Società italiana di economia pubblica

WORKING PAPER
No 406
June 2005

A DECOMPOSITION OF THE PERSONAL INCOME TAX CHANGES IN ITALY: 1995-2000

FRANCESCA GASTALDI
PAOLO LIBERATI
CHIARA RAPALLINI

JEL CLASSIFICATION: H24

KEYWORDS: PERSONAL INCOME TAX

A DECOMPOSITION OF THE PERSONAL INCOME TAX CHANGES IN ITALY: 1995-2000.

Francesca Gastaldi (*).
Paolo Liberati (**).
Chiara Rapallini (***).

Abstract

Most of the empirical studies on personal income tax reforms, based on micro-simulation modelling, focus on the effects of legislative changes of the income tax structure, while all other parameters are usually left unchanged. However, the way in which the income tax attracts revenue and produce redistributive effects over a time interval also depends on external factors, as the evolution of the number of taxpayers; the level of average pre-tax income; the way in which pre-tax income is distributed among individuals; and fiscal drag effects due to nominal and/or real changes of pre-tax income. Considering these effects may well change the sign and/or the intensity of the overall redistributive power of the personal income tax, especially in those cases where external factors may countervail the sign and/or the intensity of the changes of the tax structure. In this paper, evidence is provided for both tax revenue changes and redistributive power of the income tax in Italy over two periods, 1995 and 2000. The paper, using two microsimulation models based on two different reference years, applies the methodology developed by OECD (1987) to decompose tax revenue changes and extends this methodology to measure the redistributive contribution of each factor to the total redistributive effect. The main result is that both the reduction of tax revenue and the positive redistributive effect of tax law changes in Italy are more than neutralised by fiscal drag on nominal incomes, while the most important contribution to the overall positive redistributive effect comes from the growth of average income.

* Università di Roma La Sapienza, Dipartimento di Economia Pubblica.
** Università di Urbino Carlo Bo, Istituto di Scienze Economiche
*** Università di Firenze, Dipartimento di Studi sullo Stato.
E-mail for correspondence: liberati@econ.uniurb.it

1. Introduction

The analysis of the effects of the personal income tax in Italy has a long history[1]. The most investigated issues have been those of how tax revenue, inequality and/or progressivity may change following a change of tax legislation. However, the personal income tax may change because of the action of external factors. For example, average income growth may affect the amount of tax revenue collected; the way in which income is distributed may make a given tax system more or less progressive; fiscal drag, especially due to inflation, may increase tax revenue but undermine redistribution. Therefore, the measured effect of changes in tax legislation may represent only a small part of the total tax revenue change or of the total redistributive effect.

This paper tries to highlight these issues considering the changes of the personal income tax occurred in Italy between two points in time, 1995 and 2000. The quantification of the various effects is performed by using two microsimulation models built upon the data from Bank of Italy for 1995 and 2000. This allows us to perform the redistributive analysis on two different underlying populations, which makes possible to explicitly introduce into the analysis those effects that are external to the changes of tax legislation. As will be explained below, the analysis is based on a methodology developed by OECD (1987) for changes in tax revenue and extended in this paper in order to encompass redistributive effects.

The paper is organised as follows: Section 2 deals with methodological issues in decomposing tax revenue changes, basically proposing the OECD methodology. Section 3 extends this methodology to redistributive issues. Section 4 briefly describes the main adjustments of the personal income tax between 1995 and 2000. Section 5 discusses the results, while Section 6 concludes.

2. Methodological issues: decomposing tax revenue changes

According to the methodology developed by OECD (1987), tax revenue changes due to changes of the personal income tax, between any two periods, may be decomposed into the following parts:

a) a proportional effect due to the change of the number of taxpayers (*NT*). With an unchanged distribution of taxable income, a change of the number of taxpayers is equivalent to a change of the income tax proportional to the ratio between the number of taxpayers in the final year observed and the number of taxpayers of the initial year. Let us

[1] This analysis has started at the very beginning of the introduction of the personal income tax in Italy in 1974. See, among many: Russo (1981); Visco (1984); Tutino (1985); Sartor (1987); Marenzi (1991); Lugaresi (1992); Stroffolini (1992); Lugaresi and Toso (1993); Marenzi (1995); Russo (1996); Matteuzzi e Toso (1996); Gastaldi and Liberati (2000); Baldini and Bosi (2002); Marino and Rapallini (2003); Gastaldi and Liberati (2004); De Vincenti *et al*. (2004); Declich and Polin (2004); Emiliani *et al.* (2004).

identify this ratio as *k*. In the case analysed in this paper, i.e. considering 1995 as the base year and 2000 as the final year, the change of tax revenue can be expressed as follows:

[1] $$NT = kT_{95}(Y_{95}) - T_{95}(Y_{95})$$

where T_{95} denotes the tax system prevailing in fiscal year 1995, Y_{95} denotes the income distribution of the same year and $T_{95}(Y_{95})$ denotes the application of the tax regime of 1995 to the income distribution of the same year.
Expression [1] reveals that the pure effect of a change of the number of taxpayers is equivalent to the additional tax revenue that is measured by a proportional scaling (*k*) of the original distribution of tax liabilities. This implies that the additional tax revenue is measured as if any taxpayer of the original distribution would count *k* times. Obviously, this effect exhausts the tax revenue effect of the change of a number of taxpayers in the unlikely case that the new population of taxpayers is an exact replication of the original population of taxpayers. In all other cases, a change in the number of taxpayers is likely to cause other effects, e.g. altering mean income or the way in which it is distributed. Measuring *NT* requires to consider those changes of the number of taxpayers that are not due to the change of tax law (as the change of the minimum taxable income or the definition, say, of dependent children or dependent spouse). Any such change, indeed, should be included in the legislation effect (see below). Quite obviously, if the number of taxpayers were equal in the two years, k=1 and NT=0.

