

# **Reported Taxable Income and Marginal Tax Rates: Evidence for Spain Based on the Fiscal Drag**

Jorge Onrubia-Fernández  
&  
José Félix Sanz-Sanz

July 2009

Research Paper Number 1075

ISSN: 0819-2642

ISBN: 978 0 7340 4039 8

# Reported Taxable Income and Marginal Tax Rates: Evidence for Spain Based on the Fiscal Drag\*

Jorge Onrubia-Fernández and José Félix Sanz-Sanz†

*Universidad Complutense de Madrid, Spain*

## Abstract

This paper quantifies the *taxable income-marginal tax rate* elasticities associated with Spanish Personal Income Tax. To that effect, according to Saez (2003), the fiscal drag between 1993 and 1994 was used as an instrument to identify the changes in the taxable income induced by changes in the marginal tax rates. The paper comes to the conclusion that income level, marital status and the tax declaration framework for married couples are determining factors of the fiscal response to changes in the marginal tax rates. Likewise, irregular income significantly increases the responses of taxpayers. The obtained elasticities suggest the existence of efficiency costs higher than those obtained by the traditional literature based exclusively on earned income.

**JEL codes:** H2, H3

**Key words:** Personal income tax, taxable income elasticity, excess burden, fiscal drag.

\* An earlier version of this paper was presented at the 16<sup>th</sup> Spanish Meeting on Public Economics, held in Granada on February 5-6, 2009. We gratefully acknowledge the comments and suggestions received from the participants at the above-mentioned meeting. Financial support received from *Fundación de las Cajas de Ahorros* (FUNCAS) is acknowledged. The funding from the Spanish Ministry of Science and Innovation through grant SEJ2006-04444 and from Universidad Complutense through Research Group grant 940392 are also gratefully acknowledged. This paper was finished during a research leave enjoyed by Jose Felix Sanz-Sanz at the Department of Economics with Professor John Creedy in Melbourne University. The provision of facilities by the Department of Economics at Melbourne University during this research period is greatly acknowledged. Jose Felix Sanz-Sanz appreciates the funding from the Spanish Ministry of Science and Innovation through its program for promoting mobility among senior researchers.

† Corresponding author: *Department of Applied Economics (VI). Facultad de Ciencias Económicas y Empresariales, Universidad Complutense de Madrid (Campus de Somosaguas). 28223 - Pozuelo de Alarcón; Madrid.*

e-mail: [jfeliz@ccee.ucm.es](mailto:jfeliz@ccee.ucm.es) and [jsanz@unimelb.edu.au](mailto:jsanz@unimelb.edu.au)

## 1. Introduction

Traditionally, taxpayers' reaction to changes in the tax rates on personal income has been evaluated by analysing exclusively the labour supply. This type of analysis has focused on the changes affecting earnings, restricting the study of the distorting effects of Personal Income Taxation (PIT) to only two dimensions of the labour market: the decision on labour participation and the number of hours worked.

The widespread use of this approach is justified for several reasons. First, earnings make up the largest part of the taxable base of the PIT. In most countries earned income makes up for 75% of total declared income<sup>1</sup>. Second, economic theory on labour supply is much more developed than for other types of taxpayer behaviour, such as the role as savers, investors or business entrepreneurs. Lastly, it should be noted that most of current data sets available for empirical analysis are much richer in terms of wage income information -i.e. number of hours worked, labour participation, multiple job-holding, etc.- than for any other type of income from economic activities undertaken by taxpayers.

However, and as pointed out by Feldstein (1995, 2008), such an approach based solely on earned income is limited and incomplete. It is limited because the analysis of the labour supply, restricted to labour participation and number of hours worked, does not include other aspects that are very relevant. Among these aspects it is worth mentioning the effort put into performance at work, the search for fiscally beneficial compensatory alternatives or access to more satisfactory and fiscally innocuous work conditions (better offices, access to support personnel, business expenses, and other perks associated with work status). It is limited because it does not include the influence the tax changes exert on other aspects of the taxpayers' behaviour such as their decisions in terms of savings, investment, acceptance of corporate risk, or even their predisposition to elude or to evade this tax (Slemrod, 2001).

To overcome these shortcomings, Feldstein (1995) proposes an alternative methodology that captures the impact of the elements overlooked by the traditional approach. His alternative approach consists of quantifying the response of the taxable income to changes in the marginal rates. As demonstrated by Feldstein (1995, 1999a) and Saez (2003), this response is identified with the compensated elasticity of all sources of income with respect to marginal rates and would also include the effects of tax avoidance and evasion. This means that with the calculation of this *taxable income-marginal tax rate* elasticity it is possible to quantify the total excess burdens caused by PIT.

To be able to estimate these elasticities, it is necessary to identify the change in marginal tax rates between two moments in time, in order to observe the induced change in taxable income. However, it must be emphasised that even though the literature usually refers to these elasticities as responses of taxable income to changes in marginal tax rates, in reality what is calculated is the elasticity of taxable income with respect to the complementary notion of the marginal tax rate:  $1-tmg$ . This transformation must be taken into account when comparing the obtained elasticities with the values derived from the estimates using conventional labour supply models,

---

<sup>1</sup> See OECD (2005, 2006).

in which the tax changes are usually gathered through the marginal tax rates themselves.

To identify the variability of marginal tax rates, Feldstein (1995) resorts to explicit tax reforms, such as the one occurred in the United States in 1986, whereas Saez (2003) uses fiscal drag as an implicit tax reform. In our opinion, this second option presents two essential advantages as opposed to the one used by Feldstein. The first advantage is that fiscal drag causes changes solely in marginal tax rates, whereas a legal reform usually comprises a change “package” that affects not only the tax schedule but also other elements of the tax structure (rules for measuring the taxable base, reductions and exemptions, tax credits, etc.). This makes it difficult to accurately isolate the change in the marginal tax rate. Furthermore, in the case of explicit reforms it is possible that some taxpayers experience a change in their marginal tax rates as the result of a tax change but keeping their taxable income. The second advantage is that fiscal drag entails a tacit reform that affects the vast majority of taxpayers throughout the income distribution. This fact makes it easier to identify the taxpayers who were affected by the creep in marginal tax rates in each tax bracket.

Another difference between Feldstein’s and Saez’s works is the procedure used to calculate the elasticities. To estimate the implicit elasticities, Feldstein compares the changes in marginal tax rates and the taxable income between groups deemed homogeneous<sup>2</sup>. For his part, Saez uses the Wald difference-in-difference estimator, identifying the affected taxpayers in each bracket –treatment group- and the unaffected taxpayers –control group- by fiscal drag. In addition, Saez uses panel data whereas Feldstein uses a set of cross-section data for subsequent years.

With this research we aim to quantify the magnitude of these *taxable income-marginal tax rate* elasticities for the Spanish case by using the methodology proposed by Saez. These elasticities constitute a fundamental input for carrying out estimations of the efficiency costs associated with personal income tax. This calculation is carried out by levels of income bearing in mind three different categories of taxpayers: single, married couples with one income earner, and married couples with two income earners. To that effect, we use the microdata provided by the income tax panel data from Spain’s Institute of Fiscal Studies for the fiscal years 1993 and 1994. The selection of these years was determined for three reasons: the existence of relatively high inflation rates during this period, the fact that the tax code did not change during these two years, and the need to use a sample of a data source (pure panel), which is available in Spain for the period up to 1998. The results obtained will be compared to the results obtained by other research work applicable to the Spanish case.

This paper has the following structure: directly after this introduction, section two describes the impact of inflation on personal income tax structure. Section three introduces the relevant tax elements of the Spanish personal income tax used in the years covered by this paper and analyses the differences between the regular and irregular components of income, as well as its influence on the marginal tax rate. The theoretical framework followed while carrying out the empirical work is presented in

---

<sup>2</sup> Feldstein differentiates between three specific groups according to the three types of marginal tax rates introduced by the 1986 reform. Given the fact that the previous tax rate had seven brackets, each of these groups incorporated several brackets of the tax schedule for 1985. A homogeneous income concept was used for equivalence purposes between both years.

section four. The data and the simulation processes used are incorporated in section five. Section six presents the calculated elasticities, including a comparison with the elasticities obtained by other research work carried out on the Spanish personal income tax. Section seven concludes.

## 2. Inflation and personal income tax

The effect of inflation on the fiscal system is a topic that has been widely studied by economists. From amongst the research works that quantify this impact, Feldstein's (1999b) stands out. In this work it is shown that, in a group of five countries, inflation even at reduces rates of 1.5% or 2% exacerbated the tax distortions causing very significant economic efficiency costs.

Focusing on the personal income tax, the mechanism by which inflation distorts its structure is due to the fact that the tax schedule, allowances, deductions and tax credits are expressed in nominal terms. That is why without respective adaptive adjustments, inflation causes the real value of these tax parameters to erode, thus increasing the actual tax liability paid by the taxpayer. This effect is a cumulative phenomenon which increases over time exponentially according to the number of years without indexation or with incomplete indexation. As such, we can say without a doubt that fiscal drag is a tax reform that can be construed as an implicit tax reform whose most relevant feature is that it operates silently and in a much less transparent way<sup>3</sup>.

However, this type of tax change may lead to more severe impacts in terms of tax collection, distribution and assignation than the explicit reforms, which expressly and publicly introduce changes in standards. Good examples of the latter for the Spanish PIT can be found in Argimón and González-Páramo (1987), Sanz *et al.* (2004) and in Sanz y Romero (2007).

In order not to lose purchasing power, economic agents tend to use retrospective inflation and expected increases in future prices as a reference to seek monetary increases in the income they receive (Aaron, 1976). Even though all income is subject to this readjustment process, the most evident example is perhaps that of earned income, which is usually indexed by more or less automatic mechanisms incorporated in labour agreements. These increases in monetary values of taxable income, together with the progressivity and complexity of the personal income tax are at the origin of the increases in the tax burdens (Tanzi, 1980). The way in which the several elements of the tax structure can contribute to this phenomenon is the following:

- *Bracket creep*

The best known interaction is produced by the scale of marginal tax rates that are part of the graduated tax schedule. This phenomenon is known as "bracket creep"

---

<sup>3</sup> This opacity, no doubt, acts as an incentive for governments to face inflation as a profitable tax with reduced costs in terms of popularity. On the other hand, if we take into account that over 80% of the declared income in terms of personal income tax relates to wage income, the interaction between inflation and personal income tax becomes particularly damaging to employment income.

or “cold progressivity”, but this second term may include the interaction of other elements that affect the quantification of the taxable income. The increase of income in nominal terms entails a parallel increase in the taxable income, with the corresponding transfer of part of the taxable income to a higher marginal tax rate. Even if this transfer does not take place, the proportion of the taxable income that will be taxed by the highest marginal tax rate will increase which will lead to an increase in the actual tax liability.

- *Nominal increase in the taxable income*

“Bracket creep” is not the only effect of fiscal drag, and it may not even be the most important one. Before applying a progressive tax schedule the tax structure is subject to a set of rules that aim to quantify the taxable income. The rules operate at different levels.

- *Quantification of income*

Tax regulations set forth the necessary rules to quantify the different types of taxable income, setting forth the criteria applicable both to taxable income and to eligible deductions. These criteria may be sensitive to inflation. Thus, quantification of some types of deductible expenses is done through a preset amount or by applying a percentage of income to a maximum absolute cap. The non-indexation of the fixed amount or of these absolute limits as opposed to the nominal increase in income entails an immediate increase in the income included in the taxable income.

- *Quantification of tax relief and exemptions*

The same effect can be seen if the caps that affect certain exemptions or tax reliefs are not readjusted. From among the main tax reliefs affected by this effect we can highlight the contribution to Pension Plans which is limited by a maximum contributory amount, and tax relief from income received for personal work which is limited both in its maximum amount and in the amount of taxable work determining eligibility. It seems obvious that if these amounts are not readjusted they will lead to increases in the taxable income.

- *Minimum allowances*

The incorporation of minimum allowances in the tax structure, both personal and associated with family dependants, has the same problem as tax reliefs and exemptions regarding inflation. The failure to update these amounts represents an increase of the base rate levied by the tax. The setting of these minimum amounts according to personal circumstances such as age, handicap level, or according to family circumstances such as kinship, age of the dependant, etc., makes them very sensitive to inflation.

- *Tax credits*

The deductions that reduce the gross tax charge are also affected by inflation. If these tax credits are set as a fixed amount and they are not readjusted according to the increase in prices, it will lead to an increase in tax liability because tax credits were reduced in real terms.

For ad-valorem tax credits, in principle, an automatic indexation applies. This is due to the fact that the amounts of expenses or investments that are eligible for deduction are expected to compensate the increase in prices. However, the possible application of absolute limits that restrict the magnitude upon which the set percentage operates for a specific deduction (as is currently the case in Spain with the tax credit for the acquisition of main residences or contributions to retirement savings schemes) may lead to a reduction of the amount of the deduction in real terms, whenever the increase of the expenses or investments as a consequence of inflation is higher than the limit specified.

### **3. The PIT applicable during the years covered by this paper**

As mentioned at the outset, the fiscal years 1993 and 1994 were chosen for three reasons. Firstly, because both years show the highest inflation rates occurring while Act 18/1991 was in force. The absence of suitable indexation leads to an important fiscal drag, which ensures that a large number of taxpayers had significant changes in their marginal tax rates. Secondly, because in these two fiscal years there were no regulatory changes so the changes in marginal tax rates were due exclusively to the effects of fiscal drag. Lastly, the examination of the same taxable income over time requires the existence of panel data, such as the samples included in the panel data of personal income taxpayers for these years. Although this requirement is met by other microdata such as the *European Community Household Panel* survey (ECHP) or the *Living Conditions Survey* (LCS), the need to count on effectively declared fiscal magnitudes recommends the use of data based on tax returns.

To implement the empirical analysis, this paper relies on the data provided by the Spanish Institute of Fiscal Studies regarding PIT taxpayers. This panel includes a sub-sample of a pure panel that currently encompasses the period 1982-1998. We will specifically focus on the fiscal years 1993 and 1994. The tax code regulating the Spanish PIT in those years was Act 18/1991.

Since our goal is to quantify a series of elasticities, it is necessary to define with precision several income concepts in which the taxable income is the fundamental reference. Firstly, it is necessary to emphasise that the PIT, during the years analysed, included two types of taxable income: regular and irregular income. Irregular income included irregular income and capital gains. These two major income categories were subject to different tax schedules and tax rules, which led respectively to two different liabilities: the regular liability and the irregular liability, being the sum of both the total liability of the taxpayer.

Where regular income is concerned, it was mainly composed of the income from regular work, movable and immovable capital, as well as income from professional or business activities. Income generated over a period of two years and income earned in a notoriously irregular way were considered irregular incomes regardless of their sources<sup>4</sup>.

---

<sup>4</sup> The main irregular income from the source "personal work" was the one corresponding to the redemption of the Pension Schemes in the form of capital.

These irregular incomes, together with positive capital gains, were subject to an individual annualisation process, which consisted of dividing its magnitude by the number of years in which it was generated. The resulting ratios were included in the regular taxable base together with the rest of regular incomes mentioned before. By contrast, the remnants of this annualisation process, that is the remainder of the annualised part, directly constituted the irregular taxable base. The rare reductions recognised by law – deposits for pension plans and payment of pensions to spouses for separation or divorce – were applied exclusively to the regular taxable base, which gave rise to the regular taxable income.

The regular gross tax liability was obtained by applying the general tax schedule to the regular taxable income. We must bear in mind that Act 18/1991 introduced a double-tax schedule system: one for individual tax declarations and one for joint tax declaration for married couples. As for irregular income, this was taxed by a proportional tax rate, resulting from choosing the highest of the following alternatives: a) the average rate as a result of applying the general tax schedule to the regular taxable income; b) the average rate resulting from applying that same general tax schedule but only at 50% of the irregular taxable income.

According to this differential structure in the burden of regular and irregular income, we can identify two marginal rates that are relevant to our analysis. The first one is the marginal rate of the progressive tax schedule ( $tmg^{REG}$ ) applied to the last unit of the regular taxable income. The second one is the marginal rate resulting from taxing the irregular taxable income ( $tmg^{IRREG}$ ). This way we can define the weighted marginal tax rate ( $tmg^P$ ) as the weighted linear combination of the two previous marginal tax rates. Where the weights coincide with the relative participation of regular and irregular taxable incomes - $TI^{REG}$  and  $TI^{IRREG}$ - in the total taxable income subject to levy ( $TI$ ):

$$tmg^P = \frac{TI^{REG}}{TI} \cdot tmg^{REG} + \frac{TI^{IRREG}}{TI} \cdot tmg^{IRREG} \quad [1]$$

Once the regular and irregular components of the tax liability had been determined, the resulting total liability was reduced by a number of tax credits, which originated the final amount of tax due. It is important to mention that until 1998, the last year Act 18/1991 was in force, all non-income characteristics of the tax unit were treated as non-refundable tax credits<sup>5</sup>.

