Inequality effects of inflation: the Spanish income tax system between 1999 and 2003 and the 2003 reform

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Abstract

The aim of this research is to analyse how inflation induced erosions of the nominally defined items of the tax rules of the Spanish income tax system, and how that may change distributional and revenue generating properties of income taxes. We further investigate the effects of the tax reform carried out in 2003. Although the Spanish government claimed that this reform would reduce tax liabilities, this is not so clear as many argue that this reform only offset the effects of inflation suffered by the population since 1999. Using the European Community Household Panel (ECHP) data set we aim to shed some light on the above issues through microsimulation techniques. Furthermore, we will also measure the inequality effects caused by the fact that the Spanish tax system does not automatically adjust the main fiscal elements to account for inflation.

JEL codes: H24 - Personal Income and Other Nonbusiness Taxes and Subsidies; H3 - Fiscal Policies and Behavior of Economic Agents; C8 - Data Collection and Data Estimation Methodology; Computer Programs

1. Introduction.

It is generally accepted that one should account for the effects of inflation on nominally denominated economic variables. However, many tax rules in fiscal systems are still designed in nominal terms, which would affect many aspects of the fiscal system. One of the most important findings is that progressivity and redistribution in nominally defined tax systems may be altered by inflation.

During the 70s and the 80s, when inflation was high in many industrialised countries, emerged a large literature that analysed the effects of inflation on taxation. The decline in the inflation rates by the end of the 80s implied a lack of interest on the topic. However, even if the inflation rates are not so high, "the effect of inflation on the progressivity of the income tax system is important and noteworthy, but usually overlooked".[1]

Why it is still interesting to investigate this topic? There are several reasons that justify this renewed interest on it. First, even at low levels of inflation (like the recently experienced by many European economies like Spain) there may be distortions on the tax liabilities (see Immerwol, 2005, for a recent study for some European countries). To avoid these distortions, one could design automatic adjustments in some tax rules to account for inflation that would alleviate or eliminate the effects of inflations on tax burdens. Alternatively, as it is the case in Spain, the government could implement discretionary adjustments in the tax system to account for the (accumulated) effects of inflation.[2] However, infrequent inflation adjustments can indeed cause significantly additional tax burdens, even at low rates of inflation. Secondly, tax reforms implemented during last decade in many countries (like Spain in 1999) significantly

[1] Bailey, 1976.

[2] Although the government in 2003 did not explicitly declared that the reform aimed at compensating for the effects of inflation one can interpret the reform in that lines as many fiscal items were inflated in 2003 with respect to their values in 1999.

altered the structure of income tax schedules leading to a reduction in the number of tax brackets and a flattening of the rate schedules. Given the importance of the shape of (effective) tax schedules in determining how inflation alters real tax burdens, it is useful to re-assess earlier arguments on the consequences of inflation, in order to check whether current tax systems still result in significant extents of "fiscal drag".

Many of the empirical studies on fiscal drag undertaken in the mid and late 70s found that tax burdens increased more for low-income families than for high-income families, indicating that fiscal drag had regressive effects in many countries.[3] These studies also obtain that in a progressive tax system, average tax rates increase for all income groups and that any discretionary adjustment of the tax schedule have not compensated enough for the effects of inflation. There are however scarce studies that investigate the topic using micro-data to analyse the effects of changes in tax burden on the distribution of household incomes. Immerwoll (2005) constitutes one of the first attempts to analyse how inflation alters the distribution properties of nominally defined tax systems using micro-data for three European countries (Holland, Germany and the UK). This study presents evidence that the effects on individual tax burdens can be substantial even at low inflation rates and how well automatic adjustments regimes work in two Holland and Germany.

Very recently, some studies have appeared for Spain. Sanz, Castañer y Romero, (2004, cap. VII) compare the 1998 Income Tax, before the 1999 reform, with the 2003 Income Tax resulting from the reform made this year. They used the annual expected rates of inflation, not the real ones, to update the monetary values. The authors conclude that the 2003 income tax is more progressive but less redistributive.

[3] Most of these studies are quoted in Immerwoll (2005). And these are: an international comparative study carried out by the OCDE in 1976, an study for Australia (Taxation Review Commitee, 1974), two for Canada (Vukelich, 1972; and Jarvis, 1977), some for the USA (Goetz and Weber, 1971; Von Fursternberg, 1975; Sunley and Pechman, 1976); and for Italy (Majocchi, 1976).

