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Welfare analysis of fiscal reforms in Europe: Does the representation of family decision processes matter? Evidence from Italy

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Abstract

This paper adopts a "piece-meal" approach to empirically identify, on a sample of Italian households, a collective model where both non-participation and non-convex budget sets are allowed for. Two tax reforms, i.e. the 2002 tax changes recently introduced in Italy and a revenue neutral linear income tax are evaluated by the collective framework derived. The predictions obtained for individual labour supplies, income and welfare distribution are then compared with those of a traditional unitary model. The exercise provide an assessment of the distortion introduced in positive and normative analyses when individuals are assumed to behave as if in a unitary, rather than in a collective world. The results suggest that further efforts should be devoted to the analysis of intra-household decision models.

Key words: collective models, intra household allocation, tax reform
JEL Classification: D11, D12, J22

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1. Introduction

An economic evaluation of a tax and benefit reform should include measuring its impact on individual behaviour and welfare. Until recently, "unitary" models were providing the theoretical justification to consider households, rather than individuals, as the basic unit of decision, assuming either directly a household utility function or a representative agent preference structure. The drawback of such models is that they can provide no explanation of why households might present different consumption patterns depending on who receives child benefits or on other aspects of the tax-benefit system.

A more appealing framework to deal with these issues is provided by the collective approach, which considers Pareto efficient decisions within a household, but imposes no restriction on the point of the Pareto frontier that is reached. The starting papers Chiappori (1988, 1992) and since then a good number of results have been added. One of the most relevant contributions of the literature at hand is to prove that the question of intra-household redistribution of resources can be crucial in determining the household decision process. Moreover, several parametric tests have been proposed to verify whether the traditional unitary model or more refined versions of the initial Chiappori's model better describe the household behaviour. They are all (except for Vermeulen, 2001) consistent in rejecting the assumption of a unique household utility function being maximised.[1]

However, a lot of questions within the collective field remain yet unanswered. As far as the labour supply is concerned, it is only recently that issues such as (non) participation to the labour market and income taxation have received attention (see Blundell *at al.*, 2001, Donni, 2002 and Donni and Moreau, 2002).

Nevertheless for policy purposes, it is time to explore the potential of the collective approach, since the use of a unitary approach has two main disadvantages. First, it can produce misleading predictions on individual behaviour, as shown on synthetic data in Beninger and Laisney (2001). Secondly, it takes for granted that a socially optimal redistribution of resources within the household will always follow any economic policy reform.

This paper contains results of a research jointly developed by seven research units based in various European countries (Belgium, Denmark, France, Germany, Italy, Spain and the UK) and it provides empirical evidence based on a sample of Italian households.

The aim of the research is twofold. First it proposes an alternative approach to model household labour supply in a collective framework when taxation may produce non convex budget sets. Rather than empirically estimating a structural model of household labour supply, it focuses on modelling, with a "piece-meal" method the within household allocation along the Pareto frontier for any given tax and benefit system. Specifically, it calibrates a collective data set so that it closely reproduces the choice over disposable income and labour supply of a sample of Italian couples selected from the 1998 Bank of Italy survey, SHIW. The strategy followed is based on the identifying assumption that some aspects of individual preferences over consumption and leisure are unchanged after marriage. This hypothesis allows us to estimate preferences of singles and to use them to simulate the within couple allocation of time and consumption. But single preferences are also complemented with a leisure interaction term allowing for substitution or complementarity in non working time when individuals in couples are examined. Both the leisure interaction term and a bargaining index describing the position reached by each household along the Pareto frontier are then calibrated on the Italian sample of couples.

Secondly, the paper provides a measure of the distortion produced in the evaluation of the economic effects of a tax reform based on more traditional household models. Starting from the

[1] A survey of these themes is contained in Chiuri (2000) and Vermulen (2000).

1998 Italian income tax system, two tax reforms are taken into account: the recent 2002 income tax corrections and a revenue neutral linear income tax. The analysis is preceded by the estimation of the calibrated bargaining power index on a set of demographic and economic variables, including the way income taxes affect individual contributions to net household earnings. Such econometric analysis will provide the predicted values of the within household bargaining power in any given tax reform. Afterwards, predictions on labour supply, on income redistribution and on welfare changes derived by the calibrated collective model are compared with those by a unitary model.

In the unitary model here estimated we assume a functional form that mimics a linear combination of the individual preferences chosen in the collective framework and explicitly estimate unobserved heterogeneity. In so doing, any divergence in predictions between the two approaches has to be attributed to model specifications. The larger is the distortion, the stronger is the need to switch to more appropriate household economic models.

The paper is organised in eight sections. Section 2 describes in brief the 1998 Italian tax-benefit system and the two reforms under consideration. In Section 3 the collective model and the "piece-meal" approach used are discussed. The data set and the main sample characteristics are contained in Section 4. Section 5 reports the empirical specification adopted and the relative results obtained. Section 6 concerns the calibration of the sharing rule and simulation of couple's behaviour. The unitary model estimates are reported in Section 7. Finally, the discussion of intra-household effects of tax reforms and the divergence in predictions between the collective and the traditional household model are left to Section 8, followed by the conclusions.

2. Italian tax- benefit system, the 2002 financial law and a linear tax reform

2.1 The 1998 Italian tax-benefit system

The progressive income tax (IRPEF - Imposta sul reddito delle persone fisiche) represents the main source of revenue in the Italian tax system. The tax unit is the individual, while the household composition affects the tax liability through a system of tax credits for dependant spouse and children. The tax base is mainly given by the sum of earnings (from labour, self-employment and unincorporated firms) and income from real estate; income from financial assets is generally taxed separately with a proportional withholding tax.

A more detailed description of the tax structure is provided in Tables 1 and 1.a with reference to the 1998 tax year. The tax schedule is piece-wise linear with five brackets, with rates going from a minimum of 19% to a maximum of 46% (over € 69,722). Figure 1 depicts typical profiles of marginal and average tax rates, computed on the basis of liabilities before tax credits.

The final tax liability depends on a quite cumbersome system of tax credits, generally decreasing with income. The main credits are allowed for earned incomes and for dependent relatives. The former decreases with liable income, with different schedules according to the type of income, (depending on whether the tax payer is an employee, self-employed or entrepreneur): in particular, the credit allowed to income from employment varies from a maximum of € 868 to a minimum of 52 (for income over € 51,646). The amount of tax relief for dependant spouse is decreasing with income from € 546 till a minimum of 422. In 1998 the presence of dependent children entitled to a fixed tax credit of € 173 per child, the amount being shared by parents when they both have taxable income.

As far as labour income is concerned, the picture must be completed by considering social security contribution and a family benefit in cash. The rates of social security contribution are

quite high: for a blue collar of the industrial sector the overall rate is about 44%. But the tax burden is shared by employers and employees. As it is difficult to measure the economic incidence of social security contribution on employees/employers, we exclude them from the current research.

On the benefits side, employees at low and middle wage levels are eligible to receive child benefits, whose amount decreases both with the number of children and with the level of household income (see Table 1.a) .

The joint effects of employees' income taxation, tax credits and child benefits are depicted in Figure 2 in terms of weekly hours of work. The reference case is a single person household with a dependent child and gross hourly wage of 10.24 Euro (observed average value in the 1998 sample of single women).

2.2 The income tax reform in project and the 2002 financial law

The Italian Government has announced a huge reform of the income tax structure that will be implemented in different stages starting in 2003 up to 2006. The plan is based on a considerable flattening of the tax function, that eventually will be based on just two rates (23% up to € 100,000; 33% over). The system of tax credits will be replaced by a simplified structure of allowances vanishing with income: their precise schedule has not yet been announced. The bill attributing the Government the power to implement gradually the reform is now under the scrutiny of Parliament.

In the meantime, with the Financial Law for 2002, the Government has introduced a substantial increase in the tax credit for children at low and middle income levels. The 2002 income tax structure is given in Table 2. Figure 3 compares the 1998 and 2002 tax functions in terms of net income for a taxpayer with dependant spouse and two children. In what follows, the 2002 Financial Law income tax changes, which are not revenue neutral, will be introduced first in the model.

2.3. The linear income tax hypothesis

We will also consider a hypothetical reform consisting in the introduction of a linear income tax with a negative component. Given a tax liability *R,* gross hourly wage $\widetilde{w}$ and *h* hours of labour supply, such that:

$$R = (1-t)\widetilde{w}h - G\,;$$

this exercise will choose the marginal tax rate *t* and a minimum guaranteed income *G* so that revenue neutrality will be satisfied.

Table 1: Description of the 1998 Italian tax- benefit system

Taxable income from:			
- employment			
- self employment			
- business and unincorporated companies			
- real estate			
Tax unit: individual			
Tax schedule			
Income brackets		Rates	
0 – 7,747		0.19	
7,748 - 15,493		0.27	
15,494 - 30,987		0.34	
30,988 - 69,722		0.40	
> 69,722		0.46	
Tax relieves			
- decreasing tax credit for employment income			
maximum amount: 868			
minimum amount: 52 (for incomes over 51,646)			
- decreasing tax credit for dependent spouse			
maximum amount: 546			
minimum amount: 422 (for incomes over 51,646)			
- fixed tax credit for each child			
amount: 173			
Rates of social security contribution*			
Employer		Employee	
White collar	Blue collar	White collar	Blue collar
33.52	34.74	10.19	9.19

Note: * for the employer, net of the special regimes of incentives ("fiscalizzazione degli oneri sociali"). Nominal variables in Euro per year.

Table 1.a Description of the 1998 Italian tax- benefit system: Child Benefits Schedule

Income brackets		Number of children				
		1	2	3	4	5+
0	10304	130.66	250.48	358.94	492.18	619.75
10305	12751	114.65	220.53	339.83	481.34	600.64
12752	15198	92.45	190.57	312.97	473.07	584.11
15199	17643	65.59	158.04	283.02	453.97	565.00
17644	20090	43.90	111.55	241.70	407.48	507.68
20091	22537	25.82	81.60	217.43	390.96	488.57
22538	24984	15.49	57.33	176.63	364.10	466.88
24985	27430	15.49	38.73	135.83	339.31	439.50
27431	29876	12.91	25.82	102.77	317.62	426.08
29876	32322	12.91	25.82	91.93	225.18	398.70
32323	34769	12.91	23.24	91.93	154.42	292.83
34770	37216		23.24	78.50	154.42	218.98
37216	39663		23.24	78.50	132.21	218.98
39663	42109			78.50	132.21	189.02
42110	44556				132.21	189.02
44557	47003					189.02

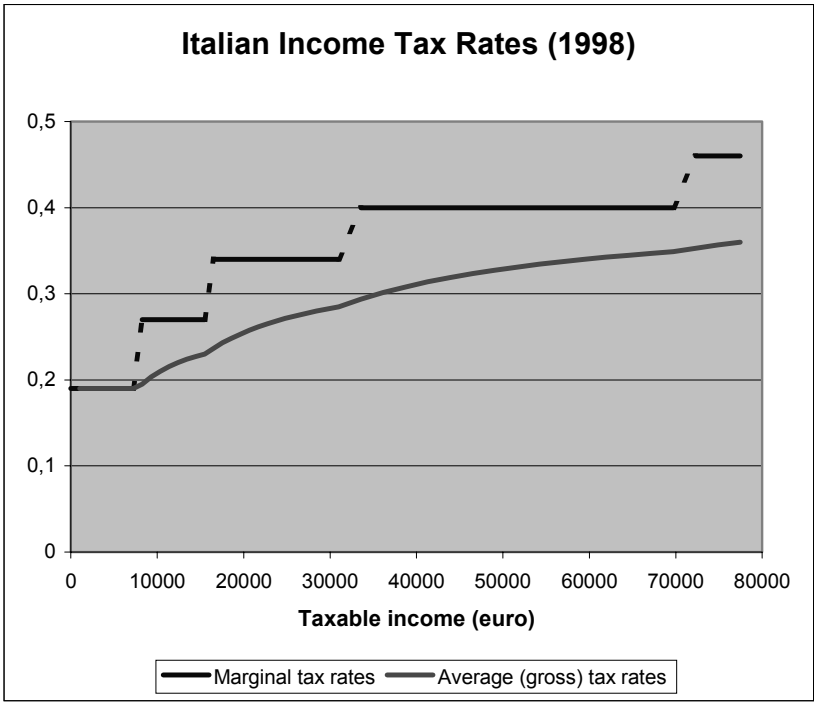

Figure 1: 1998 Italian marginal and average tax rates.

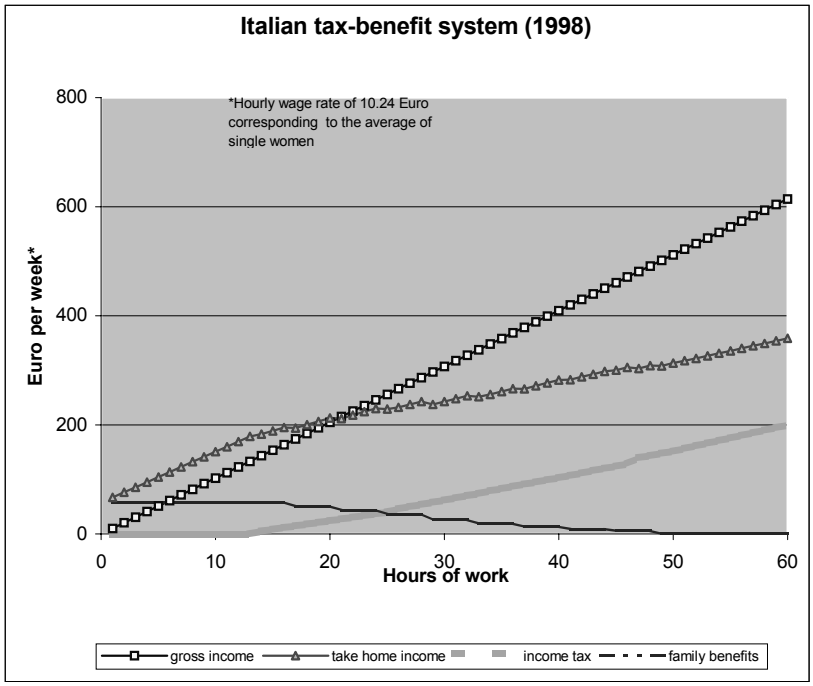

Figure 2: Italian tax and benefit system

Note: reference household is single person with a dependent child and gross hourly wage of 10.24 Euro.