#### 4. Theoretical framework

The analysis of the taxpayers' behaviour to changes in the PIT by means of *taxable income-marginal tax rates* elasticities has been handled by different methodologies. The most used methodology, ever since Feldstein's seminal work (1995), has been the difference-in-difference estimator. This methodology is an

---

<sup>5</sup> Act 40/1998, in force between 1998 and 2002, as well as its partial reform by Act 46/2002, in force until 31 December 2006, transferred these personal and family treatments of the tax charge to the taxable base through the figure of minimum personal and family exemptions. The last tax law, Law 35/2006, in force since January 2007, has returned to the system of tax reduction in spite of the fictitious maintenance of the personal and family minimum concepts.



empirical method of observational assessment based on the theory of statistical causal inference. Its use is supported by the need to overcome problems related with the absence of counterfactual events, which is a common fact in the behavioural analysis of large and very heterogeneous populations.

The analysis of taxpayers' behavioural changes induced by changes in the PIT is a good example for the application of this technique. If we assume that there is a causal relationship between the marginal rate variation and the variation in taxable income, the use of statistical inference based on information on relevant variables before and after the studied phenomenon may offer robust results regarding the intensity of this relationship.

The application of this technique requires the separation of the observed samples in two different groups, the so-called "treatment group" and the "control group". The first group includes the taxpayers affected by the phenomenon that is the object of this analysis, while the second group includes the taxpayers which are not affected. Formally, this separation can be established by setting a dichotomous variable  $D$  that alternatively assumes value 1 for the "treatment" observations -in our case the taxpayers that experience an increase in their marginal tax rates because the fiscal drag was not corrected- and value 0 for the "control" observations -in this case, the taxpayers who were not affected by bracket creep-. Therefore, the treatment group (Tr) is characterised by having  $D=1$ , and the control group (C) by  $D=0$ .

Generally speaking, we defined  $Y_i(D, T)$  as the variable for the consequence of the phenomenon object of this analysis for observation  $i$ , where  $D$  differentiates, as we have seen, belonging to the observation of treatment or control group, and  $T$  reflects the time of observation,  $T=t$  if it is previous to the phenomenon,  $T=t+1$  if it is subsequent. Thus,  $Y_i(1, t)$  represents the value of the variable for an observation affected by the analysed event ( $D=1$ ) the moment before it takes place ( $T = t$ ), while  $Y_i(1, t+1)$  is the value of said variable for the same observation  $i$  after the event. For the observations that were not affected ( $D=0$ ),  $Y_i(0, t)$  e  $Y_i(0, t+1)$  are, respectively, the values before and after the analysed phenomenon.

The use of the difference-in-difference estimator compensates for the impossibility of obtaining information, for the same observation, about the consequences of the analysed phenomenon, both in the event that the phenomenon takes place and in the event that it does not:  $Y_i(1, t+1)$  e  $Y_i(0, t+1)$ . This limitation in terms of information is determining for the counterfactual problem inherent to the non-experimental nature of the analysed phenomena, which makes it impossible to assess the reaction to each of the observations to possible changes in the analysed events. Any analysis that does not take into consideration this problem of selection of information biases the assessment of the corresponding casual effect.

One question that is fundamental for the application of a method of causal inference based on the differentiation between treatment and control groups is the fixing of a criterion to define the location of the observation in one of the groups. In our analysis, the treatment group is made up of the taxpayers who bear a higher marginal rate as a consequence of fiscal drag, under the assumption that their incomes increase

strictly according to the inflation rate. The rest of the taxpayers are included in the control group.

The difference-in-difference estimator is an estimator of the average effect generated by the analysed phenomenon. To use it, first it is necessary to obtain, for the treatment group, the difference of average values of the variable for the consequence of the event in consecutive moments in time  $t$  y  $t+1$ :

$$\delta_{Tr} = E[Y_i(1,t+1) - Y_i(1,t)] = E[Y_i(t+1) - Y_i(t) | D = 1] \quad [2]$$

After that, we calculate the value of the average values difference of the variable before and after the phenomenon for the control group:

$$\delta_C = E[Y_i(0,t+1) - Y_i(0,t)] = E[Y_i(t+1) - Y_i(t) | D = 0] \quad [3]$$

The difference-in-difference estimator ( $\delta$ ) is obtained as a difference between the differences  $\delta_{Tr}$  and  $\delta_C$  obtained in [2] y [3]:

$$\delta = \delta_{Tr} - \delta_C = E[Y_i(t+1) - Y_i(t) | D = 1] - E[Y_i(t+1) - Y_i(t) | D = 0] \quad [4]$$

An interesting transformation of this estimator is the Wald estimator. The Wald estimator is a quotient in which the numerator and the denominator are both estimators of difference-in-difference. This estimator allows for causal response elasticities of the analysed variable  $Y_i(D,T)$  with respect to another variable  $S_i(D,T)$  that usually is connected with the occurrence of the analysed phenomenon. As such, the Wald estimator is formally defined as:

$$\eta_{Y,S} = \frac{E[Y_i(t+1) - Y_i(t) | D = 1] - E[Y_i(t+1) - Y_i(t) | D = 0]}{E[S_i(t+1) - S_i(t) | D = 1] - E[S_i(t+1) - S_i(t) | D = 0]} \quad [5]$$

To analyse the response of the taxable income to changes in the marginal tax rates caused by fiscal drag, Saez (2003) uses the following logarithmic transformation of the Wald estimator outlined in [5], with interesting properties in terms of the elasticity provided by:

$$\zeta_{Y,S} = \frac{E[\ln Y_i(t+1) - \ln Y_i(t) | D = 1] - E[\ln Y_i(t+1) - \ln Y_i(t) | D = 0]}{E[\ln S_i(t+1) - \ln S_i(t) | D = 1] - E[\ln S_i(t+1) - \ln S_i(t) | D = 0]} \quad [6]$$

This is the transformation we will use in our analysis.

## 5. Fiscal drag impact on marginal tax rates for Spanish Personal Income Tax

As mentioned above, the main goal of this paper is to quantify to what extent the taxable income declared by taxpayers reacts to changes in marginal tax rates. As explained in the previous section, the most common method used to calculate these *taxable income-marginal tax rates* elasticities is the use of a difference-in-difference estimator.

Once this choice has been made, the quantification of these elasticities requires identification of those observations that show the reaction of their declared taxable income to changes in marginal tax rates. To implement this empirical analysis the first step is to determine the type of changes in marginal tax rates that have to be taken into account in order to be able to assess their impact on taxable income. Given the nature of the exercise, it is necessary to consider exogenous and temporal changes in the marginal tax rates, so that they may be regarded as a phenomenon whose occurrence may lead to changes in taxpayers' behaviour.

Feldstein (1995) proposes identification of this phenomenon with the application of a specific tax reform, as was the application of the *Tax Reform Act* of 1986<sup>6</sup>. This reform, known as the "Reagan Reform" significantly reduced the brackets of tax rates, initially from 12 to 5 (in 1987) and then from 5 to 3 (from 1988 onwards), reducing at the same time the maximum marginal tax rate from 50% to 28% while increasing the minimum marginal tax rate from 11% to 15%. As pointed out by Feldstein (1995), this reform represents a natural experiment that is very useful to study the degree of reaction of the taxpayers to significant tax changes.

Upon detailed revision of the main studies carried out in North-American tax reforms between 1979 and 1993, Saez (2003) comes to the conclusion that the enormous variability that can be found in the estimated values is caused mainly by two factors: a) the reforms used, apart from changes in marginal tax rates, introduce other changes in the tax structure which makes it very complicated to compare taxable income before and after the reform in homogeneous terms; and b) the reforms used combine important changes in the marginal tax rates faced by high income taxpayers with almost no changes in marginal tax rates experienced by those taxpayers with average or low incomes, which makes the results sensitive to the distribution of income.

In view of these limitations, Saez (2003) suggests that the event used to identify the marginal tax rates variation should meet the following requirements: a) the adopted tax changes should only affect the marginal tax rates, without affecting the rest of the elements of the personal income tax structure; and b) the changes in marginal tax rates can be associated with comparable taxpayers' groups, both in terms of income and of socioeconomic features. With these conditions, Saez chooses an attractive alternative as a source of variation for marginal tax rates: bracket creep due to fiscal drag when tax parameters are not suitably adjusted for inflation.

As explained in section 2, fiscal drag can be perceived as the result of an implicit reform, articulated through the different elements of its structure that are not properly adjusted to the increase in prices. Saez's (2003) proposal isolates the bracket creep effect that inflation has on the progressive schedule when the bracket limits are not adapted according to the change registered in the price index. This causes an inevitable increase in the effective marginal tax rates faced by a relevant number of taxpayers. This would imply the use of an implicit or silent tax reform instead of an explicit reform. With this alternative, which is the one we use in this research, we can

---

<sup>6</sup> Previously, Lindsey (1987) had already considered the -tax cuts in personal income tax in the US in 1981 to assess the reaction of the taxable income (reduction of brackets from 15 to 12, with a drop from 70% to 50% in the top marginal tax rate and from 14% to 12% in the bottom tax rate).

identify in a precise manner the changes experienced by the marginal tax rates as a consequence of non-indexation of tax.

To use this approach a suitable timeframe has to be chosen, and entails at least two considerations: a) a period in which the tax codes did not change; and b) that the inflation level in that period is high enough to induce enough bracket creeps that lead to a significant and statistically robust number of treatment observations. In Spain, both conditions can clearly be found between 1992 and 1994. Act 18/1991 regarding personal income tax entered into force in 1992. This Act reformed the PIT in its entirety<sup>7</sup>. During the first three years Act 18/1991 was in force it remained practically unaltered, its progressive tax schedule was not corrected (one for individual taxation and the other one for joint taxation), and the reductions and eligible expenses needed to calculate taxable income did not suffer any changes. This occurred with annual inflation rates according to the consumer price index (CPI) at the following rates: 5.3% for 1992, 4.9% for 1993, and 4.3% for 1994.

### 5.1. The data

The Spanish Institute for Fiscal Studies provides a panel of microdata for tax returns for the period 1982-1998, i.e. including the time Act 18/1991 was in force. For reasons already stated, we specifically used the consecutive fiscal years 1993 and 1994 in our analysis. We dropped 1992 because, although it registered a higher CPI, it was also the first year Act 18/1991 was in force and this could distort our intended analysis<sup>8</sup>.

As mentioned above, the methodology used for empirical analysis requires the use of samples with a “pure panel” structure. In this particular case, the sample used initially included all taxpayers who declared PIT in 1993 and 1994, which was one of the conditions. However, in order to carry out a homogeneous and consistent analysis by taxpayers’ categories, the sample we finally used was limited to taxpayers’ whose type of declaration (joint, individual or separate) is the same in both fiscal years. As can be seen in Table 1, of a total of 270,093 viable tax returns, only 247,864 presented the same type of declaration in both years: 100,221 were single taxpayers, 58,838 were couples with separate tax assessment, and 88,805 couples with joint filing.<sup>9</sup>

According to the goals of this paper, it is necessary to annotate the concepts of income upon which we will define our elasticities: gross income and taxable income. When defining the gross income we tried to bring it as close as possible to the concept of economic rent. Since the information available does not allow us to include some of the concepts that are usually not considered as income by law, the adjustments made

---

<sup>7</sup> This new tax came into force after a four-year transitory period (from 1988 to 1991) as a consequence of the ruling of the Constitutional Court on 20 February 1989, decreeing that the mandatory joint taxation for spouses set forth in Act 44/1978 was unconstitutional.

<sup>8</sup> This reform entailed radical changes both in the tax structure and the definition of numerous taxable events, exemptions and tax reductions, as well as a new optional tax system for separate or joint filing for couples.

<sup>9</sup> The joint category also includes single parent family units. The information provided by the panel does not allow differentiation between the couples in this category.

were limited basically to retrieving some gross income (income without eligible expenses and some deductions)<sup>10</sup>.

**Table 1. Panel data of PIT tax returns (years 1993 and 1994)**

PIT 1993		PIT 1994		
Type	Singles	Married couples filing separately	Married couples filing jointly	Total
Singles	100,221	6,480	5,544	112,245
Married couples filing separately	3,825	58,838	1,061	63,724
Married couples filing jointly	4,774	545	88,805	94,124
Total	108,820	65,863	95,410	270,093

Source: Own calculations

Table 2 presents disaggregated information on the magnitudes of gross income and taxable income by type of taxpayer for the years 1993 and 1994. In both years the income of all taxpayers increased in nominal terms, with a surprising and noteworthy increase registered in irregular incomes (35.88%). Where the regular tax component is concerned, its increase is much more moderate (3.44%), and the taxable income increase is even lower (2.87%). The most modest increase registered by type of taxpayer was the case of the main earner in married couples filing separately. For the rest of declaration types the increase is similar. With respect to the groups analysed, married couples with a single breadwinner have, on average, a more reduced gross income (12,601 and 13,156 Euros). At the opposite end of the scale are married couples with two income earners (16,762 and 17,270 Euros), while single taxpayers are in the middle (14,650 and 15,279 Euros). We must emphasise that in the case of the group with the highest average income there is an important difference between the first and the second income earner. The first exhibits the highest average income of all taxpayers (21,811 y 22,330 Euros) while the second earners are the taxpayers with the lowest average income (11,712 and 12,209 Euros). This ranking can be seen both in total gross income and in its regular component. On the other hand, in the case of the irregular gross income, the lowest average value is that of married couples with only one income earner (93 and 136 Euros) as opposed to the income obtained by the second income earner in the case of separate tax filing (137 and 193 Euros), by single taxpayers (155 and 211 Euros), and by the first income earners in the case of separate tax assessment (266 and 321 Euros).

Tables A.1.1. to A.1.3 in Appendix 1 provide, for each taxpayer category, statistical information on the values of the various income components, grouped by source and by its regular or irregular nature. As could be expected, in this breakdown the relative weight carried by income from labour stands out: over  $\frac{3}{4}$  of the total income declared. Likewise, Appendix 1 includes disaggregated information about tax credits and deductions by type of taxpayer as well as the top, bottom and mean values for marginal and average tax rates.

<sup>10</sup> This way, the income resulting from personal work rendered, both in money and in kind, have been identified with total income. For equity, the income before tax has been defined as net income before applying any type of decrease or reduction, as is the case with "legal reduction" set forth by law. In the case of income from fixed capital, we have classified the income as from rented and non-rented housing. In the first case, these have been identified with the declared income, whereas the second has been identified with the total income. Where income from business and professional activities is concerned we have reflected them in declared income. In terms of net taxable income we used the definition set forth in the tax law both for the regular and the irregular components.

**Table 2. Gross Income and Taxable Income by Taxpayer type. IRPF 1993 and 1994**

Taxpayer type	Income concept	PIT 1993		PIT 1994		93-94 Change (%)
		Mean (euros)	CV	Mean (euros)	CV	
Singles	Total Gross Income	14,650.43	0.8654	15,278.52	1.0000	4.29
	Regular Gross Income	14,495.68	0.8556	15,067.04	0.8012	3.94
	Regular Taxable Income	12,810.42	0.8957	13,239.03	0.8364	3.35
	Irregular Taxable Income	154.75	13.3300	211.48	41.6000	36.66
Married Couples with only one income earner	Total Gross Income	12,601.04	0.9678	13,155.99	0.9181	4.40
	Regular Gross Income	12,508.22	0.9636	13,020.07	0.9003	4.09
	Regular Taxable Income	11,039.59	1.0280	11,417.99	0.9597	3.43
	Irregular Taxable Income	92.82	14.6300	135.92	16.8700	46.44
Main breadwinner in married couples filing separately	Total Gross Income	21,811.57	1.5730	22,330.08	1.4560	2.38
	Regular Gross Income	21,546.00	1.5760	22,009.18	1.4560	2.15
	Regular Taxable Income	19,279.16	1.7300	19,603.70	1.5990	1.68
	Irregular Taxable Income	265.57	14.0200	320.90	13.2200	20.84
Second earner in married couples filing separately	Total Gross Income	11,711.99	0.8105	12,209.13	0.7917	4.24
	Regular Gross Income	11,575.23	0.8034	12,015.89	0.7414	3.81
	Regular Taxable Income	10,107.21	0.8416	10,470.56	0.7693	3.59
	Irregular Taxable Income	136.76	10.3500	193.24	15.6500	41.30
Total Taxpayers	Total Gross Income	14,343.03	1.1380	14,882.65	1.1270	3.76
	Regular Gross Income	14,200.08	1.1330	14,688.41	1.0490	3.44
	Regular Taxable Income	12,554.55	1.2250	12,915.45	1.1330	2.87
	Irregular Taxable Income	142.96	14.3000	194.25	30.9900	35.88

CV: Coefficient of variation  
Source: Own calculations

## 5.2. Changes in marginal tax rates in face of fiscal drag

To identify which taxpayers could have been affected by a change in marginal tax rates in 1993, as a consequence of fiscal drag, we used the inflation rate of 1994 ( $\pi_{1994}=4.3\%$ ) to index the various concepts of gross income and taxable income for each taxpayer in the fiscal year 1993. This way we obtained monetary values that in 1994 would be equivalent, in terms of real ability to pay, to the values obtained in 1993. Using these indexed values, we simulated tax liabilities using the tax code for 1994. Based on the results of this new settlement we distinguish between two groups of taxpayers according to whether the marginal tax rate has been altered or not in respect of the settlement reached in the 1993. In the first case, in which the marginal tax rate increases as a consequence of fiscal drag, the affected taxpayers are included in the so-called treatment group, whereas in the second case, when the marginal tax rates remain unaltered, the taxpayers are included in the control group. This differentiation between treatment and control group has been applied to the four types of taxpayers considered: single, married couples with joint tax declaration, and first and second income earners of married couples filing separately. In this last category, as the taxpayers have separate tax returns, each spouse has been analysed independently.

