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**The recent reforms of the Italian
personal income tax:
distributive and efficiency effects**

by

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distributive and efficiency effects**

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Abstract

The aim of this paper is the study of three reforms of the Italian personal income tax that have been implemented over the past six years. The analysis is carried out in three stages. In the first stage we study their distributive effects using a static microsimulation model. In the second stage we focus on the labour supply effects by means of a structural microeconomic model of household labour supply; finally, we analyze the distributive effects of the reforms accounting for labour supply reactions. Our findings confirm that the extension of the no-tax area had positive effects in terms of both redistribution and work incentives, while greater benefits for households with children improved income distribution but with negative effects on the labour supply of married women.

JEL: J22, H24, H31

Keywords: microsimulation, labour supply, income distribution, income tax.

Introduction

The reform of the personal income tax and more generally of the tax-benefit system has recently become a very controversial topic in Italy. In the last 15 years any new government, either from the left or from the right, has started its mandate with the intention of implementing some radical reform, but it has always ended with small adjustments with respect to the announced claims. However the tax-benefit structure has significantly changed over the last six years, possibly creating important effects in terms of redistribution and labour supply incentives.

Many studies have examined the theoretical problems inherent in the design of a consistent reform of the Italian personal income tax (for example, De Vincenti, Paladini and Pollastri, 2005). Others have focused on the distributive impacts of some of the recent reforms, considering their social welfare implications and changes in effective marginal tax rates (Baldini and Bosi 2002, Gastaldi and Liberati 2005).

The empirical papers that have considered specific cases of reform of the Italian tax-benefit system have so far made use of static microsimulation models, without consideration for possible labour supply effects, apart from calculating changes in effective marginal rates. A given modification of the structure of marginal tax rates, however, can be followed by very different efficiency consequences, depending on the magnitude of labour supply elasticities and on their distribution across the population.

Many recent papers focus on the possible equity-efficiency trade-offs implicit in any tax or benefit reform, and introduce in traditional static microsimulation models reaction functions by taxpayers and other family members. These studies have been applied to the equity and efficiency effects of the implementation, in Italy, of some basic structural reforms of the tax-benefit system, for example the switch to a negative income tax (Aaberge et al., 2000) or the introduction of a guaranteed income scheme (Berliri and Parisi, 2001; Mancini, 2008).

In this paper we use a structural microsimulation model that allows to consider both the distributive and the efficiency effects of a given reform. We focus not on hypothetical general reforms of the whole system of personal taxation, but on three adjustments of the structure of the Italian personal income tax that have actually taken place in the last few years. The results show what would have happened to income distribution and labour supply if the only change in the economic environment was represented by the modifications in the personal income tax and, in one case, in family benefits. In this sense, they do not correspond to what has actually taken place, because changes in the tax-benefit system are only one of the many factors that can influence variations in inequality and labour supply during a given period of time. These simulations capture the “pure” effects of the reforms, something that cannot be easily observed in cross-sectional data.

The model that we use integrates a detailed static tax-benefit simulator with a household labour supply model based on the Bank of Italy Survey on household income and wealth (SHIW). We study the effects of the three most recent reforms of the personal income tax on income distribution and on incentives, and show whether and in which occasions equity and efficiency moved in the same direction or followed different paths.

The next section describes the evolution of the Italian personal income tax over the past six years. In section 3 we introduce the empirical framework for our analysis. Section 4 contains the results and section 5 concludes.

2. The recent evolution of the Italian personal income tax

We simulate the effects of three subsequent reforms of the personal income tax (*Irpef*, i.e. *Imposta sul reddito delle persone fisiche*) that have taken place in Italy over the last few years. These changes were inspired by very different intellectual benchmarks, but none of them has come close to a complete and consistent reform. They are mainly partial attempts that have left the most important component of the Italian tax system in what is now an uncertain and unstable equilibrium.

The starting point of our analysis is the structure that *Irpef* had before all the reforms we simulate. Since the first of them come into force in the fiscal year 2003, we must adopt as a base case for our simulations the characteristics of *Irpef* in 2002. Here we sketch the main traits of the personal income tax before and after each of the reforms.

Irpef 2002. Individual taxable income is subject to five brackets, with the lowest rate at 18% and the highest at 45% (starting from 70000 euros).

Progressivity is realised also through a series of tax credits, all piecewise decreasing with respect to income, so as to further strengthen the rise in the effective average tax rate: for dependent spouse, for children (starting at about 500 euros for each child for middle-low income levels), for dependent workers and pensioners (decreasing with respect to income from 1150 to 52 euros), and for the self-employed (from 573 to 52 euros). The presence of these tax credits produces a minimum level of income that is exempt from the tax. This no-tax area corresponds to 6200 euros for dependent workers and pensioners, and to 3100 euros for independent workers.