b) a proportional effect due to the change of average income (*AI*). Other things being equal, the variation of average income may cause tax revenue to change. If one wants to exclude the interaction of this change with the progressivity of the income tax (due to both real and nominal fiscal drag), the following expression should be used:

[2] $$AI = gkT_{95}(Y_{95}) - kT_{95}(Y_{95})$$

where *g* indicates the ratio between average incomes in the two periods.
Expression [2] indicates that, for a given number of taxpayers, a change of average income causes, at least, a change of tax revenue that is proportional to *g*. In other words, the tax revenue due to a change of average income must be at least *g* times as much the tax revenue obtained in the absence of such a change. This effect exhausts the change in tax revenue in the case of a proportional income tax. With progressivity, an increase of average income may cause a more than proportional increase of tax revenue if interactions with formal progressivity occur. In this case, the measurement of this effect does not exhaust the change in tax revenue. If average income does not grow (i.e., g=1), AI=0.

c) changes in the income distribution (*ID*). The degree of inequality of a given income distribution may affect the amount of tax revenue that a given tax may produce for a given number of taxpayers and a given average income. The quantification of this effect is given by the following expression:

[3] $$ID = gT_{95}\left(\frac{Y_{00}}{g}\right) - gkT_{95}(Y_{95})$$

It is worth exploring some characteristics of expression [3]. It is best done by assuming, for the moment, *k*=1. In this case, in order to quantify the change in tax revenue due to a different underlying income distribution and not to its mean, it is needed to neutralise differences in average income. Therefore, one must compare the initial distribution (Y_{95}) with a final income distribution with the same mean, which is given by Y_{00}/g. Obviously, there is no reason to expect that Y_{00}/g is distributed exactly in the same way as Y_{95}, unless the growth is at the same rate for all incomes. If it were, $y_{95}^i = y_{00}^i / g,\ \forall i$ and a given income tax structure (T_{95}) would produce exactly the same tax revenue. In this case, $gT_{95}\left(\frac{Y_{00}}{g}\right) = gT_{95}(Y_{95})$. This would imply *ID*=0. Therefore, with the same number of taxpayers, *ID*=0 only in the case where the new income distribution is a scaled version of the original one. With a different number of taxpayers ($k \neq 1$), expression [3] equal zero only in the case where $k = \frac{T_{95}(Y_{oo}/g)}{T_{95}(Y_{95})}$. This may of course happen when the new income distribution is an exact replication of the original one, as, say, doubling the same taxpayers yields twice the same revenue. In all other cases in which $k \neq 1$ the fact that the ratio between tax revenues is equal to *k* is just one of the many possible events. In general, one could therefore expect $ID \neq 0$ when $k \neq 1$.

d) fiscal drag (*FD*) effects. The fiscal drag effect is quantified by the additional tax burden that is caused by variation of incomes that makes them falling into different income brackets (and therefore under different marginal tax rates). When incomes change, tax revenue increases at least proportionally (*AI* effect). However, if incomes fall into different income brackets, fiscal drag effects also occur because of the interactions between income growth and tax progressivity. Formally, the additional tax revenue due to fiscal drag may be represented as follows:

[4] $$FD = T_{95}(Y_{00}) - gT_{95}\left(\frac{Y_{00}}{g}\right)$$

The obvious case in which *FD*=0 is when the tax structure is proportional. In all other cases, income growth may cause more than proportional increases in tax paid if the income falls under more than one marginal tax rate. In order to see this, let us focus on the second term of [4]. In this case, incomes are first scaled by *g*, as if income growth were absent. Applying T_{95} to this income distribution and multiply the result by *g* gives the part of tax revenue which is equivalent to the action of a proportional tax. If the tax were proportional, the application of T_{95} to Y_{00} (the first term) would give the same result. However, with a progressive tax, the first term will generally be higher than the second one. The difference between the two tax revenues is therefore the additional tax revenue generated by the presence of a progressive tax (the fiscal drag effect). This effect may be split in two parts: inflationary fiscal drag and real fiscal drag.

d1) fiscal drag due to inflation (*IFD*). This effect captures the variation of tax revenue due to *nominal* incomes moving across income brackets. The following expression quantifies *IFD*:

[4.1] $$IFD = T_{95}\left(Y_{00}\right) - hT_{95}\left(\frac{Y_{00}}{h}\right)$$

where *h* is the price index between the two years.
The interpretation of [4.1] is analogous to that of expression [4]. Let us again focus on the second term of [4.1]. Incomes in year 2000 are first scaled by *h*, as if it were not inflation. Then, T_{95} is applied to this scaled income distribution and tax revenue is multiplied by *h*. This gives the tax revenue that would be produced under a proportional tax regime with inflation. If the tax were proportional, the application of T_{95} to Y_{00} (the first term) would give the same result. However, with a progressive tax, the first term will generally be higher than the second one. The difference between the two tax revenues is therefore the additional tax revenue generated by inflation in the presence of a progressive tax (the inflationary fiscal drag effect).

d2) real fiscal drag (*RFD*). This effect isolates the additional tax revenue due to a real income growth. The following expression holds:

[4.2] $$RFD = hT_{95}\left(\frac{Y_{00}}{h}\right) - gT_{95}\left(\frac{Y_{00}}{g}\right)$$

Interpretation of [4.2] is now straightforward, as it is obtained by subtracting inflationary fiscal drag [4.1] from the total fiscal drag effect [4]. As in the first term, the income distribution is scaled by inflation and in the second term the income distribution is scaled by total growth (inflation + real), the difference must be the additional tax revenue due to real income growth.

e) it is worth noting that until now, all effects are calculated embodying the application of T_{95}, the initial tax structure to various income distributions. It implies that, until now, all effects quantify that part of the change of tax revenue that is driven by external factors. The effects of the change in legislation are instead captured by the tax law effect (*TL*). This effect quantifies the change in tax revenue that is given by the change of tax legislation. One can measure it as follows:

