23	-0.26	-1.32	-0.09	-1.67
%	-	-	100.00	129.91	-4.69	-23.66	-1.56	-29.91

Source: Own elaborations on SHIW.

Table 7: *RE* decomposition for taxpayers in 2007 without surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	0.52	0.62	0.10	0.70	-0.02	-0.58	0.00	-0.61
2	2.80	3.37	0.58	0.87	-0.05	-0.24	-0.01	-0.29
3	4.32	5.14	0.82	1.20	-0.11	-0.25	-0.01	-0.38
4	6.00	6.85	0.85	0.90	-0.07	0.05	-0.02	-0.05
5	7.53	8.34	0.80	0.66	0.01	0.15	-0.01	0.15
6	8.94	9.61	0.67	0.49	0.04	0.16	-0.01	0.18
7	10.32	10.87	0.55	0.31	0.04	0.18	0.02	0.24
8	12.10	12.46	0.36	0.06	0.07	0.23	0.01	0.31
9	15.14	15.07	-0.07	-0.44	0.06	0.27	0.03	0.37
10	32.33	27.67	-4.66	-4.74	0.03	0.04	0.02	0.09
Total	44.14	38.80	5.34	6.94	-0.26	-1.27	-0.08	-1.60
%	-	-	100.00	130.07	-4.79	-23.82	-1.46	-30.07

Source: Own elaborations on SHIW.

Table 8: *RE* decomposition for households in 2006 with surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	1.72	2.14	0.42	0.46	-0.01	-0.03	0.00	-0.04
2	3.72	4.51	0.79	0.99	-0.05	-0.14	-0.01	-0.20
3	5.01	5.76	0.75	0.82	-0.01	-0.05	-0.01	-0.07
4	6.27	6.92	0.65	0.73	-0.02	-0.05	0.00	-0.08
5	7.46	8.05	0.59	0.58	0.00	0.00	0.00	0.00
6	8.77	9.27	0.49	0.48	0.00	0.01	0.00	0.01
7	10.24	10.61	0.37	0.33	0.00	0.06	-0.01	0.04
8	12.06	12.24	0.18	0.10	0.03	0.06	0.00	0.09
9	15.18	14.84	-0.34	-0.42	0.01	0.07	0.01	0.08
10	29.56	25.66	-3.90	-4.06	0.06	0.07	0.03	0.16
Total	39.36	34.09	5.26	5.75	-0.12	-0.32	-0.05	-0.49
%	-	-	100.00	109.31	-2.31	-6.10	-0.91	-9.31

Source: Own elaborations on SHIW.

Table 9: *RE* decomposition for households in 2006 without surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	1.73	2.12	0.39	0.42	-0.01	-0.02	0.00	-0.03
2	3.73	4.47	0.74	0.96	-0.05	-0.15	-0.01	-0.21
3	5.02	5.74	0.73	0.79	-0.01	-0.04	-0.01	-0.06
4	6.27	6.90	0.63	0.71	-0.03	-0.05	0.00	-0.08
5	7.46	8.03	0.57	0.56	0.00	0.01	0.00	0.01
6	8.76	9.25	0.48	0.48	0.00	0.01	0.00	0.01
7	10.25	10.61	0.37	0.32	0.00	0.06	-0.01	0.05
8	12.06	12.25	0.18	0.10	0.02	0.06	0.01	0.08
9	15.16	14.84	-0.32	-0.40	0.02	0.06	-0.01	0.08
10	29.56	25.77	-3.79	-3.95	0.05	0.07	0.04	0.16
Total	39.34	34.28	5.06	5.54	-0.12	-0.32	-0.04	-0.48
%	-	-	100.00	109.53	-2.41	-6.24	-0.87	-9.53

Source: Own elaborations on SHIW.

Table 10: *RE* decomposition for households in 2007 with surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	1.74	2.16	0.41	0.55	-0.02	-0.12	0.00	-0.14
2	3.73	4.54	0.81	1.03	-0.05	-0.15	-0.02	-0.22
3	5.01	5.82	0.80	0.86	-0.01	-0.04	0.00	-0.05
4	6.28	6.97	0.70	0.79	-0.03	-0.06	-0.01	-0.09
5	7.47	8.12	0.64	0.63	0.00	0.02	-0.01	0.02
6	8.77	9.30	0.53	0.54	-0.01	0.00	0.00	-0.01
7	10.23	10.64	0.41	0.35	0.00	0.07	-0.01	0.06
8	12.06	12.27	0.21	0.09	0.01	0.09	0.01	0.11
9	15.22	14.88	-0.34	-0.48	0.03	0.11	0.00	0.14
10	29.48	25.31	-4.17	-4.36	0.07	0.08	0.04	0.19
Total	39.26	33.73	5.53	6.21	-0.15	-0.46	-0.06	-0.68
%	-	-	100.00	112.24	-2.75	-8.41	-1.08	-12.24

Source: Own elaborations on SHIW.

Table 11: *RE* decomposition for households in 2007 without surtaxes

Decile	Pre-tax income	Post-tax income	Difference	Potential equity	Axiom 1	Axiom 2	Axiom 3	Total Axioms
1	1.75	2.13	0.38	0.51	-0.02	-0.11	0.00	-0.12
2	3.74	4.50	0.77	0.97	-0.05	-0.14	-0.01	-0.20
3	5.02	5.80	0.78	0.85	-0.02	-0.04	-0.01	-0.07
4	6.27	6.95	0.68	0.77	-0.03	-0.06	0.00	-0.09
5	7.48	8.10	0.63	0.62	0.00	0.01	-0.01	0.01
6	8.76	9.28	0.52	0.53	-0.01	0.00	0.00	-0.01
7	10.23	10.64	0.41	0.35	0.00	0.07	-0.01	0.06
8	12.06	12.27	0.21	0.10	0.01	0.08	0.01	0.11
9	15.21	14.90	-0.31	-0.45	0.04	0.10	0.00	0.14
10	29.48	25.42	-4.06	-4.24	0.06	0.08	0.04	0.18
Total	39.25	33.93	5.32	5.97	-0.15	-0.45	-0.05	-0.65
%	-	-	100.00	112.21	-2.83	-8.36	-1.02	-12.21

Source: Own elaborations on SHIW.