Table 2: The 2002 Income Tax structure

Tax schedule	
Income brackets	Tax Rates
0 – 10,328	0.18
10,328 - 15,493	0.24
15,494 - 30,987	0.32
30,988 - 69,722	0.39
> 69,722	0.45
Tax relieves	
- decreasing tax credit for employment income	
maximum amount: 1146	
minimum amount: 52 (for incomes over 51,646)	
- decreasing tax credit for not working spouse	
maximum amount: 546	
minimum amount: 422 (for incomes over 51,646)	
- decreasing tax credit for each child	
maximum amount: 516	
minimum amount: 285 (for incomes over 51,646)	

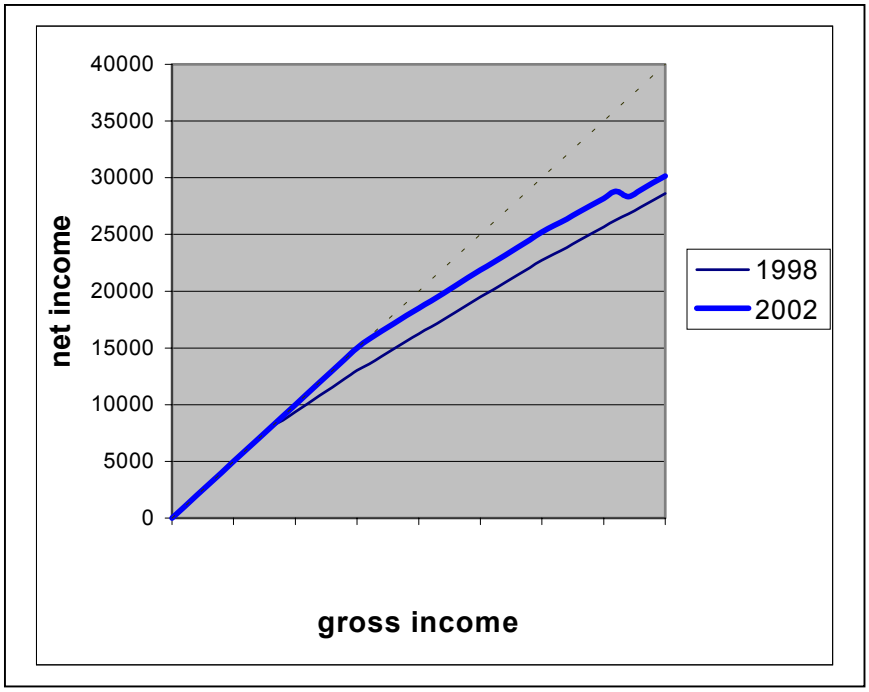

Figure 3: Net income under 1998 and 2002 tax structures

Note: Reference group: household with dependent spouse and two children.

3. Tax reform, labour supply and intra-household allocation of resources: empirical specification and identification strategy

The initial papers of Chiappori (1988 and 1992) define a collective model as the one where resources are always allocated according to the Pareto criterion and final outcomes are Pareto efficient. Formally, in a two member household each individual $i \neq j = m, f$ defines his own consumption bundle and leisure demand by solving the following Pareto optimality problem:

$$\begin{aligned} &\max U^i(l^i, c^i, \mathbf{z}) \\ &s.t. \quad U^j(l^j, c^j, \mathbf{z}) \geq \overline{u}^j(\mathbf{w}, y, \mathbf{d}, \mathbf{z}) \\ &\qquad c + w^m l^m + w^f l^f \leq \left(w^m + w^f\right)T + y \end{aligned} \tag{1}$$

In (1) the two individuals *m* and *f* have egoistic preferences over consumption c^i (with $c = c^i + c^j$) and leisure time l^i and, as in the simplest case, externalities and household public goods are excluded from the analysis. T, w^i and y indicate respectively total individual available time, net wage rate and household non labour income, whereas **z** is a vector of demographic variables which affects preferences and **d** are extra variables called distributional factors, since they only influence the distribution of resources, not their aggregate value.

Problem (1) allows individual *i* to maximise his utility, assuring *j* a level of $\bar{u}^j$ and meeting the aggregate budget constraint, which includes labour and non-labour earnings. The distribution of individual welfare that the final aggregate bundle will satisfy,

$$\left[\bar{u}^m(\mathbf{w}, y, \mathbf{d}, \mathbf{z}), \bar{u}^f(\mathbf{w}, y, \mathbf{d}, \mathbf{z})\right],$$

is assumed as an exogenous function of wages, non-labour income, and the distributional factors.

The framework in (1) can be used to introduce non-participation and a non-linear budget constraint into the analysis, as shown in studies by Blundell at al. (2001) and Donni (2002), respectively. But, their approaches cannot deal with a non convex budget set, which is an effect of the Italian tax and benefit system. Therefore, instead of deriving a structural model and fully estimating it, we follow a composite approach of econometrics and calibration techniques that allows us to reproduce a collective behaviour with minimal discrepancy from the Italian household data set, as later clarified.

First of all, we treat labour supply as a discrete choice. This simplification already proved its usefulness in the unitary setting (see among others van Soest, 1995) when non linear taxes and participation have to be incorporated in the analysis. As usual the labour supply equation is introduced in the theoretical model (1) by adding a time constraint, such that $h^i = T - l^i$.

Also, we assume that individual preferences have an extended Stone Geary specification, i.e. for *i=m, f*:

$$U^i = \beta_c^i \log\left(c^i - \bar{c}^i(z)\right) + \beta_l^i \log\left(l^i - \bar{l}^i(z)\right) + \delta^i \log\left(l^m - \bar{l}^m(z)\right)\log\left(l^f - \bar{l}^f(z)\right) \tag{2}$$

where the extension concerns a leisure interaction term, capturing complementarity in leisure sharing for couples or substitution in market/non market use of time, as household production is not explicitly modelled here. [2] Note that preferences as in (2) are non separable in the use of time and thus are more general than egoistic or "caring" usually analysed in the collective framework. The variables $\bar{c}^i, \bar{l}^i$ stands for the "subsistence" or minimum requirement of individual consumption and leisure time and, as explained later, they both will capture the equivalent costs and minimum caring tasks in the presence of children.

In order to identify all the parameters of the model we follow a two-step procedure. First, we estimate classical LES preferences on a sample of singles in Italy. In other words, we assume that in a one-person households, choices over total consumption and leisure satisfy the maximisation of

$$U^i = \beta_c^i \log\left(c^i - \bar{c}^i(z)\right) + \beta_l^i \log\left(l^i - \bar{l}^i(z)\right) \qquad i=m, f \tag{3}$$

subject to a constraint:

$$c^i = g\left(l^i, w^i, y^i, \phi^i\right) \tag{4}$$

defining disposable income for any given ϕ^i, a function of the Italian personal tax system and of individual characteristics. Note that the introduction of tax reforms will alter the function *g(.)*. Secondly, under the basic assumption that individuals do not change their preferences when they get married apart from the extra leisure term, the parameters estimated in the previous step

[2] The extended Stone Geary preferences are well-behaved, if $\beta_c^i > 0$ and $\beta_l^i + \delta^i \log\left[l^j - \bar{l}^j\right] > 0$ with $i \neq j = m, f$.

will be used for the sample of couples, and the bargaining power and the leisure interaction term δ will be calibrated. [3]

Given the non convexity in the household budget set raised by the Italian tax system, the Pareto frontier is not necessarily concave (see for proofs MasCollel et al., 1995). Therefore instead of maximising a social welfare function derived from the household problem (1), we implement a procedure that, moving along the Pareto frontier, searches for the point which is closest to the observed behaviour. [4] The steps followed here are four:

1. We first define for any given leisure interaction term δ the minimum (the maximum) utility level a man can reach in all combinations of spouses' labour supplies when the woman receives the maximum (the minimum) consumption level.

2. We then select K+1 points along the Pareto frontier and define:

$$U_k^m = U_{\min}^m + \frac{k}{K}\left(U_{\max}^m - U_{\min}^m\right) \qquad \text{for } k=0,\ldots,K \tag{5}$$

   where the ratio $\frac{k}{K} = \omega$ defines the man's bargaining power.

3. For a given ω the wife maximises her utility subject to the household budget constraint, the man's utility level being equal U_k^m.

4. Given the choice bundle l^f, l^m, c^m, c^f, which is function of (ω, δ), the value for ω and δ are then selected according to the following criterion:

$$\min_{\omega,\delta}\left[h_f^* - h^f(\omega,\delta)\right]^2 + \left[h_m^* - h^m(\omega,\delta)\right]^2 \tag{6}$$

   where h_f^*, h_m^* indicate respectively the observed husband' and wife's labour supply.

The procedure described above is based on the underlying assumption that the leisure interaction parameter δ is the same for men and women. Successively, the simplification can be removed once the bargaining power ω is regressed on a set of income variables, as well as on distributional factors **d**. Given the predicted values for ω, a new calibration procedure can be implemented in order to obtain the values for δ^m and δ^f according to:

$$\min_{\delta^m,\delta^f}\left[h_f^* - h^f\left(\delta^m,\delta^f\right)\right]^2 + \left[h_m^* - h^m\left(\delta^m,\delta^f\right)\right]^2 \tag{7}.$$

[3] A similar assumption is also made in Barmby and Smith (2001).
[4] This procedure was jointly developed by D. Beninger, F. Laisney and F. Vermeulen.

4. The Data Set

The data set used in this study is the 1998 Bank of Italy's Survey of Household Income and Wealth (SHIW). This is the most comprehensive survey of micro data on income and wealth in Italy, covering the socio-economic status, labour and non-labour income and wealth of more than 8,000 Italian households (24,000 individuals). Started in 1977 and re-designed in 1987, SHIW provides detailed information on a representative sample of the whole Italian population. Moreover it has a rotating panel component (about 40% of the sample) and the last three surveys refer to 1993, 1995 and 1998.

From the 1998 survey a sub-sample of individuals between 25 and 55 years old was selected, composed by either employees or non-employed. People still in education, unemployed, self-employed and retired are not considered in the current study.

Even though household composition in Italy changed considerably during the eighties/nineties due to the increase in the number of single persons and the decline in fertility, still a peculiarity of the Italian demographic structure is a relatively high percentage of young adults (compared to other European countries) that tends to live with their parents well beyond the age of 25, owing to higher unemployment and more difficult access to independent living arrangements. As the phenomenon of co-residence of relatively mature young adults with their parents would require a more complex model of intra-household decision, a further selection was necessary and households with children over age 25 were discarded.

However, due to small sample size, the sample of singles had to be enlarged. This was done by carefully matching non panel observations from the two previous SHIW surveys (1993 and 1995). Thus, the female sample size is 233 (75 observations from 1998, 64 from 1995, 94 from 1993 surveys), whereas the male sample size is 250 (77 observations from 1998, 84 from 1995, 89 from 1993 surveys). Nominal variables from the 1993 and 1995 surveys have been inflated to 1998 values (ISTAT CPI) and before tax income has been imputed considering respectively the 1993 and 1995 tax schedule. The main demographic characteristics of the two samples of one-person households are described in Table 3 and Table 4, respectively.[5] Given our selection criteria, men and women with college degree and residing in the North-West are over-represented. A consequence of both educational and geographical characteristics might also be that the female participation rate (82%) is remarkably higher than the national female participation rate (around 40%), as living in the North-West provides higher job opportunities but also higher living standards compared to the rest of the country. Concerning marital status, 68% of single men (women) never married, the remaining are separated, widowed or divorced. The main income source is on average labour earnings, whereas weekly unearned income includes return from financial investments and income from transfers, which can both assume negative values. On average a single man has higher non labour income than a single woman. Figures 4 and 5 display histograms of weekly hours for each sample of singles, with peaks at 0 and at 40 hours in both cases.

[5] All nominal variables are in Euro.

Table 3: Descriptive statistics for single men

	no.	mean	std. dev.	min	max
(1) Individual Characteristics					
Age	250	39.48	8.67	25	55
Education:	250				
Primary school		.12			
Secondary school		.44		0	1
Univ. and post-grad. Degrees		.43		0	1
Geographical area:	250				
North-west		.42		0	1
North-east		.20		0	1
Centre		.20		0	1
South		.09		0	1
Islands		.08		0	1
Marital status:	250				
Married separated		.02		0	1
Never married		.68		0	1
Divorced		.29		0	1
Widow		.02		0	1
(2) Employment characteristics					
Participation	250	.92		0	1
Weekly hours of work	233	35.90	11.95	6	60
Net hourly wage	232	7.70	4.03	1.04	29.80
Gross hourly wage	232	9.57	6.48	1.04	49.62
(3) Weekly unearned income	250	102.31	150.75	-108.26	1452.10
Income from transfers		3.11	46.62	-238.36	387.34
Capital income		93.29	127.70	-34.85	1064.76

Note: Weekly unearned income includes capital income from housing rent (effective or imputed), from financial capital (interests from portfolios or paid) and income from transfers, pensions and maintenance paid and received (social benefits from Welfare State). All nominal variables are in Euro.