Delgado (2005) analyses the effect of inflation inside this period: he maintains unchanged the income tax structure and search for the effect of inflation in 1999, 2001 and 2002. Inflation produces, as a result, a reduction in progressivity and a rise in redistribution.[4] In our work we try to combine this two studies.

The objective of this paper is twofold. On the one hand, we will analyse the effects of inflation on progressivity and redistribution properties for the Spanish income tax system for the period 1999-2003, which defines a period between two significant fiscal reforms. On the other hand, we will investigate if the discretionary adjustment embodied in the 2003 fiscal reform compensated enough for the accumulated inflation bore in Spain during that period.[5] To this end we will use a representative household data set for Spain (the 2000 European Community Household Panel, ECHP, whose income data refers to 1999) for the micro-simulations. Using 1999 as our baseline year (for which we will calculate all fiscal rules) we will first repeat all calculations after increasing all monetary variables in the data to simulate the increase in the retail price index (RPI) between 1999 and 2003.[6] This procedure would allow us to focus on the pure inflation effect.[7] In a second simulation exercise we compare results for the baseline with the 2003 fiscal reform assuming that this reform "only" aimed to compensate for the effects of inflation since 1999. In this second exercise we can asses if the discretionary reform in 2003 compensated enough for the accumulated inflation suffered in Spain between 1999 and 2003.

[4] Domínguez (2005) analyses the effect of inflation over the income tax, too. But it describes how inflation could affect the final tax, and analyses the existing regulation in the spanish income tax.
[5] Although the declared objectives of the 2003 reform were not to compensate for the inflation effects since 2000 (the last time that the tax rates were deflated to account for inflation), we are going to assume that the reform in 2003 aimed to offset the effects of inflation.
[6] We implicitly assume that all incomes increase in line with inflation, although we could think of other ways of upgrading incomes like specific income deflators of growth rates.
[7] With this procedure we keep everything else constant and avoids identification problems that one has to face when comparing household income data for different periods.

The rest of the paper is organized as follows. In section 2 we outline the effects of inflation in terms of income distribution and progressivity. Section 3 is devoted to describe the main features of the Spanish tax system. In section 4 we summarize both the data and the simulations. The main results are reported in section 5. And, finally, section 6 concludes.

2. The effects of inflation on income tax burdens and on income distribution.

There are many ways inflation may affect real income tax burdens. First, in general, inflation has effects on real tax burdens due to the fact that there are collections lags. As stated by Immervoll (2005), if the income tax system does not adjust for these lags, the effects on tax burdens can lead to unequal tax treatment between individuals subject to the pay-as-you-earn system and self-employed individuals. Secondly, another way inflation can affect the tax burdens is through the distortions that inflation can introduce in taxable income, in the sense that inflation may have effects in the power to consume (see Feldstein, 1997 and 1999, for some studies on the implications of these distortions). Finally, inflation can produce distortions in the tax function itself. The aim of this paper is to study the extent of these last effects of inflation on income tax burdens and on the progressivity and redistribution properties of the Spanish tax system.

In general, one can define taxes t as a function of gross income, y, i.e., $t = t(y)$. The income tax system embodies some adjustments in the form of deductions, a, tax rates, s, or tax credits, c. Deductions are applied to the pre-tax income y to obtain taxable income. Both a and c may depend on y, therefore tax burdens are obtained as:

$$t(y) = s\big(y - a(y)\big) - c(y)$$

If not corrected, inflation would erode any nominally defined parameters of *s(.)*, *a(.)* or *c(.)*. The most popular effect of inflation is the erosion of tax bracket limits, *s(.)*, known as "bracket creep".

If *t* is progressive such that $\forall$ *y* marginal tax rates are never smaller than average tax rates and there exist at least one tax unit for whom marginal tax rate is bigger than average tax rate, household total income will fall and tax revenues will rise.[8] However, it is not obvious the way these losses are distributed, that is, how inflation changes the degree of redistribution built into the tax system.

The two factors determining to which extent inflation affects the real tax burden levied on a given income *y*, are the rate of inflation and the shape of the tax rate schedule. If we want to determine this effect, then the elasticity of tax burden, ξ, is the right tool. This elasticity depends both on the marginal and the average tax rates:

$$\xi = \frac{t'(y)}{t(y)/y} \text{ or, } \xi = \frac{y \cdot t'(y)}{t(y)}$$

The usual conjecture is that tax increases that result from inflation-induced distortions of *t* depend upon tax progressivity while relative tax burden changes also depend upon the size of the tax.