According to the personal income structure used in these years, the analysis was carried out using the two alternative concepts of marginal tax rate defined in section 3, regular marginal tax rate and weighted marginal tax rate. The first concept only considers the effects caused by fiscal drag on marginal tax rates levied on regular taxable income. The second concept also includes the effects of fiscal drag on irregular income. In the first case, the taxpayers were included in the treatment group if

$$tmg^{REG}(TI_{1993}^{REG}, \pi_{1994}) > tmg^{REG}(TI_{1993}^{REG}) \quad [7]$$

Whereas in the second case the taxpayers were included in the treatment group if:

$$tmg^P(TI_{1993}^{REG}, TI_{1993}^{IRREG}, \pi_{1994}) > tmg^P(TI_{1993}^{REG}, TI_{1993}^{IRREG}) \quad [8]$$

Conditions [7] and [8] have been applied to each taxpayer categories and to each income bracket in the 1993 tax schedule.

The results of this analysis, by types of taxpayers and for both types of marginal tax rates that we have just mentioned are presented in Tables 7 to 10. The analysis is carried out by the tax schedule bands corresponding to year 1993. Whether we used the weighted marginal tax rate or the regular marginal tax rate, there is a pattern for all types of taxpayers with regard to the proportion of observations identified as control and treatment. In view of this and apart from the last bracket, the proportion of taxpayers affected by changes in the marginal tax rates increases with the bracket and thus with the level of declared taxable income. This fact is explained by the combination of three factors: the bracket width, the inflation rate used for indexation and the distribution of taxable income within brackets. Specifically, the wider the bracket the fewer cases leading to marginal tax rate creep; the higher the inflation rate, the higher the number of affected taxpayers; and lastly, the higher the concentration of taxpayers in the upper limit of the bracket the higher the number of taxpayers who will experience an increase in the marginal tax rate. On the other hand, as may seem obvious, when the calculations are made based on the concept of regular marginal tax rate, the last bracket does not have any taxpayer in the “treatment” category, since it is not feasible to exceed the maximum marginal tax rate. However, when we use the weighted marginal tax rate, taxpayers in the top bracket may be categorized as “treatment” since in this case the tax levied on irregular income causes the top income taxpayers to face non-integer weighted marginal tax rates which are lower than the top marginal tax rate for regular income.

Tables 3 to 6 contain, for each category of taxpayer, information on taxable income and marginal tax rates grouped by 1993 tax schedule bands. Obviously, the average values for regular taxable incomes increase with the bracket. However, this does not necessarily need to be the case in 1994, since the inclusion of an observation in a specific bracket is conditioned by the 1993 regular income. It means, therefore, that in 1994 the bracket may include taxpayers whose taxable income for that year is not included, by excess or by default, in the limits of the bracket defined according to the 1993 income. In fact, this phenomenon, defined by Saez (2003) as *mean reverse*, is particularly intense in the first bracket for all categories of taxpayers considered (for example the single taxpayers in the first bracket, in Table 3, present an average regular taxable income for 1993 of 1,404 Euros, while this average for 1994 is 5,905 Euros, an amount that exceeds the 2,404.05 Euros limit of this bracket).

This phenomenon is caused by the panel methodology used and which is based on the longitudinal comparison of the same taxpayer over time. Given its relevance, we have deemed it opportune to thoroughly analyse the transition between brackets that is produced in the various taxpayers’ categories. This information on the frequency of transition is presented as a matrix, by type of taxpayer, in Tables A.2.1 to A.2.4 of Appendix 2.

**Table 3. Single Taxpayers. Taxable income and marginal tax rates (mean values by 1993 tax schedule brackets)**

Bracket	Tax Schedule 1993		Taxpayers		Taxable Income 1993		Taxable Income 1993 (prices of 1994)		Taxable Income 1994		Taxable Income 1994 (prices of 1993)		Marginal Tax Rate (%) (Weighted)			Marginal Tax Rate (%) (Regular)		
	Lower limit (€)	Marginal Tax Rate	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Ti 1993	Ti 1993 (prices 1994)	Ti 1994	Ti 1993	Ti 1993 (prices 1994)	Ti 1994
1	0.00	0.00	5,881	1,404.11	1,757.04	1,487.54	1,832.59	5,904.61	1,170.43	5,992.81	1,122.17	1.20	2.73	17.05	0.00	1.72	17.10	
2	2,404.05	20.00	12,967	4,678.76	537.44	4,884.19	560.55	6,641.38	89.62	6,618.27	85.93	19.90	20.15	20.36	20.00	20.25	20.39	
3	6,010.12	22.00	24,265	7,916.96	170.72	8,260.98	178.06	8,436.57	101.79	8,326.44	97.59	21.95	22.29	22.25	22.00	22.34	22.29	
4	9,435.89	24.50	20,490	11,138.44	315.95	11,621.18	329.53	11,327.06	132.16	11,129.55	126.71	24.45	24.83	24.48	24.50	24.88	24.52	
5	12,861.66	27.00	13,365	14,508.23	347.43	15,137.07	362.37	14,376.60	167.85	14,096.49	160.93	26.94	27.48	26.82	27.00	27.55	26.86	
6	16,287.43	30.00	8,463	17,935.33	311.69	18,711.30	325.10	17,684.00	252.14	17,313.49	241.74	29.94	30.36	29.35	30.00	30.42	29.40	
7	19,713.20	32.00	5,178	21,309.84	347.87	22,232.01	362.83	20,812.00	325.48	20,375.69	312.06	31.93	32.41	31.33	32.00	32.49	31.42	
8	23,138.97	34.00	3,084	24,760.58	460.75	25,831.54	480.56	23,963.76	338.44	23,464.73	324.49	33.89	34.48	33.24	34.00	34.59	33.32	
9	26,564.74	36.00	1,815	28,186.16	422.96	29,404.08	441.15	27,173.77	363.79	26,602.13	348.79	35.91	36.56	35.13	36.00	36.65	35.21	
10	29,990.50	38.00	1,204	31,625.08	411.41	32,994.42	429.10	30,233.34	565.40	29,616.19	542.09	37.91	38.62	36.87	38.00	38.72	36.99	
11	33,416.27	40.00	832	35,062.81	402.23	36,578.07	419.52	33,257.26	441.29	32,574.51	423.10	39.92	40.97	38.77	40.00	41.05	38.88	
12	36,842.04	42.50	605	38,468.90	1,036.51	40,139.31	1,081.08	36,596.79	505.05	35,830.29	484.23	42.33	43.47	40.97	42.50	43.63	41.10	
13	40,267.81	45.00	432	41,906.75	798.08	43,720.13	832.40	39,561.06	641.90	38,742.01	615.43	44.81	45.76	42.87	45.00	45.95	43.00	
14	43,693.58	47.00	320	45,330.41	1,204.43	47,293.43	1,256.22	43,253.33	890.25	42,338.88	853.55	46.76	47.81	44.87	47.00	48.05	45.07	
15	47,119.35	49.00	258	48,792.80	260.74	50,905.61	271.95	45,928.89	1,273.58	44,904.57	1,221.08	48.92	50.12	46.65	49.00	50.20	46.86	
16	50,545.12	51.00	196	52,311.47	365.77	54,576.64	381.49	47,149.48	553.05	46,114.18	530.25	50.89	52.55	47.02	51.00	52.66	47.13	
17	53,970.89	53.50	147	55,712.63	377.20	58,135.81	393.42	52,919.32	137.13	51,695.91	131.47	53.39	55.07	50.56	53.50	55.19	50.60	
18	57,396.66	56.00	719	111,610.83	2,770.17	116,458.31	2,889.29	95,362.12	1,659.55	93,096.85	1,591.14	55.81	55.81	51.61	56.00	56.00	51.77	

NOTE:  
Ti: Taxable income.  
Source: Own calculations

**Table 4. Married couples in joint taxation. Taxable income and marginal tax rates (mean values by 1993 tax schedule brackets)**

Bracket	Tax Schedule 1993		Taxpayers		Taxable Income 1993		Taxable Income 1993 (prices of 1994)		Taxable Income 1994		Taxable Income 1994 (prices of 1993)		Marginal Tax Rate (%) (Weighted)			Marginal Tax Rate (%) (Regular)		
	Lower limit (€)	Marginal Tax Rate	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Ti 1993	Ti 1993 (prices 1994)	Ti 1994	Ti 1993	Ti 1993 (prices 1994)	Ti 1994
1	0.00	0.00	17,010	3,442.53	546.54	3,599.44	570.04	5,533.84	141.25	5,458.26	135.42	0.19	2.33	9.43	0.00	2.14	9.47	
2	4,808.10	20.00	43,242	8,640.30	136.90	9,015.54	142.78	8,960.36	98.02	8,744.63	93.98	19.94	20.26	19.20	20.00	20.31	19.24	
3	12,020.24	24.50	11,486	13,861.76	131.24	14,461.94	136.89	13,880.88	159.79	13,526.50	153.20	24.45	24.87	23.92	24.50	24.92	23.98	
4	15,776.57	27.00	7,556	17,536.90	124.62	18,295.79	129.98	17,405.03	159.83	16,929.32	153.24	26.96	27.48	26.63	27.00	27.52	26.69	
5	19,532.89	30.00	3,770	21,230.94	561.85	22,150.30	586.01	20,777.11	211.09	20,223.08	202.39	29.92	30.33	29.01	30.00	30.41	29.10	
6	23,289.22	32.00	2,012	25,001.63	578.95	26,085.60	603.84	24,321.32	308.81	23,696.91	296.08	31.85	32.34	30.98	32.00	32.48	31.07	
7	27,045.54	34.00	1,142	28,815.64	655.22	30,062.90	683.40	27,618.06	998.22	26,943.99	957.07	33.91	34.53	32.90	34.00	34.63	33.02	
8	30,801.87	36.00	733	32,501.19	823.64	33,905.99	859.06	30,446.28	571.25	29,747.60	547.70	35.82	36.45	34.38	36.00	36.63	34.54	
9	34,558.20	38.00	458	36,306.72	430.83	37,873.50	449.36	33,152.33	412.39	32,323.93	395.39	37.87	38.60	35.86	38.00	38.73	35.98	
10	38,314.52	40.00	338	40,144.93	1,365.06	41,878.08	1,423.76	36,791.73	1,013.78	35,913.18	971.98	39.74	40.79	37.82	40.00	41.07	38.04	
11	42,070.85	42.50	219	43,898.98	271.18	45,792.89	282.84	40,271.18	663.82	39,331.00	636.45	42.42	43.64	39.60	42.50	43.73	39.78	
12	45,827.17	45.00	173	47,716.45	397.88	49,773.53	414.98	44,069.75	578.29	42,948.35	554.45	44.90	45.98	42.07	45.00	46.08	42.20	
13	49,583.50	47.00	122	51,349.36	964.41	53,564.43	1,005.88	47,269.82	680.12	46,153.85	652.08	46.74	47.82	43.32	47.00	48.08	43.49	
14	53,339.82	49.00	93	55,107.92	1,101.37	57,511.65	1,148.73	54,679.19	896.40	53,323.77	859.44	48.73	49.90	43.57	49.00	50.18	43.79	
15	57,096.15	51.00	63	59,170.54	251.56	61,904.25	262.38	58,370.23	821.30	56,912.95	787.44	50.93	52.68	47.07	51.00	52.76	47.28	
16	60,852.48	53.50	77	63,106.27	350.01	66,111.33	365.06	63,856.82	1,269.90	62,574.80	1,217.54	53.40	54.54	46.50	53.50	54.64	46.82	
17	66,111.33	56.00	311	185,712.74	832.36	193,525.90	868.16	131,020.64	1,847.24	127,414.57	1,771.08	55.89	55.89	50.39	56.00	56.00	50.57	

NOTE:  
Ti: Taxable income.  
Source: Own calculations

**Table 5. Main income earners of married couples in individual taxation. Taxable income and marginal tax rates (mean values by 1993 tax schedule brackets)**

Bracket	Tax Schedule 1993		Taxpayers		Taxable Income 1993		Taxable Income 1993 (prices of 1994)		Taxable Income 1994		Taxable Income 1994 (prices of 1993)		Marginal Tax Rate (%) (Weighted)			Marginal Tax Rate (%) (Regular)		
	Lower limit (€)	Marginal Tax Rate	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Ti 1993	Ti 1993 (prices 1994)	Ti 1994	Ti 1993	Ti 1993 (prices 1994)	Ti 1994
1	0.00	0.00	163	903.27	17,732.72	1,089.52	18,495.22	11,423.36	1,979.00	11,624.94	1,897.41	0.00	2.34	23.31	0.00	2.59	21.81	
2	2,404.05	20.00	1,837	4,935.38	1,037.99	5,153.40	1,082.63	6,467.34	387.17	6,388.54	371.21	20.00	20.32	20.92	20.00	20.32	20.90	
3	6,010.12	22.00	4,614	7,966.13	470.20	8,312.78	490.41	8,627.21	170.05	8,470.80	163.04	22.00	22.38	22.56	22.00	22.38	22.55	
4	9,435.89	24.50	5,086	11,212.21	316.97	11,698.71	330.60	11,592.36	122.21	11,327.02	117.17	24.50	24.92	24.75	24.50	24.92	24.75	
5	12,861.66	27.00	4,163	14,619.61	318.22	15,253.18	331.90	14,912.78	227.37	14,559.93	218.00	27.00	27.65	27.28	27.00	27.64	27.28	
6	16,287.43	30.00	4,069	18,035.80	329.11	18,820.56	343.26	18,351.89	197.03	17,881.47	188.91	30.00	30.49	29.95	30.00	30.49	29.95	
7	19,713.20	32.00	2,718	21,303.99	428.35	22,227.47	446.77	21,392.66	274.82	20,842.01	263.49	32.00	32.48	31.83	32.00	32.48	31.83	
8	23,138.97	34.00	1,706	24,786.63	316.72	25,860.23	330.34	24,309.14	423.90	23,692.13	406.42	34.00	34.60	33.56	34.00	34.60	33.55	
9	26,564.74	36.00	1,181	28,223.00	590.76	29,445.51	616.16	27,987.64	420.13	27,268.51	402.81	36.00	36.68	35.77	36.00	36.68	35.78	
10	29,990.50	38.00	838	31,631.37	265.45	33,000.29	276.86	30,959.93	359.73	30,150.66	344.90	38.00	38.75	37.43	38.00	38.75	37.42	
11	33,416.27	40.00	609	35,021.61	523.20	36,539.26	545.70	33,857.22	263.33	32,941.80	252.47	40.00	41.01	39.33	40.00	41.01	39.33	
12	36,842.04	42.50	525	38,541.78	560.65	40,212.87	584.76	36,347.52	401.85	35,444.21	385.28	42.50	43.70	41.04	42.50	43.71	41.05	
13	40,267.81	45.00	359	41,907.63	1,148.86	43,730.18	1,198.26	38,840.28	728.48	37,864.35	698.45	45.00	46.00	42.56	45.00	45.99	42.57	
14	43,693.58	47.00	289	45,258.48	490.77	47,237.15	511.88	42,890.51	535.04	41,795.07	512.98	47.00	47.98	45.02	47.00	47.99	45.02	
15	47,119.35	49.00	236	48,838.33	1,820.03	50,957.80	1,898.29	44,596.80	630.53	43,438.75	604.54	49.00	50.26	45.67	49.00	50.27	45.66	
16	50,545.12	51.00	184	52,158.37	22,392.74	54,650.08	23,355.62	48,228.49	705.60	46,961.62	676.51	51.00	52.77	47.88	51.00	52.77	47.88	
17	53,970.89	53.50	146	55,618.75	970.75	58,042.68	1,012.49	52,632.77	713.17	51,282.48	683.76	53.50	55.28	50.36	53.50	55.28	50.36	
18	57,396.66	56.00	696	122,112.52	2,665.82	127,414.57	2,760.44	95,362.12	1,659.55	93,096.85	1,591.14	55.81	55.81	51.61	56.00	56.00	51.77	



Table 6. Second income earners of married couples in individual taxation. Taxable income and marginal tax rates (mean values by 1993 tax schedule brackets)