[5] $$TL = T_{00}\left(Y_{00}\right) - T_{95}\left(Y_{00}\right)$$

The interpretation of [5] is obvious. It will be equal to zero only in the case where the tax structure is unchanged. Any modification of the tax system, instead, will affect tax revenue. Note that in [5], the application of two different tax structures at the same income distribution (Y_{00}) neutralises any tax revenue change that is due to the change of the underlying distribution. These latter effects are captured by the effects discussed in a) to d). It is worth noting that under the tax law effect, one should also include indexation provisions in order to neutralise fiscal drag due to inflation. For example, if the only cause of additional tax revenue be inflation, one should measure a positive effect in *IFD* and a negative effect (of the same size) under *TL*.

From the decomposition so far analysed, one can get the following total expression:

[6] $$\Delta T = T_{00}(Y_{00}) - T_{95}(Y_{95}) = NT + AI + ID + IFD + RFD + TL$$

where the total change in tax revenue ΔT is decomposed in factors.

3. Methodological aspects: redistributive effects.

Any effect so far discussed contributes to the decomposition of tax revenue changes. It is of particular interest to investigate how each of them contributes to the total redistributive effect. In order to analyse this aspect, an extension of the previous methodology is proposed, on the basis of the Reynolds-Smolensky (1977) (*RS*) index. This index is obtained as the difference between the Gini indices of the distribution before and after a given adjustment. In the specific case of this paper, a decomposition of the total redistributive effect of the tax structure prevailing in year 2000 is provided. Let us therefore suppose that one is interested in measuring the change of the Gini index when moving from T_{95} on Y_{95} to T_{00} on Y_{00}.

In general terms, when measuring the effect of a given tax structure on the corresponding income distribution, the following expression can be used:

[7] $$RE = G_{Y00} - G_{Y00-T00} = \underbrace{\frac{t_{00}}{1-t_{00}}}_{\text{average tax rate}} \underbrace{\Pi_{T00}}_{\text{Kakwan}i} + \underbrace{R}_{\text{reranking}}$$

where the income distribution of 2000 is considered. Expression [7] indicates that the difference between Gini indices (before and after the income tax) is equivalent to the product between the *average tax rate* and the *Kakwani index*. The first measures the size of the redistribution (how much income is redistributed); the second measures how much progressive is the distribution of the income tax. The last effect is a *reranking effect*, measuring the change of the relative position of taxpayers after the income tax, compared to the position they were placed before it.

In particular, the Kakwani index measures the difference between the concentration index of the income tax and the Gini index of the income distribution before the income tax:[2]

[8] $$\Pi_{T00} = C_{T00} - G_{Y00}$$

If the income tax were proportional, $C_{T00} = G_{Y00}$. As a consequence, $\Pi_{T00} = 0$. The characteristic of a progressive income tax is that the tax concentration is higher than the Gini of the initial income distribution. In other words, the tax is less equi-distributed than the initial income. Therefore, with a progressive income tax, the Kakwani index is positive and is increasing with the progressivity of the income tax.

[2] Just to recall that the concentration index must be measured on an income distribution ranked by before-tax income levels.

Now, when applying the methodology of Section 2 to redistributive issues, it is necessary to convert changes of tax revenue in changes of redistributive effects. When comparing two tax structures (in the case 1995 and 2000), it is therefore needed to calculate the change in the redistributive effect as follows:

[9] $$\Delta RE = \underbrace{\left[G_{Y00} - G_{Y00-T00}\right]}_{RE_{T00}} - \underbrace{\left[G_{Y95} - G_{Y95-T95}\right]}_{RE_{T95}}$$

Expression [9] simply describes the fact that the application of T_{00} to the corresponding income distribution (Y_{00}) has its own redistributive effect (RE_{T00}). Analogously, the application of T_{95} to the corresponding income distribution (Y_{95}) has its own redistributive effect (RE_{T95}). The difference between the two redistributive effects measures the change ΔRE when moving from one tax structure to another. As in the case of the previous paragraph, this change may be decomposed in the same factors. As also noted before, only one of these factors includes the modifications of tax laws.

a) Using the same order of the previous paragraph, one can start from the redistributive consequence of a change in the number of taxpayers:

[10] $$\Delta RE_{NT} = \left(\tau_{kT95}\Pi^{Y95}_{kT95}\right) - \left(\tau_{T95}\Pi^{Y95}_{T95}\right)$$

where, in general terms, one can indicate $\tau = \frac{t}{1-t}$.[3] Now, one can easily note that the two Kakwani indices have the same size:

[10.1] $$\Pi^{Y95}_{kT95} = C^{Y95}_{kT95} - G_{Y95}$$
$$\Pi^{Y95}_{T95} = C^{Y95}_{T95} - G_{Y95}$$

This is because the way in which T_{95} and kT_{95} are distributed on Y_{95} is the same, as the latter tax is only a scaled version of the former one. The concentration index is therefore the same. But also the Gini index of the initial distribution is the same. Therefore, expression [10.1] can be rewritten as follows:

[10.2] $$\Delta RE_{NT} = \Pi_{T95}\left(\tau_{kT95} - \tau_{T95}\right)$$

[3] When defining both Kakwani index and concentration indices, the subscript indicates the tax structure of which the concentration is measured. The superscript, instead, indicates the income distribution on which the concentration is calculated. Expression [10] derives from considering the change of the redistributive effect as follows: $\left[G_{Y95} - G_{Y95-kT95}\right] - \left[G_{Y95} - G_{Y95-T95}\right]$. The first term represents the redistributive effect of T_{95}, adjusted by the number of taxpayers; the second measures the redistributive effect of T_{95} *tout court*. The first term, disregarding the reranking term (omitted to save notation), can be rewritten as follows: $\tau_{kT95}\Pi^{Y95}_{kT95}$. The second term can be rewritten as $\tau_{T95}\Pi^{Y95}_{T95}$, from which [10] is obtained. The same procedure is used to measure the redistributive content of the other factors.

