FAMILY TAX CREDITS VERSUS FAMILY ALLOWANCES WHEN LABOUR SUPPLY MATTERS: EVIDENCE FOR SPAIN

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De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

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Family tax credits *versus* family allowances when labour supply matters: Evidence for Spain[*]

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Summary:

This article evaluates the effects of replacing tax allowances with tax credits in the context of the Spanish personal income tax. We show that such a reform induces huge substitution effects as the marginal tax rates grow up sharply. Focusing on labour supply changes, the paper highlights the importance of taking into account tax-induced behavioural reactions by comparing behavioural and non behavioural simulations.

Keywords: family, distribution, welfare, labour supply, microsimulation.
J.E.L. Codes: H24, H31

1. Introduction

The tax treatment of dependants is a fundamental aspect of personal income taxation (PIT). Dependants are normally incorporated into the tax structure in two ways: either through a system of *family tax allowances* (TA) (i.e. Luxemburg and Belgium) or by means of *family tax credits* (TC) (i.e. Italy or Ireland)[2]. With a progressive tax, the choice between these two alternatives is not neutral in a distributive sense. In this regard, the literature has proclaimed the distributive superiority of TC over TA[3]. The reason for this is that while TC generates tax savings which are homogeneous and independent of the income of taxpayers, the tax savings generated by TA increase in accordance with the marginal tax rates and, therefore, with household income. To resolve this apparent attack on distributive principles, in countries where a TA system applies, it is usual to propose reintroducing TC as a means of addressing tax treatment of dependants.

Despite this apparent general consensus, the ranking of these two options from a distributive point of view is, at the very least, open to question. Our view is that the superiority of one or other system is an empirical matter (*country specific*) that basically depends on three factors: the initial design of the tax, the way population is distributed by size and composition of the family and the correlation between the family size and the distribution of income. Moreover, moving from a TA system to a TC system, even under the assumption of revenue neutrality, would be likely to produce significant substitution effects by causing a general increase in marginal tax rates. This increase in marginal tax rates could distort the behaviour of taxpayers and, as a result, it could affect their income and therefore the distributive effect of the reform itself. This is why a distributive analysis which skirts around the impact of the reform on taxpayer behaviour is risky and may hide its real distributive impact. This has been studied from a theoretical perspective by Preston (1987, 1989) and by Onrubia, Salas and Sanz (2005), who explore the effect of personal income taxation when labour supply is endogenous. They find that classical non-behavioral results on redistribution are not necessarily satisfied in a more general behavioural framework. In other words, behavioural changes induced by taxes matters in assessing redistribution. In addition to these points, given that marginal tax rates represent the "price" taxpayers pay during periods of inflation, it is likely that TC would also be more

[2] In other European countries, such as in United Kingdom, Netherlands, Greece, Austria or Germany, the family tax treatment includes both tax credits and allowances.
[3] There are some exceptions, for example, Lambert and Yizthaki (1995, 1997).

vulnerable to price increases than a TA system (McHugh, R., 1979). Doubtless to say, that a balanced evaluation of these matters must take all these factors into account and it will heavily hinge on the specific income distribution of the country as well as its distribution of households by size, by composition and by income.

Taking advantage of the fact that recently the Spanish government has proposed replacing the current TA system with a set of tax credits (TC), this article analyses the expected global impact of such a hypothetical reform for Spain under the assumption of revenue neutrality. The paper highlights the differences between behavioural and non-behavioural simulations.

2. Design of the simulation

The simulation will compare two alternative tax scenarios. The pre-reform scenario depicts the treatment of dependants in 2005 characterised by a system of personal and family minimum allowances (TA system) – see Table 1. The post-reform scenario replaces these allowances with a set of family tax credits (TC system) under the assumption of tax revenue neutrality. This assumption requires *equivalent family tax credits* to be calculated. These tax credits have been computed using [1]:

$$c_x = \frac{\sum_{i}^{h_x} m_x}{h_x} \cdot t_{h_x} \qquad [1]$$

where c_x is the equivalent tax credit, m_x is the personal or family minimum allowance x, h_x is the number of households which benefit from m_x and t_{h_x} is the relevant average marginal tax rate of beneficiary households. The resulting values of equivalent tax credits are shown in Table 1. This means that, for the Spanish case, applying the existing allowances in 2005, shown in the second column, would cost in revenue terms exactly the same amount as the application of the computed equivalent tax credits reported in column three.