Bracket	Tax Schedule 1993		Taxpayers		Taxable Income 1993		Taxable Income 1993 (prices of 1994)		Taxable Income 1994		Taxable Income 1994 (prices of 1993)		Marginal Tax Rate (%) (Weighted)			Marginal Tax Rate (%) (Regular)	
	Lower limit (€)	Marginal Tax Rate	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Regular	Irregular	Ti 1993	Ti 1993 (prices 1994)	Ti 1994	Ti 1993	Ti 1994 (prices 1994)
1	0.00	0.00	1,813	1,394.12	2,834.22	1,460.59	2,956.09	7,228.73	650.12	7,389.19	623.32	0.00	1.85	17.44	0.00	1.86	17.98
2	2,404.05	20.00	7,354	4,666.54	266.80	4,871.93	278.27	6,060.80	203.22	6,043.40	194.84	20.00	20.23	20.45	20.00	20.23	20.46
3	6,010.12	22.00	7,961	7,762.94	233.46	8,100.72	243.49	8,280.86	124.06	8,182.50	118.95	22.00	22.29	22.32	22.00	22.29	22.33
4	9,435.89	24.50	4,945	11,070.32	102.11	11,552.18	106.50	11,232.95	130.51	11,053.02	125.13	24.50	24.87	24.55	24.50	24.87	24.54
5	12,861.66	27.00	2,985	14,619.66	153.47	15,253.33	160.06	14,755.14	255.01	14,495.87	244.49	27.00	27.65	27.12	27.00	27.65	27.12
6	16,287.43	30.00	2,343	17,854.38	174.63	18,627.65	182.14	17,935.61	263.28	17,572.94	252.42	30.00	30.38	29.65	30.00	30.38	29.64
7	19,713.20	32.00	970	21,204.69	158.44	22,125.33	165.25	21,041.96	379.52	20,667.47	363.88	32.00	32.43	31.61	32.00	32.42	31.60
8	23,138.97	34.00	394	24,729.62	722.25	25,816.77	753.30	24,882.47	243.32	24,423.20	233.29	34.00	34.57	33.76	34.00	34.58	33.78
9	26,564.74	36.00	232	28,142.13	1,046.08	29,370.53	1,091.06	28,532.18	1,113.87	28,020.18	1,067.95	36.00	36.60	36.07	36.00	36.58	36.00
10	29,990.50	38.00	123	31,599.88	301.98	32,970.26	314.96	31,278.35	251.50	30,653.72	241.13	38.00	38.82	37.22	38.00	38.83	37.33
11	33,416.27	40.00	89	35,117.19	1,165.18	36,644.28	1,215.28	32,829.02	1,883.05	32,352.92	1,805.42	40.00	41.25	38.81	40.00	41.29	38.81
12	36,842.04	42.50	61	38,421.29	2,136.19	40,088.91	2,228.05	33,732.26	2,612.21	33,233.83	2,504.52	42.50	43.61	39.50	42.50	43.59	39.45
13	40,267.81	45.00	34	41,926.02	170.63	43,739.69	177.97	37,365.52	240.10	37,213.62	230.20	45.00	46.06	41.70	45.00	46.10	41.53
14	43,693.58	47.00	27	45,479.81	1,491.70	47,448.55	1,555.85	42,085.03	959.87	41,768.95	920.29	47.00	48.27	43.86	47.00	48.19	43.88
15	47,119.35	49.00	18	49,028.81	318.76	51,151.24	332.47	38,281.72	142.85	37,639.86	136.96	49.00	50.34	42.34	49.00	50.30	42.16
16	50,545.12	51.00	18	52,223.73	216.47	54,522.26	225.78	44,463.56	1,423.95	43,902.98	1,365.24	51.00	52.70	44.64	51.00	52.70	44.64
17	53,970.89	53.50	11	55,469.37	594.82	57,862.55	620.40	49,120.27	40,571.37	50,105.45	38,898.72	53.50	54.86	47.30	53.50	54.86	47.30
18	57,396.66	56.00	41	108,783.19	2,969.80	113,591.29	3,097.50	91,954.85	965.51	89,550.80	925.70	56.00	56.00	49.60	56.00	56.00	49.60

NOTE:  
Ti: Taxable income.  
Source: Own calculations

In the construction of this transition matrix we have taken into account the tax schedule bracket in which each taxpayer was assigned in 1993 and 1994 according to their declared incomes. One of the first features observed is its mobility, since at least about 30% of the taxpayers change brackets. However this mobility is not homogeneous. If we exclude the extreme brackets, mobility increases as we move up the bracket, reaching a maximum mobility of about 82% for single taxpayers (bracket 16), about 90% for married couples with only one earner (bracket 15) and, for married couples with two earners, 79% for the main earner (bracket 15) and 94% for second earners (brackets 15 and 16). Likewise, we must take into account that these transitions are bidirectional, namely backward and forward. As a rule, transitions to lower brackets are more common than transitions to higher brackets. This mobility is the result of several factors ranging from the effect of inflation on taxpayers' income to the impact of the economic cycle on the period analysed.

## 6. Calculation of elasticities

The necessary inputs to estimate the required elasticities are shown in Tables 11 to 18. The results were obtained for the four categories of taxpayers considered and for the two concepts of marginal tax rates used. Each of these tables exhibits, broken down by brackets, the estimates of the elasticities using the Wald estimator. These elasticities correspond to total income subject to levy, that is, the result of adding the regular and the irregular income components.

To comment on these results, graphs 1 and 2 show the elasticities by income brackets of 1993 PIT for each type of taxpayer and for the two notions of marginal tax rates used in the analysis -regular and weighted-.

Table 7. Elasticities "taxable income to net marginal tax rates" for single taxpayers

Tax Schedule 1993			Elasticity "taxable income to weighted marginal tax rate"					Elasticity "taxable income to regular marginal tax rate"							
Bracket	Lower limit (€)	Marginal Tax Rate	Taxpayers		Obs. by group	%	[ 1 ]	[ 2 ]	Wald Estimator	Obs. by group	%	[ 1 ]	[ 3 ]	Wald Estimator	
1	0.00	0.00	5,881	Treatment	308	5.24	-0.024524	-0.146944	-29.962562	Treatment	258	4.39	0.725368	-0.209845	30.263775
				Control	5,573	94.76	1.164313	-0.186621		Control	5,623	95.61	1.250489	-0.192494	
2	2,404.05	20.00	12,967	Treatment	1,443	11.13	-0.071262	-0.024597	16.937106	Treatment	1,271	9.80	0.092530	-0.016770	15.795284
				Control	11,524	88.87	0.263480	-0.004833		Control	11,696	90.20	0.266589	-0.005750	
3	6,010.12	22.00	24,265	Treatment	3,037	12.52	-0.071435	-0.016929	5.763599	Treatment	21,485	88.54	-0.017377	-0.015613	1.850316
				Control	21,228	87.48	0.011732	-0.002499		Control	2,780	11.46	0.006252	-0.002843	
4	9,435.89	24.50	20,490	Treatment	2,975	14.52	-0.122589	-0.014086	6.010222	Treatment	17,769	86.72	-0.054161	-0.012979	1.341170
				Control	17,515	85.48	-0.029525	0.001398		Control	2,721	13.28	-0.035428	0.000988	
5	12,861.66	27.00	13,365	Treatment	2,430	18.18	-0.117195	-0.014015	3.465359	Treatment	11,162	83.52	-0.057984	-0.013851	-0.251639
				Control	10,935	81.82	-0.052770	0.004576		Control	2,203	16.48	-0.062541	0.004258	
6	16,287.43	30.00	8,463	Treatment	1,832	21.65	-0.113479	-0.004038	3.944430	Treatment	6,804	80.40	-0.076732	-0.003616	0.890605
				Control	6,631	78.35	-0.055237	0.010728		Control	1,659	19.60	-0.064385	0.010248	
7	19,713.20	32.00	5,178	Treatment	1,305	25.20	-0.110831	-0.002280	3.709746	Treatment	4,001	77.27	-0.084571	-0.002541	0.806297
				Control	3,873	74.80	-0.062033	0.010874		Control	1,177	22.73	-0.074361	0.010121	
8	23,138.97	34.00	3,084	Treatment	954	30.93	-0.113705	-0.005347	1.418337	Treatment	2,222	72.05	-0.079871	-0.004248	-0.998279
				Control	2,130	69.07	-0.085352	0.014644		Control	862	27.95	-0.097700	0.013611	
9	26,564.74	36.00	1,815	Treatment	622	34.27	-0.112821	-0.002128	1.299920	Treatment	1,249	68.82	-0.098222	-0.000924	0.059325
				Control	1,193	65.73	-0.088526	0.016561		Control	566	31.18	-0.097273	0.015080	
10	29,990.50	38.00	1,204	Treatment	463	38.46	-0.122193	-0.005024	1.930985	Treatment	785	65.20	-0.115044	-0.003984	0.397179
				Control	741	61.54	-0.096555	0.018301		Control	419	34.80	-0.109747	0.017320	
11	33,416.27	40.00	832	Treatment	370	44.47	-0.134847	-0.010357	4.340166	Treatment	490	58.89	-0.132872	-0.010739	3.941928
				Control	462	55.53	-0.099605	0.018477		Control	342	41.11	-0.108843	0.016834	
12	36,842.04	42.50	605	Treatment	296	48.93	-0.137770	-0.002034	0.631925	Treatment	336	55.54	-0.101502	-0.000157	-0.997996
				Control	309	51.07	-0.116861	0.035122		Control	269	44.46	-0.136019	0.034743	
13	40,267.81	45.00	432	Treatment	216	50.00	-0.169395	-0.019849	4.468079	Treatment	229	53.01	-0.153284	-0.002636	10.864561
				Control	216	50.00	-0.094775	0.036550		Control	203	46.99	-0.105386	0.031145	
14	43,693.58	47.00	320	Treatment	180	56.25	-0.149521	-0.024871	8.477665	Treatment	155	48.44	-0.106828	-0.019784	-0.918712
				Control	140	43.75	-0.073704	0.033814		Control	165	51.56	-0.125471	0.040294	
15	47,119.35	49.00	258	Treatment	162	62.79	-0.132790	-0.038428	-6.901464	Treatment	105	40.70	-0.148911	-0.034679	-11.655679
				Control	96	37.21	-0.074541	0.029988		Control	153	59.30	-0.106609	0.031049	
16	50,545.12	51.00	196	Treatment	135	68.88	-0.207296	-0.059681	2.406407	Treatment	67	34.18	-0.202322	-0.055697	-0.012371
				Control	61	31.12	-0.173531	0.073712		Control	129	65.82	-0.202825	0.080198	
17	53,970.89	53.50	147	Treatment	102	69.39	-0.151232	-0.035091	-1.043820	Treatment	49	33.33	-0.148138	-0.038712	-1.212428
				Control	45	30.61	-0.190998	0.073188		Control	98	66.67	-0.182382	0.066956	
18	57,396.66	56.00	719	Treatment	78	10.85	-0.380530	0.041033	2.172519	Treatment	0	0.00	—	—	—
				Control	641	89.15	-0.294798	0.080495		Control	719	100.00	-0.294037	0.076458	

NOTES:

- [1] Ln (Taxable Income 1994 in prices of 1993 / Taxable Income 1993)
  - [2] Ln ((1 - Weighted Marginal Tax Rate 1994) / (1 - Weighted Marginal Tax Rate 1993))
  - [3] Ln ((1 - Regular Marginal Tax Rate 1994) / (1 - Regular Marginal Tax Rate 1993))
- Source: Own calculations

Table 8. Elasticities "taxable income to net marginal tax rates" for married couples in joint taxation

Tax Schedule 1993			Elasticity "taxable income to weighted marginal tax rate"					Elasticity "taxable income to regular marginal tax rate"							
Bracket	Lower limit (€)	Marginal Tax Rate	Taxpayers		Obs. by group	%	[ 1 ]	[ 2 ]	Wald Estimator	Obs. by group	%	[ 1 ]	[ 3 ]	Wald Estimator	
1	0.00	0.00	17,010	Treatment	1,169	6.87	-0.048153	-0.121964	17.226565	Treatment	1,119	6.58	0.102308	-0.129246	8.689707
				Control	15,841	93.13	0.303010	-0.101579		Control	15,891	93.42	0.322621	-0.103893	
2	4,808.10	20.00	43,242	Treatment	2,618	6.05	-0.112634	-0.023543	2.627462	Treatment	2,109	4.88	-0.057047	-0.023257	0.892782
				Control	40,624	93.95	-0.024734	0.009911		Control	41,133	95.12	-0.027831	0.009468	
3	12,020.24	24.50	11,486	Treatment	1,916	16.68	-0.079454	-0.009347	1.614260	Treatment	1,721	14.98	-0.061713	-0.008556	0.340452
				Control	9,570	83.32	-0.049376	0.009286		Control	9,765	85.02	-0.055920	0.008459	
4	15,776.57	27.00	7,556	Treatment	1,370	18.13	-0.078948	-0.012170	1.009158	Treatment	1,217	16.11	-0.061260	-0.012261	-0.250655
				Control	6,186	81.87	-0.059474	0.007127		Control	6,339	83.89	-0.065922	0.006340	
5	19,532.89	30.00	3,770	Treatment	845	22.41	-0.143403	-0.006639	4.601600	Treatment	719	19.07	-0.107641	-0.000825	1.904165
				Control	2,925	77.59	-0.071643	0.014956		Control	3,051	80.93	-0.078925	0.014256	
6	23,289.22	32.00	2,012	Treatment	544	27.04	-0.172502	-0.003779	9.864124	Treatment	461	22.91	-0.131382	-0.005655	5.630192
				Control	1,468	72.96	-0.077841	0.013376		Control	1,551	77.09	-0.089203	0.013146	
7	27,045.54	34.00	1,142	Treatment	378	33.10	-0.115486	-0.002512	0.935057	Treatment	339	29.68	-0.107016	-0.002352	-0.242176
				Control	764	66.90	-0.101283	0.017703		Control	803	70.32	-0.110357	0.016146	
8	30,801.87	36.00	733	Treatment	255	34.79	-0.174396	-0.008639	2.842147	Treatment	224	30.56	-0.141224	-0.007276	-0.315927
				Control	478	65.21	-0.130048	0.024243		Control	509	69.44	-0.146549	0.024133	
9	34,558.20	38.00	458	Treatment	184	40.17	-0.204964	-0.018269	2.360343	Treatment	161	35.15	-0.185545	-0.016873	0.107643
				Control	274	59.83	-0.168265	0.033817		Control	297	64.85	-0.183748	0.033562	
10	38,314.52	40.00	338	Treatment	159	47.04	-0.181684	-0.011788	0.458693	Treatment	140	41.42	-0.150622	-0.010325	-1.195076
				Control	179	52.96	-0.168783	0.039913		Control	198	58.58	-0.184994	0.039086	
11	42,070.85	42.50	219	Treatment	114	52.05	-0.228806	-0.047233	-6.004871	Treatment	105	47.95	-0.238802	-0.049245	-4.345593
				Control	105	47.95	-0.120294	0.028996		Control	114	52.05	-0.135544	0.025483	
12	45,827.17	45.00	173	Treatment	96	55.49	-0.172328	-0.030359	-1.101807	Treatment	92	53.18	-0.185424	-0.032920	-0.397362
				Control	77	44.51	-0.197472	0.053179		Control	81	46.82	-0.191637	0.048556	
13	49,583.50	47.00	122	Treatment	72	59.02	-0.220926	-0.044348	2.954738	Treatment	65	53.28	-0.172206	-0.040521	-1.858865
				Control	50	40.98	-0.166487	0.062772		Control	57	46.72	-0.223726	0.068237	
14	53,339.82	49.00	93	Treatment	57	61.29	-0.303635	-0.093369	-5.232935	Treatment	53	56.99	-0.319173	-0.102818	-4.018104
				Control	36	38.71	-0.121679	0.058598		Control	40	43.01	-0.116984	0.052499	
15	57,096.15	51.00	63	Treatment	45	71.43	-0.207577	-0.071303	-6.652228	Treatment	44	69.84	-0.214728	-0.067902	-7.033347
				Control	18	28.57	-0.014234	0.037959		Control	19	30.16	-0.011837	0.039055	
16	60,852.48	53.50	77	Treatment	38	49.35	-0.245205	-0.117576	-3.715046	Treatment	34	44.16	-0.228987	-0.099337	-2.671473
				Control	39	50.65	-0.279084	0.126696		Control	43	55.84	-0.322683	0.134409	
17	66,111.33	56.00	311	Treatment	46	14.79	-0.479097	0.097367	46.761191	Treatment	0	0.00	—	—	—
				Control	265	85.21	-0.454053	0.097902		Control	311	100.00	-0.466721	0.096787	

NOTES:

- [1] Ln (Taxable Income 1994 in prices of 1993 / Taxable Income 1993)
- [2] Ln ((1 - Weighted Marginal Tax Rate 1994) / (1 - Weighted Marginal Tax Rate 1993))
- [3] Ln ((1 - Regular Marginal Tax Rate 1994) / (

**Table 9. Elasticities "taxable income to net marginal tax rates" for main income earners of married couples in individual taxation**