In redistributive terms, therefore, it is clear that a change of the number of taxpayers has only an *average tax rate* effect. A Kakwani effect is instead absent.

b) The redistributive power of the average income effect (*AI*) is identified by the following expression:

$$\Delta RE_{RM} = \left(\tau_{gkT95}\Pi^{Y95}_{gkT95}\right) - \left(\tau_{kT95}\Pi^{Y95}_{kT95}\right) \quad [11]$$

Again, one can note that also in this case the two Kakwani indices are equal. Indeed:

$$\begin{aligned} \Pi_{gkT95} &= C^{Y95}_{gkT95} - G_{Y95} \\ \Pi_{kT95} &= C^{Y95}_{kT95} - G_{Y95} \end{aligned} \quad [11.1]$$

The Gini index of the initial income distribution is the same. Also, the way in which gkT_{95} and kT_{95} are distributed against the initial income distribution is the same, as the two distribution of tax liabilities differ only by a scalar. The average income effect, as before, therefore records only an average tax rate effect; it is not affected, instead, by the Kakwani index.

c) The effect due to a changing income distribution is measured as follows:

$$\Delta RE_{DR} = \left(\tau_{gT95}\Pi^{Y00/g}_{gT95}\right) - \left(\tau_{gkT95}\Pi^{Y95}_{gkT95}\right) \quad [12]$$

In this case (see above expression [3]), the two Kakwani indices are defined by the following expressions:

$$\begin{aligned} \Pi_{gT95} &= C^{Y00/g}_{gT95} - G_{Y00/g} \\ \Pi_{gkT95} &= C^{Y95}_{gkT95} - G_{Y95} \end{aligned} \quad [12.1]$$

It is now clear that the Gini indices of the two underlying distributions differ. The two distributions have in fact the same mean, but they can obviously differ in the way income is distributed, unless the average income growth has been the same for all incomes. It follows that the way in which gkT_{95} and gT_{95} are distributed is different. A different Kakwani index is therefore expected. Furthermore, the average tax rate is also different, if $k \neq 1$. Therefore, the redistributive impact of a changed income distribution contains both the average tax rate and the Kakwani effect. It is also worth noting that the Kakwani effect is partly due to a different underlying distribution and partly due to the way in which the tax is distributed.

d1) With regard to the fiscal drag due to inflation, the redistributive impact can be measured as follows:

$$\Delta RE_{DFI} = \left(\tau_{T95}\Pi^{Y00}_{T95}\right) - \left(\tau_{hT95}\Pi^{Y00/h}_{hT95}\right) \quad [13]$$

The Kakwani indices assume the following form:

[13.1]

$$\Pi_{T95} = C_{T95}^{Y00} - G_{Y00}$$
$$\Pi_{hT95} = C_{hT95}^{Y00/h} - G_{Y00/h}$$

Now, the Gini index of the initial distributions is the same, as Y_{00}/h is only a scaled version of the original Y_{00}. However, the way in which the tax is distributed on these two income distributions may change. Therefore, the concentration indices will be different, leading to different Kakwani indices. If $h \neq 1$, also the average tax rate will be different. The redistributive content of fiscal drag due to inflation therefore contains an average tax rate effect and a Kakwani effect.

d2) With regard to the real fiscal drag, instead, the redistributive effect is measured as follows:

[14]

$$\Delta RE_{DFI} = \left(\tau_{hT95}\Pi_{hT95}^{Y00/h}\right) - \left(\tau_{gT95}\Pi_{gT95}^{Y00/g}\right)$$

Again, let us consider the definition of the Kakwani indices:

[14.1]

$$\Pi_{hT95} = C_{hT95}^{Y00/h} - G_{Y00/h}$$
$$\Pi_{gT95} = C_{gT95}^{Y00/g} - G_{Y00/g}$$

From expression [14.1] it is easily noted that the Gini indices of the initial income distribution are the same, as both distributions are obtained by scaling the original one by either a factor *h* or a factor *g*. However, the concentration indices of tax is different, unless $h=g$. The Kakwani indices will therefore be different. If $h \neq g$, the average tax rate will also be different. As in the previous case, the redistributive content of the real fiscal drag effect is therefore a mixture of average tax rate and Kakwani effect.

e) Finally, the tax law effect may be quantified as follows:

[15]

$$\Delta RE_{L} = \left(\tau_{T00}\Pi_{T00}^{Y00}\right) - \left(\tau_{T95}\Pi_{T95}^{Y00}\right)$$

with the two Kakwani indices defined by :

[16]

$$\Pi_{T00} = C_{T00}^{Y00} - G_{Y00}$$
$$\Pi_{T95} = C_{T95}^{Y00} - G_{Y00}$$

The Gini indices of [16] are obviously the same, as they are based on the same income distribution (Y_{00}). However, it is likely that T_{95} and T_{00} are distributed in different ways. This implies a difference of the Kakwani indices. It is worth noting that in this case, however, the difference between the two Kakwani indices is entirely due to differences in tax structures and not to modifications of the underlying distributions. Furthermore, if the two tax structures are not revenue-neutral, the average tax rate will also be different.

Equipped with this methodological issues, one can now turn to examine the results of the analysis.