Table 1
Allowances versus *equivalent* family tax credits
(Annual euros)

Item	Allowances	*Equivalent family tax credits*
General	3,400	967
Additional for taxpayer > 65 years	800	120. 50
First child	1,400	242.06
Second child	1,500	259.35
Third child	2,200	380.38
Fourth child and subsequent children	2,300	397.67
Ascendant > 65 years	800	90.16
Ascendant > 75 years	1,800	293.02

2.1 The data base

The data base used in the simulation is the Spanish section of the European Union Household Panel (EUHP) for year 2000. The EUHP describes the socio-economic characteristics of individuals and economic households and provides data about wages, pensions and income from financial investment and property. It also offers information essential for estimating behavioural labour-supply models. EUHP contains information for 15,614 households (36,148 individuals over 16 years of age), which grossed-up to population implies 39 million individuals grouped in 12.9 million households.

2.2 Behavioural reactions of taxpayers

To highlight the potential distorting effects of the reform, behavioural and non-behavioural simulations are performed. To quantify labour-supply changes, it is necessary to estimate the labour-supply response of taxpayers. Personal income taxation is included in the model through the linealization of the budget constraint proposed by Hall (1973). For doing so, the following labour supply function is used:

$$h = \alpha + \beta\,\omega + \gamma\, m + \lambda\,\omega^2 + \mu\, Z + \varepsilon \qquad [2]$$

where ω is the marginal net wage of the individual, m is her virtual income and Z is a vector of employees' socioeconomic variables. Using the pool of EUHP data for years 1994-1998, equation [2] is estimated separately for men and women according to their marital status. Retired and self-employed individuals are not considered for estimation.

The estimation is implemented following Heckman's two-stage procedure (1979). Estimation results are reported in Appendix I.

Table 2 exhibits average estimated labour supply elasticities. The negative sign for income elasticity indicates that, with the exception of single women, leisure is a normal good. However, as we can see, the income effect is small and even smaller for married women. As for the substitution effect, its sign is always positive indicating that an increase in net salary increases the supply of hours of labour. The extent of the substitution effect varies between the different groups analysed. Specifically, the substitution effect is smallest among married men (0.1336), while the average value is higher amongst married women (0.5092). Single men and women also have intermediate substitution effect values. The combination of income and substitution effects generates positive marshallian elasticities.

Table 2
Average elasticities

		Non-compensated	Income	Compensated
Single	Men	0.3078065	-0.0004420	0.3082485
	Women	0.2240269	0.0121900	0.2118369
Married	Men	0.1257485	-0.0078626	0.1336111
	Women	0.4465245	-0.0627656	0.5092901
Total		0.2493289	-0.0129828	0.2623117