As it is commonly known, the progressivity of tax burdens will unambiguously increase if ξ increases, however ξ is undefined for all tax units that who pay zero taxes. So that explaining progressivity only in terms of ξ will not be possible. At least, we know that as far as the number of tax-exempt tax units remains unchanged progressivity will unambiguously increase if ξ increases ($\forall y$) where *t(y)* > 0.

Inflation can affect tax units in two different ways when rate schedules have uniformly increasing tax rates. First, the nominally higher income may increase taxpayers' marginal rates (if they jump to the next tax bracket). In this case the average

[8] The opposite is true for regressive taxes.

tax rate will also increase but less than the marginal rate, so as ξ will increase. Some other tax units will remain in the same tax bracket and then their marginal tax rate will not change but their average tax rate will increase as a result of the compression of the brackets. In this case, and for these tax units, ξ will therefore, decrease. Thus, in this case there are ambiguities, and the width of the brackets will play a key in the resulting effect role, since with narrower brackets inflation-induced progressivity will probably increase.

Secondly, inflation can affect tax units in another way. We have to consider situations in which the number of tax units exempted from tax can change. In this case the number of taxpayers with zero tax burdens is influenced both by tax deductions and by tax credits. For non-refundable fixed-amount tax credits, higher values of c enlarge the tax threshold so that for some tax units the tax burden is reduced to zero (except in case c does reduce to zero all tax burdens). Therefore, an inflation induced-erosion of the real value of c will reduce progressivity.

For deductions, a, the effect is less straightforward. If deductions do not depend on the income, they affect progressivity in two opposite ways. First, deductions leave with no tax burden those taxpayers with $y < a$ (thus increasing progressivity) but, secondly, at the same time, deductions reduce the absolute tax liabilities for those taxpayers facing higher marginal tax rates more than those taxpayers with lower marginal rates. Thus the final result is ambiguous, and to avoid this ambiguity the rate schedule must not be 'too progressive', therefore the decrease of tax burdens due to the increase of the tax deductions is higher for the poor than for the rich.

Therefore, we need to use inequality and progressivity indexes that allow to account for the whole distribution of individuals. As it is well known the Gini coefficient is a measure of income inequality. To calculate it we first order income from

lower to higher values, accumulate them, and finally calculate the index. This index ranges from 0 to 1, and the lower its value the greater the equality of income. Now, if we call G_b and G_a the Gini coefficients of income before tax and after tax, respectively, we can obtain a measure of redistribution, obtaided by Reynolds and Smolensky (1977), also known as the Reynolds-Smolensky index of the redistributive effect of taxes:

$$RS = G_b - G_a$$

If this index is positive it means that income is distributed more equally after taxation; if the index is negative the distribution of income worsens and if the index equals zero the distribution remains unchanged.

To measure the dregree of progressivity of the income tax, in terms of the distance from proportionality, we use the measure suggested by Kakwani (1977), known as the Kakwani index of tax progressivity:

$$K = C_t - G_b$$

where C_t is the concentration coefficient for tax liabilities. If K is positive (negative) tax burdens are more (less) unequally distributed than income before taxes. Thus a positive (negative) value of K implies a progressive (regressive) tax and a value equal to zero implies a proportional tax.

Finally, we can link both Reynolds-Smolensky index and Kakwani index, so that:

$$RS = K\frac{t}{1-t} - D$$

where t is the average tax rate and D is a measure of re-ranking caused by the effect of some elements of the tax, different from the tax rates (through personal or familiar characteristics, several expenses, and so on). This effect introduces some "imperfections" in the redistributive effect of the tax. The re-ranking effect leads

taxpayers to different ranking before and after tax. If there is no re-ranking, $D = 0$. Moreover, this equation suggests that redistribution is an increasing function of progressivity, but also depends of tax rates.

3. The Spanish income tax system in 1999 and the subsequent reforms until 2003.

Many industrialised countries have implemented income tax reforms following the so-called "extensive model". The main characteristics of this model are the broadening of taxable income, the reduction in the number of tax rates and the flattering of the tax rate structure.[9] Most countries undertook this pattern of reform mainly during the eighties, although for other countries, included Spain, the reform was applied with some delay. In 1999 a major income tax reform took place in Spain within the "extensive model" framework and in line with other OCDE countries.