4. Adjustments of the personal income tax, 1995-2000.

Table 1 reports the main adjustments of the personal income tax implemented between 1995 and 2000. The main point seems to be the reduction of the range of marginal tax rates. The top marginal tax rate has been lowered by 5.5 percentage points, while the bottom marginal tax rate has been increased by 8.5 percentage points. These adjustments, and many others reported in table 1, have in fact emerged in 1998. While the reduction of the top marginal tax rate has an immediate interpretation in terms of the need to reduce the distortionary effects of taxes, the increase of the bottom marginal tax rate has been implemented mainly to compensate (for earned incomes) the abolition of health contributions. This increase, however, has been in turn compensated by the increase of tax credits in the lowest part of the income distribution. Comparing the two systems one can note that all main tax credits (dependent spouse, dependent children, earned incomes, etc.) have been significantly increased. On the other hand, the measure of the remaining tax credits has been reduced from 22 per cent to 19 per cent of the original expenditure (interest expenses, insurance premiums, etc.).

Other studies (Gastaldi and Liberati, 2004), using a constant population methodology, find ambiguous social welfare outcomes in comparing the tax structures of 1995 and 2000. In particular, even though the tax structure of 2000 seems to have changed tax credits in the right direction for a social welfare improvement, the new set of income brackets and marginal tax rates appears to neutralise this positive effect. As a consequence, less detailed tax credits and a better structure of income brackets – as in 1995 – could have produced a social welfare improvement. More recently, Emiliani *et al.* (2004) argue that the redistributive power of the tax structure of year 2000 is higher just because of a higher average tax rate τ and not because of a more disproportional distribution of tax liabilities.

From an empirical point of view, therefore, there is no definite answer about the ranking of these two tax structures in social welfare terms. It is worth recalling, however, that the previous studies have dealt with this issue leaving the underlying income distribution unchanged (either 1995 or 2000). Using the methodology developed by OECD (1987), instead, requires to include into the analysis the income distribution of both years, 1995 and 2000. It is only in this way that the previous decomposition can be applied.

To this purpose, the following results are derived by the use of two different micro-simulation models, one built on the income distribution prevailing in 1995 (AWARETAX) and one built on the income distribution prevailing in 2000. This overcomes the shortcoming of leaving population unchanged. On the other hand, results are shown in terms of redistributive indices without going through an overall welfare analysis.

5. The results of the decomposition.

5.1. Changes in tax revenue.

Table 2 reports the outcome of the decomposition of tax revenue changes. First of all, it is worth noting that from 1995 to 2000, the estimated tax revenue change is about 30 billions of euros. Some points are worth noting:

a) the decomposition reveals that the greatest contribution to this change is due to the increase of average income (slightly more than ½ of the total change). It is particularly important that a decomposition by quartiles reveals that about 60 per cent of the additional tax revenue is collected from the last quartile, even though the initial income share of this quartile is slightly above 47 per cent. This implies that other quartiles must have paid as a share of taxes less than their share of income. Table 3 illustrates that the additional average tax burden is indeed progressive across quartiles (from 1.3 per cent for the first quartile to 4.3 per cent of the last quartile).

b) quite surprisingly, because of the negative impression attached to it, a significant part (about 24 per cent) of the additional tax revenue comes from the effect of inflation (about 7 billions of euros). In terms of additional average tax burden, the additional tax revenue represents 1.7 per cent of initial income for the first quartile and 1.3 per cent of the initial income for the last quartile (table 3). Overall, the path of the average tax burden seems slightly regressive across quartiles. It means that, in the absence of tax indexation provisions, inflation would hit more low-income households. A similar effect, at a reduced scale, is caused by the real fiscal drag; in this case, the second quartile is particularly burdened (1.5 per cent of the initial income);

c) the effect of tax legislation is to reduce tax revenue, by about 4.7 billions of euros. It means that external factors have driven the increase of tax revenue at the same time the policy choice was to reduce it. Particularly important is the comparison between this effect and the additional tax revenue caused by inflation. If T_{00} were a perfect indexation of T_{95} (and nothing else), the reduction of tax revenue should have been of the same size (and with opposite sign (– 13.84)) of the inflation effect. The difference between the two means that T_{00}, in reducing taxes, has not been sufficient to recover the additional tax revenue due to inflationary fiscal drag. Changing the income tax, therefore, has been less effective than perfectly indexing it. However, as a partial dismissal of this critique, one can observe that the tax reduction due to tax law overcompensates the additional tax revenue due to inflation for the first two quartiles, while it is insufficient to compensate households above the median. It can be easily noted from table 3 that the tax reduction due to tax law has a progressive structure, as it reduces more, in percentage of the initial income, for very low-income households. In any case, it must be underlined that the tax reduction occurred between 1995 and 2000 is just a fraction of the additional tax revenue extracted by inflation;

d) the positive contribution of the income distribution effect implies that T_{95} would have been more effective if applied to the income distribution of year 2000. This is partly due to the fact that Y_{00} is more unequal than Y_{95} (the Gini of the former is 0.389, while the Gini of the latter is 0.373). This greater inequality stems from a greater amount of income concentrated in the last quartile in 2000 compared with 1995. As a consequence, about 68 per cent of the additional tax revenue due to the income distribution effect is collected from households above the median income level. However, as shown by the quartile analysis, the additional tax burden has not a definite progressive or regressive path, even though the last quartile is less burdened (0.6 per cent of the initial income);

e) finally, the additional tax revenue due to the changing number of taxpayers is about ten per cent of the total change and appears progressively distributed across quartiles.

5.2. Redistributive effects.

Let us now move to the conversion of the tax revenue decomposition into a redistributive decomposition. Table 4 illustrates. First of all, one can note that the redistributive power of taxation, as measured by Gini indices, has increased from 0.0305 (T_{95} on Y_{95}) to 0.0391 (T_{00} on Y_{00}). The difference to be explained is therefore equal to 0.0086, which is about 2.3 per cent of the initial Gini index.