The sample of couples selected from the 1998 survey is composed of 1,717 households with one- or two-generations only (couples with or without children). In Tables 5.a, 5.b and 5.c the main households and individual characteristics can be found. The geographical distribution of the sample units is much more balanced compared to singles and nearly half of the households have at least two children.

Except for a few observations, all husbands work, most of them full time, as shown in Figure 6, whereas only 53% of the married women participate in the labour market. Their labour supply is more dispersed than for men (see Figure 7).

In principle we could even observe in the SHIW individual non labour income, as shown in Table 5.b and 5.c. However, for most observations in the sample, female unearned income is a rather small portion of the entire household income, and it does not seem to provide any relevant piece of information on the household redistribution mechanism. Note also that income from transfers are either transfers from the welfare state, including child benefits, or allowances received from or addressed to other relatives; for the latter reason they can assume negative values. As child benefits appear in the SHIW as a form of unearned income, we do not consider them as labour earning component in the analysis of the tax reforms, even though their amount does depend on labour incomes, as shown in Table1.a.

Table 4: Descriptive statistics for single women

	no.	mean	std. dev.	min	max
(1) Individual Characteristics					
Age	233	41.89	9.12	25	55
Education:					
Primary school	233	.16			
Secondary school	233	.43		0	1
Univ. and post-grad. degrees	233	.39		0	1
Geographical area:					
North-west	233	.43		0	1
North-east	233	.20		0	1
Centre	233	.17		0	1
South	233	.13		0	1
Islands	233	.06		0	1
Marital status:					
Married separated	233	.02		0	1
Never married	233	.68		0	1
Divorced	233	.29		0	1
Widow	233	.02		0	1
(2) Employment Characteristics					
Participation	233	.82		0	1
Weekly hours of work	192	35.31	9.54	7	60
Net hourly wage	191	7.29	3.74	0.66	27.68
Gross hourly wage	191	8.50	4.78	0.66	31.33
(3) Weekly unearned income		81.01	110.43	-259.87	725.22
Income from transfers	233	14.99	52.52	-397.27	262.20
Capital income	233	65.00	93.92	-69.17	725.22

Note: see Table 1.

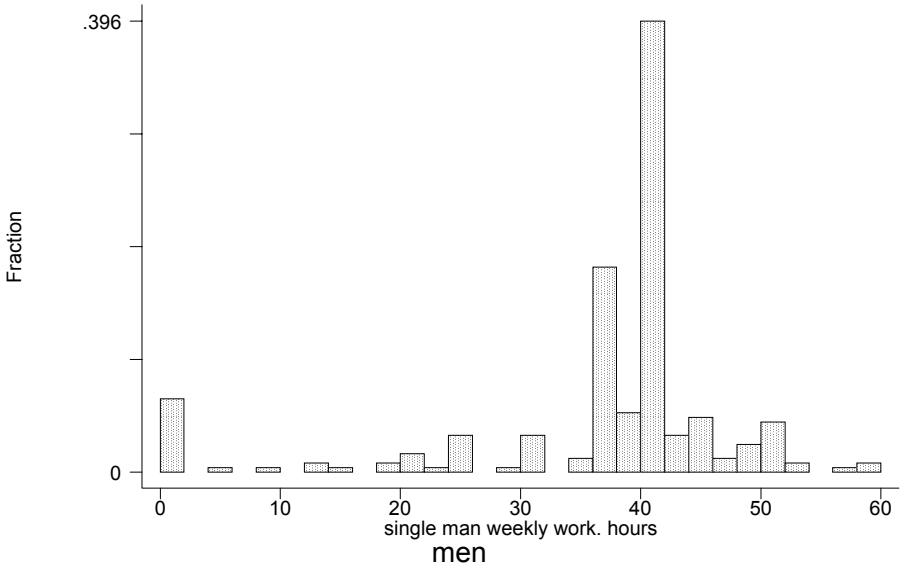

Figure 4: Single men weekly working hours

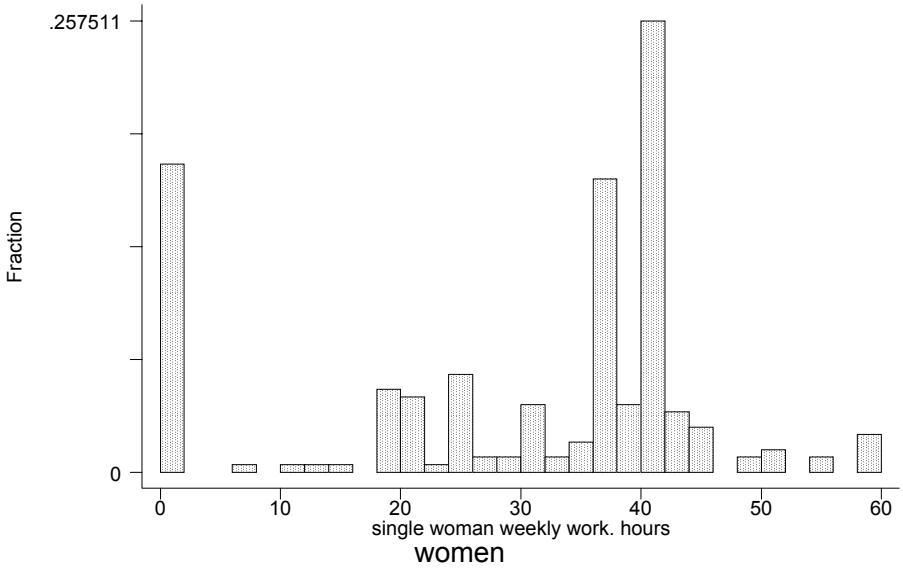

Figure 5: Single women weekly working hours

Table 5.a: Descriptive statistics for couples

	no.	mean	std. dev.	min	max
(1) Household Characteristics					
Household without children (a)	182	0.11			
Number of children: (a)	1535	1.88	0.79	1	7
With 1 child	474	0.27		0	1
With 2 children	803	0.47		0	1
3 or more	258	0.17		0	1
No. children aged 0-2	1535	0.16	0.40	0	3
No. children aged 3-6	1535	0.25	0.48	0	2
No. children aged 7-12	1535	0.45	0.63	0	3
No. children aged 13-18	1535	0.54	0.70	0	4
No. children aged 19-25	1535	0.48	0.76	0	4
Geographical area:					
North-west	1717	.24		0	1
North-east	1717	.18		0	1
Centre	1717	.21		0	1
South	1717	.26		0	1
Islands	1717	.11		0	1
(2) Weekly unearned income					
Total weekly unearned income (a)	1667	140.85	156.12	-1285.84	2526.46

Note: (a) the number of positive observations only is reported.

Table 5.b: Individual statistics for husbands

	no.	mean	std. dev.	min	max
(1) Individual Characteristics					
Age	1717	43.08	7.16	25	55
Education:					
Primary school	1717	.46			
Secondary school	1717	.43		0	1
Univ. and post-grad. degrees	1717	.10		0	1
(2) Employment Characteristics					
Participation	1717	.997		0	1
Weekly hours of work	1712	39.91	6.86	5	60
Net hourly wage	1696	8.04	3.95	1.99	45.52
Gross hourly wage	1696	10.24	5.83	1.99	68.29
(3) Weekly unearned income (a)	1667	99.50	123.13	-164.11	2377.48
Income from transfers	1717	2.73	27.93	-198.64	536.32
Capital income	1717	93.88	119.10	-55.22	2377.48

Note: see Table 1.
(a) The number of observations with positive values is reported.

Table 5.c: Individual statistics for wives

	no.	mean	std. dev.	min	max
(1) Individual Characteristics					
Age	1717	39.85	7.29	25	55
Education:					
Primary school	1717	.46			
Secondary school	1717	.41		0	1
Univ. and post-grad. degrees	1717	.11		0	1
(2) Employment Characteristics					
Participation	1717	.53		0	1
Weekly hours of work	916	32.87	9.25	5	60
Net hourly wage	893	7.41	3.51	0.86	35.8
Gross hourly wage	893	9.03	4.59	0.86	43.19
(3) Weekly unearned income (a)	1667	9.20	38.34	-62.25	477.66
Income from transfers	1717	1.15	11.78	-59.59	278.09
Capital income	1717	7.78	36.14	-62.25	477.66

Note: see Table 1.
(a) The number of observations with positive values is reported.

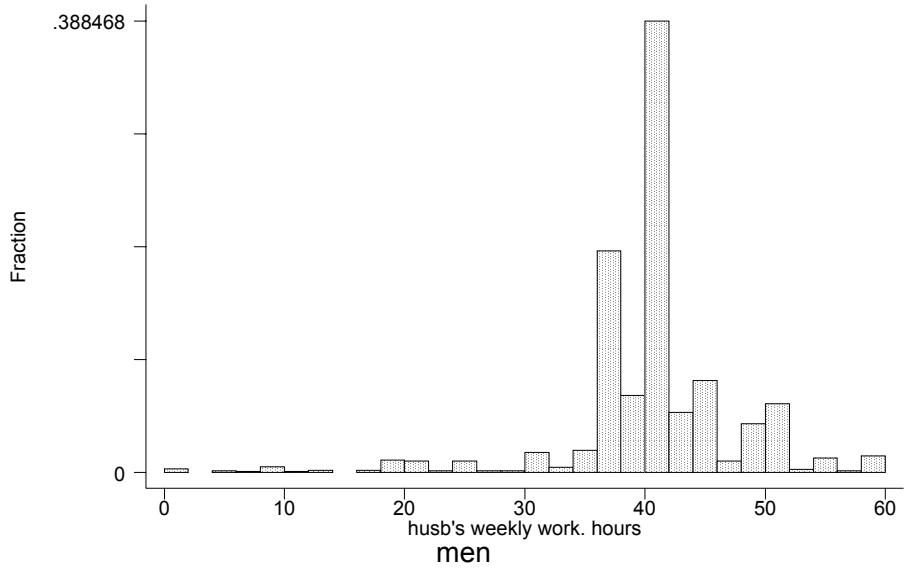

Figure 6: Husbands weekly working hours in the sample of couples

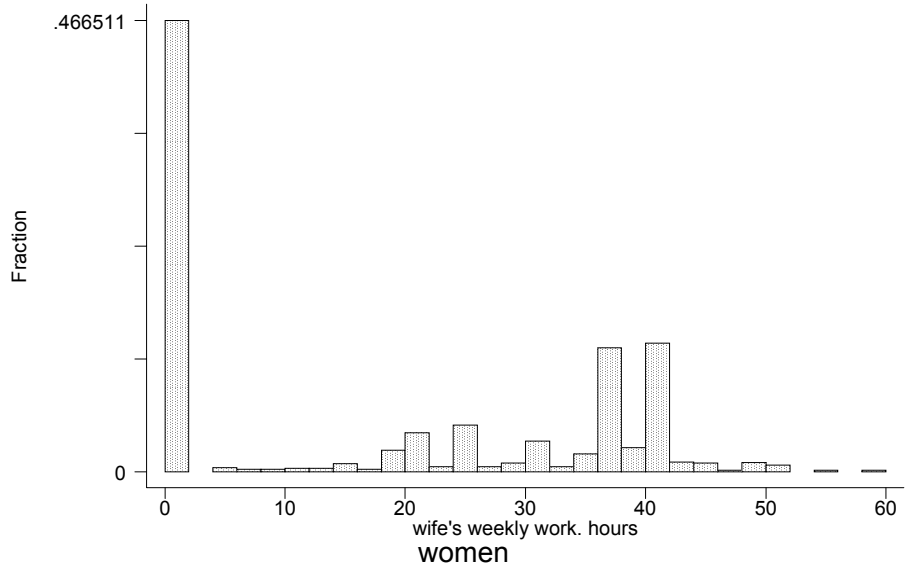

Figure 7: Wives weekly working hours in the sample of couples

5. Empirical specifications and results

5.1 Estimation of wage equations

In order to obtain predicted wage rates for the whole sample, including those non working, we estimate equations for gross wages for both men and women, for singles and couples separately.

For singles we tried several estimation methods (two-step Heckman OLS method, Heckman with maximum likelihood and two step with a simpler correction than the hazard function). Table 6 contains results of the one that provided the most accurate predictions for those working: we used the two-step OLS Heckman procedure for men's wages and an ML method for women's wages. In both regressions the identification of the selection process is ensured by gross unearned income, significant in both participation equations. The wage equations include also age and its squared value, educational and geographical dummies and a constant term. Age variables are significantly different from zero only in men's wage estimation and higher education increases the wage level, as expected, in both cases. Geographical dummies, having as reference category the North with higher job opportunities, appear all with a negative sign.

In estimating wages for men and women in couples, in principle, we should take account of the selection mechanism for participation arising in a collective model (as in Blundell et al., 2001), which might turn out difficult to be developed in our framework. However, husbands are all working in our sample except for very few observations. As far as the woman is concerned, Lewbel (2000) proposes an alternative econometric method which does not require the specification of the selection mechanism, but still corrects for selection bias with a 2SLS estimator. We use the simplest form of Lewbel's estimator. Among several other estimation techniques, including also two-step OLS Heckman and ML method, Lewbel's estimator provides the most accurate predictions of women's gross wage rates.