After this intensive fiscal reform, the Spanish tax system has not suffered any remarkable reform until 2003.[10] In 2003 there was a reform on the tax system, although it was not as important as the one experienced in 1999. This reform aimed two main objectives. First, the government declared that this reform would reduce the tax burdens for all tax payers. In order to reach this objective both the number of tax rates and the marginal tax rate in each tax bracket were reduced[11]. Secondly, the reform focused on helping some types of families involved in specific circumstances. In this sense, deductions were raised for families with dependents (children and elderly people) or for families with any disabled member. Also, a new deduction was designed for working women with children younger than three years, in order to make it easier for these

[9] See Alvarez *et al.* (2001) for a description of the main fiscal reform undertaken recently by OCDE countries. See also Sanz (1994)

[10] Between 1999 and 2003 the only change in the Spanish fiscal system took place in 2000, where the tax rates were deflated a 2% to account for the predicted inflation of that specific year.

[11] In 1999 there were six tax rates ranging from 18% to 48%, whereas in 2003 the number of rates was reduced to five, ranging from 15% to 45%.

women to combine their working life with motherhood. Table 1 below presents a summary of the main figures of the income tax items that have been modified in 2003 and the increase with respect to the corresponding figures in 1999.[12]

It should be noted that, although not explicitly declared by the government, the 2003 reform can be seen as a discretionary adjustment of the inflation bore since 1999. Therefore, one of the empirical exercises we present below will focus on assessing if this "discretionary adjustment" (reform) compensated enough for the effects of inflation.

[PLACE TABLE 1 HERE]

4. The data and the simulations

For the micro-simulation exercise we use micro-data for Spain drawn from the European Community Household Panel (ECHP) for 2000 (which correspond to the 7th wave). This data is collected by the Spanish Statistical Office (Instituto Nacional de Estadística) in cooperation with the European Statistical Office (EUROSTAT). This is a representative data set of the Spanish population for 2000.[13] There is comprehensive information about socio-economic and demographic characteristics corresponding to 2000 and detailed income information reported by households corresponding to 1999.

The original number of individuals in the sample is 46,046. In order to implement our empirical exercise we dropped the households in which there are individuals with significant missing information, and the households living in País Vasco and Navarra due to the different income tax system applied in these two regions. After considering the above criteria we have brought to a sample of 37,499 individuals living in 13,018 households. However we have to identify the fiscal unit each individual

[12] In this table we only present those fiscal items that have been modified between 1999 and 2003.
[13] We do not include Ceuta and Melilla due to the lack of representiveness of the data corresponding to these cities.

belongs to, as the Spanish fiscal system has to be implemented for fiscal units.[14] Thus, we calculate the income tax from these tax units, identified from our sample of households. Finally, it should be noted that we assume that tax units behave optimally and choose the most convenient alternative when comparing individual *versus* joint filing.[15]

Now we turn to describe the three simulations we have undertaken. First, we simulate the income tax for 1999 which is the base year for our comparisons, using information from ECHP. Secondly, we upgrade all income information to 2003 using the RPI (retail price index) and simulate the tax system under the 1999 fiscal structure. Finally, using data upgraded to 2003 we simulate the tax system in 2003 after the reform that took place that year.[16]

The two first simulations aim to check to what extent inflation had effects on the revenues, tax burdens and the distributive properties of the income tax system, assuming that there were neither automatic nor discretionary adjustments for inflation between 1999-2003.[17] Given that the tax system was reformed in 2003, we will carry out a third empirical exercise. In this exercise we are going to compare the estimates for 1999 to the estimates obtained after taking into account the income tax structure in 2003. Doing so, we will check to what extent the reform implemented in 2003 compensated the erosion of incomes caused by inflation. As stated before, although in the explicit objectives declared by the government for the 2003 reform, adjustment for inflation was

[14] In general, in the Spanish tax system a fiscal unit is defined by the spouse/spouses and her/his/their children under 18 years old.
[15] Although all calculations have been carried out at individual/fiscal unit level, when we report our estimates we present national aggregates using the grossing-up factors provided by the data set.
[16] We carry out a static analysis in all our simulations as we will not consider any behavioural response taken by individuals to changes (both current or anticipated) in inflation. We neither change the population in order to make comparisons easier.
[17] Although in 2000 the tax rates were inflated a 2% (it was the predicted inflation for that year), we will not consider this in our simulation.

not explicitly mentioned, we are going to consider the reform as if it was designed for this purpose.[18]

Comparing different scenarios using micro-simulations, it is possible to obtain information about the tax revenues, the tax burdens and the distributional effects of the inflation erosion. To carry out the simulations we have programmed an income tax micro-simulation model that allows computing income tax at the fiscal units level, for a representative sample of Spanish households. The micro-simulation model includes all relevant tax rules, as well as any standard tax deductions, allowances and tax credits. The limits in our simulations are imposed by data availability. Thus, capital gains, extraordinary income and retirement plans are not simulated due to lack of information in our data set.