Decomposing this difference according to the methodology described in Section 3, one can note that the most important contribution come from the average income effect and the income distribution effect. Each of them has a quantitative effect that is almost equivalent to the total redistributive change. In the first case (average income effect), the positive contribution emerges exclusively from a higher average tax rate (0.236 against 0.187). The Kakwani index is indeed unchanged, as the concentration index of the two tax distributions involved in the measurement of this effect is the same, as one distribution is just a scalar version of the other one. Also, the Gini index of the initial income distribution (Y_{95}) is the same.

In the second case (income distribution effect), the positive contribution emerges from the combination of two opposite forces. The first is the higher average tax rate (0.273 against 0.236). This is due to the fact that the same tax structure (T_{95}) generates more tax revenue if applied to the income distribution of year 2000 even after correcting proportionally for the growth rate g. The second force works in the opposite direction, as the Kakwani index is lower when T_{95} is applied to the scaled income distribution of year 2000, i.e. less disproportional. In turn, this is not due to the concentration of taxes, which is higher (0.577 against 0.565 – not reported in the table), but to a higher Gini index of the income distribution obtained by scaling Y_{00} by g. This means that a lower Kakwani is entirely an effect of more inequality in the income distribution of year 2000, which makes the same tax structure (T_{95}) less disproportional. However, this force is not sufficient to compensate for the higher average tax rate, so that the total redistributive change is positive. However, the combination of the two forces implies that higher taxes fall more on the lowest part of the income distribution, if one has to have a less disproportional distribution. Indeed, if one looks at the distribution of tax revenue by quartiles in the income distribution effect, it is easily realised that higher additional average tax burden are extracted from lowest quartiles.

Particularly important is the redistributive power of fiscal drag. In both cases (real and inflationary), their contribution is negative. With regard to the inflationary fiscal drag, by scaling Y_{00} by h, one would have a more disproportional Kakwani index and a higher average tax rate. In turn, the effect on the Kakwani index is now entirely driven by the concentration of tax (0.566 against 0.551 – not reported in the table), as the Gini of the reference income distribution is the same. A higher concentration means, in this case, that T_{95} is more concentrated on high incomes when applied to the income distribution of real incomes (scaled by *h*). The effect of inflation is therefore that of reducing the disproportionality of the income tax (0.163 against 0.177) as well as the average tax rate (0.248 against 0.263). An analogous line of reasoning holds for the real fiscal drag. Quantitatively, the two effects contributes negatively for about 0.01 points (0.0062+0.0040), with a regressive additional tax burden across quartiles particularly pronounced in the case of inflationary fiscal drag.

Finally, the tax law effect shows a positive contribution of 0.0023 points, just more than ¼ of the total redistributive change. Its positive contribution is mainly due to the Kakwani index (0.182 against 0.163), which denotes that the tax structure of year 2000 (T_{00}) is more disproportional than T_{95} when applied to the same income distribution (Y_{00}). As the initial income distribution is the same, the change of the Kakwani index is entirely driven by a change of the concentration index of the tax, which is higher for T_{00} (0.570 against 0.551 – not reported in the table). The fact that taxes have been reduced is also denoted by a lower average tax rate (0.235 against 0.248). This reduction, however, weights less than the increase in the Kakwani index in determining the total redistributive change associated to changes in tax law.

With regard to changes in tax law, however, it is particularly worth noting that its positive contribution in redistributive terms is much lower than the negative contribution due to inflationary fiscal drag. This means that the adjustments made in year 2000 are not even sufficient to recover the negative effect of inflation. A perfect indexation of T_{95} might have produced a better result in redistributive terms than that produced by T_{00}. Therefore, even though the tax revenue change due to legislative changes is negative (less taxes are paid in year 2000 compared with what one would have paid applying T_{95} at the same income distribution), the redistributive effect is only a fraction of what is lost on the fiscal drag side. This implies that the negative effect of fiscal drag is not fully recovered at low income levels.

6. Conclusions.

This paper has highlighted that a change in the redistributive power of the personal income tax may be significantly driven by factors external to the tax structure. The comparison between 1995 and 2000 shows that not negligible increases in tax revenue may be obtained in the presence of legislative changes pushing taxes downward. On the other hand, one can state that pushing taxes downward is necessary in order to compensate for the natural increase of tax revenue due to external factors. Whatever the direction of causality might be, it is particularly interesting that even in periods of low inflation, lack of indexation of the personal income taxes may end up in heavy additional tax burdens. About ¼ of the additional tax revenue in the period, indeed, may be imputed to the action of inflation. On the tax revenue side, neutrality to inflation would require that the alleged purpose of reducing taxes be at least equivalent, in absolute terms, to the increase in taxes generated by inflation. The paper shows that this is not the case if one considers the time interval between 1995 and 2000. The tax reduction embodied in the tax structure prevailing in year 2000 is indeed less than the tax increase embodied in the inflationary dynamic. On the redistributive side, inflation is thought to be more harmful at low income levels, where nominal increases may cause incomes to end up under increasing marginal tax rates. This is what the paper actually show, by recording a negative redistributive effect of inflation which is about 70 per cent of the size of the total redistributive change. More important is the fact that legislative changes are not able to compensate this negative effect on the redistributive side. Their effect is indeed progressive, but less than required to neutralise the adverse impact of inflation. If the total redistributive change between 1995 and 2000 is positive is therefore due to factors that are not directly linked with the tax structure. This marks an important step in the study of the redistributive effects of the personal income tax, as it show how meaningless might be the comparisons of redistributive effects of the personal income tax over time in a given country or across countries when the underlying income distribution changes, i.e. if one does not take into account which part of these effects is exogenous to the tax structure. Confining ourselves at the total redistributive change, one would have concluded that T_{00} is more redistributive than T_{95}. The analysis has allowed us to shed some light on the fact that the contribution of the tax structure is just ¼ of that total change and it does not even recover the perverse effect of inflation, quite a completely different picture of the effects of the personal income tax in Italy.