Irpef 2003. The first of the two reforms operated by the centre-right government became effective in the fiscal year 2003. The number of rates was maintained at 5, but with changes in the first three rates. This reform had effects for low and middle incomes, and replaced the tax credits for earned incomes and pensions with deductions. The tax credits for dependent family members were maintained. The new deductions had therefore the main aim of guaranteeing a no-tax area, whose levels were also raised from 6200 to 7500 euros for dependent workers and pensioners, and from 3100 to 4500 euros for the self-employed. To further enhance the progressivity effect, the tax deductions were defined as a linearly inverse function of income, falling to zero for incomes greater than 33500 euros for dependent workers, 30500 for the self-employed and 33000 for pensioners. The reduction in tax revenue from these changes has been estimated in 6 billions euros.

Irpef 2005. The second module of reform accomplished by the centre-right government replaced also the family-related tax credits with deductions (linearly decreasing with income like the no-tax area deductions) and reduced the number of brackets from 5 to 4. The highest tax rate has been cut by two percentage points, from 45% to 43%. This top rate applies to the income share exceeding 100.000 euros. Under Irpef 2003, the 45% rate applied instead to incomes starting from 70000 euros. While the 2003 reform benefited middle and low incomes, this reform provided tax rebates for the highest deciles of the income distribution. The reduction of the top rate and its application to a narrower bracket were steps that the government took along a path that had, as a final objective, a structure of the personal income tax based on only two brackets: the first one up to 100000 euros, taxed at 23%, and the rest subject to the 33% rate. Progressivity would have been further enhanced by a deduction decreasing with income. The intellectual reference point of the whole reform action of the centre-right government in this context is clearly the flat-rate tax, with a limited degree of progressivity and the application of the same legal tax rate (23%) to the great majority of taxpayers. The cost of this second piece

of reform has been broadly similar to that of the first one, around 6 billion euros.

Irpef 2007. The flat-tax plan could not be completed because of fears of excessive revenue losses, and above all because the objective of a two-rate scheme was not shared by the centre-left government that took power in 2006. In the budget law for 2007 the new coalition introduced a deep change in the structure of the personal income tax, which is still basically effective. The top rate has been kept at 43%, but now applies to incomes above 75000 euros. The main deductions have been replaced by tax credits, all linearly decreasing with respect to income. Formal tax rates have been reduced for middle-low incomes, but raised for those earning more than 40000 euros (or more, if the taxpayer has dependent family members). Unlike the two previous reforms, this one accounted for a deep restructuring in cash transfers for households with children (*Assegno al nucleo familiare*). Before the reform, this benefit decreased in a piecewise way with respect to family income, therefore producing high marginal effective tax rates and risks of poverty traps. Now its amounts have been increased, and its structure is linearly decreasing with respect to family income. According to official estimates, this complex reform has had a very limited cost: the reduction of the tax burden and the rise in family benefits for middle and low incomes have been financed by taxpayers with higher incomes or without children. The intellectual paradigm of the centre-left coalition was completely different from that of the preceding government: the Prodi government tried to move the first steps towards a negative income tax scheme, integrating together in a consistent scheme the personal income tax and cash transfers to families with children, so as to guarantee an income support to taxpayers with family burdens and low incomes. This objective, however, had a life even shorter than the flat-rate tax scheme, given the rapid fall of the government and its replacement with a new centre-right coalition, in power since May 2008. The new government has not introduced any relevant modification in the personal income tax so far.

3. Empirical Methodology.

In order to evaluate the distributive effects and the work incentives produced by the last three reforms of the Italian personal income tax, we make use of a behavioral microsimulation model based on the Survey on Household Income and Wealth conducted every two years by the Bank of Italy. The model has two main parts: a static detailed simulator of the Italian tax-benefit system for

