

THE EFFECT OF 1988 SPANISH TAX REFORM ON LABOUR SUPPLY OF MARRIED WOMEN. AN EMPIRICAL ANALYSIS USING PROPENSITY SCORE

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ABSTRACT

The analysis of income tax changes over labour supply is of special interest, not only for an economic point of view but also for policy makers. Up to 1987 the Spanish Income Tax imposed the compulsory joint filing for married couples, but the 1988 reform allowed them to choose between joint taxation and separate taxation. The purpose of this work is to analyse this tax reform as a quasi-natural experiment, assessing the effects of tax changes over the labour participation. The income tax reform implied a strong reduction in tax rates for secondary earners in married couples. To find out the causal effect of this reforma we have used the difference-in-differences technique. We have used data from the IRPF IEF-AEAT Panel 1982-1998. Our results show that, as a consequence of the differential tax changes, secondary earners pertaining to families more strongly affected by the fiscal reform (treatment group) reacted more heavily to this reform than secondary earners from families less affected by this reform (comparison group).

Keywords: income taxation reform, treatment effects, propensity score, joint filing, tax unit

Códigos JEL: H24, H31, C15

1. Introduction

There is a wide literature analysing the effect of taxes on agent's behaviour¹. And an important part of this literature analyses the effect of fiscal reforms on married women labour force. Leuthold (1979) studies, for US economy, the effect on labour supply for two-earner families taxed jointly. Fan (1988) works on the effect of changing tax rates over labour force participation of women in Taiwan. Eissa (1996) and Eissa and Hoynes (2004, 2005) analyse the consequences of different US fiscal reforms. Tsounta (2006) relates the supply of women work in connection with the Canadian fiscal system. Yamada (2011) examines married women labour responses facing changes in tax rates, as a result of the Japanese tax reform during the 1990s.

There is a minor but growing literature using tax reforms as quasi-experiments. They focus on the labour supply responses of married women to income tax reforms. Gustafsson (1992) could be a precedent, analysing the change in labour force participation of Swedish women (individually taxed) if they would work in Germany (and being taxed jointly), and vice versa. Nevertheless, the seminal work was undoubtedly, the study of Eissa (1995) for US.

In this work, Eissa analyses the effects of 1986 Tax Reform Act on labour supply of married women. To show the causal effect, changes in labour supply of women married with high income husbands are compared with changes in labour supply of women married to low income husbands. The main result of this work is that tax reform significantly rose the labour supply of women married to high income husbands, which was the collective really affected by the tax reform. This causal effect allows her to evaluate for a particular segment of the population the incentives in the decision to offer hours of work.

Moreover, Crossley and Jeon (2007) analyse the effects of 1988 federal income tax reform in Canada. This reform reduced the 'jointness' of the tax system. Using the differences in differences approach, they produced evidence that this reform involved a significant increase in labour force participation of women married to high income husbands (those actually affected by the reform), with respect to women married to lower income husbands.

¹ See, for example, the Blundell and MaCurdy (1999) work.

Furthermore, Lalumia (2008) analyses the US tax reform of 1948, which introduced the compulsory joint taxation. This reform affected several states, so she carried on a natural experiment comparing affected and unaffected states. For highly-educated tax payers the tax change (from separate to joint tax filing) implied a decline of 2 points in the employment rate of married women. So her results went in the same direction as Eissa and Crossley and Jeon.

Finally, Selin (2013) studies the 1971 Swedish tax reform, which abolished joint taxation. His results show that employment grew more among women married to high-income earners, supporting previous works. Unlike Eissa, Crossley and Jeon and Lalumia, all of them using repeated cross section data, Selin exploits a rich longitudinal register data.

The purpose of this paper is to use the 1988 Spanish income tax reform as a quasi-natural experiment, analysing its effect over the labour force participation of secondary earners. For doing that, we have worked with longitudinal register data. Our main contribution is to explicitly establish a procedure to select the treatment group and the comparison group in order to find out the possible different labour behaviour between these groups. For this purpose, we use the difference in differences approach. Our results, not being exactly the same as in previous literature, support the main idea: the groups more heavily affected by the tax reform will react more strongly in their labour force participation.

Our paper is organised as follows. The next section outlines the 1988 Spanish income tax reform, and its complex effects over family taxation. In section 3 we describe the data and calculate the average tax rates for secondary earners. This results lead us to find, in section 4, the treatment group and the comparison group. In section 5 we present the main results. And finally, in section 6, we conclude.

2. The 1988 fiscal reform

The main effect caused by the 1988 tax reform was related with family taxation. Before 1988 married couples were taxed jointly, but the tax took into account this circumstance through a variable tax credit. After the reform, married couples could choose between joint taxation (including a variable tax credit to reduce their tax bill) and separate taxation.

Before the tax reform, a variable tax credit was applied, the so-called *Polynomial Formula*. This tax credit depended on couple's total income and on its distribution between spouse and wife, according with the next formula:

$$VTC = 5000 - 8B + 0.04(B_1B_2)^2$$

The VTC depended negatively on the Tax Base (B , in thousand pesetas) and positively on the product of B_2 (Net Labour Income from second earner, in thousand pesetas) and $B_1 = B - B_2$ (in thousand pesetas).

The 1988 income tax reform implied the end of compulsory joint taxation in Spain. From this moment on, married couples can choose between joint taxation and separate taxation. But this reform was imposed by the Constitutional Court, which passed a sentence on 20th February declaring some rules of the Spanish Income Tax unconstitutional. As a consequence the government approved the Law 20/1989 as late as 29th July, forcing the delay of the tax return period.

The new law introduced more changes, as it included or changed some tax credits. These changes undoubtedly influenced the choice between joint filing and individual filing. The main tax credits related with married couples could be seen in Table 1, and are the following:

- The General Tax Credit disappeared with the 1988 Tax Reform. It amounted 17,850 pesetas², and increased to 53,550 pesetas if there were two earners obtaining labour income or business income higher than 150,000 pesetas.
- The Variable Tax Credit changed: instead of polynomial formula used up to 1987, there were introduced percentages depending on total family income and the proportion of labour and business income from the secondary earner. The main difference is that the former had an upper limit (315,000 pesetas) while the latter hadn't.
- The Labour Income Tax Credit was changed. In 1987 it amounted 21,000 pesetas for the first earner, plus 1% of the second earner net labour income. In 1988 the new Labour Income Tax Credit amounted for 22,000 pesetas for the first earner, and the same quantity for the second, no matter her labour income.

² The peseta was the Spanish currency before the euro introduction. 1 euro equals 166.386 pesetas.

- Married couples could apply for a fix tax credit of 22,050 pesetas in 1987. In 1988 this quantity was changed to 35,000 pesetas, which was in fact the lower limit of the new variable deduction.