References.

Baldini M., Bosi P. (2002), "La riforma dell'imposta sul reddito: aspetti di equità ed efficienza" *Politica Economica,* 3, 303-340.

De Vincenti C., Paladini R., Pollastri C. (2004), "For a welfare oriented taxation reform in Italy", paper presented at the Conference *La Questione Tributaria in Italia*, Milano.

Declich C., Polin V. (2004), "Individuo e famiglia: quale fisco?" paper presented at the Conference *La questione tributaria in Italia*, Milano.

Emiliani N., Gastaldi F., Pisauro G., Salvemini G. (2004), «Riduzione della spesa per interessi (1996-2003); chi ne ha beneficiato?», *Economia Pubblica*, 4, 45-85.

Gastaldi F., Liberati P. (2004), *Dall'Irpef all'IRE: modifiche strutturali dell'imposta personale negli ultimi dieci anni*, Working Paper SIEP n. 314, www.unipv.it/websiep/wp/314.pdf.

Lugaresi S. (1992), "L'impatto redistributivo dell'indicizzazione Irpef: una microsimulazione con ITAXMOD" in Bosi P., Lugaresi S. (a cura di), *Bilancio pubblico e redistribuzione,* Il Mulino Bologna.

Lugaresi S., Toso S. (1993), "Tassazione progressiva del reddito e correzione del fiscal drag: effetti reditributivi e di benessere sociale", *Politica Economica,* 9, 105-127.

Marenzi A. (1991), "Gli effetti redistributive dell'adozione del quoziente familiare per la tassazione dei redditi Irpef", *Politica Economica,* 7, 179-204.

Marenzi A. (1995), "Effetto verticale, equità orizzontale ed effetto di riordinamento: qual è il vero effetto redistributivo dell'Irpef?", *Politica Economica,* 11, 243-263.

Marino M.R., Rapallini C. (2003), "La composizione familiare dell'imposta sul reddito delle persone fisiche: un'analisi delgi effetti reditributivi ed alcune considerazioni sul benessere sociale", Temi di Discussione BdI 477.

Matteuzzi M., Toso S., (1996) "Una proposta di riforma dell'Irpef e dell'istituto dell'assegno al nucleo familiare ", in Fossati A. Giannini S. (a cura di) *I nuovi sistemi tributari*, Angeli Milano.

OCDE (1987), Une analyse empirique des variations de l'impôt sur le revenu des personnes physiques, Paris.

Reynolds M., Smolensky E. (1977), Public expenditures, Taxes and the Distribution of Income: the United States, 1950, 1961, 1970, Academic Press New York.

Russo V. (1981), "La progressività dell'Irpef nel 1975 e 1976", *Rivista di diritto finanziario e scienza delle finanze,* 40, 195-226.

Russo V. (1996), "Redistribuzione del reddito e progressività dell'Irpef " in Marzano F. (a cura di), *Differenziali e rendite nella distribuzione funzionale del reddito,* La Sapienza editrice Roma.

Sartor N.(1987), "L'evoluzione dell'Irpef negli anni 80:un'analisi strutturale", *Rivista di diritto finanziario e scienza delle finanze,* 46 , 595-619.

Stroffolini F. (1992), "Welfare effects of tax progressivity: a normative analysis of some tax reforms in Italy" in Galeotti G., Marrelli M., (eds.), *Design and Reform of Taxation Policy,* Kluwer Academic, London.

Tutino S. (1985), *La questione Irpef* , Ispe Quaderni n.32-33, Ispe Roma.

Visco V. (1984), "Disfunzioni ed iniquità dell'Irpef e possibili alternative: un'analisi del funzionamento dell'imposta sul reddito in Italia nel periodo 1977-83", in Gerelli E., Valiani R. (a cura di), *La crisi dell'imposizione progressiva sul reddito,* Franco Angeli, Milano.

Table 1 – The main adjustments of the personal income tax 1995-2000.

	1995	2000
Top marginal tax rate (%)	51	45.5 (3)
Bottom marginal tax rate	10	18.5 (3)
Intermediate tax rate	22 - 27 - 34 - 41 - 46	25.5 - 33.5 - 39.5
max tax credit for earned income	375.5 (1)	903.8 (4)
Max tax credit for pensioners	0.0	98.13 / 222.08
Max tax credits for dependent children	45.2 (2)	210.7 (5)
Max tax credit for dependent spouse	422.5	546.2 (6)
Insurance premiums limit	1,291.1	1,291.1
Interest expenses limit	3,615.2	3,615.2
Base deduction	NO	NO

Notes:
(1) It does not consider the additional tax credit for earned incomes
(2) In case of other children, the amount must be multiplied by the number of children
(3) Excluding the regional surtax
(4) For incomes up to 4,700 euros
(5) 334.7 euros for children up to 3 years
(6) Decreasing with income

Source: Authors' calculations

Table 2 – Decomposition of changes in tax revenue.