Tables 8 and 9 contain the empirical results of estimations and predictions referred to all sample.

Table 6: Estimated wage equations for singles

Variables	men			women		
	Coef.	Std. er.	t-value	Coef.	Std. er.	t-value
Age	2.01	0.59	3.43	0.28	0.49	0.57
Age^2	-0.23	0.07	-3.20	-0.02	0.06	-0.38
Educ. Dummy: Secondary school	0.17	0.09	1.85	0.24	0.18	1.35
Univ. and post-grad. Degrees	1.57	0.28	5.51	0.61	0.19	3.29
Geographical Dummies: Centre	-0.13	0.08	-1.66	-0.27	0.11	-2.40
South	-0.46	0.14	-3.18	-0.02	0.12	-0.17
Islands	-0.56	0.19	-2.93	-0.03	0.12	-0.24
Constant	-2.04	0.95	-2.16	1.06	0.90	1.18
Lambda	-0.24	0.07	-3.51	0.30	0.22	1.39
(Uncensored) obs.	232			189		
	R^2 =0.32			Log*L*=-193.68		

Note: The table contains results of a two-step OLS Heckman procedure for men's wages and a maximum likelihood method for women's wages. In both cases the dependent variable is the logarithmic transformations of gross wages.

Table 7: Estimated gross hourly wages for singles

Variable	no.	mean	std dev	10%	50%	90%	min	max
w^m	250	9.63	4.69	7.35	9.79	14.52	5.32	66.59
w^f	233	8.18	2.45	6.64	8.45	12.19	3.91	14.55

Note: In the table predicted values obtained from single men and women's wages. Predictions refer to all observations, including non workers. They have been imputed taking account of the estimated variance of the log wage.

Table 8: Estimated wage equations for couples

Variables	men			women		
	coef.	std. er.	t-value	coef.	std. er.	t-value
Age	0.04	0.02	2.28	-0.09		
Age^2	-0.00	0.00	-1.68	0.00		
Educ. Dummy: Secondary school	0.26	0.02	13.59	0.25		
Univ. and post-grad. Degrees	0.62	0.04	17.52	0.50		
No. children aged 0-2	_	_	_	0.12		
No. children aged 3-6	_	_	_	-0.05		
No. children aged 7-12	_	_	_	-0.05		
No. children aged 13-16	_	_	_	0.21		
Geographical Dummies: Centre	-0.08	0.02	-3.25	0.01		
South	-0.16	0.02	-6.66	0.15		
Islands	-0.08	0.04	-2.05	-0.05		
Constant	1.14	0.32	3.58	3.44		
(Uncensored) obs.	1696			893		
	Adj. R^2 =0.25			Log*L*=-189.22		

Note: The table contains results of an OLS procedure for men's wages (robust standard errors) and a Lewbel (2000) method for women's wages. The variance of the Lewbel estimator is still to be computed and the specification search is based on the two-step Heckman procedure.

Table 9: Estimated gross hourly wages for couples

Variable	no.	mean	std dev	10%	50%	90%	min	max
w^m	1717	10.14	2.41	7.74	9.49	12.84	6.00	18.16
w^f	1717	8.20	1.87	6.01	7.92	10.72	4.76	18.76

Note: In the table predicted values obtained from men and women's wages using the sample of couples. Predictions refer to all observations, including non workers. They have been imputed taking account of the estimated variance of the log wage.

5. 2 Estimation of preferences and simulation of singles' behaviour

This section discusses the econometric method and the results obtained in the estimation of singles' preferences assumed of the Stone–Geary form as earlier specified in equation (3).

In order to adequately control for population heterogeneity, we use a mixed multinomial logit model with two mass points on the consumption coefficients that capture unobserved heterogeneity, following the method described in Hoynes (1996)[6]. Moreover, we suppose that each individual can choose *K* different categories of labour supply, since we discretize the individual working time. As a consequence, leisure time is discretized, with $l^k = T - h^k$. We specify *T=168* total weekly hours available and we consider $h^i \in \{0,20,30,40,50\}$ and *K=5,* the number of categories labour supplies can take. We disregard the categories 10 and 60 due to too few observations (as Figures 3 and 4 indicate).

Thus, the contribution of person *i* choosing $\left(c_i^s, l^s\right)$ to the likelihood function is:

$$L = \sum_{p=1}^{mp} \pi_p \frac{\exp\left(\beta_{cp}^i \log\left(c_i^s - \bar{c}_i\right) + \beta_l^i \log\left(l^s - \bar{l}_i\right)\right)}{\sum_{k=1}^{K} \exp\left(\beta_{cp}^i \log\left(c_i^k - \bar{c}_i\right) + \beta_l^i \log\left(l^k - \bar{l}_i\right)\right)} \tag{8}$$

where *mp* is the number of mass points (*mp=2*) and π_p is the probability associated with each mass point (or regime). To ensure that the two probabilities add up to 1, we adopt the following parametrization:

$$\pi_1 = \exp(e_1)/[1 + \exp(e_1)] \tag{9}$$

$$\pi_2 = 1 - \pi_1 .$$

The subsistence levels for consumption and leisure in the Stone-Geary preference function are derived as follows. In order not to produce infinite disutility, in (3) we consider $\bar{c}^i = \tilde{c}^i - c_0^i$ (with *i=m, f*) where $\tilde{c}^i$ is the lowest disposable income (maximum potential dissaving) obtainable over all possible labour supplies in the sample and c_0^i is found by grid search (specifically $c_0^m = 2$ and $c_0^f = 1.5$). The value $\tilde{c}^i$ for single men is set at -110.26, a unique value for the whole sample; for single women labour supply estimates remarkably improved when $\tilde{c}^i$ was differentiated according to whether women had a degree (-261.37) or not (-70.67). Minimum leisure $\bar{l}^i$ is instead fixed according to the average value for minimum time of physiological regeneration (sleeping time, household production and time for self care) reported in the 1995 Time Use Survey from Multiscopo[7]. The weekly hours of minimum leisure for a single man aged 25-55 is 82 and for a single woman 88.

[6] In a preliminary searching procedure, we also estimated a random parameter multinomial logit (see Mc Fadden and Train, 2002) assuming a normal distribution of the constant terms in β_i^c, β_i^l. However, the variance of the consumption term only was found significant. The specification with mass points of support on the consumption coefficient proved to be preferable to the RPL according to the LR statistics and in terms of accuracy in predictions.

[7] For a description of the Multiscopo survey see Perali (1999).

In Tables 10 and 11 the ML estimation results based on equation (8) are reported. They have been obtained using analytical gradients and Hessian. The last two rows of each table reports the log-likelihood obtained from a standard multinomial logit and the one with two mass points. In both cases a LR test easily rejects the multinomial logit model.

An interpretation of the sign and the magnitude of the estimated coefficients is not easy, as both the propensities to consume and to demand leisure appear in a non linear form. Marginal propensities are instead computed and reported in Table 12 for single men and single women. In both cases the propensity to consume is, on average, slightly higher than the propensity to demand leisure. Also in both estimates the mass point with the higher value is the one with the highest probability.

In order to compute the elasticities we use the marginal propensities in Table 12 and we linearise the budget constraint at the observed hours for each individual. Results are included in Tables 13 and 14. The price and wage elasticities are consistent with existing literature, whereas income elasticities are larger in absolute value.[8]

Table 10: Estimation of preferences – single men

Variables		Coef.	Std. Error	t-value
β_{l0}^m	$\log\left(l^m - \bar{l}^m\right)$	22.61	5.06	4.47
β_{l1}^m	$\log\left(l^m - \bar{l}^m\right)\times$ South	1.85	2.00	0.93
β_{c0}^m	$\log\left(c^m - \bar{c}^m\right)\times$ high education	2.57	2.13	1.20
β_{c1}^m	$\log\left(c^m - \bar{c}^m\right)\times$ regime 1	39.15	8.03	4.87
β_{c2}^m	$\log\left(c^m - \bar{c}^m\right)\times$ regime 2	8.60	2.49	3.45
e_1	"logit" regime 1	2.09	0.29	7.23
No obs. $\times K$			250×5	
Log Likelihood with *mp=2*			-309.57	
Log likelihood multinomial logit			-344.79	

Note: The table contains results of a mixed multinomial logit regression with two mass points of support capturing unobserved heterogeneity as in Hoynes (1996). The variables South and High Education are geographical and educational dummies, respectively.

[8] The LES should yield positive wage elasticities of labour supply, negative price elasticities of consumption, positive income elasticities of consumption, and negative income elasticities of labour supply. This is not always the case here and this is due to the fact that the virtual unearned income obtained in linearising the budget constraint is in a few cases lower than $\bar{c}^i$.

Table 10.a: Estimation and prediction of regimes' probabilities -single men

Probabilities		Estimated probability	Frequencies
π_1	regime 1	0.89	0.88
π_2	regime 2	0.11	0.12

Note: The table contains results of the estimated probability and frequencies of each regime. Frequencies correspond to the regime which gives the best prediction in labour supply.

Table 11: Estimation of preferences – single women

Variables		Coef.	Std. Error	t-value
β_{l0}^f	$\log\left(l^f - \bar{l}^f\right)$	15.70	3.61	4.35
β_{l1}^f	$\log\left(l^f - \bar{l}^f\right)\times$ South	1.44	1.44	1.00
β_{c0}^f	$\log\left(c^f - \bar{c}^f\right)\times$ high education	9.66	2.45	3.94
β_{c1}^f	$\log\left(c^f - \bar{c}^f\right)\times$ regime 1	30.13	6.52	4.62
β_{c2}^f	$\log\left(c^f - \bar{c}^f\right)\times$ regime 2	4.25	1.39	3.05
e_1	"logit" regime 1	0.71	0.18	3.90
No obs. $\times K$			233×5	
Log Likelihood with *mp=2*			-341.73	
Log likelihood multinomial logit			-362.54	

Note: see Note Table 10.

Table 11.a: Estimation and prediction of regimes' probabilities -single women

Probabilities		Estimated probability	Frequencies
π_1	regime 1	0.67	0.65
π_2	regime 2	0.33	0.31

Note: See Table 10.a.

Table 12: Marginal propensities

	no.	mean	std dev	10%	50%	90%	min	max
B_c^m	250	0.60	0.11	0.33	0.63	0.65	0.26	0.65
B_l^m	250	0.40	0.11	0.35	0.37	0.67	0.35	0.74
B_c^f	233	0.58	0.18	0.21	0.66	0.72	0.20	0.72
B_l^f	233	0.42	0.18	0.28	0.34	0.79	0.28	0.80

Note: The table reports marginal propensities from estimates in Table 10-11. Each $B_j^i = \beta_j^i / \left(\beta_c^i + \beta_l^i\right)$ with i=m,f and j=c,l.

Table 13: Estimated elasticities for single men

	no.	mean	std dev	min	max
Price elasticity (c)	249	-1.58	1.90	-29.23	-1.03
Wage elasticity (h)	234	0.48	0.53	-0.08	5.06
Income elasticity of consumption (c)	249	3.09	3.93	1.39	59.66
Income elasticity of labor supply (h)	234	-2.01	2.04	-24.35	-0.76

Note: In the table point estimates of elasticities obtained from the estimations of single men preferences.

Table 14 Estimated elasticities for single women

	no.	mean	std dev	min	max
Price elasticity (c)	231	-2.06	6.39	-92.63	0.48
Wage elasticity (h)	192	0.58	0.51	-0.14	4.80
Income elasticity of consumption (c)	231	4.49	13.25	-2.89	192.28
Income elasticity of labor supply (h)	192	-2.02	1.77	-19.41	0.10

Note: see note Table 13.

In predicting the optimal labour supply for each single we choose the regime which gives the best prediction and in case of indifference the point which yields the normalised marginal propensity to consume closest to 0.5. Predictions computed (in columns) are compared with actual discretised labour supply (in rows) in Tables 15 and 16. The 65% of the sample of single men is predicted correctly, moreover the remaining 35% are predicted almost with an error of only 10 hours. The quality of the predictions for single women is similar, as 66% of the observations appears in the diagonal and the remaining with a minimal difference.

Table 15: Actual vs. predicted labour supply- Sample of single men

	Predicted					
Actual	0	20	30	40	50	Total
0	**15**	1				16
20		**10**	2	4		16
30		4	**2**	6		12
40		1	17	**129**	27	174
50		1	4	21	**6**	32
Total	15	17	25	160	33	**250**

Table 16: Actual vs. predicted labour supply- Sample of single women

	Predicted					
Actual	0	20	30	40	50	Total
0	**37**	4				41
20		**20**	4	9		33
30		3	**2**	16		21
40		2	13	**92**	14	121
50		1	4	10	**2**	17
Total	37	30	23	127	16	**233**

6. Calibration of the sharing rule and simulation of couple's behaviour

As already discussed in Section 3, preferences for married individuals are based on the estimations obtained from the single samples, under the basic assumption that individuals do not change their preferences when they get married except for an extra term which captures the substitutability or complementarity in leisure time (or home production) especially when pre-school children are present in a household. This identifying assumption will allow us to calibrate two parameters, the bargaining power ω and a unique leisure interaction term δ for each couple, in the first place. Then after regressing ω on several relevant distributional factors, it will be possible to calibrate two individual δ^i, with *i=m,f*.