As can be seen in Table 1, the 1988 tax system remained unchanged the following years, just updating monetary quantities. Being an unexpected reform (in fact, it was approved after the year was finished), agents could not react to new law during 1988. Reactions also are slow in this context. For these reasons we took more than one year to measure changes: we follow people up to 1991.

Table 1. Main tax credits before and after the 1988 reform

	1987	1988	1989	1990	1991
General Tax Credit	$17,850 \times 1,5 \times n$	-			
Married Couples Tax Credit	22,050	-			
Variable Tax Credit / Joint Filing Tax Credit	Polynomial formula	Tables RDL6/1988	Tables RDL6/1988	Tables Order 29-11-90	Tables Order 31-07-91
Minimum	-	35,000	-	38,000	40,000
Maximum	315,000	-	36,000	-	-
Labour Income Tax Credit	$21,000 + 1\% \times LI_{2nd}$	$22.000 \times n$	$22.700 \times n$	$24.000 \times n$	$25.200 \times n$

Notes: n = number of labour income earners (up to a maximum of 2).

LI_{2nd}: Second earner Labour Income

Source: own calculations

3. In which extent the tax reform modified tax rates? Who benefit more? How did average tax rates change?

The 1988 Tax Reform was no simple, there were many changes related with labour income, business income and married couples. In fact, one could not establish *a priori* the characteristics of married couples that could benefit more for tax reform, especially relating the income level.

3.1 The data

We used the Spanish Income Tax Panel 1982-1998 (“Panel del IRPF IEF-AEAT 1982-1998”). It is a very wide survey released by fiscal authorities from the fiscal register of income tax. From this data-base we have selected 1987, 1988, 1989, 1990 and 1991. The survey corresponding to 1987 has 173,979 tax returns, including individual tax returns for singles, and joint tax returns for married couples. After this year, in the case of married couples we can also find separate tax returns. Since 1988, married couples could choose between joint taxation and separate (individual) taxation. The total number of tax returns has increased during these years. In 1988 there were 193,444 tax returns, in

1989 the survey included 208,808 tax forms, in 1990 there were 235,646 and in 1991 the sample had 251,197 observations. In this work, we were interested just in married couples. The next diagram show the data base structure:

1987				1988				1989				1990				1991			
I	J	S1	S2	I	J	S1	S2	I	J	S1	S2	I	J	S1	S2	I	J	S1	S2

I: Individual Tax Filing

J: Joint Tax Filing

S1: Separate Tax Return for the first earner

S2: Separate Tax Return for the second earner

Our first task was to form, from these five groups of data, a pure panel. Beginning in 1987, when we necessary have joint tax filing, we could follow each married couple for the rest of the years, studying if they remain in joint taxation or if they change into separate tax filing.

Data are quite old, and the origin is an administrative register from tax authorities. Owing they were not designed to this purpose, we had to do a lot of work to check the coherence of them and to solve some silly mistakes. For example, we found married couples that filed two joint returns, or one joint return and one separate filing. Sometimes the labour income of second earner was higher than the first earner. There was inconsistency in tax credits, as using the labour income tax credit when there is nobody working. Or temporal inconsistency as partners that disappeared one year, appearing later. Our main goal was to keep the highest number of data, but if one observation can offer ambiguous information, we thought it was better to remove it.

After this cleaning task, observations are depicted in Table 2. As a result of 1988 Tax Reform, joint taxation plummets this fiscal year, and smoothly dropped after this year. Even so, 86% of married couples file joint taxation in 1991, because they found more profitable to do so.

The next problem we observed in the panel was *attrition*: every year some individuals disappeared from the sample, and authorities try to compensate it adding more observations. Nevertheless, for our purposes new additions do not give up useful information, so we have worked with the smallest sample.

Table 2: Tax returns

Nº of tax returns:	1987		1988		1989		1990		1991	
Individual filing	48,112	29%	53,893	29%	61,778	31%	72,777	33%	81,645	34%
Separate filing	0	0%	19,652	11%	24,618	12%	32,616	15%	37,900	16%
Joint filing	117,603	71%	109,285	60%	111,559	56%	117,393	53%	118,511	50%
Total	165,715	100%	182,830	100%	197,955	100%	222,786	100%	238,056	100%

Nº married couples:										
Doing separate filing	0	0%	9,826	8%	12,309	10%	16,308	12%	18,950	14%
Doing joint filing	117,603	100%	109,285	92%	111,559	90%	117,393	88%	118,511	86%
Total	117,603	100%	119,111	100%	123,868	100%	133,701	100%	137,461	100%

Source: own calculations based on Spanish Income Tax Panel 1982-1998

A different kind of problem was trying to disentangle who is the the secondary earner in joint returns. Using the data we could see that there is a labour income and/or a business income, but it is not straightforward if there is one or two people earning it. We have to study other variables, mainly tax credits, to decide if we are talking about a couple with just one earner, or if there are more than one. Finally we have worked with the quantities collected in Table 3.

Table 3: Final tax returns considered

	1987		1988		1989		1990		1991	
Joint returns	94,835	100%	7,539	8%	9,814	10%	11,830	12%	14,332	15%
Individual returns	0	0%	87,296	92%	85,021	90%	83,005	88%	80,503	85%
Total	94,835	100%	94,835	100%	94,835	100%	94,835	100%	94,835	100%

Source: own calculations based on Spanish Income Tax Panel 1982-1998

3.2. Calculating the Average Tax Rate for secondary earner

We need to know in which extent the 1988 Fiscal Reform has affected the Average Tax Rate for secondary earner³. That is, considering family income as a whole, which part of income must be devoted to taxes if the second earner enters the labour market (or begins a business)? So we first need to define this ‘family income’ without considering the new income from the secondary earner. In order to do so, we have defined the

³ We are implicitly identifying secondary earner and woman. Data do not provide the gender variable, so we could not distinguish in which cases the secondary earner is a woman. Nevertheless, we thought that for this period (1987-1991) the assumption is quite realistic.

Remaining Family Income (RFI), being the Total Family Income (TFI) being taxed, except for the net Working (or business) Income for Secondary Earner (WI_{2E})

We will use average tax rates, instead of marginal rates. There is an important part of the literature stressing the role of marginal tax rates, especially if they have to take into account the intensive margin (increasing or decreasing the hours of work). Nevertheless we couldn't detect this type of behavior, as we do not have the number of hours worked in the database. Average Tax Rate (ATR) seems more interesting is we try to measure, as we did here, the change in the extensive margin, related with participation in the labour market (Selin, 2013).