Tax Schedule 1993			Taxpayers	Elasticity "taxable income to weighted marginal tax rate"					Elasticity "taxable income to regular marginal tax rate"						
Bracket	Lower limit (€)	Marginal Tax Rate		Obs. by group	%	[ 1 ]	[ 2 ]	Wald Estimator	Obs. by group	%	[ 1 ]	[ 3 ]	Wald Estimator		
1	0.00	0.00	163	Treatment	18	11.04	-0.542498	-0.087800	-13.616011	Treatment	5	3.23	1.072000	-0.230694	-29.760712
				Control	145	88.96	1.588830	-0.244331		Control	158	96.77	1.784853	-0.254647	
2	2,404.05	20.00	1,837	Treatment	315	17.15	-0.056528	-0.028392	13.409580	Treatment	245	13.36	0.078052	-0.012785	203.584400
				Control	1,522	82.85	0.177150	-0.010966		Control	1,592	86.64	0.183692	-0.012266	
3	6,010.12	22.00	4,614	Treatment	720	15.60	-0.081887	-0.024061	5.053907	Treatment	607	13.16	-0.006305	-0.016951	2.179919
				Control	3,894	84.40	0.015959	-0.004701		Control	4,007	86.84	0.017349	-0.006100	
4	9,435.89	24.50	5,086	Treatment	861	16.93	-0.105415	-0.019260	4.757604	Treatment	744	14.62	-0.024781	-0.017358	0.069677
				Control	4,225	83.07	-0.017243	-0.000727		Control	4,342	85.38	-0.023662	-0.001582	
5	12,861.66	27.00	4,163	Treatment	926	22.24	-0.071892	-0.020817	2.123743	Treatment	810	19.47	-0.031777	-0.020069	-0.152974
				Control	3,237	77.76	-0.026573	0.000522		Control	3,353	80.53	-0.034753	-0.000615	
6	16,287.43	30.00	4,069	Treatment	1,043	25.63	-0.060281	-0.013932	1.773120	Treatment	923	22.68	-0.028372	-0.013228	-0.351860
				Control	3,026	74.37	-0.027183	0.004735		Control	3,146	77.32	-0.034372	0.003827	
7	19,713.20	32.00	2,718	Treatment	718	26.42	-0.087213	-0.010405	3.011587	Treatment	614	22.60	-0.053676	-0.009317	0.444709
				Control	2,000	73.58	-0.038501	0.005770		Control	2,104	77.40	-0.047420	0.004749	
8	23,138.97	34.00	1,706	Treatment	569	33.35	-0.082537	-0.005382	0.736773	Treatment	485	28.42	-0.069603	-0.007623	-0.782690
				Control	1,137	66.65	-0.070149	0.011432		Control	1,221	71.58	-0.083878	0.010615	
9	26,564.74	36.00	1,181	Treatment	429	36.33	-0.073284	-0.013233	0.263895	Treatment	382	32.38	-0.051483	-0.011706	-1.053660
				Control	752	63.67	-0.067266	0.009571		Control	799	67.62	-0.072047	0.007811	
10	29,990.50	38.00	838	Treatment	344	41.05	-0.078035	-0.004556	-0.671318	Treatment	305	36.43	-0.070107	-0.007342	-1.333608
				Control	494	58.95	-0.090832	0.014507		Control	533	63.57	-0.099381	0.014608	
11	33,416.27	40.00	609	Treatment	272	44.66	-0.126377	-0.008189	0.764135	Treatment	239	39.28	-0.104715	-0.009351	-0.288740
				Control	337	55.34	-0.106050	0.018412		Control	370	60.72	-0.112685	0.018255	
12	36,842.04	42.50	525	Treatment	275	52.38	-0.137638	0.010344	0.641857	Treatment	249	47.34	-0.118367	0.009178	-0.915174
				Control	250	47.62	-0.124055	0.031505		Control	276	52.66	-0.138155	0.030800	
13	40,267.81	45.00	359	Treatment	193	53.76	-0.169427	0.026676	1.860587	Treatment	176	48.89	-0.135277	0.027699	-0.845432
				Control	166	46.24	-0.128268	0.048798		Control	183	51.11	-0.161640	0.052879	
14	43,693.58	47.00	289	Treatment	153	52.94	-0.137101	0.023057	1.924262	Treatment	138	47.75	-0.133813	0.022646	1.083711
				Control	136	47.06	-0.110852	0.036699		Control	151	52.25	-0.118454	0.036819	
15	47,119.35	49.00	236	Treatment	155	65.68	-0.194500	0.044974	0.559862	Treatment	148	62.87	-0.185928	0.050963	1.284712
				Control	81	34.32	-0.183477	0.064662		Control	88	37.13	-0.178322	0.056884	
16	50,545.12	51.00	184	Treatment	121	65.76	-0.369405	0.047080	33.202573	Treatment	117	63.59	-0.215919	0.053491	-13.721847
				Control	63	34.24	-0.093110	0.055401		Control	67	36.41	-0.096708	0.044804	
17	53,970.89	53.50	146	Treatment	109	74.66	-0.121925	0.047631	-0.988112	Treatment	103	70.55	-0.114916	0.049786	-1.404130
				Control	37	25.34	-0.149283	0.075317		Control	43	29.45	-0.146836	0.072519	
18	57,396.66	56.00	696	Treatment	114	16.38	-0.386518	0.049774	40.918340	Treatment	0	0.00	—	—	—
				Control	582	83.62	-0.193291	0.054496		Control	696	100.00	-0.2346233	0.0540283	

**NOTES:**

- [1] Ln (Taxable Income 1994 in prices of 1993 / Taxable Income 1993)
- [2] Ln ((1 - Weighted Marginal Tax Rate 1994) / (1 - Weighted Marginal Tax Rate 1993))
- [3] Ln ((1 - Regular Marginal Tax Rate 1994) / (1 - Regular Marginal Tax Rate 1993))

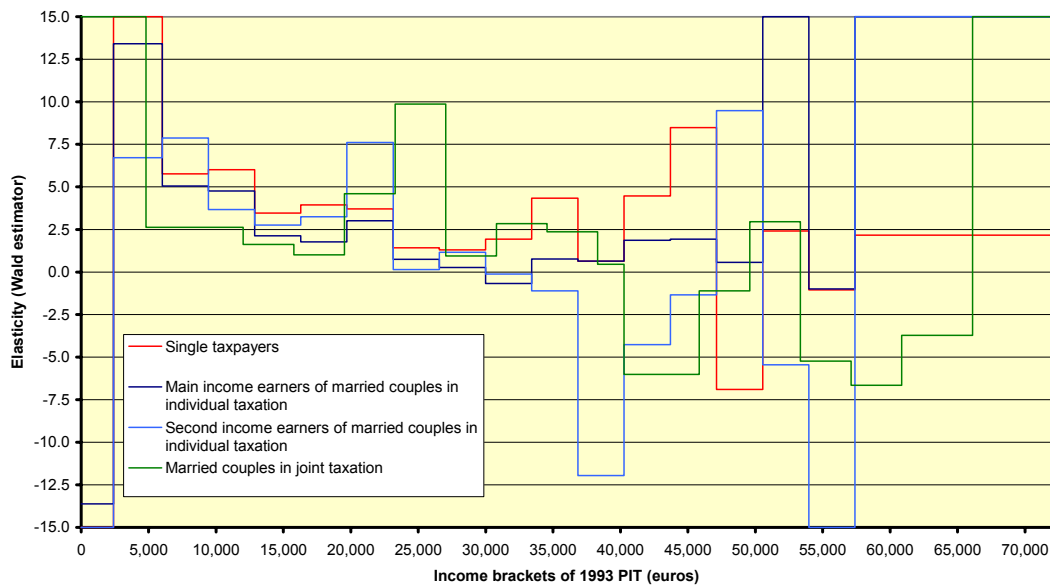
Source: Own calculations

**Table 10. Elasticities "taxable income to net marginal tax rates" for second income earners of married couples in individual taxation**

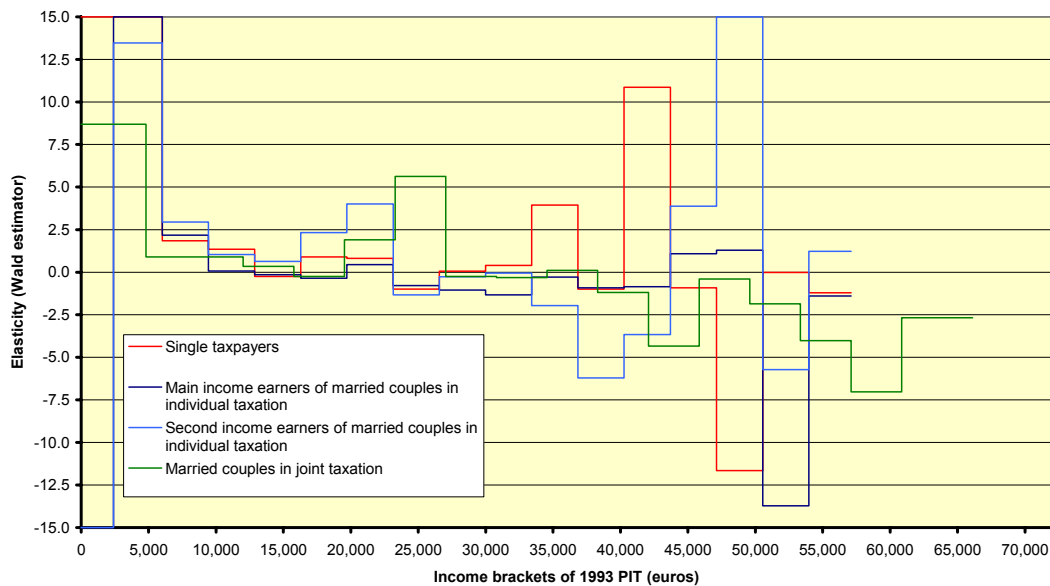
Tax Schedule 1993			Taxpayers	Elasticity "taxable income to weighted marginal tax rate"					Elasticity "taxable income to regular marginal tax rate"						
Bracket	Lower limit (€)	Marginal Tax Rate		Obs. by group	%	[ 1 ]	[ 2 ]	Wald Estimator	Obs. by group	%	[ 1 ]	[ 3 ]	Wald Estimator		
1	0.00	0.00	1,813	Treatment	131	7.23	-0.063200	-0.140883	-22.590214	Treatment	91	5.00	0.716339	-0.198253	-47.366769
				Control	1,682	92.77	1.076045	-0.191314		Control	1,722	95.00	1.205353	-0.208577	
2	2,404.05	20.00	7,354	Treatment	843	11.46	0.037333	-0.026432	6.715807	Treatment	641	8.72	0.071872	-0.014876	13.467179
				Control	6,511	88.54	0.180029	-0.005184		Control	6,713	91.28	0.185306	-0.006453	
3	6,010.12	22.00	7,961	Treatment	927	11.64	-0.076692	-0.014992	7.879623	Treatment	756	9.50	-0.022509	-0.015554	2.949400
				Control	7,034	88.36	0.018509	-0.002910		Control	7,205	90.50	0.012604	-0.003649	
4	9,435.89	24.50	4,945	Treatment	736	14.88	-0.077583	-0.013159	3.674085	Treatment	631	12.77	-0.049747	-0.012827	1.035566
				Control	4,209	85.12	-0.024405	0.001315		Control	4,314	87.23	-0.036570	0.000767	
5	12,861.66	27.00	2,985	Treatment	694	23.25	-0.058639	-0.011131	2.763772	Treatment	593	19.85	-0.045387	-0.014235	0.636567
				Control	2,291	76.75	-0.022865	0.001032		Control	2,392	80.15	-0.035885	0.000691	
6	16,287.43	30.00	2,343	Treatment	494	21.08	-0.068720	-0.005834	3.240919	Treatment	408	17.40	-0.064106	-0.005627	2.327030
				Control	1,849	78.92	-0.026358	0.007237		Control	1,935	82.60	-0.035824	0.006527	
7	19,713.20	32.00	970	Treatment	233	24.02	-0.085822	0.000150	7.607631	Treatment	194	19.96	-0.084027	-0.002729	4.017261
				Control	737	75.98	-0.033732	0.006997		Control	776	80.04	-0.046844	0.006527	
8	23,138.97	34.00	394	Treatment	135	34.26	-0.070358	-0.017637	0.145612	Treatment	110	27.96	-0.028283	-0.020324	-1.328802
				Control	259	65.74	-0.066208	0.010862		Control	284	72.04	-0.067797	0.009412	
9	26,564.74	36.00	232	Treatment	85	36.64	-0.069228	-0.020636	1.152768	Treatment	64	27.68	-0.049279	-0.018805	-0.266334
				Control	147	63.36	-0.037942	0.006504		Control	168	72.32	-0.050576	0.002963	
10	29,990.50	38.00	123	Treatment	57	46.34	-0.088722	-0.021538	-0.119530	Treatment	50	40.50	-0.083595	-0.028078	-0.047041
				Control	66	53.66	-0.095043	0.031345		Control	73	59.50	-0.086221	0.027754	
11	33,416.27	40.00	89	Treatment	50	56.18	-0.082450	-0.000363	-1.100686	Treatment	45	50.57	-0.091243	0.005209	-1.955017
				Control	39	43.82	-0.118669	0.032543		Control	44	49.43	-0.137462	0.028850	
12	36,842.04	42.50	61	Treatment	32	52.46	-0.200562	0.045073	-11.960273	Treatment	25	41.67	-0.274612	0.059950	-6.205101
				Control	29	47.54	-0.130030	0.039176		Control	36	58.33	-0.129924	0.036632	
13	40,267.81	45.00	34	Treatment	18	52.94	-0.257284	0.074859	-4.261687	Treatment	19	54.55	-0.250075	0.076697	-3.655536
				Control	16	47.06	-0.055933	0.027612		Control	15	45.45	-0.075978	0.029071	
14	43,693.58	47.00	27	Treatment	18	66.67	-0.129532	0.015178	-1.348796	Treatment	16	59.26	-0.177850	0.037927	3.884866
				Control	9	33.33	-0.214674	0.078302		Control	11	40.74	-0.153854	0.044103	
15	47,119.35	49.00	18	Treatment	12	66.67	-0.391622	0.108636	9.480138	Treatment	12	64.71	-0.436363	0.111181	18.189404
				Control	6	33.33	-0.292525	0.119089		Control	6	35.29	-0.292525	0.119089	
16	50,545.12	51.00	18	Treatment	12	66.67	-0.382507	0.129910	-5.450933	Treatment	12	66.67	-0.409941	0.124237	-5.723292
				Control	6	33.33	-0.103862	0.078791		Control	6	33.33	-0.119955	0.073569	
17	53,970.89	53.50	11	Treatment	7	63.64	0.119721	0.120508	-63.618986	Treatment	6	54.55	-0.125436	0.133308	1.225600
				Control	4	36.36	-0.209582	0.125684		Control	5	45.45	-0.169422	0.097419	
18	57,396.66	56.00	41	Treatment	5	12.20	-0.573297	0.109147	33.217652	Treatment	0	0.00	—	—	—
				Control	36										

It is worth noting that for the four taxpayers' categories the elasticities are almost always higher when the weighted marginal tax rate is used. This is doubtless a consequence of the particular features of irregular income, that is, irregular income and capital gains. Likewise, we should point out that irregular income tends to be obtained in a sporadic fashion over the years, which often leads taxpayers to use this type of income strategically for fiscal planning purposes. On the other hand, the peculiar distribution of this type of irregular income when compared to the distribution of the regular income should also be highlighted. The combination of these irregular income features introduces an important variability in the magnitudes that affect the calculations of the Wald estimator, which in turn explains this higher response when the irregular income is taken into account.

**Figure 1. Elasticities "taxable income to net weighted marginal tax rate" by income brackets of 1993 PIT for each type of taxpayer**



**Figure 2. Elasticities "taxable income to net regular marginal tax rate" by income brackets of 1993 PIT for each type of taxpayer**



Although the results are not unanimous when analyzed by type of taxpayer, the comparison allows us to come to some interesting conclusions. One of the first patterns we observed up to 23,000 Euros is the higher sensitivity of the spouses who are second income earners in married couples that file separately. From these income levels and up to about 44,000 Euros, the higher response comes from single taxpayers, but we have to point out that in the 23,000 to 27,000 Euros band the highest elasticity is exhibited by married couples with only one breadwinner, that is married couples with joint taxation. From a level of income close to 50,000 Euros, there is no clear pattern, although it is worth emphasising that for the concept of regular marginal tax rate, the positive highest value elasticities re-appear for spouses who are second income earners. In the case of weighted marginal tax rates we cannot speak of a clear pattern, since between 50,000 and 54,000 Euros the highest elasticity is exhibited by the first earners, whereas between this level and 58,000 Euros there is a drop to negative values, that can also be seen when we use the regular marginal tax rate. Above this level of income the second income earners and married couples with only one income earner are those that once again show a higher response.

Another element that has to be taken into account to adequately evaluate these elasticities is the dispersion of the taxable income within each bracket. As shown in Tables in Appendix 2, the number of bracket transitions experienced by taxpayers is high. These transitions, that on several occasions affect multiple brackets, are the result of combining the monetary increase of the income, leading to fiscal drag, with the real variations of income caused by the economic cycle. Greater variability in each bracket will lead to a higher absolute value of the elasticity calculated by the Wald estimator.

A third consideration is connected with the tails in the income distribution. As can be seen in Tables 7 to 10 and in the transition Tables in Appendix 2, the transition rate of taxpayers in the first bracket in 1993 is significantly intense, only a reduced proportion of them remained in the first bracket in 1994 (25.91% single taxpayers, 59.12% taxpayers with joint declarations, 7.98% main income earners and 19.91% second income earners with separate filing). Since this methodology requires the inclusion of the same taxpayers as per the 1993 classification, we are incorporating a very important change in the taxable income, which explains the very high values of the calculated elasticities for the first bracket and to a lesser extent in the second. This fact, defined by Saez (2003) as mean reverse is common to the analysis that uses this methodology. We therefore consider it appropriate that the calculated elasticities are suitable only after the second income bracket used. This phenomenon is also relevant from 45,000 Euros of income onwards.