We consider, as subsistence level for consumption in the functional form (2), $\bar{c}^i = \frac{\tilde{c}^i * hen_r}{hen_4} - c_0^i$ (with *i=m, f* and *r=1,...,9*) where $\tilde{c}^i$ is the lowest disposable income (maximum potential dissaving) derived over all possible labour supplies in the sample, c_0^i is fixed at 2. This avoids, as before, an infinite disutility. hen_r is the household equivalent number with *r* household components, based on ISE (see Table 17). ISE is the equivalence scale, computed since 1998 by the Italian Department of Welfare for the construction of an "Indicator of Economic Conditions" (ISE – Indicatore della Situazione Economica) to be employed in a number of means tested social programs. The lowest value for $\tilde{c}^i$ was found at -82.06 and it corresponds to a household with two children (i.e. four household components). Therefore for each observation with *r* children we rescale the value $\tilde{c}^i$ with the ratio hen_r/hen_4 , thus computing an individual equivalent disposable income.

Table 17: ISE Equivalence Scale

Number of household components	Scale value
2	1.57
3	2.04
4	2.48

Note: Italian Welfare Department Equivalence Scale (ISE). Increase of 0.35 for each additional member. Increase of 0.2 in the case of mono-parental family and under age children.

The minimum leisure is fixed at 82 for men and 88 for women with no children or with children older than 12 years, as for singles. However, in order to account for minimum needs of extra household productions in the presence of children under age 12, we added extra time depending on the number of children living in the household. This extra time is computed according to the average values found in the Multiscopo survey for each corresponding case. In particular, we add 9 (4) hours to women (men) minimum leisure time, if less than 6 years old children were present in the household and 7 (2) hours in case of kids aged between 6 and 12.

Following the four steps described in Section 2 we choose the bundle $\left(\omega, \delta, p^m, p^f\right)$, i.e. the bargaining power, the leisure interaction term and the probabilities for each individual regime (or mass point), which satisfies the criterion:

$$\min_{\omega,\delta,p^m,p^f} \left[h_f^* - h^f\left(\omega, \delta, p^m, p^f\right)\right]^2 + \left[h_m^* - h^m\left(\omega, \delta, p^m, p^f\right)\right]^2 \tag{10}$$

under the initial condition that leisure interaction terms are identical for the couple. We only search values for δ in the range [-3,-2.5,-2…,3]. The program loops around the starting values of 0 for δ and 0.5 for ω. In case of multiple solutions, we select the value for δ closest to 0, the value for ω closest to 0.5 and the regime with higher probabilities in the single estimations.

Results of the calibration procedure are contained in Tables 18 and 19 and in Figure 8. The mean value for δ is –2.10, and for ω 0.38. The negative value found for the leisure interaction term is hardly justifiable from an economic point of view; it might be due to the fact that the "leisure" of the woman includes hours of home work in the specification here used. So she seems to have a higher utility than is really the case. If that is true, then only time use surveys could prevent us from facing this inconvenient. It might well also be that δ is here bearing all the weight of the two simplifying assumptions made on couples' preferences, specifically that they could easily be expressed by singles' preferences and that there is a unique leisure interaction term for husbands and wives. Later on, removing the latter simplifying assumption will improve this result.

Table 18: Leisure interaction effect and power index

	no.	mean	std dev	min	max
δ	1717	-2.10	0.99	- 3	3
ω	1717	0.38	0.18	0.02	0.99

Table 18.a: Leisure interaction effect and power index by number of children

	No children	1 child	2 children	3 (more) children
δ	-2.16	-2.20	-2.08	-1.92
ω	0.41	0.39	0.38	0.35
no.	182	474	803	258

Note: In the table mean value only is reported for each case.

Table 19: Regime frequencies for couples

	regime 1	regime 2
p^m	0.76	0.24
p^f	0.70	0.30

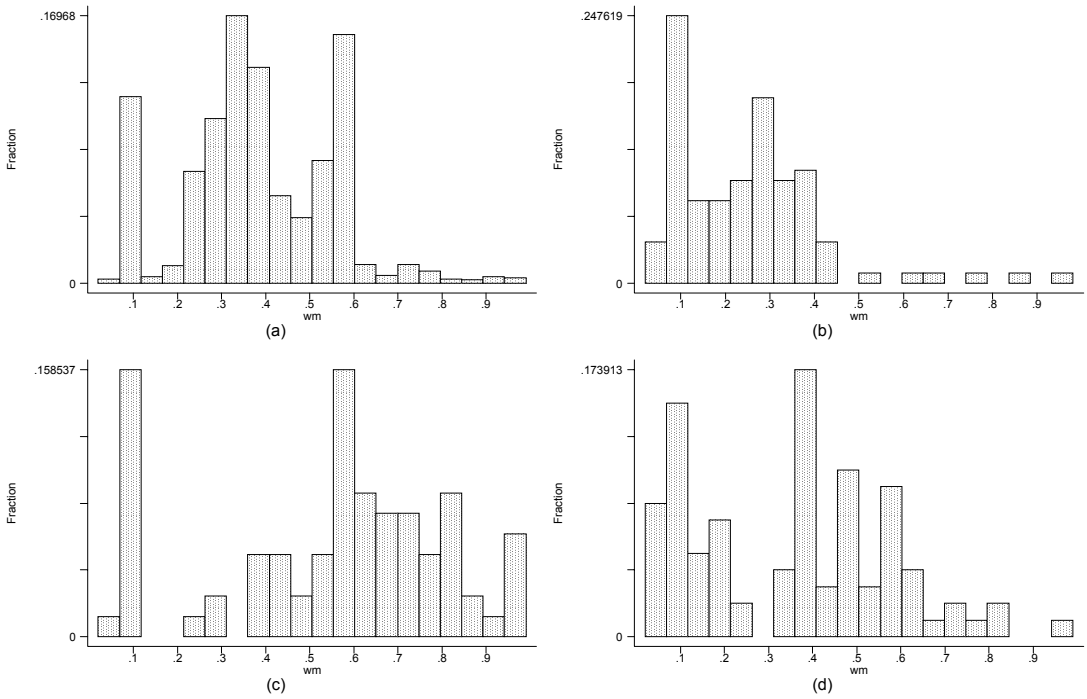

Figure 8: Power index and couple's educational level

Note: In figure (a) neither wife nor husband have high education (first degree and post-graduate studies); in (b) wife only has high education; in (c) husband only has high education and in (d) both husband and wife have high education.

Table 18.a also describes the mean values of δ and ω for different household compositions. The leisure interaction term slightly increases in absolute value with 1 child, but it decreases as the number of children further raises. A plausible explanation for this effect is that children, especially when at school age, can be of help to parents in child care. However, this interpretation does not result from the model, rather from the literature on child care. The bargaining power instead seems to be in favour of the woman as the number of children increases. Figure 8 shows how a (high) educational level of husband and wife affects the distribution of the bargaining power. In particular, when the spouses differ in their educational level (Figure 8.b and 8.c), it is likely that the more educated partner ends up having a higher bargaining power.

Table 19 reports the frequencies of the two regimes, estimated in the samples of singles, when applied to individuals in couples. For both husband and wife the first regime is the most selected; this result is also consistent with what found in the sample of singles.

Tables 20 and 21 compare the calibrated labour supply (in columns) with the actual discretised working hours (in rows). The prediction is rather accurate, as nearly 98% of the 1,717 observations are located in the diagonal.

Table 20: Actual vs. predicted labour supply using a collective model- Sample of men in couples

	Predicted					
Actual	0	20	30	40	50	Total
0	**5**					5
20	9	**51**				60
30		7	**45**			52
40			4	**1252**		1256
50				6	**338**	344
Total	14	58	49	1258	338	**1717**

Table 21: Actual vs. predicted labour supply using a collective model - Sample of women in couples

	Predicted					
Actual	0	20	30	40	50	Total
0	**801**					801
20	17	**196**				213
30		20	**99**			119
40			10	**530**		540
50				2	**42**	44
Total	818	216	109	532	42	**1717**

6.1 Estimating the power index and recalibrating the leisure interaction terms

In a collective model the power index, which attributes to each partner a given utility level for any budgetary situation, is not a constant, rather depends on income, prices and distributional factors, in an unspecified way. Finding the relevance and the sign of all the factors mentioned is a role left to the empirical work. This has been partly produced by the current

literature so far and still needs to be further developed. An important contribution of the current research is the analysis of the impact that income taxes have on the power index in a couple. If we can find that the tax system, affecting the relative earning power of the couple, alters also the bargaining power, then we can prove that collective models provide a description of individual behaviour and welfare closer than unitary models to the real world. We compute two variables, namely *Yd20* and *Yd40*, capturing the way in which tax and benefit system affects the bargaining power in a couple, in the way that follows.

If n_k^f and n_k^m are the frequencies of women and men, respectively, observed working h_k discretised hours, define $R_{mk}^{fk_0}$ as the household disposable income when the husband works k hours and the wife k_0. Then, the variable *Yf20* is defined as:

$$Yf20 = \sum_{k=1}^{K} n_k^f \left(R_{mk}^{f20} - R_{mk}^{f0} \right) \tag{11}.$$

The expression in (11) computes the expected increase in household disposable earnings if the wife increases her labour supply from 0 to 20, i.e. from non-participation to part-time. Similarly *Yf40* and *Ym40* can be derived. Thus, *Yd20* is defined as the ratio *Yf20*/*Ym40* and *Yd40*= *Yf40*/*Ym40*. Descriptive statistics for such distributional factors are contained in Table 22, which shows a lot of variation in the variables computed.

The logistic transformation of the power index, i.e. $\log\left(\frac{\omega}{1-\omega}\right)$, is regressed on the ratios *Yd20* and *Yd40* and several demographic variables, such as the log of each spouse's age, dummies for high educational level for each spouse, and the number of children. Results are reported in Table 23. Other variables, as geographical dummies, (household or individual) non labour income and a constant term were included in the searching procedure, but later excluded because not significantly different from 0.

The number of children and the educational dummies appear with coefficients consistent in sign with the descriptive statistics: children reduce the man's power index; having a high educational level positively affects one's own bargaining power. Interestingly enough, both *Yd20* and *Yd40*' coefficients are significantly different from zero, however, they do appear with opposite sign. The woman's power index is reduced when she begins to work part-time, possibly due to her now smaller role in home production combined with earnings that remain relatively low compared to those of the husband. The decision for the woman to participate as a full time worker, instead, significantly reduces the man's power in the household.

Table 24 compares the calibrated and the predicted bargaining power values: they are very close except for values at the tails.

As the simulated labour supply obtained using the predicted values for ω and the value for δ previously calibrated were not as accurate as those in Tables 20 and 21, we prefer to recalibrate the model, allowing for heterogeneity in individual δ for each couple. After enlarging the range of investigation to [-4,...,3] with an increment of 1 for men and to [-4,...,3.5] with an increment of 0.5 for women, we obtain two new distributions for δ^m, δ^f (see Table 25 and Figures 9 and 10), where now the negative values are substantially reduced as men's cross leisure terms are skewed around 0, whereas women's show in most cases complementarity in leisure time.

The new predictions in labour supply are as accurate as the previous one: more than 95% of the sample is on the diagonal (see Tables 26 and 27).

Table 22: Distributional factors: descriptive statistics

	no.	mean	std dev	min	max
Yf20	1717	127.81	49.37	14.00	570.81
Yf40	1717	243.93	90.97	31.22	1063.40
Ym40	1717	310.20	141.83	68.66	1625.45
Yd20	1717	0.46	0.22	0.05	2.41
Yd40	1717	0.88	0.40	0.11	4.50

Note: *Yfh* (*Ymh*) is wife's (husband's) increase in the contribution to the household disposable income when she (he) switches the labour supply from 0 to *h*. *Ydh=Yfh*/*Ym40* is her relative earning power at *h* hours.

Table 23 Estimation results of husband's power index

Variables	coef.	std. error	t-value
Yd40	-5.05	1.11	-4.54
Yd20	7.97	2.05	3.88
log (wife's age)	0.61	0.26	2.36
log (husband's age)	-0.50	0.26	-1.96
No. children	-0.09	0.02	-3.64
Wife's education: high	-0.79	0.08	-9.77
Husband's education: high	0.49	0.09	5.78
No. observations		1717	
		$AdjR^2$=0.36	

Note: In the table results of an OLS regression of the power index logistic transformation.

Table 24 Calibrated and estimated power index

	no.	mean	std dev	10%	50%	90%	min	max
ω	1717	0.38	0.18	0.10	0.36	0.90	0.02	0.99
$\hat{\omega}$	1717	0.37	0.09	0.25	0.37	0.46	0.04	0.70

We use the new calibrated data- set in the remaining two sections of the study for two main purposes: 1) to measure the bias produced when tax reforms are evaluated assuming a unitary rather than a collective model; 2) to simulate the changes in labour supply as well as in individual welfare, when the two tax reforms**,** described in Section 2**,** are implemented according to the collective model developed so far.