Calculating these ATR is not straightforward. To connect changes in labour behaviour with tax reform we have calculated the ATR suffered by the secondary earner. But this ATR depends on her income, and also on the partner's income. To do so, we calculate the Net Tax⁴ associated with Total Family Income (NT_{TFI}) by families with working secondary earner, and we compare it with the Net Tax corresponding to the Remaining Family Income (NT_{RFI} , that is, family income if secondary earner didn't work). This difference in net tax divided into Secondary Earner Working Income (WI_{2E}) is the ATR_{2E} . Calculations are different if married couples fulfil joint taxation or separate taxation;

$$ATR_{2E}(Joint\ taxation) = \frac{NT_{TFI} - NT_{RFI}}{WI_{2E}} \quad (1)$$

$$ATR_{2E}(Separate\ taxation) = \frac{(NT_{1E} + NT_{2E}) - NT_{RFI}}{WI_{2E}} \quad (2)$$

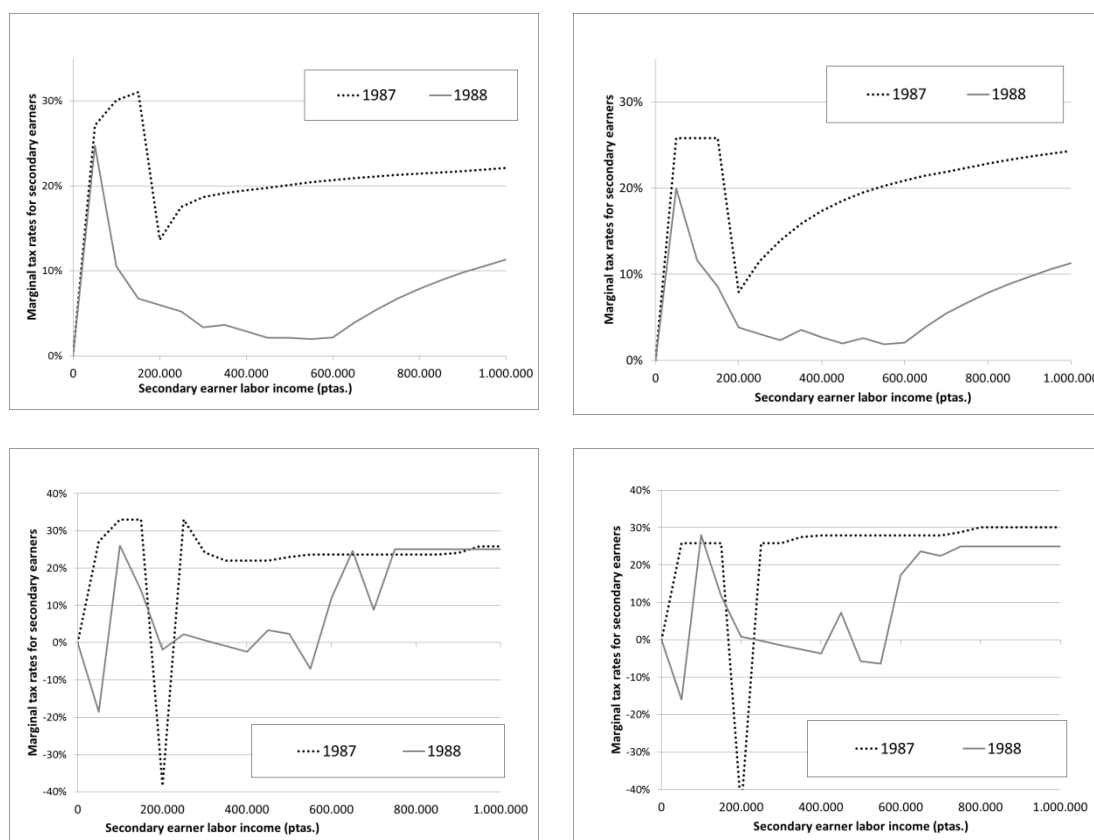
As an example, we have calculated the ATR_{2E} for a whole range of income, and also the Marginal Tax Rate for secondary earners (MTR_{2E}). But in a joint taxation framework this tax rate will change depending on the Remaining Family Income (RFI). For this reason

⁴ Calculating tax rates, we have chosen the effective tax rates, that is, the results of dividing Net Tax by Tax Base. In order to calculate Net Tax we considered all the tax credits related with tax unit: General Tax Credit, Married Couples Tax Credit, Variable Tax Credit / Joint Filing Tax Credit and Labour Income Tax Credit. Nevertheless, we didn't consider other family tax credits, that wouldn't affect the choice between individual filing and joint filing: Children Tax Credit, Ancestors Tax Credit, Age Tax Credit, and Handicapped Tax Credit. In order to simplify calculations, we assumed that second earner income is always labour income.

we have chosen a relatively low RFI and a relatively high RFI (1 million and 2 million pesetas, respectively), as we can derive from From these two values of RFI we could compare how ATR and MTR of secondary earner change as a result of 1988 Tax Reform. In 1987 (dotted line in Figure 2) is easier to calculate, but in 1988 we have to select in any case the best option between individual filing and compulsory filing. We have chosen as first earner's income 1 million pesetas and 2 million pesetas, low income families and higher income families.

The first results were in someway surprising. The secondary earner of low income families (left side of Figure 2) faced in 1987 higher tax rates than their counterparts from higher income families (right side of Figure 2). On the other side, marginal tax rates suffered by secondary earners had a lot of discontinuities. The presence of tax credits must be blamed for all of these effects. But in any case the important idea is that the pattern of the reform is the opposite of those describe in other papers.