This model has been programmed in order to check the effects of income tax reforms although we will use it to simulate the effects of inflation on household tax burdens if, as it is the case of Spain, the income tax system does not adjust (automatically) for the changes in income due to inflation. We will increase individual incomes (using the increase in the RPI) and will maintain all tax parameters constant at their original nominal value to simulate the effects of inflation on a nominally defined income tax. With the estimates computed one can compare any variable of interest using the before and after inflation results.

As stated above, if tax rules are not modified to account for inflation, a general increase in incomes (due to inflation) would shift taxable income upward in relation to nominally defined tax rules. To see how sensitive tax burdens are in relation to that shift, we plot the initial distribution of taxable income in 1999 through a kernel density in relation to the tax rate schedule in that year (see Figure 1). The Spanish tax rate

[18] We understand that the effective results of any reform should account for inflation and this is why we assume that the reform also aimed to compensate by the effects of accumulated inflation since last time the system was adjusted to that end.

schedule is steep, but relative to the distribution of taxable incomes, the largest increase in marginal tax rates occurs at a rather high level of taxable income.

[PLACE FIGURE 1 HERE]

By simple inspection of Figure 1, it is obvious that there is considerable scope for inflation to push taxpayers to brackets with higher marginal rates. Although the plot of taxable income distribution in relation to tax rates provides a useful description of the rate schedules and a graphical illustration of the mechanism of "bracket creep" in terms of *s(.)*, it is limited to provide information of the effects of inflation on the total tax function *t(.)*. This is so because taxable income will not generally move up or down in line with inflation as they are also determined by other fiscals items like deductions or other adjustments, *a(.)*. Since these fiscal items can be eroded by inflation as well, nominally taxable income can increase more than the rate of inflation. One should also take into account any erosion suffered by tax credits, *c(.)*. Finally, one needs to look at the whole income distribution of fiscal units to analyse the net effect of inflation on the distributional properties of the series. We do that in next section.

5. Results

The results we present in this section are organised as follows. First, we present the main aggregates (in real terms) for the three simulations carried out. Secondly, we report detailed information of income taxes and disposable incomes (by deciles). The inspection of the information organised by deciles can be seen as a first approach to detect any redistributive changes for the Spanish population under different simulated

scenarios. Finally, we report standard inequality, progressivity and re-distributive indexes which would allow us to conclude the direction of changes.

[PLACE TABLE 2 HERE]

In Table 2 we report the main aggregates (in real terms) of our simulations. In column (1) we report the results for the simulation of the 1999 income tax system using data from 1999 (this would be our base year for comparisons). In column (2) we present the simulation for the 1999 income tax system upgrading the data up to 2003, i.e. these results are computed similarly to the baseline figures, being the only difference that all monetary variables have been inflated before we compute taxes. Therefore, comparing these results to the ones in column (1), we capture de net effect of inflation (fiscal drag).[19] Finally, in column (3), we present the estimates applying the 2003 income tax system to the 2003 upgraded data. Comparing these results to the ones obtained in the column (2), we can check if the discretionary adjustment embodied in the 2003 reform compensated enough for the accumulated inflation since 1999.

Comparing the results between columns (1) and (2) we can see that, as expected, both labour and personal allowances decrease due to inflation. Therefore we get that taxable income increases an 11% for the whole population (from 105,405 to 117,020 millions of €, in real terms). Further, given that we have a progressive tax rate schedule, we obtain that the increase in the total tax due (before subtracting tax credits) is higher (13.5%: from 25,871 to 29,371 millions of € in real terms) that the increase in taxable income. However, as the tax credits simulated have income defined limits, we also get that the tax credits rise from 1999 to 2003 (from 1,407 to 1,477 millions of € in real

[19] Using a simulation model it is straightforward to show the tax burdens that result for a given inflation scenario when keeping tax parameters nominally constant.

terms) . Therefore, in order to asses the effects on total tax burden we have to account for both compensating effects defined above. As a final result we get that the tax due after credits increases a 14% for the whole Spanish population, which will be capturing the pure inflation effect (from 24,464 to 27,895 millions of € in real terms) .