Table 25 Husband's and wife's leisure interaction effects

	no.	mean	std dev	10%	50%	90%	min	max
δ^m	1717	-0.05	1.65	-3.00	0.00	2.00	-4.00	3.00
δ^f	1717	0.41	1.46	-1.50	0.00	2.50	-4.00	3.5

Table 26: Actual vs. predicted labour supply using estimated power index $\hat{\omega}$ and calibrated individual leisure interaction effect δ^m and δ^f - Sample of men in couples

	Predicted					
Actual	0	20	30	40	50	Total
0	**4**	1				5
20	4	**49**	6	1		60
30		1	**51**	0		52
40			28	**1217**	11	1256
50				30	**314**	344
Total	8	51	85	1248	325	**1717**

Table 27: Actual vs. predicted labour supply using estimated power index $\hat{\omega}$ and calibrated individual leisure interaction effect δ^m and δ^f - Sample of women in couples

	Predicted					
Actual	0	20	30	40	50	Total
0	**801**					801
20	16	**195**	2			213
30		20	**98**	1		119
40		5	27	**507**	1	540
50				8	**36**	44
Total	817	220	127	516	37	**1717**

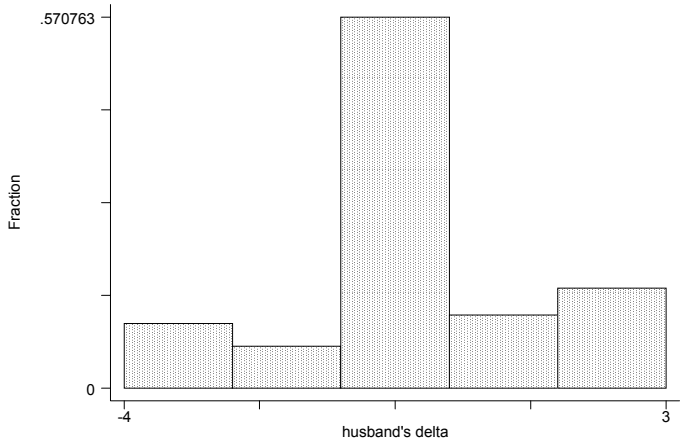

Figure 9: Distribution of husbands' calibrated leisure interaction effect

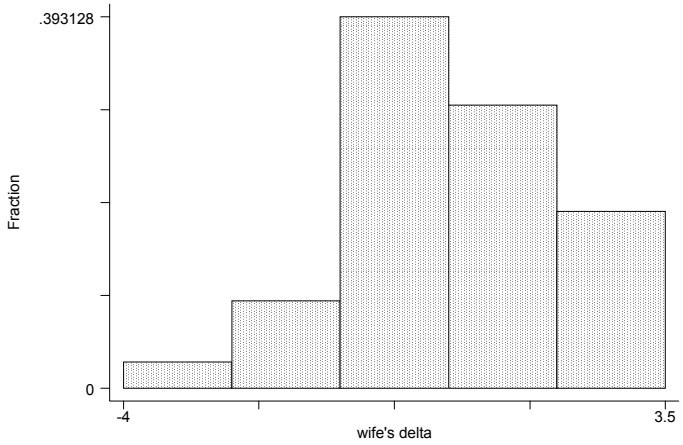

Figure 10: Distribution of wives' calibrated leisure interaction effect

7. Comparing the analysis with a unitary model

Before simulating behavioural changes due to tax reforms within the collective framework, we will try to measure the bias produced when unitary, rather than collective models are considered to evaluate future fiscal reforms. In order to provide a direct measure of the distortion, we specify a unitary model, allowing for unobserved heterogeneity in a way similar to what previously done for the collective framework. We estimate the traditional model using the simulated data-set. Given the strong similarities in the procedures adopted, divergences in predicted behaviour can be attributed to model misspecification.

We consider an extended Stone-Geary household utility function, as the following:

$$U\left(c,l^f,l^m\right)=\beta_c(z)\log\left(c-\bar{c}(z)\right)+\beta_l^f(z)\log\left(l^f-\bar{l}^f(z)\right)+\beta_l^m(z)\log\left(l^m-\bar{l}^m(z)\right)+\delta^{mf}(z)\log\left(l^m-\bar{l}^m(z)\right)\log\left(l^f-\bar{l}^f(z)\right) \tag{12}$$

In (12) preferences are defined over total household disposable income and couple's leisure terms, which appear in a non-separable form, similar to the one used in the collective model[9]. The minimum requirements for consumption and leisure derived in the collective model are also included here.

Given that each individual can still choose among K categories of labour supply, the household now has K^2 combinations of $\left(c,l^f,l^m\right)$ to examine. Adding to (12) an error term, assumed independently and identically distributed as a type I extreme value, the probability that household i makes the choice k equals:

$$\Pr\left[U_k>U_j,\forall k\neq j\right]=\frac{\exp\left[U\left(c_k,l^{fk},l^{mk}\right)\right]}{\sum_{j=1}^{K}\exp\left[U\left(c_j,l^{fj},l^{mj}\right)\right]}.$$

Moreover, two mass points on the household consumption coefficient will be added to capture unobserved heterogeneity.

Results are reported in Table 28. In the estimation, on the top of two mass points we also include dummies drawn on the regime chosen in the collective model, as in a preliminary checking they resulted highly significant (see Table 19). They further control for unobserved heterogeneity. All households display positive marginal utilities for consumption and individual leisure (see Table 29) and the estimated average value of 0.81 for the leisure interaction term δ^{mf} is higher than those calibrated in the collective context.

[9] See Beninger, Laisney and Beblo (2002) Appendix for the derivation of the conditions under which (12) is increasing in its arguments and concave.

Table 28: Estimation of preferences – Unitary Model

Variables		coef.	std. error	t-value
β_{l0}^{f}	$\log\left(l^{f}-\bar{l}^{f}\right)$	-11.41	0.74	-15.41
β_{l1}^{f}	$\log\left(l^{f}-\bar{l}^{f}\right)\times$ regime^{f} 2	9.00	0.37	24.10
β_{l2}^{f}	$\log\left(l^{f}-\bar{l}^{f}\right)\times$ wife medium educated	-1.61	0.14	-11.79
β_{l3}^{f}	$\log\left(l^{f}-\bar{l}^{f}\right)\times$ wife highly educated	-0.57	0.32	-1.78
β_{l0}^{m}	$\log\left(l^{m}-\bar{l}^{m}\right)$	-5.28	0.67	-7.88
β_{l1}^{m}	$\log\left(l^{m}-\bar{l}^{m}\right)\times$ regime^{m} 1	-13.56	0.41	-33.18
β_{l2}^{m}	$\log\left(l^{m}-\bar{l}^{m}\right)\times$ husband highly educated	3.45	0.32	10.78
δ_{0}^{mf}	$\log\left(l^{m}-\bar{l}^{m}\right)\times\log\left(l^{f}-\bar{l}^{f}\right)$	4.13	0.23	17.84
δ_{1}^{mf}	$\log\left(l^{m}-\bar{l}^{m}\right)\times\log\left(l^{f}-\bar{l}^{f}\right)\times$ log(wife's age)	0.01	0.00	9.24
δ_{2}^{mf}	$\log\left(l^{m}-\bar{l}^{m}\right)\times\log\left(l^{f}-\bar{l}^{f}\right)\times$ no. children	0.39	0.03	15.15
δ_{3}^{mf}	$\log\left(l^{m}-\bar{l}^{m}\right)\times\log\left(l^{f}-\bar{l}^{f}\right)\times$ husband highly educated	-0.38	0.06	-6.18
β_{c1}	$\log\left(c-\bar{c}\right)\times$ regime^{m} 1	9.72	0.95	10.20
β_{c2}	$\log\left(c-\bar{c}\right)\times$ wife highly educated	35.52	1.50	23.62
e_1	"logit" regime 1	-4.42	0.15	-28.72
No obs. $\times K^2$			1,717×25	
Log Likelihood with *mp=2*			-3868.71	
Log likelihood multinomial logit			-3903.17	

Note: The table contains results of a mixed multinomial logit regression with two mass points of support capturing unobserved heterogeneity as in Hoynes (1996). Regime^{m} 1, husband highly educated, wife highly or medium educated, regime^{f} 2 are dichotomous variables.

Table 28.a: Estimation and prediction of regimes' probabilities – couples using the unitary model

Probabilities		Estimated probability	Frequencies
π_1	regime 1	0.01	0.02
π_2	regime 2	0.98	0.97

Note: See Table 10.a.

Table 29: Marginal utilities and leisure interaction terms δ^{mf}

	no.	mean	std dev	10%	50%	90%	min	max
MU_l^m	1717	5.99	5.51	2.10	3.15	15.84	0.82	19.25
MU_l^f	1717	12.35	4.50	8.09	10.41	19.62	5.30	21.22
MU_c	1717	16.55	11.21	9.84	9.84	35.52	9.84	39.43
δ^{mf}	1717	0.81	0.21	0.52	0.86	1.02	-0.02	1.20

In producing predictions derived from the estimates of the unitary model, again we select for each observation the regime which gives the closest value to the observed one. Tables 30 and 31 show that only 34% of predicted men working hours and 57% of women labour supplies are correct, a result markedly weaker than with the collective setting. The unitary model here estimated tends to smooth the distribution of labour supply; as a consequence only 301 men and 123 women are predicted working at 40 hours, consistently with the collective predictions; but, both values are far below those found with the collective approach (1248 and 516, respectively). Moreover 13% of wives are predicted to be out of the labour market when instead they are observed working full time.

Table 30: Collective vs. unitary working hours with the 1998 tax schedule – men in couples

	Unitary					
Collective	0	20	30	40	50	Total
0	**0**		3	2	3	8
20		**0**	3	18	30	51
30		1	**1**	34	49	85
40	1	17	67	**301**	862	1248
50	1	2	5	39	**278**	325
Total	2	20	79	394	1222	**1717**

Table 31: Collective vs. unitary working hours with the 1998 tax schedule- women in couples

	Unitary					
Collective	0	20	30	40	50	Total
0	**739**	75	3			817
20	80	**79**	32	15	14	220
30	28	35	**28**	19	17	127
40	63	103	75	**123**	152	516
50	2	8	6	9	**12**	37
Total	912	300	144	166	195	**1717**

8 Effects of Tax Reforms on Labour Supply and Welfare

8.1 Positive aspects

Once a collective framework has been built satisfactorily close to the observed behaviour, our interest moves on evaluating the effects of two tax reforms, namely the 2002 tax system and a linear income tax, on individual behaviour.

The introduction of the 2002 tax changes compared to the 1998 tax schedule are not expected to be revenue neutral, due to both a reduction in tax rates and a relevant increase in tax credit for children and for employment income. All categories of households here considered (singles and couples with or without children) will likely benefit at least in terms of tax savings. The hypothetical linear tax system is instead built under the assumption of revenue neutrality. The unique marginal tax rate has been fixed at 0.44 whereas the minimum guaranteed income G at 3,000 Euro, with a small correction for couples with/ without children, such that they are entitled of an individual guaranteed income of 3,200 Euro. Those values are purely discretionary and more refined versions of a linear tax reform might be easily considered. However, the one here analysed satisfies overall the requirement of revenue neutrality, as shown in Table 32 (even though single men tax liabilities are higher compared to 1998, for the benefit of couples and single women).

Both tax reforms have the effect of raising the woman's bargaining power (see Table 33). This result is due to the fact that the first tax reform, compared to 1998 tax schedule, reduces tax liabilities at low income brackets and entitles of higher child tax credits households with children, whose internal distribution of power was already favouring the woman (see Table 23).[10] With a linear tax system all non working women have a subsidy which again alters even more the within household income redistribution, due to the change in the individual contribution to total earnings. Figures 11 and 12 are consistent with this view, as they show that households with already smaller male bargaining power are the ones that witness a further reduction, whereas the very few cases with an increase in the power index $\hat{\omega}$ are those that were already experiencing the highest values.

Table 32: Tax revenue in million euro

	1998 system	2002 reform	Linear income tax
Single men	1.32	1.20	1.56
Single women	0.69	0.60	0.57
Couples	9.40	8.25	9.31
Total	11.42	10.04	11.44

Note: Tax revenues are computed using sampling weights.

[10] For those with more than three children the credit is directly proportional to their number depending on income, with a maximum of 516 Euro per child.

Table 33: Changes in bargaining power due to the fiscal reforms

	no.	mean	std dev	10%	50%	90%	min	max
$\hat{\omega}$	1717	0.37	0.09	0.25	0.37	0.46	0.04	0.70
$\hat{\omega}^{2002}$	1717	0.28	0.13	0.11	0.27	0.45	0.01	0.76
$\hat{\omega}^{lin}$	1717	0.24	0.14	0.07	0.21	0.42	0.00	0.85

Note: In the table the predicted values of the bargaining power computed with the 1998 income tax schedule, with the 2002 tax changes and with a revenue neutral linear income tax are compared.

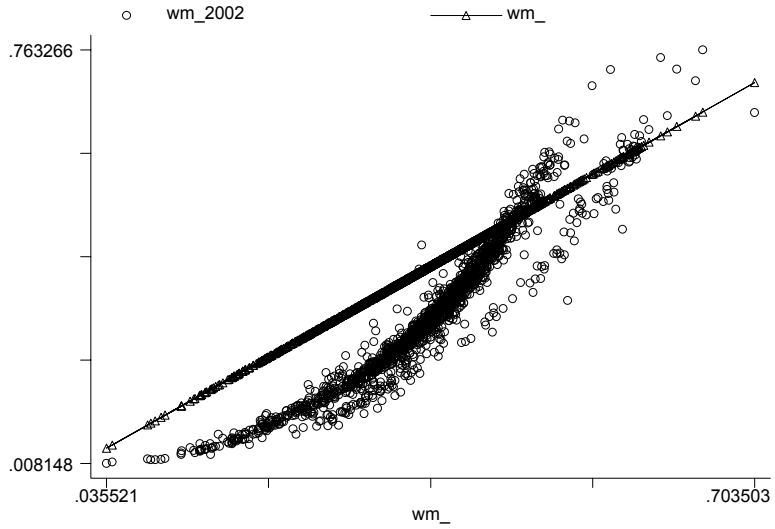

Figure 11: Power index pre and post reform: 1998 vs. 2002 tax schedule

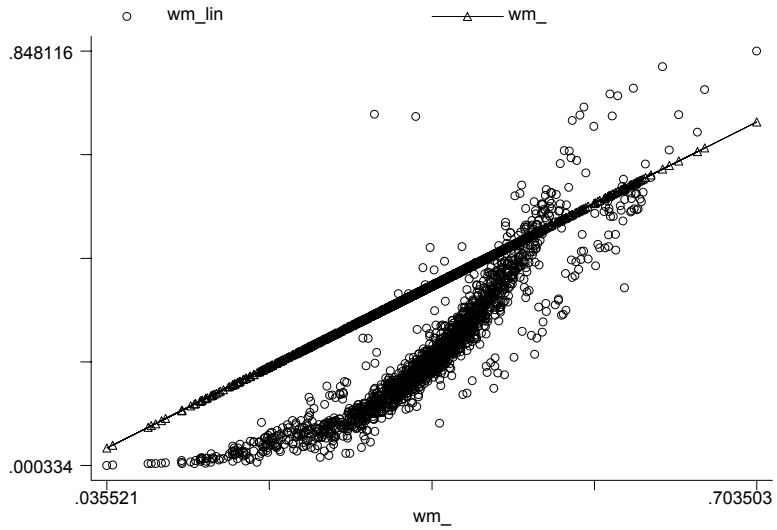

Figure 12: Power index pre and post reform: 1998 vs. linear tax schedule

Tables 34 to 37 compare women and men' labour supply at the 1998 tax system and after the introduction of the 2002 tax changes, or with a linear income tax. Note, however, that the labour supplies derived from the two tax reforms are computed on the base of the 1998 gross labour incomes; therefore they are not meant to predict employment effects of either reform.