To assess the effect of irregular income, we compute elasticities separately for observations with regular and irregular income. As Tables 11-14 show, when we restrict the sample to taxpayers who only have regular income, the absolute values of the elasticities are significantly lower than the values obtained for the whole population. Furthermore, these elasticities are much lower when the complete sample of taxpayers is used according to the concept of weighted marginal tax rate, i.e. when the taxation of irregular income is taken into account.

The elasticities by type of taxpayer when we restrict the sample to those taxpayers who only obtained regular income in 1993 and in 1994 are shown in figures 3 to 6. These figures also include the comparison with the elasticities obtained for the

whole population. Figure 7 shows a comparison of these elasticities for the four categories of taxpayers considered.

**Table 11. Elasticity "taxable income to net regular marginal tax rate" for single taxpayers  
Restricted samples**

Bracket	Tax Schedule 1993		Elasticity (Wald estimator)	Elasticity (Wald estimator)
	Lower limit (€)	Marginal Tax Rate	Single Taxpayers 95,563 obs. including only regular income both in 1993 and 1994	Single Taxpayers 4,658 obs. including only regular and irregular income both in 1993 and 1994
1	0.00	0.00	23.69	-170.78
2	2,404.05	20.00	14.69	52.66
3	6,010.12	22.00	1.65	9.96
4	9,435.89	24.50	1.04	8.90
5	12,861.66	27.00	-0.06	-1.87
6	16,287.43	30.00	0.80	3.00
7	19,713.20	32.00	0.50	5.92
8	23,138.97	34.00	-0.87	-2.00
9	26,564.74	36.00	-0.09	1.11
10	29,990.50	38.00	0.66	-1.36
11	33,416.27	40.00	2.22	-28.07
12	36,842.04	42.50	-0.56	-2.02
13	40,267.81	45.00	9.13	8.97
14	43,693.58	47.00	4.09	-3.28
15	47,119.35	49.00	3.56	-3.15
16	50,545.12	51.00	-0.69	32.72
17	53,970.89	53.50	-2.02	-5.21
18	57,396.66	56.00	—	—

Source: Own calculations

**Table 12. Elasticity "Taxable income to net marginal tax rate" for married couples in joint taxation  
Restricted samples**

Bracket	Tax Schedule 1993		Elasticity (Wald estimator)	Elasticity (Wald estimator)
	Lower limit (€)	Marginal Tax Rate	Married couples in joint taxation 84,849 obs. including only regular income both in 1993 and 1994	Married couples in joint taxation 3,956 obs. including only regular income both in 1993 and 1994
1	0.00	0.00	6.96	-19.98
2	4,808.10	20.00	0.81	3.02
3	12,020.24	24.50	0.21	3.67
4	15,776.57	27.00	-0.44	5.36
5	19,532.89	30.00	1.01	43.98
6	23,289.22	32.00	5.50	6.59
7	27,045.54	34.00	-0.47	3.48
8	30,801.87	36.00	-0.11	-1.01
9	34,558.20	38.00	0.52	-5.64
10	38,314.52	40.00	-1.54	3.13
11	42,070.85	42.50	-4.11	-6.06
12	45,827.17	45.00	-1.33	-2.61
13	49,583.50	47.00	-1.32	-6.63
14	53,339.82	49.00	-5.37	-2.25
15	57,096.15	51.00	-5.93	-2.03
16	60,852.48	53.50	-2.53	-3.14
17	66,111.33	56.00	—	—

Source: Own calculations

**Table 13. Elasticity "Taxable income to net regular marginal tax rate"  
for main income earners of married couples in individual taxation. Restricted samples.**

Bracket	Tax Schedule 1993		Elasticity (Wald estimator)	Elasticity (Wald estimator)
	Lower limit (€)	Marginal Tax Rate	Main income earners of married couples 26,275 obs. including only regular income both in 1993 and 1994	Main income earners of married couples 1,768 obs. Including only regular and irregular income both in 1993 and 1994
1	0.00	0.00	-10.47	-71.81
2	2,404.05	20.00	205.09	-28.90
3	6,010.12	22.00	1.80	28.16
4	9,435.89	24.50	0.14	-3.39
5	12,861.66	27.00	-0.06	2.66
6	16,287.43	30.00	-0.17	-2.74
7	19,713.20	32.00	0.14	14.37
8	23,138.97	34.00	0.00	-3.02
9	26,564.74	36.00	-1.35	0.31
10	29,990.50	38.00	-1.29	-1.75
11	33,416.27	40.00	0.15	-2.36
12	36,842.04	42.50	-0.73	-1.77
13	40,267.81	45.00	2.57	-1.99
14	43,693.58	47.00	2.17	8.47
15	47,119.35	49.00	-15.03	-3.32
16	50,545.12	51.00	-0.88	-5.30
17	53,970.89	53.50	-1.68	-1.07
18	57,396.66	56.00	—	—

Source: Own calculations

**Table 14. Elasticity "Taxable income to net regular marginal tax rate"  
for second income earners of married couples in individual taxation. Restricted samples.**

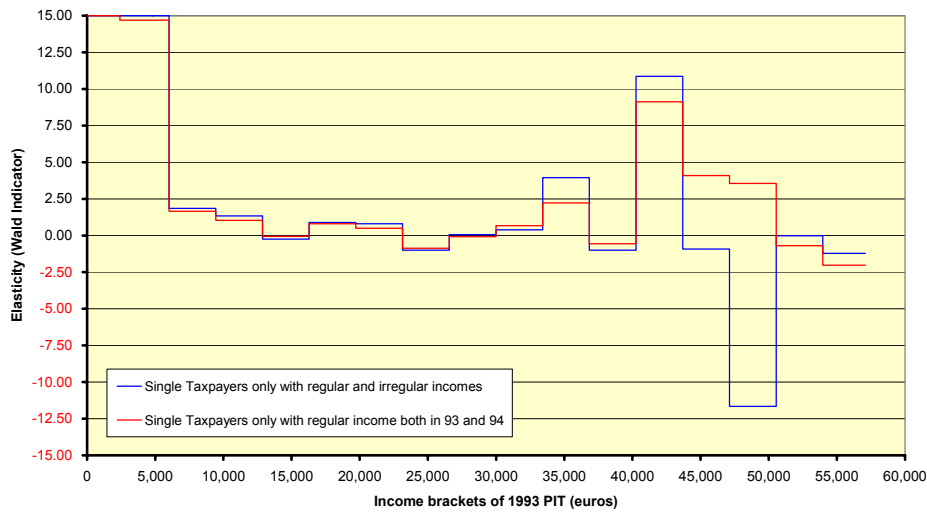
Bracket	Tax Schedule 1993		Elasticity (Wald estimator)	Elasticity (Wald estimator)
	Lower limit (€)	Marginal Tax Rate	Second income earners of married couples 26,275 obs. including only regular income both in 1993 and 1994	Second income earners of married couples 3,144 obs. Including only regular and irregular income both in 1993 and 1994
1	0.00	0.00	-78.28	19.47
2	2,404.05	20.00	11.05	-103.22
3	6,010.12	22.00	2.70	4.06
4	9,435.89	24.50	1.73	-2.21
5	12,861.66	27.00	0.29	-0.13
6	16,287.43	30.00	1.32	27.10
7	19,713.20	32.00	3.75	2.01
8	23,138.97	34.00	-1.88	-1.83
9	26,564.74	36.00	-0.79	-9.36
10	29,990.50	38.00	0.08	-1.10
11	33,416.27	40.00	4.38	61.01
12	36,842.04	42.50	-10.09	-6.89
13	40,267.81	45.00	14.21	-3.25
14	43,693.58	47.00	-2.21	-2.85
15	47,119.35	49.00	-1.91	-3.68
16	50,545.12	51.00	-4.84	-3.98
17	53,970.89	53.50	-2.30	-2.15
18	57,396.66	56.00	—	—

Source: Own calculations

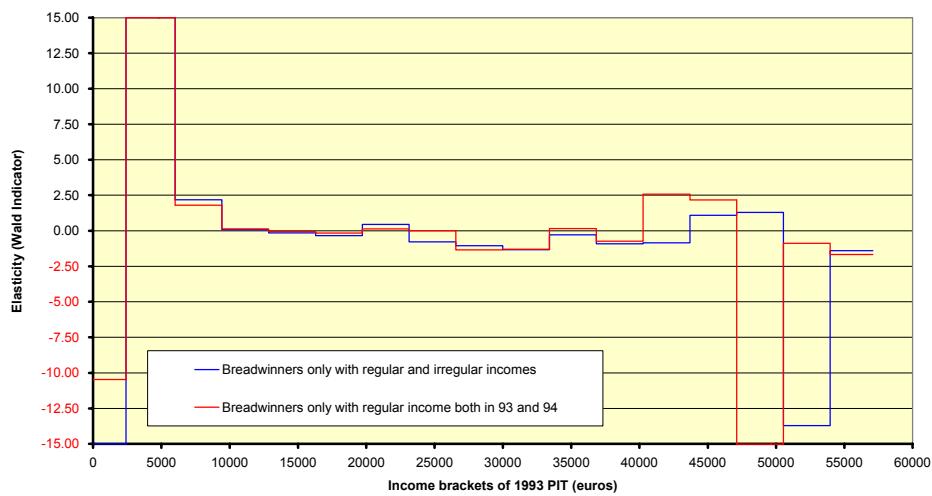
We would like to point out that this paper includes, for the first time, the calculation of the *taxable income-marginal tax rate* elasticities taking into account the irregular component of income as well as the peculiarities of its taxation. Without a doubt this element is particularly relevant to assess the intensity of the taxpayers' reaction to changes in their marginal tax rates. So it is important to remember that the elasticities obtained solely from regular income are those that would be comparable to

the elasticities calculated in the literature. Hereafter we will comment on the elasticities obtained for regular income, comparing them to those provided by other analyses that have used the Panel of Taxpayers of Personal Income Tax of the Institute of Fiscal Studies, even though as stated before these studies resorted to explicit tax reforms.

**Figure 3. Elasticities "Taxable income to net regular marginal tax rate" for single taxpayers. Restricted samples**

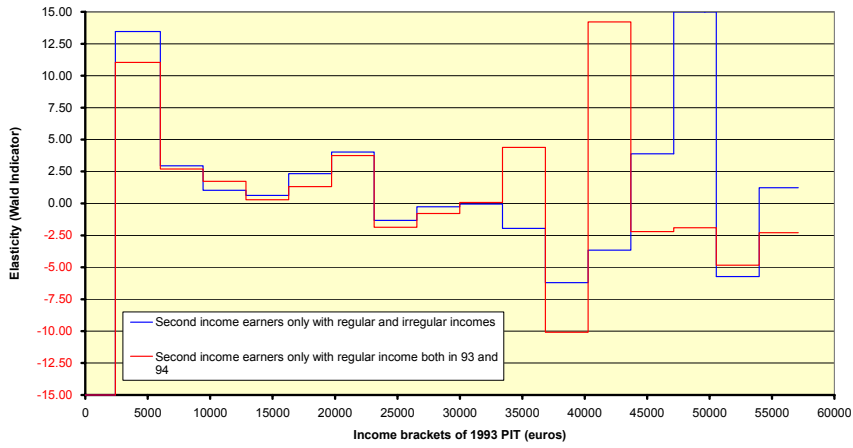


**Figure 4. Elasticities "Taxable income to net regular marginal tax rate" for main income earners of married couples in individual taxation. Restricted samples**

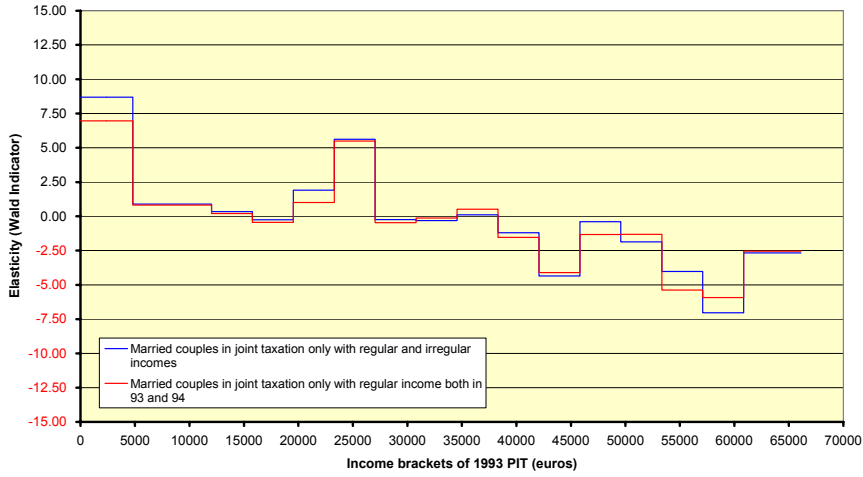




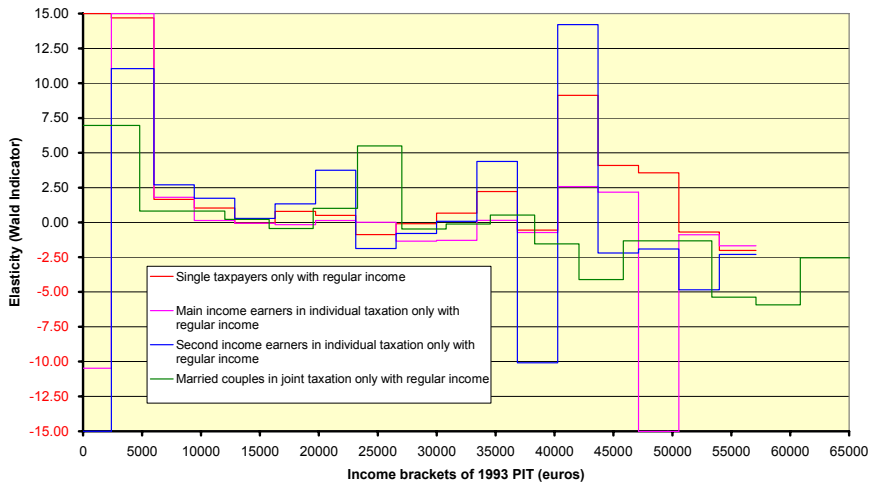
**Figure 5. Elasticities "Taxable income to net regular marginal tax rate" for second income earners of married couples in individual taxation. Restricted samples**



**Figure 6. Elasticities "Taxable income to net regular marginal tax rate" for married couples in joint taxation. Restricted samples**



**Figure 7. Elasticities "taxable income to net regular marginal tax rate" by income brackets of 1993 PIT for each type of taxpayer. Restricted samples**



The first paper applied to the Spanish case is Badenes (2001). Following Feldstein (1995), this paper investigates for years 1988-1992 the reaction of taxable income to marginal tax rate changes based on the 1989 tax reform, which eliminated

the obligation of joint taxation for married couples. Badenes (2001) focuses exclusively on married couples filing separately. The calculated elasticities are presented according to the income brackets of the first year of the analysis. In the case of the first earners the elasticity reported by Badenes ranges between 0.02 and 2.89 in 1989, between 0.09 and 5.19 in 1990, between 0.17 and 7.53 in 1991 and 0.07 and 6.72 in 1992 showing a great variability between brackets. The average values for each of these years are 0.30, 0.88, 1.34 and 1.32. As was the case in our results, the second income recipients show higher elasticities. In 1989 the values range from 0.15 to 3.99 with an overall average of 0.71, in 1990 they vary from 0.31 to 5.38 with an average of 1.42, in 1991 from 0.42 to 16.51, with an aggregated average of 1.96 and lastly for 1992 the values range from 0.38 to 13.70 with an average of 2.08.

Two more recent papers reporting taxable income marginal tax rates elasticities are Diaz Mendoza (2004) and Sanmartín (2007). Even though they use the same database as the one in the current research they do not present such disaggregated calculations neither by levels of income nor by taxpayers' categories. In our opinion this poses a serious limitation when it comes down to interpreting these elasticities from an economic standpoint. On the other hand, the analysis they present is limited to married couples in which both spouses declare separately, but they treat them both as a single unit by calculating a weighted average marginal tax rate according to the income of each spouse. In our opinion, this approach is not satisfactory since the concept of microeconomic behaviour that underlies this type of elasticity suggests the use of disaggregated information for each income recipient in a marriage, especially when the microdata used allows for independent separate calculations. Likewise, this argument supports the presentation of elasticities disaggregated by levels of income, since the more aggregated the analysis the more heterogeneity can be hidden in the calculations.

Elasticities reported in Mendoza (2004) are calculated following three different approaches. In his first approach he uses the difference-in-difference estimator *à la* Feldstein, separating taxpayers in three groups according to their marginal tax rate in 1987 (group A between 22 and 41, B between 43 and 58, and C between 60 and 66). In his second approach he uses Auten and Carroll's (1999) econometric model estimated by minimum two-stage squares, and in his third approach he modifies the previous regression model by introducing 10 splines deciles according to Goolsbee (2000). The obtained results can be seen in Table 15.