each reform and a microeconomic labour supply model based on utility maximizing agents. The static model recovers gross earnings from net earnings provided in the survey. In this way, it is possible to compute net household income for each possible tax-scenario so as to analyze the changes in the income distribution from one reform to the other. However, any conclusion based on the static distributional analysis is partial because it does not take into account efficiency considerations. In order to consider this latter aspect, we make use of the second part of our model that allows us to compute labour supply changes from one reform to the other. In this paper we allow for flexible labour supply only for couples and consider singles as being fixed on the observed labour supply behavior. In particular, we focus on married/*de facto* couples and use a unitary model of labor supply¹. Given the unitary framework, we consider the couple as the decision maker. This means that the two spouses choose simultaneously a combination of hours of work for each of them in order to maximize a joint utility function defined over the net household income and the hours of work of both partners. The labour supply model we develop is based on a discrete choice framework. In other words, we treat the number of average weekly worked hours contained in our dataset as a category variable and consider the couple as a utility maximizing agent who chooses the combination of both worked hours and income that gives the highest utility. As it will be clarified later, the main advantage of the discrete choice framework is its versatility in dealing with problems like joint labour supply and non-convex budget sets. Indeed, continuous structural models of labour supply have the main drawback in the burden of computing net household incomes for each possible hour of work. This is necessary to recover the budget constraint used in the estimation process. However, possible non-convexities in the budget set require sophisticated algorithms to create piecewise linear budget constraints and to maximize between each couple of kinks in the piecewise linear budget constraint². The discrete approach avoids all these procedures because net incomes for each possible alternative of worked hours enter in the utility function directly. Hence, the only computational burden lies in recovering net household incomes for the (few) categories of possible hours of work. Moreover, the discrete approach allows for important extensions that are difficult to incorporate in the standard continuous model. Indeed, fixed costs of working, child-care costs, unobserved heterogeneity and joint labour

¹ Collective models of labor supply are much more appealing but the literature has not developed a well-accepted framework to work with. In particular, the model has to be simplified in other parts and discountable assumptions are needed for the identification of the sharing rule. See Chiappori (2005).

² Creedy and Duncan (2005) present one of these algorithms.

supply are all aspects that can be easily fitted in the discrete framework³. To compute net households incomes for each alternative we use our static microsimulation model. This model allows us to recover the gross hourly wages for those who are employed. Gross hourly wages correspond to gross weekly earnings from employment divided by average weekly hours of work declared in the dataset. For people observed as not employed, gross hourly wages are estimated controlling for sample selection. Once gross wage rates have been recovered for all the population of interest, *potential* gross earnings from employment for each hour category are obtained by multiplying gross hourly wages by the representative hours of work in each category⁴. Finally, the static tax-benefit simulator computes tax amounts and benefit entitlements for each potential gross annual income from employment given non-labour incomes. Net household incomes are the sum over the two spouses of the gross earnings from employment, non-labour incomes, benefits and taxes. Each couple has a choice set defined over net household incomes and hours of work and choose the alternative that produces the maximum utility given the actual tax-benefit system and individual characteristics. Under the assumption that utility is not deterministic, it is then possible to recover the probability of a given choice. Formally, let $H=[h_f, h_m]$ be a vector of hours of work for both wives and husbands. Let Y_{Hj} be the net household income when the vector H_j is chosen over J alternatives and let X be a vector of individual characteristics. Then the utility for this particular choice can be defined as:

$$U_{H^j} = U(Y_{H^j}, H^j, X) + \xi_{H^j}$$

Where the last term is a choice-specific random component that could be seen as an optimization error. The net household income Y_{Hj} when the vector H_j is chosen is defined as:

$$Y_{H^j} = \bar{w}_f \cdot h_f^j + \bar{w}_m \cdot h_m^j + Nly + TB(\bar{w}_f, \bar{w}_m, H^j, Nly, X)$$

Where Nly denotes the non labour income, $TB(w_f, w_m, H^j, Nly, X)$ defines the tax-benefit system and $w_{f,m}$ denote the (fixed) gross hourly wages for female and men, respectively. It is worth to notice that $Y=Y(H)$ is highly non-linear for most of the population of interest due to the presence of the tax-benefit

³ Blundell and MaCurdy (1999) in their review of microeconomic models of labour supply conclude that the discrete approach has to be preferred to other models given its versatility in accounting for many important aspects of any labour supply decision. See Creedy and Duncan (2005) for a review of labour supply models and microsimulation.

⁴ Notice the assumption that gross hourly wages do not depend on the amount of worked hours. See Brewer et al. (2004) for this point.

function⁵. Following Keane and Moffit (1998), Blundell et al. (2001) and Brewer et al. (2004) we assume the following quadratic utility function:

$$U(Y_{H^j}, H^j, X) = \alpha_1 y_{H^j}^2 + \alpha_2 h f_j^2 + \alpha_3 h m_j^2 + \alpha_4 y_{H^j} h f_j + \alpha_5 y_{H^j} h m_j + \alpha_6 h f_j h m_j \\ + \beta_1 y_{H^j} + \beta_2 h f_j + \beta_3 h m_j$$

Individual characteristics enter in utility through the linear term coefficients. In particular, we define the coefficients of the linear terms as follows:

$$\beta_m = \sum_{i=1}^{K_m} \beta_{m,i} x_{m,i} + \mathcal{G}_m \quad m \in \{1, 2, 3\}$$

The last term is assumed to be random with a normal independent distribution.