Given the changes in income tax added to the 1998 tax schedule till the 2002 Financial Law, more women would participate to the labour market, i.e. 34.65% women in 2002 against 47.58% in 1998 prefer not to work. But they would also prefer part-time to full-time jobs, as the mode moves from 40 to 20 weekly hours (see Table 34). Men are less reactive to the 2002 tax reform compared to women, as the most relevant change is an increase of 10 weekly hours (from 40 to 50) that affects 26.44% of men (see Table 36).

Under linear taxation, instead, both men and women prefer extreme values of labour supply, due to the introduction of the minimum guaranteed income (that produces an effect similar to the poverty trap) and of the unique and high tax rate. Specifically, more women would choose not to participate (56.44% against the starting percentage of 47.58), whereas a relevant percentage of men would either reduce or raise of 10 hours their weekly full time labour supply, so that only 39.31% against the initial value of 72.68% of men would work at 40 hours (see Table 37).

Tables 38 and 39 report the joint variation in labour supply of the woman and the man within a household due to either reform. In both cases nearly a third of the sample has no variation. The 2002 tax changes encourage a tiny increase in labour supply of both partners, whereas linear taxation encourages substitutability in the use of time of the couple.

Table 40 depicts the average value for individual consumption and labour supply obtained after the two reforms. The reduction in couples' tax liabilities produced by both tax reforms benefits, at least at the mean, the woman, as her individual consumption level increases even more than proportionally.

Tables 41 and 42 show that single men and single women are less reactive compared to individuals in couple to either tax reform. The 96% of single men prefer to have the same labour supply chosen in 1998 also after each tax reform. Single women are more reactive than single men and in both cases about 40% would reduce of 10 or 20 hours their supplies.

Tables 43 to 46 compare predictions in labour supply changes induced by each tax reform, for men and women in couples and predicted by the two theoretical model here analysed. In both reforms the largest discrepancies between the collective and the unitary model are found in the male labour supply, as only 35% (31%) of the cases are on the diagonal when the 2002 reform (the linear income tax) is introduced in the simulation exercise. Moreover, husbands are expected to react much more to the first reform according to the unitary model than what predicted by the collective framework. The unitary model also predict a higher drop in women's participation, as 2.45% with the first reform and 8.91% with the second are women that prefer not to participate, even though in 1998 were observed working full-time. This effect is not recorded under the collective framework.

Table 34: Wives' labour supply pre-reform vs. 2002 reform – collective model

	2002 Reform					
1998	0	20	30	40	50	Total
0	**32.67**	14.27	0.64			47.58
20	1.63	**8.79**	2.15	0.23		12.81
30	0.17	2.97	**3.32**	0.82	0.12	7.40
40	0.17	3.03	9.32	**14.97**	2.56	30.05
50		0.06	0.29	0.47	**1.34**	2.15
Total	34.65	29.12	15.73	16.48	4.02	**1717**

Table 35: Wives' labour supply pre-reform vs. linear tax reform – collective model

	Linear Tax Reform					
1998	0	20	30	40	50	Total
0	**46.65**	0.82	0.12			47.58
20	6.52	**5.13**	1.11	0.06		12.81
30	1.81	3.84	**1.46**	0.29		7.40
40	1.46	7.69	12.17	**7.11**	1.63	30.05
50		0.35	0.29	0.93	**0.58**	2.15
Total	56.44	17.82	14.74	8.39	2.21	**1717**

Table 36: Husbands labour supply pre-reform vs. 2002 reform– collective model

	2002 Reform					
1998	0	20	30	40	50	Total
0	**0.23**	0.17	0.06			0.47
20		**1.16**	1.40	0.29	0.12	2.97
30	0.06	0.41	**2.10**	2.04	0.35	4.95
40	0.12	1.22	7.28	**37.62**	26.44	72.68
50		0.06	0.06	2.97	**15.84**	18.93
Total	0.41	3.03	10.89	42.92	42.75	**1717**

Table 37: Husbands labour supply pre-reform vs. linear tax reform– collective model

	Linear Tax Reform					
1998	0	20	30	40	50	Total
0	**0.47**					0.47
20	0.76	**0.76**	1.05	0.41		2.97
30	0.58	0.76	**1.40**	1.98	0.23	4.95
40	1.98	3.84	11.47	**33.31**	22.07	72.68
50	0.06		0.06	3.61	**15.14**	18.93
Total	3.84	5.42	13.98	39.31	37.45	**1717**

Table 38: Variation in labour supply of couples with the 2002 reform: women vs. men– collective model

				Men					
Women	-40	-30	-20	-10	0	10	20	30	Total
-40				0.06	**0.12**				0.17
-30					**0.17**	0.06			0.23
-20		0.06		0.23	**3.03**	1.57			4.95
-10			0.17	1.28	**6.06**	4.95	0.23	0.06	12.75
0	**0.12**	**0.06**	**0.93**	**6.81**	**35.64**	**16.89**	**0.52**	**0.12**	**61.09**
10			0.06	0.87	**3.15**	1.46			5.53
20			0.12	1.40	**8.27**	4.83			14.62
30					**0.52**	0.12			0.64
Total	0.12	0.12	1.28	10.66	**56.96**	29.88	0.82	0.17	**1717**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 39: Variation in labour supply of couples with the linear income tax: women vs. men– collective model

					Men				
Women	-50	-40	-30	-20	-10	0	10	20	Total
-40						**1.22**	0.23		1.46
-30				0.06	0.23	**1.05**	0.76	0.06	2.39
-20	0.06			0.23	1.75	**7.86**	4.54	0.06	15.26
-10				0.12	1.51	**9.32**	5.71	0.23	16.37
0	**0.00**	**1.98**	**0.64**	**4.02**	**11.94**	**29.41**	**12.64**	**0.29**	**60.92**
10				0.17	0.35	**1.81**	0.70		3.15
20						**0.35**	0.52		0.87
30					0.06	**0.06**			0.12
Total	0.06	1.98	0.64	4.66	15.84	**50.03**	25.10	0.64	**1717**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 40: Average labour supply and consumption –couples– collective model

	1998 system	2002 reform	Linear income tax
c^f	474.79	526.85	498.15
h^f	17.86	17.88	17.88
c^m	258.38	243.01	216.47
h^m	40.45	40.62	40.62

Note: Individual consumption in Euro per week.

Table 41: Variation in labour supply of single men: the 2002 reform vs. the linear taxation– collective model

	Linear income tax		
2002 Reform	0	10	Total
-10	0.40		0.40
0	**96.00**		96.00
10	3.20	**0.40**	3.60
Total	99.60	0.40	**250**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 42: Variation in labour supply of single women: the 2002 reform vs. the linear taxation– collective model

	Linear income tax				
2002 Reform	-30	-20	-10	0	Total
-30	**0.43**				0.43
-20		**9.01**	0.43		9.44
-10		1.72	**26.61**		28.33
0			0.43	**60.94**	61.37
10				0.43	0.43
Total	0.43	10.73	27.470	61.37	**233**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 43: Variation in men labour supply with the 2002 reform: collective vs. unitary

	Unitary										
Collective	-50	-30	-20	-10	0	10	20	30	40	50	Total
-40						0.12					0.12
-30		**0.00**		0.06			0.06				0.12
-20		0.12	**0.06**	0.12	0.58	0.99					1.28
-10		0.06	0.64	**4.78**	2.62	4.89	0.29				10.66
0	0.06	0.64	4.19	24.52	**7.05**	25.04	1.34	0.93	0.06	0.12	56.96
10		0.17	0.87	3.79	1.98	**22.60**	1.75	0.70			29.88
20			0.06				**0.52**	0.12	0.06	0.06	0.82
30							0.06	**0.12**			0.17
Total	0.06	0.99	5.82	33.26	12.23	53.64	4.02	1.86	0.12	0.17	**1717**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 44: Variation in women labour supply with the 2002 reform: collective vs. unitary

	Unitary								
Collective	-40	-30	-20	-10	0	10	20	30	Total
-40	**0.12**			0.06					0.17
-30		**0.17**							0.23
-20	0.52	0.06	**2.56**	0.23	0.82	0.58	0.12	0.06	4.95
-10	0.99	0.76	3.20	**3.15**	1.63	2.62	0.41		12.75
0	0.70	0.70	4.60	2.85	**42.46**	7.05	2.15	0.58	61.09
10	0.12	0.06	0.76	0.64	1.34	**1.98**	0.47	0.23	5.53
20		0.06		0.06	8.74		**5.53**		14.62
30					0.47			**0.00**	0.64
Total	2.45	1.81	11.12	7.05	55.45	12.23	8.85	1.05	**1717**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 45: Variation in men labour supply with the linear tax reform: collective vs. unitary

	Unitary										
Collective	-50	-40	-30	-20	-10	0	10	20	30	40	50	Total
-50	**0.00**					0.06						0.06
-40		**0.00**			0.35	0.93	0.70					2.21
-30			**0.00**			0.17	0.23	0.17				0.58
-20				**0.41**	1.22	1.28	1.51	0.41				5.07
-10	0.06	0.17	0.52	1.34	**2.74**	5.94	5.59	0.29	0.23			16.66
0	0.29	0.58	0.93	4.66	9.96	**18.40**	13.74	0.52		0.06	0.12	50.03
10		0.23		1.69	4.25	7.40	**9.38**	1.46	0.76			24.81
20						0.12	0.17	**0.29**	0.41			0.58
Total	0.35	0.99	1.46	8.33	18.52	34.30	31.33	3.15	1.40	0.06	0.12	**1717**

Note: Each cell contains frequencies and empty cells are those with 0%.

Table 46: Variation in women labour supply with the linear tax reform: collective vs. unitary

	Unitary									
Collective	-50	-40	-30	-20	-10	0	10	20	30	Total
-40	0.00	**0.99**		0.12	0.12	0.17	0.06			1.46
-30	0.17		**1.69**		0.17	0.23	0.12			2.39
-20	0.12	3.61	0.58	**7.05**	0.99	2.15	0.87	0.29	0.17	15.26
-10	0.06	2.85	0.17	2.33	**3.55**	3.79	1.69	0.41		16.37
0	0.17	1.11		3.44	1.75	**49.68**	2.33	0.93	0.41	60.40
10		0.35		0.99	0.12	0.76	**0.35**	0.17	0.23	3.15
20						0.82		**0.00**		0.87
30						0.12			**0.00**	0.12
Total	0.52	8.91	4.14	13.98	6.70	57.72	5.42	1.81	0.82	**1717**

Note: Each cell contains frequencies and empty cells are those with 0%.

8.2 Normative aspects

The empirical techniques used in this study allow us to analyse the individual welfare changes within a household, induced by a tax reform. Figures 13 to 20 reproduce the distribution of changes in individual utilities by deciles of the pre-reform distribution of household before tax disposable income. In this new framework the traditional impossibility of interpersonal welfare comparisons still stays, but, as the compositions of households by deciles remains unaffected by tax reforms, the graphs can provide a figure of the proportions of winners and losers, even within a households.

In each figure a box plot is produced, for each reform and for the four types of individuals here examined (single men, single women, men and women in couples). Each box contains welfare changes included between the 25th and the 75th percentile, whereas the lines emerging from the box define the range between $Q_{75} + 1.5(Q_{75} - Q_{25})$ and $Q_{25} - 1.5(Q_{75} - Q_{25})$, where Q indicates each quartile of the distribution. All values out of this range are plotted individually. The line in each box identifies the mean value whereas the line crossing all income deciles distinguishes welfare gains from welfare losses.

All types of households are expected to benefit in welfare terms from the 2002 tax changes since they allow higher net incomes. The two plots for singles confirm this expectation, as in both cases only positive values are plotted at all deciles (see Figures 13 and 15). Conversely, Figures 17 and 19 highlight that not necessarily both individuals in a couple benefit from the 2002 tax reform. The effect depicted in each graph indicates overall a welfare gain for women and a welfare loss for men, at least if we consider only values of the distribution included in each box. Only 10.60% of households have both partners winning from the reform, against 83.40% of women that are winning also at the expense of their husband and 5.71% of husbands that are the only one benefiting. Women gaining from the 2002 reforms are in all income deciles, whereas those few men that benefit are located from the 4th deciles onwards.