Figure 2: Comparing Average Tax Rates of secondary earners, 1987 and 1988

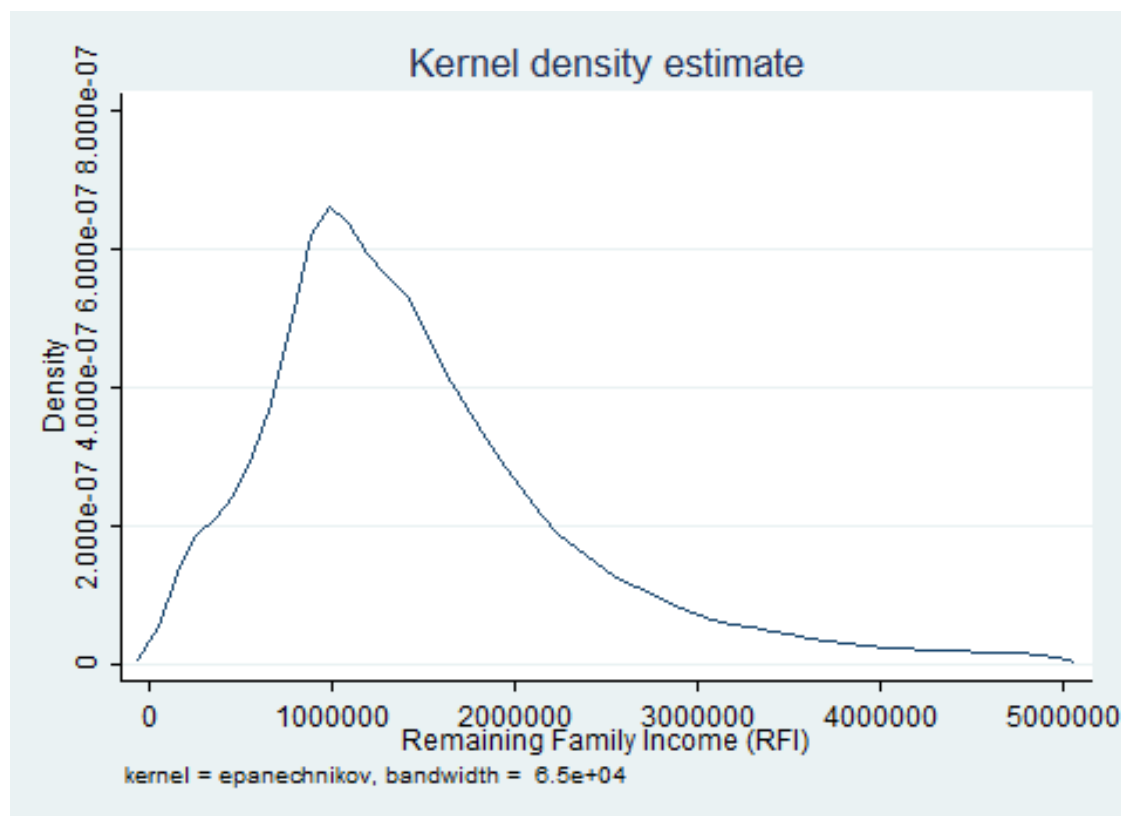


Source: own calculations based on Spanish Income Tax

Eissa (95) establishes that the 1986 US Tax Reform significantly increased the labour supply of married women with high income partners, because they were the group more affected by the reform. Moreover, Crossley and Jeon (2007) state that the 1988 Canadian tax reform implied a significant increase in labour force participation of married women with high income husbands, because they were more affected by the reform comparing with married women with low income husbands. Furthermore, Lalumia (2008) shows that the 1948 US Tax Reform negatively affected the employment rate of married women in families with highly-educated husbands. Also, Selin (2013) studies the 1971 Sweden tax reform, which abolished joint taxation. His results show that employment grew among women married to high-income earners.

. As we will see, this selection it's not very far from the treated and comparison groups.

Figure 1: Distribution of Remainin Family Income (RFI)



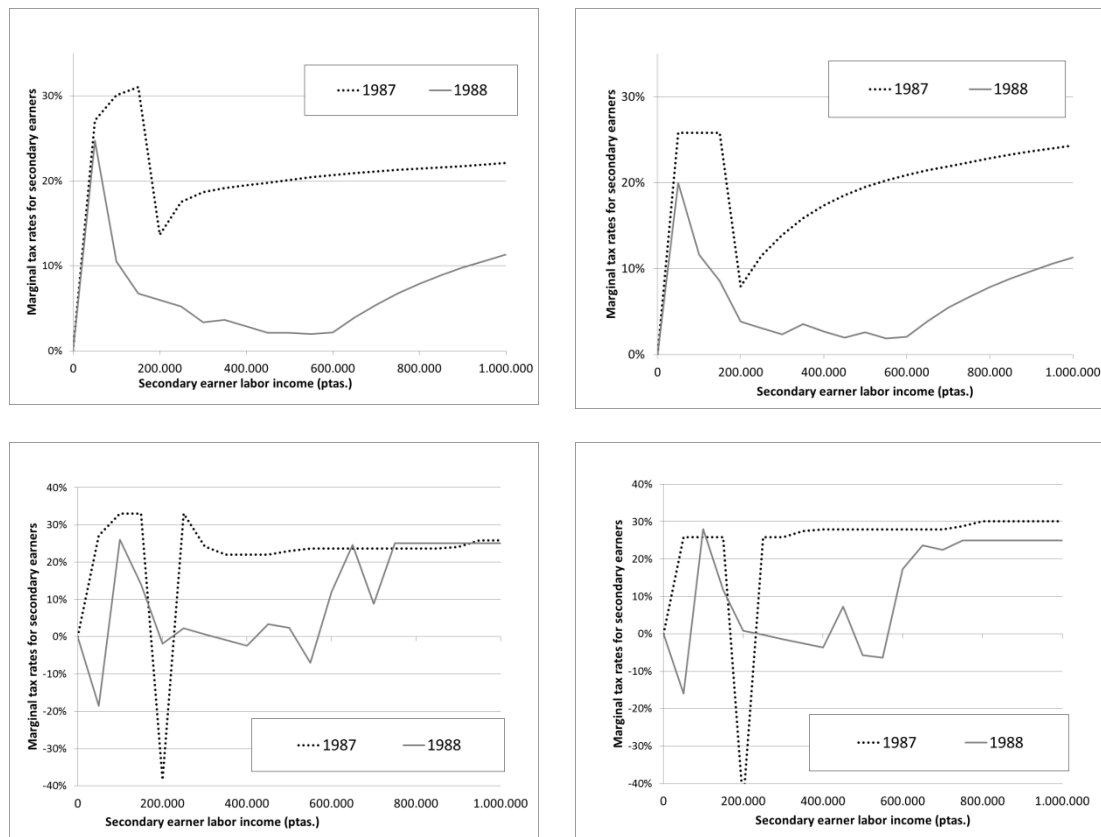
Source: Spanish Income Tax Panel 1982-1998

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Figure 2: Comparing Average Tax Rates of secondary earners, 1987 and 1988



First earner's income (Treatment group): 1,000,000 ptas.

First earner's income (Comparison group): 2,000,000 ptas.

Source: own calculations based on Spanish Income Tax

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The 1988 Spanish Tax Reform produces very strange effects. In general, tax rates of married couples were reduced, but low income families experienced a higher reduction in taxes than high income families. So we must expect a stronger change in labour force participation by women in low income families.

4. The Treatment Group and the Comparison Group

4.1. Quasi-Experimental Design: A Methodological Introduction

Possible designs of an impact assessment are classified as experimental and quasi-experimental. The main difference between them is how participants are assigned to treatment and control groups (random in the experimental design and no random in the quasi-experimental). In both cases the goal is to try to answer, in the case of post evaluation analysis, what would have been the situation of the beneficiaries if they had not participated in the program and compare it to the situation observed for the same beneficiaries in relation to an observable variable of benchmark that measures the impact of the policy.