3. Allocative, distributive and welfare results

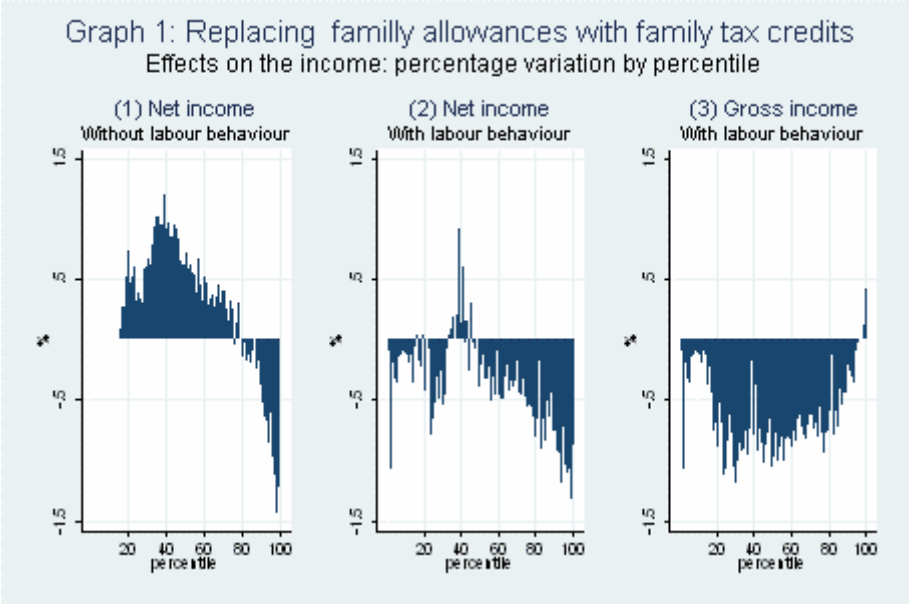
To analyze the allocative, distributive and welfare impact of the reform, we use the indices and measures traditionally used in the literature (see Appendix II). Table 3 summarises the reform effects on taxable income and on average and marginal tax rates. The invariability of average tax rates verifies that the assumption of tax revenue neutrality is fulfilled. However, the reform increases taxable income by 61.08% with a consequent sharp increase in marginal tax rates (22.73%!). Therefore, as expected, such a reform induces strong substitution effects and, according to the elasticities reported in Table 2, may have significant effects on labour supply, which may have a prominent impact on gross earned income. This fact can be seen in Graph 1, which shows the influence of the reform on net income. Panel(1) depicts the percentage variation of net income when tax-induced labour supply changes are neglected whereas Panel(2) exhibits those variations when the distorting effects on labour supply are taken into account. Differences between both

profiles are due to changes in gross income due to the distorting effects on labour supply caused by the general increase in marginal tax rates, represented in Panel(3).

Table 3
Effects on income and tax rates

	Pre-reform	Post-reform	Variation
Taxable income*	136,074.4	219,192.3	61.08%
Average effective tax rate	9.77%	9.77%	0.00%
Average weighted marginal tax rate	22.32%	27.39%	22.73%

* In millions of euros.



Regarding the whole population, the tax simulation suggests that such a reform would cut labour supply by an amount equivalent to more than 135,000 full-time jobs per year[4]. The estimated variation in the deadweight loss and the change in welfare confirm this result. Specifically, as can be seen in Table 4, the deadweight loss estimated for the total population would increase by 11,833.5 million Euros, equivalent to 976.90 Euros per household annually. Similarly, the loss of individual welfare, measured using the so-called hicksian equivalent variation, amounts to an annual average per household of 938 Euros.

[4] A full-time equivalent post is equal to 1,740 hours a year.

Table 4
Individual welfare and efficiency
(Euros per household per year)

Item	Aggregate total	Population Average	Householda verage
Cash gain	-4.9	-0.1	-0.4
Equivalent Variation	-11,362.8	-400.5	-938.0
Deadweight loss change	11,833.5	417.1	976.9

Once we have taken this robust allocative impact into account, we are able to evaluate the reform's distributive consequences. Table 5 shows Gini and Atkinson indices for after-tax income. The calculations include simulations with and without behavioural reactions. As can be observed, the reform improves equality in the income distribution in the absence of behavioural changes but worsens it when labour behaviour is taken into account. This result confirms our hypothesis that not including labour behaviour may hide the real distributive impact of tax reforms. This fact may be particularly relevant in reforms, such as the one simulated in this paper, where substitution effects are significant.

Table 5
Effects on the equality in distribution of income

Indices	Pre-reform Scenario	Without Behaviour		With Behaviour	
		Post-reform	Variation (%)	Post-reform	Variation (%)
Gini for net income	0.33258	0.33134	-0.37313	0.33306	0.14347
Atkinson for net income (0.5)	0.09055	0.08991	-0.70511	0.09080	0.27064
Atkinson for net income (1)	0.19038	0.18941	-0.50768	0.19097	0.30859
Atkinson for net income (1.5)	0.35014	0.34925	-0.25581	0.35072	0.16568

Table 6 summarises the effects of the reform on the progressivity and redistributive capacity of the tax. As can be seen, the reform increases both progressivity and the redistributive potential of the tax. However, increases are greater when the labour response of the taxpayer is taken into account.