Sanmartín (2007) also resorts to Auten and Carroll's (1999) econometric model obtaining as a result aggregated elasticities for all the population depending on whether or not the reversion problems of the average and the changes in distribution of income between periods is controlled or not. The values obtained are 0.116 and 0.216 respectively. In this work the analysis is restricted to single and married taxpayers. For single taxpayers he obtains an elasticity of 0.131 and for married taxpayers an elasticity of -0.008 even though in the second case no statistical significance is found.

An initial criticism that can be highlighted about the last two papers is that they have a low degree of disaggregation for the calculated elasticities. As mentioned before, the elasticity reflects the behaviour of taxpayers in all its heterogeneity due to factors such as income and other non-monetary variables with unquestionable fiscal relevance, such as marital status, number of dependants, ascendants, handicaps, age of the family members, etc. Excess aggregation hides the differences of response in

taxpayers as a group which prevents these elasticities from producing predictions and simulations that are consistent from a microeconomic standpoint.

Table 15. Elasticities calculated in Diaz-Mendoza (2004).

Comparison by Tax Schedule PIT 1987 Groups	1. Feldstein's approach			2. Regression IV approach				3. Splines regression approach					
	Mean	Median	Percentile 80 <sup>th</sup>	Taxable Income		Ajusted Taxable Income		Gross Income		Taxable Income		Adjusted Taxable Income	
				(1)	(2)	(1)	(2)	(3)	(4)	(3)	(4)	(3)	(4)
B-A	0.08	0.10	0.49										
C-B	2.20	1.25	0.86	0.45	0.60	0.53	0.70	0.13	0.27	0.23	0.36	0.23	0.21
C-A	0.77	0.45	0.64										

NOTES:

(1): Correcting mean reverse.

(2): Using control variables in regression

(3): Logarithmic regression

(4): Logarithmic spline regression

In addition to this, another source of criticism is the way Díaz-Mendoza (2004) creates the groups of “homogeneous” taxpayers in his paper. Specifically, this author classifies all taxpayers in 1989 in three groups. However, in our opinion this segmentation puts together very different taxpayers, which breaks one of the essential requirements necessary for the methodology used as established by Sáez (2003). To illustrate this point, it is necessary to bear in mind that the tax reform introduced by the ruling of the Constitutional Court in 1989 radically changed the 1988 rates. The number of brackets was halved from 34 to 17, the bottom marginal tax rate increased from 8% to 25% and the top marginal tax rate decreased from 66% to 56%. Given these changes, it is incongruent to consider only three groups of taxpayers according to the 1987 marginal tax rate as Mendoza does, especially when the marginal rates that define group C, between 60% and 66% were dropped in 1988.

## 7. Conclusions

In this paper the *taxable income-marginal tax rate* elasticities are calculated for the Spanish PIT. For the first time, fiscal drag has been used as an instrument to identify the marginal tax rates variation. Likewise, this paper pioneers the differentiation between regular and irregular components of taxable income when calculating the elasticities. Based on the results obtained, the following conclusions can be highlighted:

- The consideration of different categories of taxpayers is essential to suitably assess *taxable income-marginal tax rate* elasticities. Even though this differentiation is common in the literature dedicated to obtaining the traditional elasticities of labour supply, the papers aimed at calculating the elasticities of the taxable income have not always taken the existence of these categories into account. For this reason, this paper differentiates between four groups of taxpayers: single taxpayers, married taxpayers with joint taxation, and first and second earners in married couples that opt for separate filing. The arguments in favour of this segmentation rest on the different behavioural frameworks of taxpayers depending on marital status, gender or family burdens due to the existence of dependants, or age, amongst others.

- Acknowledgement of the existence of regular and irregular income has been another differentiation element that has been taken into account in this paper. The significance of this distinction, as evidenced by the results, is crucial for evaluating the elasticities calculated. In our opinion, the particular characteristics of irregular income, together with the peculiar way they are normally taxed, require a differentiated analysis of their impact on *taxable income-marginal tax rate* elasticities.

As far as we know, this paper is the first to consider this differentiation, completing the analysis with estimates of the elasticities for both income components. The results obtained by this separate analysis corroborate the importance of carrying out this distinction since we can clearly see the higher reaction to marginal tax rates from taxpayers who receive irregular income as opposed to those taxpayers who only are recipients of regular income.

- The calculated elasticities are generally higher when irregular income is taken into account. As an illustration, and with the caution that is due when using average values, the elasticities obtained for regular income are approximately a third of the values calculated when total income is taken into account -i.e. the sum of regular and irregular income-. As was to be expected, this fact is influenced by the different characteristics of irregular income that were mentioned above. Furthermore, it goes without saying that in many cases capital gains and losses are due to tax planning strategies including transfer of income between spouses.

- The elasticities by type of taxpayer show a higher response for spouses who are second income earners. Notwithstanding, this pattern is less clear from 45,000 Euros onwards. The second highest response is that of the single taxpayers even though it is significantly lower than that of the first group. For the two remaining categories, married couples with joint taxation and first income earners in married couples with separate filing, it is more complicated to compare since our calculations show significant variations. We suggest the reader take a look at the Tables in the main text and in the appendixes to suitably assess the intensity of the differential response between these groups of taxpayers.

- The empirical analysis carried out has also shown the existence of important transitions of taxpayers between income brackets during the two fiscal years studied. These transitions, of more than one bracket on many occasions, are the result of combining the monetary increase in income with real variations due to the economic cycle. It should be noted that this high mobility in the inter-temporal distribution of income introduces an upward bias in the absolute values provided by the Wald estimator. Without doubt, the exploration of the intensity with which this mobility distorts the value of the elasticities calculated constitutes a line for future research.

To sum up, the range of elasticities obtained allows us to conclude that the efficiency costs associated with the Spanish PIT tax are higher than the costs estimated in research that focused exclusively on the reaction of labour supply. This result is not surprising, since the elasticities that have been derived in this paper, according to the methodology employed, encompass a broad spectrum of effects that include the impact of the tax not only on labour income but also on all other sources of income as well as on tax avoidance and evasion.

## References

- Aaron, H. (1976). "Inflation and the Income Tax". *American Economic Association Proceedings*, 66(2): 193-199.
- Argimon I. and J. M. González-Páramo (1987). "Una Medición de la Rémorra Inflacionaria del IRPF, 1979-1985". *Investigaciones Económicas*, XI(2): 345-356.
- Auten, G. and R. Carroll (1999). "The effect of Income Taxes on Household Behavior". *Review of Economics and Statistics*, 81(3): 681-693.
- Badenes, N. (2001). *IRPF, Eficiencia y Equidad: Tres Ejercicios de Microsimulación*. Colección Investigaciones 1/01. Madrid: Instituto de Estudios Fiscales.
- Badenes, N., J. López-Laborda, J. Onrubia and J. Ruiz-Huerta, J (1998). "Tributación de la Familia, Desigualdad y Bienestar Social en el IRPF", *Revista de Economía Aplicada*, 17: 29-51.
- Díaz-Mendoza, M. (2004). *La Respuesta de los Contribuyentes ante las Reformas del IRPF, 1987-1994*. M.S. Thesis 0405. Madrid: CEMFI.
- Feldstein, M. S. (1975). "Inflation, Income Taxes, and Rate of Interest: A Theoretical Analysis", Discussion Paper 414, Harvard Institute of Economics Research.
- Feldstein, M. S. (1995). "The effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1986 Tax Reform Act", *Journal of Political Economy*, 103: 551-572.
- Feldstein, M. S. (1999a). "Tax Avoidance and the Deadweight Loss of The Income Tax", *Review of Economics and Statistics*, 81(4): 674-680.
- Feldstein, M. S. (1999b). *The Costs and Benefits of Price Stability*, Chicago, IL: National Bureau of Economic Research- University of Chicago Press.
- Feldstein, M. S. (2008). "Effects of Taxes on Economic Behavior". *NBER Working Paper* 13745, Cambridge MA: National Bureau of Economic Research.
- Goolsbee, A. (2000). "What Happens when You Tax the Rich? Evidence from Executive Compensation". *Journal of Political Economy*, 108(2): 353-378.
- Lindsey, L. (1987). "Individual Taxpayer Response to Tax Cuts: 1982-1984, with Implications for the Revenue Maximizing Tax Rate", *Journal of Public Economics*, 33: 173-206.
- OECD (2005). *Revenue Statistics 1965-2004*. Paris: OECD.
- OECD (2006). *Fundamental Reform of Personal Income Tax*. OECD Tax Policy Studies, 13. Paris: OECD.
- Onrubia, J. (2001). "La Tributación Familiar en el IRPF: Escenarios de Reforma". *Hacienda Pública Española*, Monograph Issue 2001: 79-118.
- Saez, E. (2003). "The effect of marginal tax rates on income: a panel study of 'bracket creep'", *Journal of Public Economics*, 87: 1231-1258.
- Sanmartín, J. (2007). "El Efecto de los Cambios de los Tipos Marginales sobre la Base Imponible del IRPF". *Hacienda Pública Española/Revista de Economía Pública*, 182: 9-27.
- Sanz, J.F. and D. Romero (2007), "La Erosión Inflacionista del Poder Adquisitivo de los Contribuyentes del IRPF entre 2003-2007", *Cuadernos de Información Económica*, 198: 15-22.
- Sanz, J.F., J. M. Castañer and D. Romero (2004). *La Reforma de la Imposición Personal sobre la Renta: Una Evaluación de la Reciente Experiencia Española 1998-2003*. Estudios de la Fundación de las Cajas de Ahorros. Madrid: FUNCAS.
- Slemrod, J. (2001). "A General Model of the Behavioral Response to Taxation". *International Tax and Public Finance*, 8: 119-128.
- Tanzi, V. (1980). *Inflation and the Personal Income Tax*. Cambridge MA. Cambridge University Press.

## Appendix 1

**Table A.1.1. Income categories by taxpayer type. PIT 1993 and 1994**

Taxpayer type	Income category	PIT 1993		PIT 1994		93-94 Change
		Mean (euros)	CV	Mean (euros)	CV	(%)
Singles	Regular Labour Income	10,789.07	1.3491	11,579.78	0.9597	7.33
	Irregular Labour Income	1.62	47.9490	1.56	78.7050	-4.08
	Total Labour Income	10,790.69	1.3490	11,581.33	0.9597	7.33
	Imputed income home ownership	338.90	1.3822	45.05	10.0700	-86.71
	Leased Properties	79.87	33.3280	158.53	8.2120	98.48
	Savings	861.20	3.4890	710.84	3.7496	-17.46
	Regular Capital Gains	22.70	34.0210	20.92	27.4050	-7.85
	Irregular Capital Gains	72.83	17.3900	130.02	63.8250	78.53
	Total Capital Income	1,345.61	3.0297	947.74	3.3558	-29.57
Entrepreneurship	2,173.30	2.8704	2,127.46	3.0711	-2.11	
Married couples with only one income earner	Regular Labour Income	9,478.75	0.9488	9,775.64	0.9559	3.13
	Irregular Labour Income	0.99	56.3720	1.28	52.2210	28.92
	Total Labour Income	9,479.74	0.9487	9,776.92	0.9558	3.13
	Imputed income home ownership	186.66	2.2210	24.59	13.7930	-86.82
	Leased Properties	41.15	100.5200	230.39	8.0966	459.84
	Savings	1,167.81	4.0096	914.13	3.8359	-21.72
	Regular Capital Gains	30.50	26.8850	26.48	24.1930	-13.18
	Irregular Capital Gains	64.61	16.8430	90.23	20.9010	39.66
	Total Capital Income	1,491.19	4.1029	1,203.51	3.5867	-19.29
Entrepreneurship	1,072.56	5.0850	1,086.97	5.1913	1.34	
Main breadwinner in married couples filing separately	Regular Labour Income	15,566.99	1.4759	14,969.13	1.3558	-3.84
	Irregular Labour Income	2.95	31.0100	2.28	42.0200	-22.68
	Total Labour Income	15,569.94	1.4757	14,971.42	1.3556	-3.84
	Imputed income home ownership	328.48	1.5599	49.26	21.4050	-85.00
	Leased Properties	140.73	28.1740	478.17	5.2873	239.78
	Savings	1,825.92	6.5297	1,331.92	7.8650	-27.05
	Regular Capital Gains	63.22	19.4680	44.43	16.8240	-29.72
	Irregular Capital Gains	175.07	12.3330	209.80	13.8710	19.83
	Total Capital Income	2,449.14	5.1917	1,920.34	5.8843	-21.59
Entrepreneurship	2,657.94	3.8872	2,570.41	4.0833	-3.29	
Second earner in married couples filing separately	Regular Labour Income	7,729.72	0.9839	7,438.19	0.9852	-3.77
	Irregular Labour Income	0.95	56.9040	0.08	87.1210	-92.05
	Total Labour Income	7,730.67	0.9839	7,438.26	0.9851	-3.78
	Imputed income home ownership	309.04	1.4839	33.65	10.6110	-89.11
	Leased Properties	-158.82	-11.2440	424.79	4.5914	-367.46
	Savings	1,544.10	2.6855	1,113.12	2.8552	-27.91
	Regular Capital Gains	42.19	16.0280	38.38	17.4460	-9.04
	Irregular Capital Gains	116.39	11.0380	158.79	16.6470	36.42
	Total Capital Income	1,832.50	2.3519	1,616.75	2.5048	-11.77
Entrepreneurship	980.58	3.3819	1,034.55	3.3355	5.50	
Total Taxpayers	Regular Labour Income	10,530.35	1.3063	10,829.32	1.1093	2.84
	Irregular Labour Income	1.48	47.4620	1.35	67.7200	-8.28
	Total Labour Income	10,531.82	1.3062	10,830.68	1.1093	2.84
	Imputed income home ownership	280.02	1.6424	36.72	14.5250	-86.89
	Leased Properties	44.77	74.8210	263.16	6.8676	487.81
	Savings	1,167.91	4.7427	921.57	5.2282	-21.09
	Regular Capital Gains	32.67	25.9160	28.43	22.3900	-13.00
	Irregular Capital Gains	87.42	15.4700	130.29	41.2810	49.04
	Total Capital Income	1,588.29	4.0699	1,260.47	4.3412	-20.64
Entrepreneurship	1,697.53	3.7654	1,665.66	3.9859	-1.88	

**NOTE:**

CV: Coefficient of variation

Source: Own calculations

**Table A.1.2. Tax deductions, tax credits, and tax liabilities by taxpayer type. PIT 1993 and 1994**

Taxpayer type	Income category	PIT 1993		PIT 1994		93-94 Change (%)
		Mean (euros)	CV	Mean (euros)	CV	
Singles	Tax Allowances	1,690.05	1.0250	1,833.24	1.0180	8.47
	Regular gross tax liability	2,682.22	1.7420	2,770.09	1.6210	3.28
	Irregular gross tax liability	33.78	17.6700	56.96	83.1900	68.62
	Total gross tax liability	2,716.00	1.7500	2,827.06	2.3710	4.09
	Tax credits	440.27	0.9757	506.83	0.9328	15.12
	Net Tax Liability	2,279.43	2.0020	2,331.29	2.8140	2.27
Married couples with only one income earner	Tax Allowances	1,472.46	1.0950	1,604.61	1.0080	8.97
	Regular gross tax liability	1,621.74	2.8970	1,683.13	2.6480	3.79
	Irregular gross tax liability	14.80	20.6400	24.84	35.9300	67.87
	Total gross tax liability	1,636.53	2.8890	1,707.97	2.6880	4.37
	Tax credits	405.77	1.0380	403.71	1.1840	-0.51
	Net Tax Liability	1,322.95	3.4460	1,358.62	3.2500	2.70
Main breadwinner in married couples filing separately	Tax Allowances	2,268.09	0.8391	2,405.71	0.8410	6.07
	Regular gross tax liability	4,884.96	3.6350	4,958.81	3.3500	1.51
	Irregular gross tax liability	71.26	22.8400	85.04	22.1400	19.34
	Total gross tax liability	4,956.22	3.6100	5,043.85	3.3310	1.77
	Tax credits	497.06	2.8860	510.85	2.3840	2.78
	Net Tax Liability	4,464.17	3.7520	4,533.98	3.5040	1.56
Second income earner in married couples filing separately	Tax Allowances	1,478.08	1.0060	1,548.83	1.0190	4.79
	Regular gross tax liability	1,875.19	1.6570	1,937.59	1.4830	3.33
	Irregular gross tax liability	24.60	13.9100	40.43	33.5000	64.35
	Total gross tax liability	1,899.79	1.6700	1,978.02	1.6870	4.12
	Tax credits	426.54	0.9229	407.99	0.9455	-4.35
	Net Tax Liability	1,503.01	2.0030	1,577.05	2.0400	4.93
Total Taxpayers	Tax Allowances	1,650.26	1.0290	1,776.45	1.0020	7.65
	Regular gross tax liability	2,450.08	2.9800	2,512.19	2.7370	2.54
	Irregular gross tax liability	30.08	23.1300	46.45	67.9600	54.41
	Total gross tax liability	2,480.16	2.9710	2,558.64	2.9970	3.16
	Tax credits	432.69	1.4300	457.51	1.3020	5.74
	Net Tax Liability	2,085.46	3.3390	2,125.85	3.4570	1.94