This idea can be represented by the following equation:

$$\alpha_i = Y_{1i} - Y_{0i} \quad (3)$$

Y_{1i} situation is reached when the individual participated in the program; Y_{0i} represents the situation that the individual would have attained in the absence of the program, and α_i is the program's impact on the individual "i". This impact can never be observed directly, since only one of the two potential situations (participate or not

participate) is observed for each individual at a given time (Rubin, 1974). This problem is known as the "fundamental problem of evaluation".

Thus, the impact assessment will count only observations for individuals Y_{1i} beneficiaries of the program and the problem to be solved is the estimation of Y_{0i} , which is commonly called the counterfactual and its correct estimation is the main challenge of the literature related to the impact assessment. According to Cook and Campbell (1979) the impact should be estimated by a systematic comparison between population groups that receive the benefits of the intervention (treatment group) and non-beneficiary groups (control groups) with similar relevant characteristics to treaties. In this case, the control group would simulate the counterfactual Y_{0i} .

In case of quasi-experimental design, shaping the control group from a representative sample of the target population who did not participate in the program and the impact is calculated by comparing the average of the impact indicators for the treatment group in a situation with and without project situation:

$$\alpha_P = I_{P=1} - I_{P=0} \quad (4)$$

In order to understand and isolate the net effect of a policy, comparing two groups: the experimental group that has been applied to the program and the control group, being in the same condition to receive it, does not. The net effects are the result of the difference in behavior between the two groups on a target variable.

4.2. Calculating the Average Tax Rate for secondary earner

As explained in the previous section, the quasi-experimental literature usually searches for treated and control groups. Usually we know people treated, and the strategy consists on looking for similar people not receiving this policy. But in fiscal reforms things change slightly. *A priori* every couple must be considered as treated, because all of them change their tax bills. So we have to select whom of them suffered more intensely the tax reform (treatment group) and whom are less affected by it (comparison group).

In these cases there is not a clear strategy on how to choose the treated and the comparison group. Generally it seems to be an intuitive process, trying to find these groups without having a criterion to select some choice over another. In this work we will

try to shed light about this problem, offering a quite objective process to check the selection of treated and control groups.

In our case this task is no easy, so we have taken our pure panel and calculate the real tax rates for married couples before and after the 1988 Tax Reform. 1987 was the starting point, and 1991 was the year of comparison. We have chosen 1991 due to two reasons. Firstly, in 1988 we might not observe any change, as the reform was introduced by surprise, as it was a reform ordered by the Constitutional Court. Secondly, we expect that changes in labour force participation are slow, then taking 1991 implies to give time to individuals to modify their labour behaviour. In any case, considering other years don't change the sign of the results.

Our strategy begins selecting the range of the groups. There is no general rule but selecting groups not so wide to get mixed up, not so thin to lose representativeness. In this step there is a high degree of intuitiveness, but the range could be modified afterwards.

Having decided one range, we calculate for each group the change in the average tax rate for secondary earner caused by the 1988 Tax Reform, and also the change in labour participation between 1988 and 1991. These changes will guide our election of treatemen and comparison groups. We select different pairs of treated and controls and check which pair is more robust.

In the second step we calculate the Propensity Score (PS) for each couple of the groups. The PS shows the probability of being selected. The goal is that the differences between the PS of treated and controls were not significant. If PS is similar between the treated group and the comparison group, we could say that the policy affects people randomly, and could assert that our results are causal.

Having selected a superior pair of groups due to the PS, we can now try to change the range of the groups (Step 3). In this sense, we made a second analysis of pairs, changing in range. Again our criterion to select the best option will be the Propensity Score.

Step 1. Preparing the data and selecting the range

For every observation in the sample, we have calculated ATR_{2E} , as stated in equations (1) and (2). We also detect the families where there is a secondary earner, that is, more than one person obtaining labour income or business income. As we have mentioned, it is not so straightforward, specially in joint filing, because we don't know if there is one person or two obtaining the income, and if it is the same person who earns the labour income and the business income, or there are two people obtaining each. In order to find who are earning which kind of income, we ruled routines to discover if we are talking about a one-earner couple or a two-earner couple.

Married couples are ordered taking into account the Remaining Family Income (RFI). We calculate the percentiles for this variable, each of them containing 948-9 married couples. The results are depicted in Table 4.

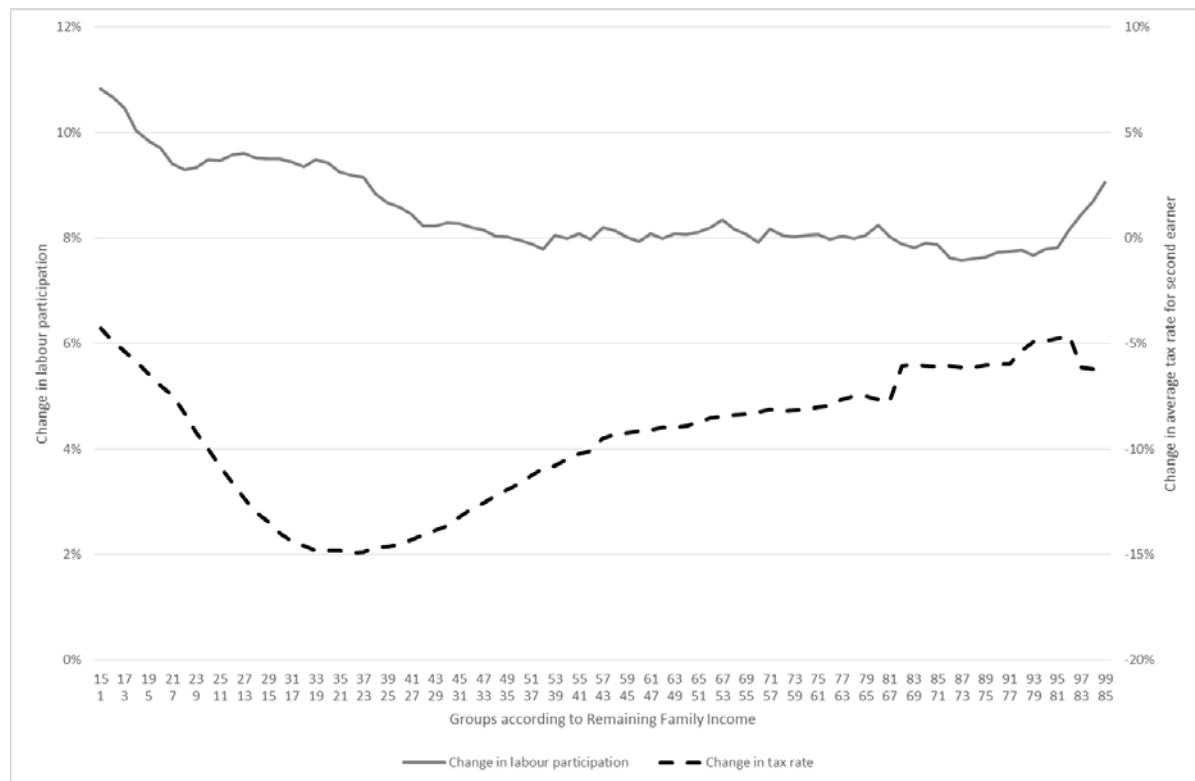
Table 4: Remaining Family Income per percentile