A different picture is drawn with the linear income tax. Because of the way linear income tax has been drawn both groups of singles are almost all welfare losers (see Figure 14 and 16). Only 19% of single women and 6.4% of single men are indifferent to the reform, all these cases are in the lowest income deciles. As far as couples are concerned, only the 2.68% are gaining from the introduction of a linear income tax and again a very high percentage of women (89%) are winning at the expenses of men. The similarity with respect to the 2002 reform might be due to the fact that the transfer to households of a minimum guaranteed income in the former, as well as the increase in child tax relieves in the latter have an analogue impact on the individual power index, benefiting particularly women. The very few cases where men only are gaining are mostly located at the highest and at the 4th income deciles (see Figures 18 and 20).

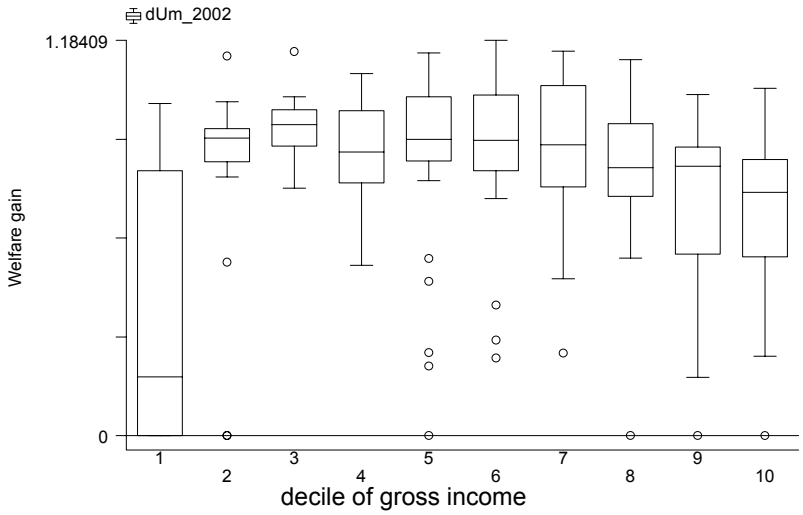

Figure 13: Welfare changes for single men- 2002 reform

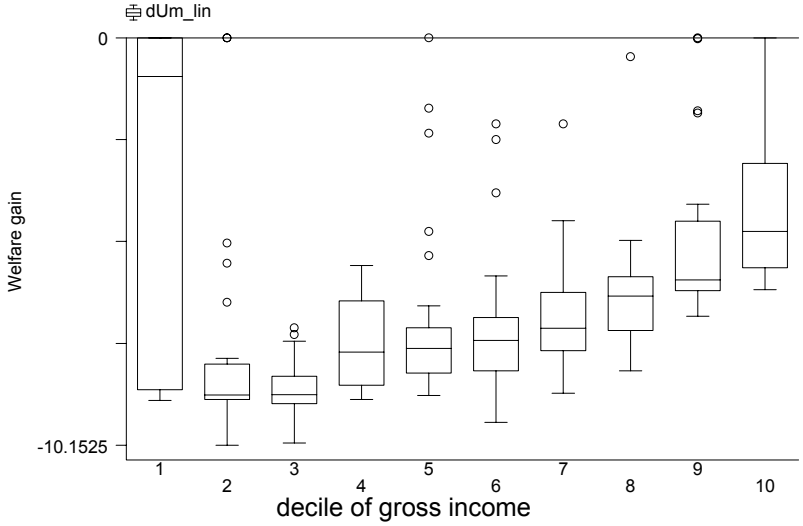

Figure 14: Welfare changes for single men linear taxation

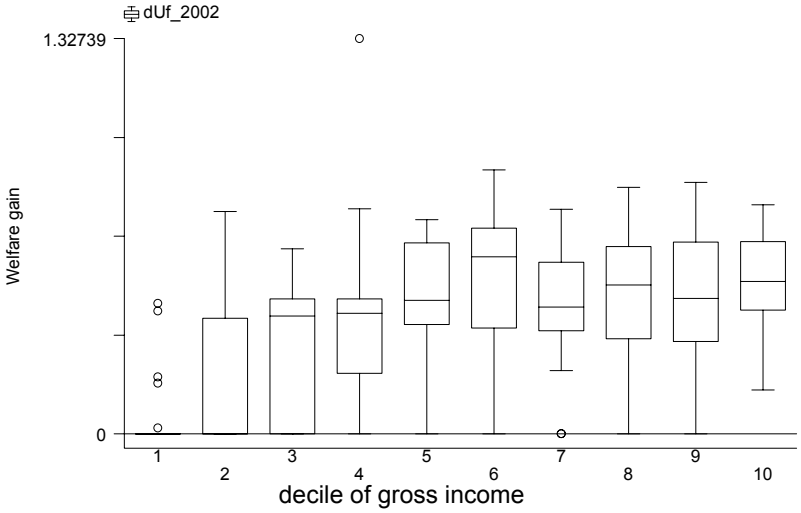

Figure 15: Welfare changes for single women-2002 reform

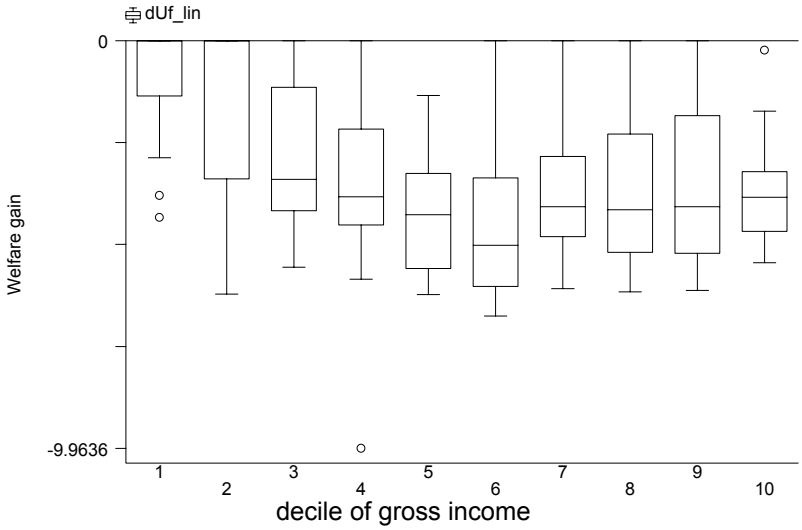

Figure 16: Welfare changes for single women- linear taxation

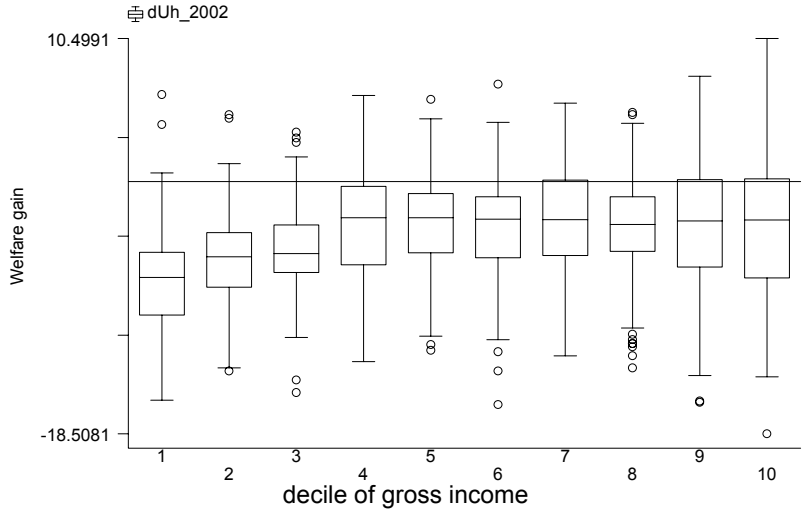

Figure 17: Welfare changes for married men- 2002 reform

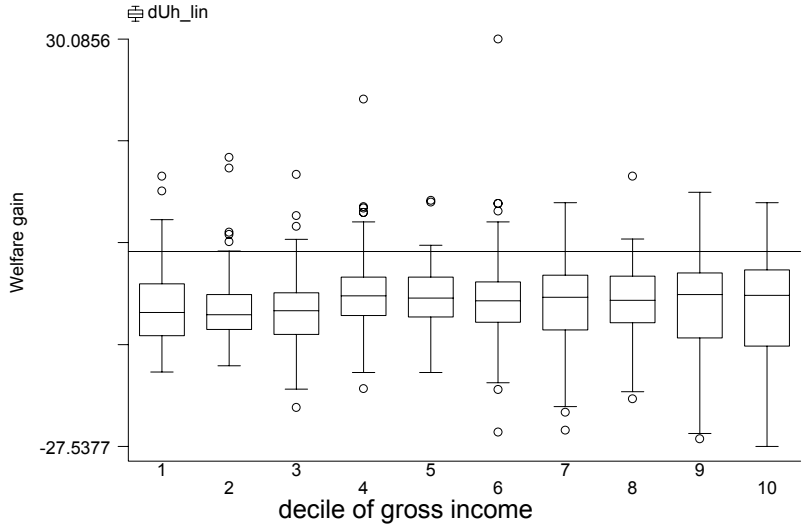

Figure 18: Welfare changes for married men- linear taxation

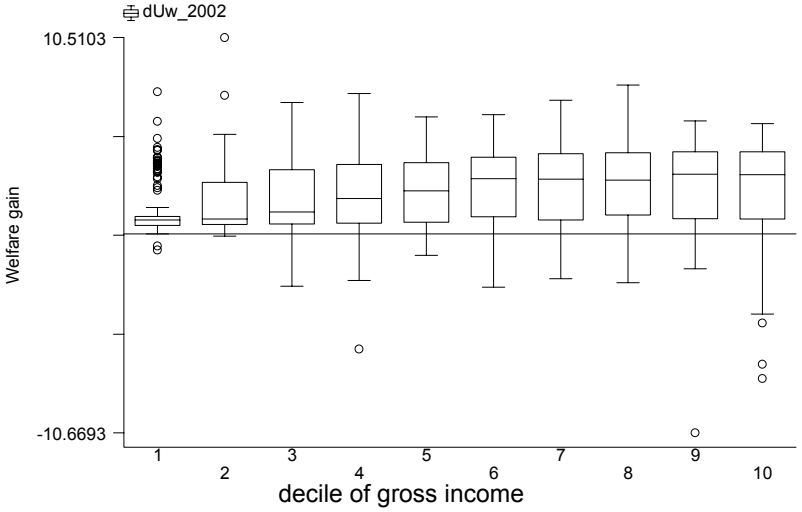

Figure 19: Welfare changes for married women- 2002 reform

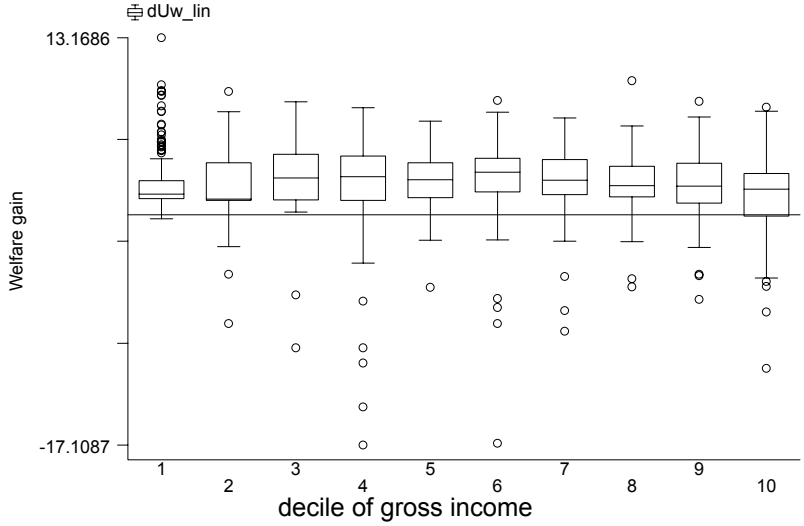

Figure 20: Welfare changes for married women- linear taxation

Conclusions

The aim of this study has been to highlight the distortions produced whenever tax reforms are evaluated on the base of unitary household models, when instead collective models provide a description of within household decision making, closer to the observed behaviour. According to the unitary view, income is shared within a household depending on demographic factors, as they affect preferences. The collective framework instead emphasises the role also plaid by each spouse' earnings in explaining the changes in their relative weight during the couple's decision process.

We addressed this issue by simulating the observed labour supplies of a sample of Italian households with a collective model and by estimating a unitary model on the simulated data. A comparison of the results produced with the two approaches pointed out that labour supplies are over-predicted for men and under-predicted for women with a unitary model. We found out also that only 34% of men working hours and 57% of women labour supplies were correctly predicted with a traditional model, much better results were previously obtained with the simulation of the collective model.

In terms of policy evaluation the discrepancies produced by the two approaches are even greater. Considering the collective model as the base and examining two tax reforms (the 2002 tax changes and a linear income tax), only a third of either women or men are well predicted by the unitary model. The same approach also recorded a much higher variation in male and female labour supply induced by each tax reform: in particular, we found a larger drop in female participation rate and a bigger increase in men working hours.

Exploring the normative implications of the two tax reforms under the collective framework here developed, the analysis pointed out a number of diverging welfare effects predicted within the couple, due to tax changes. Such effects can only be disentangled under the hypothesis that husband and wife are distinct decision makers within a household.

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