Table 6
Effects on progressivity and redistributive capacity

Indices	Pre-reform	Without Behaviour		With Behaviour	
		Post-reform	Variation (%)	Post-reform	Variation (%)
(Reynolds-Smolensky index)	0.03496	0.03620	3.54991	0.03632	3.90786

(Kakwani index)	0.32377	0.33780	4.33258	0.33871	4.61509
Re-ranking effect	7.05424E-05	0.000368045	421.73642	0.000299924	325.16791

4. Sensitivity of both systems to inflation

Finally, we illustrate the different sensitivity of both systems to inflation. For doing so, we calculate the tax revenue-income elasticity of TA and TC for an equal increase in price levels. For an individual *i* with *pre-reform* net income I_{oi} and *pre-reform* tax liability T_{oi}, the elasticity is calculated as:

$$\xi_i = \frac{\Delta T_i}{\Delta I_i} \cdot \frac{I_{0i}}{T_{0i}} \qquad [3]$$

where ΔT and ΔI stand for variations in tax liabilities and net incomes between pre-reform and post-reform tax scenarios. For each income decile, Table 7 shows the average elasticities for both systems, TA and TC, when facing an increase in prices equals to 5%. The figures show the higher sensitivity to price variation of TC compared to TA. This higher sensitivity occurs in all income deciles. It is worth noting that elasticities decrease with income both for TA and TC. In other words, regardless the system chosen, the higher the level of income is, the less its sensitiveness to inflation.

Table 7
Revenue-income elasticities for TA and TC systems
Simulation includes labour-supply reactions

	Elasticity	
Decile	TA	TC
1	.	.
2	7.7465	19.6155
3	4.7167	6.0486
4	3.6294	4.3887
5	3.2025	3.9978
6	2.6890	3.0096
7	2.4536	2.6467
8	2.1780	2.4308
9	1.9939	2.0941
10	1.6186	1.6285

Conclusion

In the context of personal income taxation, moving from family tax allowances towards a system of tax credits has always been a matter of controversy. The final impact of such a change is mainly an empirical matter that hinges on a number of factors. For the case of Spain, we quantify the allocative, distributive and welfare impacts of such a tax reform. It has been shown that this type of tax reform generates important increases in marginal tax rates which induce noticeable excess burdens. Moreover, as a result of this increase in marginal tax rates, a system based on tax credits has been confirmed more sensitive to inflation than its equivalent defined in terms of family allowances. In addition, when labour supply reactions are taken into account, simulations confirm that income inequality worsens when moving towards family tax credits. This result highlights the need for including tax-induced behavioural changes when income inequality is assessed.