Centile	RFI Value	Centile	RFI Value	Centile	RFI Value	Centile	RFI Value
1	126,996	26	916,048	51	1,328,290	76	1,937,573
2	194,093	27	930,927	52	1,347,060	77	1,973,242
3	251,492	28	945,596	53	1,366,021	78	2,010,889
4	302,181	29	960,335	54	1,384,154	79	2,051,269
5	351,419	30	975,138	55	1,403,489	80	2,094,006
6	400,374	31	990,492	56	1,422,098	81	2,141,889
7	446,935	32	1,006,520	57	1,441,957	82	2,192,264
8	490,450	33	1,021,686	58	1,461,391	83	2,246,913
9	527,068	34	1,037,300	59	1,481,674	84	2,306,362
10	562,581	35	1,052,199	60	1,503,624	85	2,366,672
11	595,948	36	1,067,899	61	1,524,654	86	2,433,287
12	626,868	37	1,084,124	62	1,548,015	87	2,505,296
13	657,187	38	1,100,448	63	1,569,977	88	2,588,194
14	685,709	39	1,117,628	64	1,594,570	89	2,677,067
15	711,408	40	1,134,027	65	1,617,224	90	2,777,917
16	735,860	41	1,150,078	66	1,641,950	91	2,896,672
17	758,358	42	1,167,770	67	1,668,690	92	3,027,204
18	779,339	43	1,184,290	68	1,694,885	93	3,200,835
19	799,792	44	1,201,278	69	1,721,718	94	3,398,507
20	818,259	45	1,218,428	70	1,747,934	95	3,645,757
21	835,558	46	1,236,295	71	1,776,317	96	3,995,014
22	851,952	47	1,255,225	72	1,807,075	97	4,467,000
23	867,400	48	1,273,380	73	1,837,970	98	5,149,214
24	883,279	49	1,291,921	74	1,870,016	99	6,569,177
25	899,974	50	1,309,561	75	1,901,776		

Source: own calculations based on Spanish Income Tax Panel 1982-1998

Taking this information into account we consider groups of 15 percentiles, the same range as selected by Crossley and Jeon (2007). But it is just a first approach, which we will check lately, in step three. Doing so we will have 85 groups, each of them make up of 14,220 married couples. That is, the first group is composed by percentiles 1-15, families with RFI over the first percentile (126,996 pesetas) and below the 15th percentile (711,408 pesetas), group 2 includes 2-16 percentiles, and so on. And for each group we have calculated its change in the ATR_{2E} and the change in second earner labour force participation.

Figure 3: Average changes in Average Tax Rates of secondary earners and in labour participation between 1987 and 1991



Source: own calculations based on Spanish Income Tax Panel 1982-1998

As can be easily noted from Figure 3, ATR_{2E} decreases substantially more for families with low Remaining Family Income than for higher income groups (right axe). In other words, 1988 Tax Reform benefited more the work of secondary earner from low income families than for higher ones. It can also be seen than during this period the rate of labour participation of married women increases for all family income groups (left

axe). Nevertheless the growth in labour participation was higher for these groups having a lower RFI. The rate of growth is clearly lower for higher income families. So intuitively it can be noted that the reduction in tax bill could be related with participation in labour market in the case of secondary earners. The bigger reduction in tax rates, the bigger increase in labour participation.

From data in Figure 3 we have selected for the treatment group families more heavily affected by tax reform. There were the 22nd-36th percentiles. And for the comparison group we took the 80th-94th. The treatment group was clearly benefited from Tax Reform, and we expect than they will enter more intensively to the labour market in comparison with control group. It must be noted that the shape of treated and controls are just the opposite in other papers as Eissa (1995) and Crossley and Jeon (2007).

Step 2. Measuring the Propensity Score (PS)

We have selected other candidates for treatment and control groups in the neighbourhood of our first choice. We will select the final control and comparison groups depending on the Propensity Score for each pair of groups. The PS is the probability of being selected. To calculate it we took into account all the disposable variables: Region, Municipality, General Tax Credit, Illness Expenses Tax Credit, Housing Investment Tax Credit, Dividends Tax Credit, Children Tax Credit, Disability Tax Credit, Age Tax Credit, and Ancestors Tax Credit. As we have noted, the objective is that the PS difference between the treatment group and the comparison group were not significant. Only in this case we could assume that policy affect people randomly, not because they fulfill a special characteristic that could influence the output variable.

In Table 5 we have depicted the best candidates of being the group of treated and controls, after multiple essays. The first group is created with families where second earner had experienced a stronger reduction in ATR_{2E} as a result of tax reform. The second group contain the families whose second earned had been affected the least. For each pair of groups we have calculated the PS, being H the best option.

Step 3. Checking the range of groups

According to Table 5 the best option for the treatment group are families with a RFI between 25th-39th percentiles. The best option for the comparison group is that including families with RFI between 69nd-83th percentiles. But we have selected the range of the groups intuitively. Based on this choice, we could now modify the range in order to improve our groups. It is what we do in Table 6. From the original 15 percentiles (H option), we have reduced the range up to 7 percentiles (H1 to H4), and widened to 23 percentiles (H5 to H8).

Table 5: Propensity Score for Treatment group and Comparison group

Option	Treatment group			Comparison group			Differences in Propensity Score
	Percentiles		Change in tax	Percentiles		Change in tax	
			Rates			Rates	
A	22	36	-0,150	80	94	-0,046	0,1346
B	19	33	-0,149	81	95	-0,046	0,1423
C	20	34	-0,149	79	93	-0,047	0,1348
D	21	35	-0,149	78	92	-0,052	0,1305
E	18	32	-0,148	68	82	-0,058	0,0931
F	23	37	-0,148	75	89	-0,059	0,1156
G	24	38	-0,147	76	90	-0,059	0,1200
H	25	39	-0,146	69	83	-0,059	0,0871
I	17	31	-0,146	70	84	-0,059	0,1008
J	26	40	-0,145	71	85	-0,059	0,0933

Source: own calculations based on Spanish Income Tax Panel 1982-1998

As can be seen in Table 6, the best option, according to the PS criterion, is H2 option. That is, the control group will be composed of 28th-36th percentiles, and the comparison will comprise 72nd-80th percentiles. Nevertheless results are quite robust, in the sense that PS does not vary too much between different options. Unfortunately, the difference between the propensity score (0.5504 for treated and 0.4657 for controls) will remain significative.