	(millions of euros)
Tax revenue 1995 (*on the 1995 income distribution*) [T95(Y95)]	**77,334**
Tax revenue 2000 *(on the 2000 income distribution)* T00(Y00)	**107,953**
Tax revenue change	**30,618**
of which:	
number of taxpayers effect	2,936
average income effect	16,602
income distribution effect	4,043
real fiscal drag effect	4,601
inflationary fiscal drag effect	7,163
tax law effect	-4,726
Note:	
Number of taxpayers in 1995	36,452,716
Number of taxpayers in 2000	37,836,428
Average income in 1995	11,747,727
Average income in 2000	14,177,452
k (*number of taxpayers 2000 over number of taxpayers 1995*)	1.04
g (*average income 2000 over average income 1995*)	1.21
h *(Inflation rate*)	1.12

Source: Authors' calculations on microsimulation models

Table 3 – Distribution of changes in tax revenue, *by quartiles of equivalent household income.*

Effect	Change in tax revenue (millions of euros)	% of change in tax revenue (within quartiles)	Change in average tax rate (percentage points)
Number of taxpayers			
1st quartile	98	3.3	0.2
2nd quartile	372	12.7	0.4
3rd quartile	708	24.1	0.5
4th quartile	1,758	59.9	0.8
	2,936	100.0	**0.6**
Average income			
1st quartile	552	3.3	1.3
2nd quartile	2,106	12.7	2.4
3rd quartile	4,001	24.1	3.1
4th quartile	9,942	59.9	4.3
	16,602	100.0	**3.4**
Income distribution			
1st quartile	483	12.0	1.1
2nd quartile	798	19.7	0.9
3rd quartile	1,278	31.6	1.0
4th quartile	1,484	36.7	0.6
	4,044	100.0	**0.8**
Real fiscal drag			
1st quartile	371	8.1	0.9
2nd quartile	1,273	27.7	1.5
3rd quartile	1,062	23.1	0.8
4th quartile	1,896	41.2	0.8
	4,601	100.0	**0.9**
Inflationary fiscal drag			
1st quartile	724	10.1	1.7
2nd quartile	1,522	21.3	1.8
3rd quartile	1,962	27.4	1.5
4th quartile	2,955	41.3	1.3
	7,163	100.0	**1.5**
Tax law			
1st quartile	-802	17.0	-1.9
2nd quartile	-1,631	34.5	-1.9
3rd quartile	-1,187	25.1	-0.9
4th quartile	-1,106	23.4	-0.5
	-4,726	100.0	**-1.0**
Income in 1995		*%*	
1st quartile		8.8	
2nd quartile		17.7	
3rd quartile		26.2	
4th quartile		47.3	

Source: Authors' elaborations on microsimulation models

Table 4 – Decomposition of the redistributive effect.

Decomposition of the redistributive effect	Gini index	Income distribution	Average tax rate index	Kakwani index	Reranking
Total effect					
G(Y95)	0.3731				
G(Y00)	0.3886				
G(Y95-T95)	0.3425	T95(Y95)	0.180	0.192	-0.0040
G(Y00-T00)	0.3495	T00(Y00)	0.235	0.182	-0.0036
G(Y95)-G(Y95-T95)	0.0305				
G(Y00)-G(Y00-T00)	0.0391				
[G(Y00)-G(Y00-T00)]-[G(Y95)-G(Y95-T95)]	**0.0086**				
1 Number of taxpayers					
G(Y95)	0.3731				
G(Y95-kT95)	0.3412				
G(Y95-T95)	0.3430	kT95(Y95)	0.187	0.192	-0.0041
G(Y95)-G(Y95-kT95)	0.0319	T95(Y95)	0.180	0.192	-0.0040
G(Y95)-G(Y95-T95)	0.0301				
[G(Y95)-G(Y95-kT95)]-[G(Y95)-G(Y95-T95)]	**0.0018**				
2 Average income					
G(Y95)	0.3731				
G(Y95-kgT95)	0.3334				
G(Y95-kT95)	0.3412	gkT95(Y95)	0.236	0.192	-0.0056
G(Y95)-G(Y95-kgT95)	0.0397	kT95(Y95)	0.187	0.192	-0.0041
G(Y95)-G(Y95-kT95)	0.0319				
[G(Y95)-G(Y95-gkT95)]-[G(Y95)-G(Y95-kT95)]	**0.0078**				
3 Income distribution					
G(Y00/g)	0.3890				
G(Y00/g-gT95)	0.3420				
G(Y95)	0.3731	gT95(Y00/g)	0.273	0.188	-0.0043
G(Y95-gkT95)	0.3330	gkT95(Y95)	0.236	0.192	-0.0056
G(Y00/g)-G(Y00/g-gT95)	0.0470				
G(Y95)-G(Y95-gkT95)	0.0401				
[G(Y00/g)-G(Y00/g-gT95)]-[G(Y95)-G(Y95-gkT95)]	**0.0069**				
4 Real fiscal drag					
G(Y00/h)	0.3890				
G(Y00/h-hT95)	0.3460				
G(Y00/g)	0.3890	hT95(Y00/h)	0.263	0.177	-0.0037
G(Y00/g-gT95)	0.3420	gT95(Y00/h)	0.273	0.188	-0.0043
G(Y00/h)-G(Y00/h-hT95)	0.0430				
G(Y00/g)-G(Y00/g-gT95)	0.0470				
[G(Y00/h)-G(Y00/h-hT95)]-[G(Y00/g)-G(Y00/g-gT95)]	**-0.0040**				
5 Inflationary fiscal drag					
G(Y00)	0.3886				
G(Y00-T95)	0.3518				
G(Y00/h)	0.3890	T95(Y00)	0.248	0.163	-0.0035
G(Y00/h-hT95)	0.3460	hT95(Y00/h)	0.263	0.177	-0.0037
G(Y00)-G(Y00-T95)	0.0368				
G(Y00/h)-G(Y00/h-hT95)	0.0430				
[G(Y00)-G(Y00-T95)]-[G(Y00/h)-G(Y00/h-hT95)]	**-0.0062**				
6 Tax law					
G(Y00)	0.3886				
G(Y00-T00)	0.3495				
G(Y00)	0.3886	T00(Y00)	0.235	0.182	-0.0036
G(Y00-T95)	0.3518	T95(Y00)	0.248	0.163	-0.0035
G(Y00)-G(Y00-T00)	0.0391				
G(Y00)-G(Y00-T95)	0.0368				
[G(Y00)-G(Y00-T00)]-[G(Y00)-G(Y00-T95)]	**0.0023**				

Note: For symbols, see text
Source: Authors' calculations on microsimulation models