Now we turn to check if the 2003 reform was enough to offset the effects of inflation. To do so we will compare results in column (3) with respect to column (1). As the differences between these two columns imply changes in income (we upgrade income from 1999 to 2003) and in the structure of the tax system, many of the variables reported are not directly comparable, so we just focus on the tax due after tax credits. Our simulated results indicate that the 2003 reform more than compensated the accumulated inflation since 1999, as the tax due after tax credits is a 1.95% lower than the correspondent figure in 1999 (from 24,464 in 1999 to 23,988 in 2003).[20]

Now in Table 3 we summarize the size and distribution of Household Gross Income, Income Tax and Household Disposable Income for the three scenarios simulated, always in real terms.[21] By simple inspection of the distribution of these variables we can see that the Spanish fiscal system is quite progressive, and comparable to neighbouring countries. In general, we get that the richest 10% paid around 50% of income taxes. Obviously the distribution of household gross income in real terms is the same under the three scenarios.

[PLACE TABLE 3 HERE]

[20] One have to bear in mind that the objectives declared by the government were others than compensating for inflation, although the accumulated inflation between 1999 and 2003 was not negligible. Further, there is also a new tax rule in the 2003 reform that affects importantly our results, that is the maternity tax credit. Not accounting for this issue would imply that the over compensation would only be 0.24% (from 24,464 in 1999 to 14,404 in 2003).

[21] To calculate household income we use an approximation to the Oxford equivalence scale. The formula of this scale is obtained as follows: $E = (n_1 + \beta\, n_2)^{\alpha}$, where n_1 is number of adults, n_2 is number of children, α=0,77 and β=0,80. Our calculations now are based in households, adding the tax burdens of all the fiscal units living together.

If we compare the distribution of income tax or household disposable income between the three possible situations studied, we obtain, as expected, changes in many deciles of the distributions. It seems that inflation reduces progressivity, which is more or less compensated by the 2003 reform. However, as the results of the changes observed have not a clear direction, the final conclusion is ambiguous. We therefore need to apply summary statistics in order to asses the definite direction of the changes, both when we only account for the effect of inflation or when we simulate the 2003 reform. This is done using standard inequality, redistribution and progressivity indexes, as are reported in Table 4.

[PLACE TABLE 4 HERE]

In Table 4 we report the inequality Gini's index for the main variables of the tax system for the three simulated scenarios. We also present estimations to assess changes in the distribution and progressivity of the Spanish income tax. Specifically, we calculate Kakwani and Reynolds-Smolensky indexes.

As regards to the inequality results, we focus on the Gini's indexes calculated for the household disposable income. The pure effect of inflation (i.e. comparing the figures between columns 1 and 2) is a 0.73% reduction in the Gini's index, indicating that we obtain an improvement in inequality. If we jointly account for inflation and for the discretionary adjustment embodied in the 2003 reform, we have that inequality in household disposable income improves in a slightly 0.03% (comparing 0.32766 for the 1999 Gini Index with 0.32756 for the 2003 Gini Index).

Looking at the effects on redistribution and progressivity, we get opposite results in the scenarios simulated. On the one hand, when we look at the pure inflation effect,

we get a reduction in the progressivity (calculated through Kakwani approach, which falls a 0.03, a 7.71%) whereas inflation improves the distribution (Reynolds-Smolensky index raised 0.002, a 6.42%). On the other hand, when we simulate the 2003 reform we obtain an improvement from 1999 in the progressivity of the tax system (0.013, a 3.51%), although distribution worsens slightly (0.0001, a 0.27%).

6. Conclusions.

This paper has focused on analysing the distributional consequences of inflation in Spain for the period 1999-2003. In a second step, we have assessed whether the discretionary change embodied in the 2003 reform compensated enough for the rise in inflation since 1999.

Income tax burdens rise when nominally defined tax rules are not adjusted for inflation. The revenue effects can be substantial even at low rates of inflation like these experienced in Spain since 1999. Theoretically, the results of the effects of inflation are ambiguous with respect to progressivity, so one has to account for the erosions on tax rates, deductions and allowances, and tax credits. However, microsimulation techniques provide a useful tool as they account for all tax rules and for all fiscal units representing a country. When analysing the pure inflation effect, our results indicate that inflation reduces progressivity although the equalising properties of income tax are enhanced as a result of increasing total tax burdens. These results are in line with Immervol (2005) for the three European countries analysed there.