Table 6: Changing the range of groups

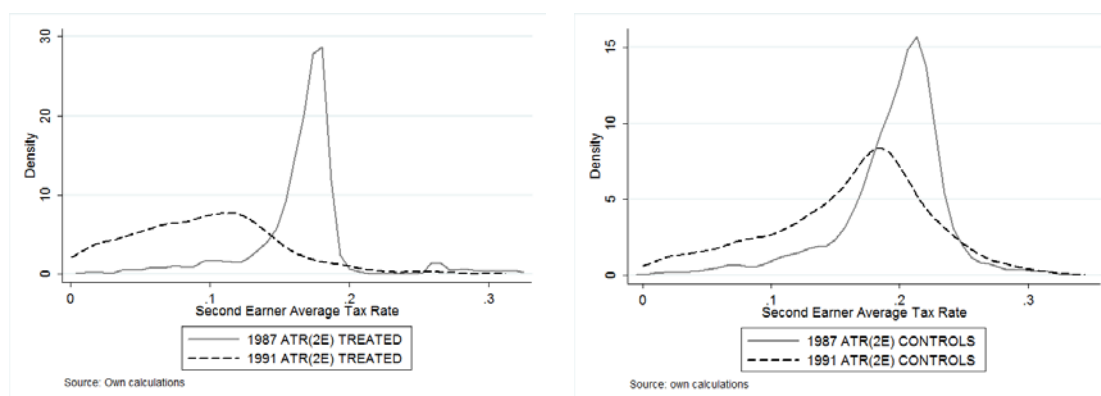
Option	No. of percentiles	Treatment group		Comparison group		Propensity Score
H1	7	29	35	73	79	0,0849
H2	9	28	36	72	80	0,0847
H3	11	27	37	71	81	0,0867
H4	13	26	38	70	82	0,0867
H	15	25	39	69	83	0,0871
H5	17	24	40	68	84	0,0876
H6	19	23	41	67	85	0,0901
H7	21	22	42	66	86	0,0929
H8	23	21	43	65	87	0,0960

Source: own calculations based on Spanish Income Tax Panel 1982-1998

5. Results

After the previous analysis, we have selected two groups including 9 percentiles each, or 8,535 families. The treatment group corresponds with 28th-36th percentiles, that is, families whose RFI is higher than 930,927 and equal or below 1,067,899 pesetas. The comparison group is made up with 72nd-80th percentiles, with RFI higher than 1,776,317 and minor or equal to 2,094,006 pesetas. As we could see, final quantities are very near to those proposed in Figure 2 (1 and 2 million pesetas).

Figure 4: Effect of tax reform over treated and controls



Source: own calculations based on Spanish Income Tax Panel 1982-1998

Figure 4 shows how the Spanish tax reform affect treated and controls. A secondary earner in a treated family faced a strong reduction in her tax bill. Nevertheless,

secondary earners in the comparison group experienced also a reduction in her tax bill, but not so huge. As a result, we expect that job market reaction will be higher for secondary earners belonging to families with low income (treatment group), in comparison with secondary earners in families with higher income (comparison group).

The average of ATR_{2E} is depicted in Table 7 for every year since 1987 to 1991. It is obvious that 1988 Tax Reform implied a reduction in tax rates for secondary earners, but it is clear that tax cuts were clearly different for treated and controls. After 1988 changes are very small: further tax reductions for treated and a tax increase for controls. T test on the equality of means show that in all cases these tax rates are significative different between treated and controls.

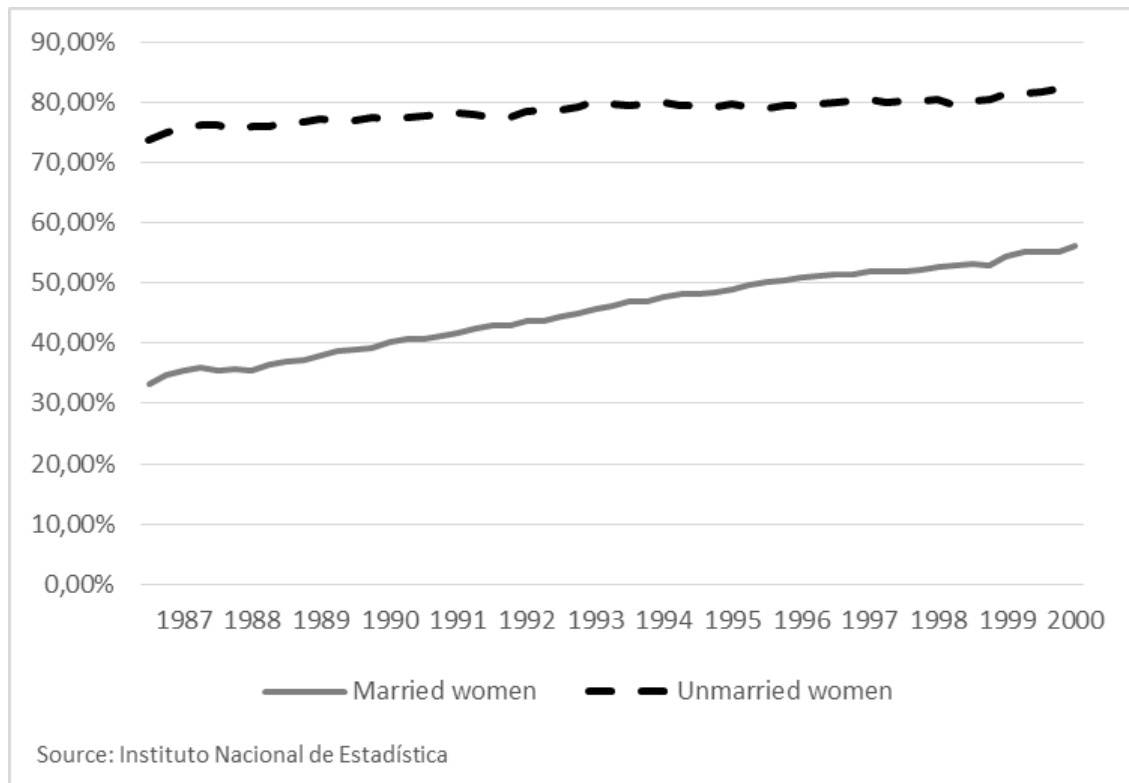
Table 7: Average ATR_{2E} . 1987 to 1991

	1987	1988	1989	1990	1991
Treated	15.68%	2.14%	1.23%	1.27%	0.08%
Controls	19.11%	8.64%	10.23%	10.98%	14.35%

Source: own calculations based on Spanish Income Tax Panel 1982-1998

Changes in second earner participation rates depend on multiple factors. We are talking about a historic period where women increased their labour participation, so we could expect an increase in the number of second earners, no matter the tax reform. As we could see in Figure 5 the general trend was increasing. Nevertheless, the rate of growth in married women are clearly higher than the unmarried women. Could the tax be responsible of part of this change? In order to shed light in this question, we use the Difference in Differences analyses (DID).