**NOTE:**

CV: Coefficient of variation

Source: Own calculations

**Table A.1.3. Average and Marginal Tax Rates by type of taxpayer. PIT 1993 and 1994**

Taxpayer type	Tax rate	PIT 1993		PIT 1994		93-94 Change (%)
		Mean value	CV	Mean Value	CV	
Singles	Regular marginal tax rate (top)	30.21	0.3088	30.25	0.3001	0.15
	Irregular marginal tax rate (top)	0.51	7.2187	0.72	6.6300	39.50
	Weighted marginal tax rate (top)	30.13	0.3083	30.15	0.2997	0.06
	Regular average tax rate (RGL/RGI)	20.75	0.3584	20.82	0.3476	0.33
	Irregular average tax rate (IGL/IGI)	20.79	0.3568	20.86	0.3501	0.38
	Weighted average tax rate	20.78	0.3569	20.86	0.3498	0.37
	Effective average tax rate (NTL/TG)	15.56	0.5229	15.26	0.5383	-1.93
Married couples with only one income earner	Regular marginal tax rate (top)	25.69	0.4048	25.81	0.3922	0.49
	Irregular marginal tax rate (top)	0.19	11.6740	0.32	9.6664	67.12
	Weighted marginal tax rate (top)	25.63	0.4044	25.72	0.3924	0.37
	Regular average tax rate (RGL/RGI)	14.47	0.6087	14.54	0.5951	0.50
	Irregular average tax rate (IGL/IGI)	14.49	0.6074	14.57	0.5960	0.57
	Weighted average tax rate	14.49	0.6075	14.57	0.5958	0.57
	Effective average tax rate (NTL/TG)	10.50	0.8578	10.33	0.8595	-1.64
Main breadwinner in married couples filing separately	Regular marginal tax rate (top)	35.43	0.3004	35.41	0.2947	-0.06
	Irregular marginal tax rate (top)	0.77	5.9988	0.87	5.5363	12.69
	Weighted marginal tax rate (top)	35.32	0.3003	35.28	0.2955	-0.14
	Regular average tax rate (RGL/RGI)	25.07	0.3620	25.05	0.3536	-0.07
	Irregular average tax rate (IGL/IGI)	25.11	0.3616	25.08	0.3532	-0.10
	Weighted average tax rate	25.10	0.3616	25.08	0.3532	-0.10
	Effective average tax rate (NTL/TG)	20.47	0.4849	20.30	0.4773	-0.80
Second income earner in married couples filing separately	Regular marginal tax rate (top)	27.43	0.2874	27.43	0.2799	0.01
	Irregular marginal tax rate (top)	0.44	7.2913	0.64	6.7085	43.94
	Weighted marginal tax rate (top)	27.36	0.2857	27.32	0.2786	-0.15
	Regular average tax rate (RGL/RGI)	18.37	0.3632	18.39	0.3511	0.11
	Irregular average tax rate (IGL/IGI)	18.41	0.3600	18.44	0.3507	0.14
	Weighted average tax rate	18.41	0.3601	18.43	0.3504	0.13
	Effective average tax rate (NTL/TG)	12.83	0.6031	12.92	0.5760	0.65
Total taxpayers	Regular marginal tax rate (top)	29.40	0.3505	29.40	0.3420	-0.02
	Irregular marginal tax rate (top)	0.45	7.7030	0.61	7.0007	35.17
	Weighted marginal tax rate (top)	29.33	0.3500	29.29	0.3419	-0.12
	Regular average tax rate (RGL/RGI)	19.30	0.4610	19.28	0.4521	-0.08
	Irregular average tax rate (IGL/IGI)	19.33	0.4598	19.32	0.4530	-0.04
	Weighted average tax rate	19.32	0.4598	19.32	0.4528	-0.04
	Effective average tax rate (NTL/TG)	14.54	0.6416	14.28	0.6469	-1.76

**NOTE:**

CV: Coefficient of variation; RGL: Regular Gross Liability; IGL: Irregular Gross Liability; RGI: Regular Gross Income; IGI: Irregular Gross Income; NTL: Net Total Liability; TGI: Total Gross Income

Source: Own calculations



## Appendix 2

### Table A.2.1.

#### Bracket mobility matrix for tax returns of single taxpayers in 1993 and 1994 (population)

BRACKET 94 → BRACKET 93 ↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total	NO TRANSITIONS (%)	FORWARD TRANSITIONS (%)	BACKWARD TRANSITIONS (%)
1	76,200	113,200	65,950	23,650	8,050	3,750	1,300	400	500	200	250	150	100	100	50	0	0	200	294,050	25.91	74.09	0.00
2	45,000	290,650	219,250	65,100	17,150	6,200	2,700	1,050	500	300	150	100	150	0	0	0	0	50	648,350	44.83	48.23	6.94
3	18,200	144,800	760,900	227,900	42,750	11,850	3,800	1,500	750	450	150	150	0	0	0	0	0	50	1,213,250	62.72	23.85	13.43
4	7,900	32,800	157,900	621,950	163,550	27,150	7,500	2,750	1,150	500	350	300	50	50	150	200	0	250	1,024,500	60.71	19.91	19.39
5	3,650	9,250	32,900	117,200	372,300	108,200	16,050	5,000	1,850	750	400	100	200	50	100	50	100	100	668,250	55.71	19.90	24.39
6	2,100	3,200	11,550	21,450	75,200	221,500	68,350	12,350	4,100	1,400	700	350	200	150	200	0	50	300	423,150	52.35	20.83	26.82
7	1,350	1,650	4,900	8,500	13,250	44,850	129,050	41,050	8,550	2,600	1,450	750	250	250	150	150	50	100	258,900	49.85	21.38	28.78
8	400	1,300	2,650	3,900	5,100	10,050	29,050	66,400	23,700	6,300	2,750	1,150	250	500	250	50	200	200	154,200	43.06	22.92	34.01
9	350	600	1,300	1,750	2,100	3,100	5,550	18,250	34,550	15,750	4,100	1,650	650	400	200	150	150	150	90,750	38.07	25.56	36.36
10	250	250	1,100	1,200	1,250	2,200	2,100	4,200	10,200	21,250	9,850	3,700	1,200	400	300	50	150	550	60,200	35.30	26.91	37.79
11	150	150	500	400	1,450	1,150	950	2,500	2,900	6,500	13,550	6,900	2,300	850	500	300	150	400	41,600	32.57	27.40	40.02
12	50	200	200	350	650	500	750	1,350	1,400	2,100	4,750	9,150	4,800	2,150	750	400	250	450	30,250	30.25	29.09	40.66
13	100	0	200	500	250	350	600	350	600	1,150	1,900	3,250	5,850	3,350	1,600	600	350	600	21,600	27.08	30.09	42.82
14	0	50	100	50	200	350	450	500	150	450	650	1,400	1,900	4,900	2,850	900	600	500	16,000	30.63	30.31	39.06
15	0	0	100	100	250	50	400	250	300	450	400	500	750	1,600	3,300	2,550	1,000	900	12,900	25.58	34.50	39.92
16	0	50	0	250	150	500	250	150	250	50	300	750	400	450	1,350	1,750	1,650	1,500	9,800	17.86	32.14	50.00
17	100	50	50	0	50	50	100	100	0	50	200	200	250	250	550	950	1,500	2,900	7,350	20.41	39.46	40.14
18	300	300	300	450	350	550	500	600	500	500	500	450	700	750	850	800	1,300	26,250	35,950	73.02	0.00	26.98
Total	156,100	598,500	1,259,850	1,094,700	704,050	442,350	269,450	158,750	91,950	60,750	42,400	31,000	20,000	16,200	13,150	8,900	7,500	35,450	5,011,050			

### Table A.2.2.

#### Bracket mobility matrix for tax returns of married taxpayers filing jointly in 1993 and 1994 (population)

BRACKET 94 → BRACKET 93 ↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	Total	NO TRANSITIONS (%)	FORWARD TRANSITIONS (%)	BACKWARD TRANSITIONS (%)
1	502,850	307,800	20,800	9,300	3,200	1,850	1,350	650	700	350	450	150	200	150	100	50	550	850,500	59.12	40.88	0.00
2	184,600	1,770,950	156,400	30,650	9,600	3,850	2,150	900	800	650	300	400	150	150	50	100	400	2,162,100	81.91	9.55	8.54
3	7,500	118,350	345,400	81,900	11,850	4,400	2,100	1,150	800	250	150	50	50	100	0	50	200	574,300	60.14	17.94	21.91
4	2,950	24,450	64,050	218,950	52,050	8,350	3,100	1,600	900	600	400	50	100	50	50	50	100	377,800	57.95	17.84	24.21
5	1,750	8,300	9,750	37,450	94,400	27,150	5,200	2,050	1,050	500	300	250	50	50	50	100	100	188,500	50.08	19.55	30.37
6	700	4,050	4,400	6,800	20,300	42,650	14,750	3,450	1,150	950	400	350	100	150	100	100	200	100,600	42.40	21.57	36.03
7	350	2,200	1,700	2,500	3,800	12,050	20,550	9,150	2,450	800	300	300	300	200	50	300	100	57,100	35.99	24.43	39.58
8	250	800	1,250	1,700	2,350	2,950	7,400	12,000	4,500	1,450	650	400	350	100	150	100	250	36,650	32.74	21.69	45.57
9	250	650	800	800	600	1,400	2,650	3,600	6,050	3,850	1,300	500	100	200	0	100	50	22,900	26.42	26.64	46.94
10	0	400	500	800	700	600	1,100	1,750	2,850	3,550	2,350	1,150	400	350	100	100	200	16,900	21.01	27.51	51.48
11	150	300	200	500	250	350	550	650	950	1,550	2,250	1,400	700	600	150	100	300	10,950	20.55	29.68	49.77
12	50	300	250	100	250	250	200	400	200	700	1,300	2,050	1,000	750	200	350	300	8,650	23.70	30.06	46.24
13	0	100	50	250	300	150	150	350	350	300	700	550	900	800	200	500	450	6,100	14.75	31.97	53.28
14	50	150	200	100	250	150	150	0	150	300	250	400	400	650	550	350	550	4,650	13.98	31.18	54.84
15	50	0	50	50	50	50	0	150	100	200	100	150	100	750	300	400	650	3,150	9.52	33.33	57.14
16	0	150	0	100	0	150	350	100	100	150	100	250	100	200	400	750	950	3,850	19.48	24.68	55.84
17	250	400	250	350	150	250	150	100	200	450	400	350	450	300	400	1150	9,950	15,550	63.99	0.00	36.01
Total	701,750	2,239,350	606,050	392,300	200,100	106,600	61,900	38,050	23,300	16,600	11,700	8,750	5,450	5,550	2,850	4,650	15,300	4,440,250			

Table A.2.3.

Bracket mobility matrix for tax returns of married taxpayers filing separately in 1993 and 1994 -main breadwinner- (population)

BRACKET 94 →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total	NO	FORWARD	BACKWARD
BRACKET 93 ↓																			TRANSITIONS (%)	TRANSITIONS (%)	TRANSITIONS (%)	
1	650	1,900	2,400	1,200	750	500	300	150	50	50	0	50	0	0	0	0	50	100	8,150	7.98	92.02	0.00
2	2,150	56,850	22,100	6,550	2,600	750	450	50	100	50	50	100	0	50	0	0	0	0	91,850	61.89	35.76	2.34
3	1,050	25,350	154,950	37,950	6,900	2,400	750	350	350	200	100	50	0	100	0	0	0	200	230,700	67.17	21.39	11.44
4	1,100	6,100	37,150	161,000	35,800	7,550	2,550	1,000	650	500	300	100	150	0	0	50	0	300	254,300	63.31	19.25	17.44
5	550	2,750	8,700	30,050	118,400	35,850	6,800	2,300	1,000	700	300	300	100	50	50	50	0	200	208,150	56.88	22.92	20.20
6	400	1,500	3,650	6,650	26,100	118,500	35,200	6,100	2,100	900	1150	500	200	100	50	100	0	250	203,450	58.25	22.93	18.83
7	250	800	2,300	2,650	4,650	21,800	72,750	22,150	4,950	1,750	800	300	250	200	50	50	50	150	135,900	53.53	22.59	23.88
8	150	650	1,100	2,100	2,450	4,400	15,400	38,050	14,350	3,600	1,700	550	300	100	200	50	50	100	85,300	44.61	24.62	30.77
9	100	150	650	650	1,700	2,100	3,550	10,350	21,700	11,250	3,750	1,300	800	350	400	150	0	100	59,050	36.75	30.65	32.60
10	0	100	550	600	1,100	1,100	1,600	3,000	7,450	14,050	8,050	2,150	1,000	250	300	0	100	500	41,900	33.53	29.47	36.99
11	100	0	400	450	800	650	750	1,300	2,050	4,650	9,150	6,400	1,900	750	550	250	100	200	30,450	30.05	33.33	36.62
12	0	100	300	350	500	450	450	1,200	1,200	2,450	3,800	8,200	4,350	1,150	750	450	200	350	26,250	31.24	27.62	41.14
13	0	0	200	200	450	350	500	650	450	800	2,000	2,950	4,950	2,450	1,050	350	100	500	17,950	27.58	24.79	47.63
14	0	0	100	300	100	250	400	200	450	400	900	950	1,900	3,900	2,700	900	200	800	14,450	26.99	31.83	41.18
15	50	0	50	100	450	250	350	200	600	350	300	800	550	1,900	2,450	1,600	600	1,200	11,800	20.76	28.81	50.42
16	0	0	0	200	0	0	50	300	250	200	250	450	550	700	900	2,100	1,700	1,550	9,200	22.83	35.33	41.85
17	0	0	0	50	50	250	50	0	50	200	300	250	350	450	450	550	1,900	2,400	7,300	26.03	32.88	41.10
18	50	150	250	150	300	450	500	350	550	450	250	600	950	1,000	1,000	1,350	1,400	25,050	34,800	71.98	0.00	28.02
Total	6,600	96,400	234,850	251,200	203,100	197,600	142,400	87,700	58,300	42,550	33,150	26,000	18,300	13,500	10,900	8,000	6,450	33,950	1,470,950			

Table A.2.4.

Bracket mobility matrix for tax returns of married taxpayers filing separately in 1993 and 1994 -second earner- (population)

BRACKET 94 →	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total	NO	FORWARD	BACKWARD
BRACKET 93 ↓																			TRANSITIONS (%)	TRANSITIONS (%)	TRANSITIONS (%)	
1	18,050	35,800	17,800	8,100	4,200	2,050	1,600	600	550	500	300	150	150	200	150	100	100	250	90,650	19.91	80.09	0.00
2	17,050	230,050	87,050	20,200	7,050	2,750	1,100	1,100	600	200	100	100	50	0	100	50	0	150	367,700	62.56	32.80	4.64
3	2,900	61,200	259,950	54,450	10,350	4,850	1,900	550	850	250	350	100	0	100	0	0	0	250	398,050	65.31	18.59	16.10
4	850	7,400	44,450	152,950	31,150	5,600	2,000	1,100	800	300	300	150	100	0	0	50	0	50	247,250	61.86	16.83	21.31
5	200	2,500	6,600	23,550	87,350	22,750	2,450	2,050	650	150	300	200	0	100	100	50	50	200	149,250	58.53	19.46	22.01
6	350	1,150	2,000	3,350	17,350	72,500	16,200	2,100	1,000	350	450	50	50	150	0	0	50	50	117,150	61.89	17.46	20.66
7	50	300	900	1,450	2,500	9,050	24,550	7,100	1,300	500	200	50	250	50	100	0	0	150	48,500	50.62	20.00	29.38
8	50	150	250	450	700	900	4,800	7,550	2,750	650	850	100	50	100	100	50	100	100	19,700	38.32	24.62	37.06
9	0	100	50	150	350	450	900	2,100	4,250	1,550	700	300	200	100	200	0	50	150	11,600	36.64	28.02	35.34
10	50	100	100	150	100	100	500	350	1,100	2,000	700	300	50	200	50	100	0	200	6,150	32.52	26.02	41.46
11	0	0	50	100	50	100	100	250	400	950	1,300	800	200	100	0	0	50	0	4,450	29.21	25.84	44.94
12	0	0	0	50	100	150	100	300	400	250	450	450	350	200	150	100	0	0	3,050	14.75	26.23	59.02
13	0	0	0	50	50	50	50	150	50	50	200	250	350	250	100	100	0	0	1,700	20.59	26.47	52.94
14	50	0	50	0	0	0	0	0	100	50	50	150	100	200	250	150	150	50	1,350	14.81	44.44	40.74
15	0	50	0	0	0	50	50	100	0	50	0	100	100	200	50	50	50	50	900	5.56	16.67	77.78
16	0	50	0	0	0	0	0	100	0	150	50	0	50	100	100	50	100	150	900	5.56	27.78	66.67
17	0	0	0	0	0	0	0	0	50	50	100	0	0	0	50	150	100	50	550	18.18	9.09	72.73
18	50	0	0	0	100	0	0	50	50	150	50	50	150	50	100	50	50	1,150	2,050	56.10	0.00	43.90
Total	39,850	338,850	419,250	265,000	161,400	121,350	56,300	25,550	14,900	8,150	6,450	3,300	2,200	2,100	1,600	1,050	850	3,000	1,470,950			