We get the opposite results in our second step. When we analysed if the 2003 reform compensated enough for the accumulated inflation since 1999 we obtained that the reform improved progressivity at the cost of reducing the redistribution properties of the system. One could concludes that 2003 reform set the record straight, as the indexes are very similar in 1999 and in the reformed 2003 income tax. But we have not forget that there were three years (2000, 2001 an 2002) that inflation had eroded all the important variables, when no one has do anything to compensate this erosion.[22]

This simple simulation exercises point out that all fiscal systems should have adjustment schemes to account for inflation and that governments should have in mind that any reform may have important implications on the redistributive and progressive properties of the fiscal system.

[22] Except in 2000, when only tax rates were adjusted using expected inflation.

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Table 1. The tax income system in 1999 and the 2003 reform.

		1999 System	2003 Reform	Increase in current terms	Change in real terms
Deductions on gross income: personal allowance[1]	General	3305	3400	2.9%	-9.3%
	33% ≥ Disabled < 65%	+ 1803	+ 2000	10.9%	-2.2%
	Disabled ≥ 65%	+ 3005	+ 7000	132.9%	105.3%
	65 ≤ Age < 75	+ 601	+ 800	33,1%	17.3%
	Age ≥ 75	+ 601	+ 1800	200%	164.0%
Deductions on gross income: children's allowance[2]	1st child	1202	1400	16.5%	2.7%
	2nd child	1202	1500	24.8%	10.0%
	3rd child	1803	2200	22.0%	7.5%
	4th or more	1803	2300	27.6%	12.4%
	Age < 3	+ 300	+ 1200	299.3%	252.6%
	3 ≤ Age < 16	+ 150	-	-	-
	33% ≥ Disabled < 65%	+ 1803	+ 2000	10.9%	-2.2%
	Disabled ≥ 65%	+ 3606	+ 7000	94.1%	71.1%
Deductions on gross income: ancestors' allowance[3]	65 ≤ Age < 75	601	800	33.1%	17.3%
	Age ≥ 75	601	1800	200%	164.0%
	33% ≥ Disabled < 65%	+ 1803	+ 2000	10.9%	-2.2%
	Disabled ≥ 65%	+ 3606	+ 7000	94,1%	71.1%
Deductions on gross income: labour allowance[4]	General	From 2253 to 3005	From 2400 to 3500	6.5% - 16.5%	-6.1% 2.7%
	working after 65 years old	-	Doubles General Ded.	-	-
	to promote geographical mobility	-	Doubles General Ded.	-	-
Tax Rates	Number of tax rates	6	5	-	-
	Minimum tax rate	18%	15%	-	-
	Maximum tax rates	48%	45%	-	-
Maternity Tax Credit	Per child < 3 years old, working mother	-	1200	-	-

Notes:

1. The personal allowance increases for elderly and disabled people. For instance, a tax payer aged 80 and with a 70% level of disability in 2003 had the following allowance: 3400+7000+1800=12200.
2. The children allowance increases with the number of children. This allowance does also account for the age of the children and for any level of disability bear by children. For example a tax payer with 3 children (aged 2, 7 and 12) and with a disabled (at a50% level) would have the following allowance: 1400 + 1500 + 2200 + 1200 +2000 = 8300.
3. The ancestor's allowance is a function of the age of the person and for any level of disability. For example, a tax-payer taking living with two ancestors (one 80 years old and the other 68 years old and with a 70% level if disability) would have the following ancestor's allowance in 2003: 800 + 1800 + 7000 = 9600.
4. The general labour related allowance is inversely proportional to labour income for employees. If the tax payer is either older than 65 or has moved from her original location then the quantities are doubled.

Table 2: The effects of inflation between 1999-2003 and the 2003 reform. Main aggregates in real terms (millions €)

	(1) 1999 Income Tax 1999 Figures	(2) 1999 Income Tax 2003 Figures	(3) 2003 Income Tax 2003 Figures
Total income	252,412	252,412	252,412
Gross employment income	205,760	205,760	205,760
Saving and Investments	4,194	4,194	4,194
Land & Property	2,179	2,179	2,179
Self-Employment	29,768	29,768	29,768
House imputed value	137	137	137
Labour allowances	54,337	48,676	35,527
Personal allowances	82,294	76,337	97,506
Taxable Income	105,405	117,020	109,004
Total tax due	25,871	29,371	25,780
Tax credits	1,407	1,477	1,376
Maternity credit	-	-	416
Tax due after credits	24,464	27,895	23,988

Notes:

(1). Micro-simulation of the fiscal system in 1999 with data from ECPH corresponding to 1999.