Figure 5: Labor force participation rates of married and unmarried women aged 25 to 54



The change in labour supply of married women⁵ pertaining to the treatment group could be represented as $(PR_{ta} - PR_{tb})$, being PR_{ta} the labour supply of treated married women after the tax reform and PR_{tb} the labour supply of treated married women before the tax reform. Part of this change could be attributed to the tax reform, and other part to external factors as general changes in labour demand. Nevertheless, we could assume non fiscal changes are reflected by women in the comparison group, that is, $(PR_{ca} - PR_{cb})$, being PR_{ca} the labour supply of secondary earners in the comparison group after the tax reform and PR_{cb} the labour supply of the same people before the tax reform. In this case we could detect the net effect due to tax reform, not considering the general trend. Doing so, we could estimate the effect of fiscal reform as $(PR_{ta} - PR_{tb}) - (PR_{ca} - PR_{cb})$. The underlying idea behind the DID estimator is that we compare the change in labour force participation of secondary earner strongly affected by tax reform with the change in labour force participation of secondary earners less affected by tax rates reduction. The underlying assumption is that the latter are the general trend, the change in labour participation without tax reform.

⁵ As stated previously, we assume that the secondary earner is a woman.

	Before the 1988 Tax Reform (1987)	After 1988 Tax Reform (1991)	Meaning
Comparison group	PR_{cb}	PR_{ca}	<i>Trend: $PR_{ca} - PR_{cb}$</i>
Treatment group	PR_{tb}	PR_{ta}	Differential behaviour: $PR_{ta} - PR_{tb}$

Having decided the families pertaining to treatment group and to comparison group, we have calculated the labour participation rate. It was not so easy, as official data do not provide explicitly this information. In the whole period labour participation rates of secondary earners from the comparison group are higher than from the treatment group. Having different levels of income, this difference might respond to differences in educational levels. Unfortunately we do not have this variable, as it is not included in tax returns. Nevertheless, we are interested not in the *level* of labour participation, but in the *differential behaviour* to the 1988 fiscal reform. The main results are depicted in Table 8.

Table 8: Labour participation rates of secondary earners in treatment and comparison groups

	1987	1988	1989	1990	1991
Treated	15.65%	19.89%	21.65%	23.52%	25.07%
Controls	26.63%	31.10%	32.14%	33.69%	34.44%

Source: own calculations based on Spanish Income Tax Panel 1982-1998

The summary results can be seen in Table 9. This table shows the effect of 1988 fiscal reform in labour participation of second earner. In an important part, as we have said, the effect of tax reform on labour participation of married women.

Table 9: Difference in differences estimator

Changes in Average Tax Rates before and after the 1988 tax reform				
	Before the tax reform (1987)	After the tax reform (1991)	Differences	Difference in differences
Treatment group	15.68%	0.08%	-16.6	- 11,84
Comparison group	19.11%	14.35%	-4.8	
Changes in labour force participation of second earner before and after the 1988 tax reform				
	Before the tax reform (1987)	After the tax reform (1991)	Differences	Difference in differences
Treatment group	15.65%	25.07%	9.43	1,62
Comparison group	26.63%	34.44%	7.81	

Source: own calculations based on Spanish Income Tax Panel 1982-1998

1988 Tax Reform generally implied an important tax cut for second earners. Nevertheless this reduction was quite different between treated and controls. The former reduced their tax bill in 16.6 percentage points, in average. The comparison group experienced quite modest reduction in tax rates, averaging 4.8 percentage points. This differential treatment conducted also to a differential response in agent's behaviour. The comparison group, representing the natural trend of society, increased their participation rate in 7.81 percentage points (29.3%). Nevertheless, the treatment group showed a stronger change in labour behaviour. Their participation rate increased 9.43 percentage points (60.3%). This differential reaction is more important if we take into account the lower starting point.

Therefore, we can attribute as the effect of fiscal reform the estimator of difference in differences, amounting 1.62 percentage points. We could say that, as a result of differential tax reform, people more affected increase their labour participation rate 31% more than their less affected counterparts.

6. Conclusions

The effect of tax changes on the labour supply has interest from the economic point of view, especially in the case of married women. In Spain in 1988 there was an income tax reform that moved from joint taxation to separate taxation. The main goal of this paper is to use this reform as a quasi-natural experiment, showing if a tax change could significantly affect the labour participation of secondary earners.

To do that we have used the IRPF IEF-AEAT 1982-1998 Panel, containing detailed income tax data from tax register. We have selected the previous year to the reform, 1987 where married couples must file the joint return; and several years after the reform, 1988-1991, where couples could choose between separate taxation and joint taxation.

Applying the treatment effects literature, we have calculated the causal effects using the difference-in-differences technique. And for selecting the treatment group and the comparison group we have developed a new methodology based on propensity score values. This technique allows us to compare the treatment group, the secondary earners most affected by the fiscal reform, with the comparison group, less affected by fiscal

reform. We have distinguished between groups according with the level of remaining family income (total family income minus secondary earner personal income). Differences in labour behaviour before and after the tax reform will allow us to identify the causal effect.

The 1988 tax reform implied a tax cut for married couples where both spouses worked. But this reduction was not homogeneous according with the remaining family income (RFI). Secondary earners from families with relatively low RFI (28th-36th percentiles) have experienced stronger tax reductions (16.6 percentage points) than secondary earners from families with high RFI (72nd-80th percentiles; 4.8 percentage points). This is a surprising result in comparison with other fiscal reforms. In the case of 1986 US tax reform (Eissa, 1995), the 1988 Canadian tax reform (Crossley and Jeon, 2007) and the Swedish tax reform (Selin, 2013), the treatment group was women married with high-income families, and the opposite for comparison group. The difference between the Spanish tax reform and the others is caused by the effect of different tax credits, which change the general pattern expected by a progressive tax.

Nevertheless, the expected labour participation results are consistent with previous works. These people more strongly affected by the tax reform (women in low income families) react heavily in their labour participation (9.43 percentage points increase in participation rates), in relation with families less affected by the tax reform (women in high income families, 7.81 percentage points). Therefore, we can attribute as the effect of fiscal reform 1.62 percentage points higher change in labour participation, 31% more than their less affected counterparts.

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