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Appendix I

Table A1
Estimations for the labour supply quadratic model

	Married men		Married women		Single men		Single women	
	Coef.	t. Stud.	Coef.	t. Stud	Coef.	t. Stud	Coef.	t. Stud
Intercept	29.731	6.7	20.780	3.2	10.811	1.6	16.366	2.6
Year 95	-3.884	-7.7	-2.547	-3.0	-4.454	-3.9	-3.089	-2.8
Year 96	-2.572	-5.0	-1.993	-2.3	-2.957	-2.6	-0.950	-0.8
Marginal wage	0.0078	5.9	0.045	16.6	0.031	8.6	0.021	5.7
Squared marginal wage	-1.2-E06	-4.1	0.000	-14.0	-5.3E-06	-6.6	-5.9E-06	-6.3
Virtual income	-1.5-E05	-1.0	-0.000	-3.0	-5.8E-06	-0.2	8.4E-06	0.4
Years of service in firm	5.831	38.1	6.267	23.5	9.937	27.6	10.345	30.2
Years of service in firm (square)	-0.252	-33.4	-0.272	-20.5	-0.476	-23.9	-0.468	-26.4
Age	-0.499	-2.5	-1.483	-4.6	-1.415	-4.3	-1.341	-4.4
Age squared	0.003	1.4	0.014	3.7	0.015	3.5	0.0149	3.8
University	-2.144	-3.2	-6.206	-5.3	-3.935	-2.9	0.007	0.0
Secondary School	0.033	0.0	-1.964	-1.9	-3.521	-3.1	2.559	2.2
Couple with Univesity studies	-1.733	-2.5	-1.957	-1.8	--	--	---	--
Couple with Secondary School studies	-1.971	-3.1	-1.173	-1.1	--	--	--	--
Children < 3 years	0.740	1.3	-0.481	-0.4	1.503	0.3	-3.171	-0.9
Children 4 y 15 years	0.5709	2.1	0.582	1.1	0.496	0.2	2.344	1.7
Time dedicated to caring for children	-0.202	-12.1	-0.083	-4.9	-0.150	-1.6	-0.142	-3.4
Time dedicated to caring for elderly	-0.050	-1.0	-0.047	-1.1	-0.213	-2.2	-0.060	-1.3
Spells of unemployment	0.424	3.4	1.362	6.0	0.961	4.2	0.699	4.6
Health status	0.063	0.0	-1.323	-0.7	1.281	0.3	-1.040	-0.3
Region 1	-0.562	-0.5	-5.538	-3.1	1.349	0.5	-3.031	-1.4
Region 2	-2.036	-2.0	-6.960	-4.1	-0.402	-0.1	-3.063	-1.5
Region 3	-1.811	-1.6	-7.337	-4.1	-1.854	-0.6	-3.861	-1.8
Region 4	-3.112	-3.0	-9.659	-5.6	1.015	0.4	-7.109	-3.4
Region 5	-1.677	-1.7	-4.495	-2.8	-1.611	-0.6	-3.379	-1.7
Region 6	-3.616	-3.7	-9.013	-5.4	-1.817	-0.7	-5.392	-2.7
Sigma	15.286	96.8	18.255	59.2	23.786	58.9	20.976	53.6
N	5906		3435		3132		2741	
Censored observ.	805		1359		1046		1021	
Non-censored observ.	5101		2076		2086		1720	
Likelihood ratio test	2886.36		2900.34		1404.10		1761.95	

Appendix II

In the distributive analysis of income, X, we use the traditional Gini, G_X, and Atkinson, $A_X(\varepsilon)$, indices defined as:

$$G_X = 1 - \frac{1}{N} - \frac{2\sum_{i=1}^{N}(N-i+1)w_i x_i}{N^2 \mu} \quad [1]$$

$$A_X(\varepsilon) = 1 - \frac{\widehat{y}_e}{\overline{Y}_e} \quad [2]$$

where, N is the sample size, i is the range of each individual, w_i is the normalised weight of the sample unit, μ is weighted average income, ε is the aversion to inequality parameter, $\widehat{y}_e$ is the equally distributed equivalent of equivalent incomes and, finally, $\overline{Y}_e$ is the average of equivalent incomes. The Reynolds-Smolensky (1977) and Kakwani (1977) indices computed to measure the progressivity and redistributive power of the simulated tax structures are defined as:

$$\prod^{RS} = G_X - G_{X-T} \quad [3]$$

$$\prod^{K} = C_T - G_X \quad [4]$$

where C_T is the concentration index of tax liabilities, G_X is the Gini index of income before taxes and G_{X-T} is the corresponding Gini index for net-of-tax income. To measure the effects on efficiency and individual welfare we use the Hicksian measurements of equivalent variation (EV) and the variation in equivalent deadweight loss (DWLV).

$$EV = e(\omega^0, v^1) - e(\omega^1, v^1) + (m^1 - m^0) = EV(\omega) + EV(m) \quad [5]$$

$$DWLV = -\sum EV(\omega) - \sum (R^1 - R^0) \quad [6]$$

where v is the level of indirect utility, ω is the net wage, m stands for virtual income and R is tax revenue. Super indices 0 and 1 refer to pre-reform and post-reform scenarios, respectively.

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