(2). Micro-simulation of the fiscal system in 1999 with upgraded data to 2003 using the accumulated inflation between 1999-2003.

(3). Micro-simulation of the fiscal system in 2003 with upgraded data to 2003 using the accumulated inflation between 199-2003.

Table 3: Income tax revenues and distribution. Mean (real terms) and percentage by deciles.

(1) 1999 Income Tax - 1999 Figures						
1999-99	**Household Gross Income**		**Income Tax**		**Household Disposable Income**	
Decile 1	2,201	2.5%	0	0.0%	2,202	2.7%
2	4,195	4.7%	0	0.0%	4,168	5.2%
3	5,175	5.9%	0	0.0%	5,179	6.4%
4	6,051	6.8%	7	0.1%	5,845	7.3%
5	6,852	7.8%	139	1.7%	6,711	8.3%
6	8,151	9.2%	336	4.2%	7,869	9.8%
7	9,166	10.4%	614	7.7%	8,381	10.4%
8	11,204	12.7%	992	12.4%	10,258	12.8%
9	13,824	15.6%	1,669	20.8%	12,488	15.5%
10	21,576	24.4%	4,252	53.1%	17,287	21.5%
		100.0%		100.0%		100.0%
(2) 1999 Income Tax - 2003 Figures						
1999-03	**Household Gross Income**		**Income Tax**		**Household Disposable Income**	
Decile 1	2,201	2.5%	0	0.0%	2,201	2.8%
2	4,195	4.7%	0	0.0%	4,116	5.2%
3	5,175	5.9%	0	0.0%	5,168	6.5%
4	6,052	6.8%	63	0.7%	5,804	7.3%
5	6,852	7.8%	254	2.8%	6,612	8.3%
6	8,151	9.2%	475	5.2%	7,734	9.8%
7	9,166	10.4%	782	8.5%	8,293	10.5%
8	11,204	12.7%	1,134	12.4%	10,070	12.7%
9	13,823	15.6%	1,868	20.4%	12,233	15.4%
10	21,576	24.4%	4,582	50.0%	17,004	21.5%
		100.0%		100.0%		100.0%
(3) 2003 Income Tax - 2003 Figures						
2003-03	**Household Gross Income**		**Income Tax**		**Household Disposable Income**	
Decile 1	2,201	2.5%	-39	-0.5%	2,204	2.7%
2	4,195	4.7%	0	0.0%	4,160	5.2%
3	5,175	5.9%	0	0.0%	5,172	6.4%
4	6,052	6.8%	7	0.1%	5,883	7.3%
5	6,852	7.8%	118	1.5%	6,689	8.3%
6	8,151	9.2%	310	4.0%	7,891	9.8%
7	9,166	10.4%	586	7.5%	8,437	10.5%
8	11,204	12.7%	966	12.4%	10,277	12.8%
9	13,824	15.6%	1,604	20.5%	12,520	15.5%
10	21,576	24.4%	4,268	54.6%	17,341	21.5%
		100.0%		100.0%		100.0%

Table 4: Inequality, redistribution and progresivity.

	(1) 1999 Income Tax 1999 Figures	(2) 1999 Income Tax 2003 Figures	(3) 2003 Income Tax 2003 Figures
	Inequality: Gini's index		
Total income	0.36490	0.36490	0.36490
Household Gross Income	0.47623	0.46313	0.35984
Personal allowances	0.23344	0.20469	0.09999
Taxable Income	0.69015	0.65672	0.68363
Total tax due	0.73081	0.70225	0.73425
Tax due after credits	0.74373	0.71451	0.75702
Household disposable income	0.32766	0.32526	0.32756
	Redistribution and Progresivity		
Kakwani	0.37883	0.34962	0.39212
Reynolds-Smolensky	0.03724	0.03963	0.03734
t	9.06%	10.36%	8.85%
D	0.000500194	0.0007821	0.00072428
Progressivity		-0.02921 (-7.71%)	0.01329 (3.51%)
Redistribution		0.00239 (6.42%)	0.0001000 (0.27%)

Table 5: Inflation rates

Year	IPC	Deflator PIB
1995	4.7	7.8%
1996	3.6	6.0%
1997	2.0	6.4%
1998	1.8	6.8%
1999	2.3	7.1%
2000	3.4	8.0%
2001	3.6	7.1%
2002	3.5	6.8%
2003	3.0	6.6%
2004	3.0	7.2%

Figure 1: Income Tax Schedule and distribution of income, 1999.