The presence of random coefficients is important for several reasons. In particular, they relax the IIA assumption that is implicit in the choice of the Gumble distribution for the random utility. Moreover, they allow for unobserved heterogeneity in preferences in the model. Under the assumptions that the couple maximizes her utility over a discrete set of alternatives and that utility follows a type one extreme value distribution, the probability of choosing the alternative H_j is given by⁶:

$$\Pr(H = H^j | X, \nu) = \Pr[U(Y_{H^j}, H^j, X, \mathcal{G}) > U(Y_{H^s}, H^s, X, \mathcal{G}), \forall s \neq j] \\ = \frac{\exp(U(Y_{H^j}, H^j, X, \mathcal{G}))}{\sum_{k=1}^K \exp(U(Y_{H^k}, H^k, X, \mathcal{G}))}$$

Given the presence of random coefficients it is necessary to integrate out these random terms when evaluating the contribution to the likelihood for each observation:

$$L_i = \int \prod_{j=1}^K d_{ij} \left(\frac{\exp(U(Y_{H^j}, H^j, X, \mathcal{G}))}{\sum_{k=1}^K \exp(U(Y_{H^k}, H^k, X, \mathcal{G}))} \right) \phi(\mathcal{G}) d(\mathcal{G})$$

Where d_{ij} is a binary indicator that takes value one for the observed choice and zero otherwise. Given that the integral above does not have a closed form solution, we follow Train (2003) and use simulation methods to approximate it. Since wages are not observed for non-workers, it is necessary to estimate

⁵ For models with a single choice maker, it could be possible to plot the function $Y(H)$ that defines the budget constraint. This is difficult in our case since we would need a three dimensional graph. Keeping fixed the husband labour supply we found a highly non-linear and non-convex budget set for most of the population of interest.

⁶ See McFadden 1973 for the proof.

them. Following Blundell et al. (1999), the estimation of the hourly gross wage for both the spouses is carried out *before* the estimation of the structural model and it is based on the standard Heckman procedure to take into account a possible selection bias.

Predicted wages for non-workers are estimated using the linear predictions of the estimated Heckman wage equations and their unobservable components are integrated out of the likelihood function by drawing from their estimated (truncated) distribution. More details on this procedure can be found in Pacifico (2009). If we define the wage error components as ε , we can rewrite the likelihood as:

$$L_i = \int_{\varepsilon} \int_{\nu} \prod_{j=1}^K d_{ij} \left(\frac{\exp(U(Y_{H^j}, H^j, X, \mathcal{G}))}{\sum_{k=1}^K \exp(U(Y_{H^k}, H^k, X, \mathcal{G}))} \right) \phi(\mathcal{G}) d(\mathcal{G}) \phi(\varepsilon) d(\varepsilon)$$

Where the integration over the unobserved components of wages takes place only when wages are not observed for one or both the spouses.

3.1 Extensions to the basic model

The model presented below can be easily extended to take into account two important dimensions in the choice of the number of worked hours. In particular, we account for unobserved fixed costs of working and child-care demand. Fixed costs of working are important for several reasons. Firstly, they allow for specific characteristics of each hour point and secondly they change the shape of the utility function increasing the likelihood of convex preferences⁷. Fixed costs are defined as a once off cost directly subtracted from net income at any positive hours of work and are estimated jointly with the other parameters of the structural model. Following Brewer et al. (2004), we assume unobserved positive fixed costs of working only for women and we allow for different fixed costs depending on whether the wife decides to work part-time or full-time. As Brewer et al. (2004) pointed out, letting fixed costs vary with full-time or part-time work gives the model more flexibility and it may serve to relax the assumption that gross hourly wages do not vary with the number of worked hours. Formally, fixed costs are defined as follows:

⁷ There are several ways to take into account specific characteristics of each discrete point of hours. Aaberge et al. (1999) introduce a number of job offers associated with each discrete hour point while Van Soest (1995) and Mancini (2008) introduce ad-hoc dummies in the utility functions. See Heim and Meier (2004) for the relationship between fixed costs of working and convex preferences.

$$FC(hf_j, Z) = Z_1 \theta_1 \cdot 1\{hf_j > 0\} + Z_2 \theta_2 \cdot 1\{hf_j \geq 30\}$$

Where $1\{.\}$ is a binary indicator that takes value one when the argument in the bracket is true. To take into account child-care costs we adopt a different strategy. As pointed out in Del Boca and Vuri (2005), Italy has a lack of data on child-care usage and child-care costs. In order to overcome this problem, we recovered information on child-care costs from another dataset⁸. Following Blundell et al. (2001), we computed the hourly price of child-care for eight groups of households and for each group we approximated the distribution of the hourly price of child-care by a 4 point mass distribution whenever the household is observed buying formal child-care. Given that households with working mother are more likely to buy formal child-care, we take into account a possible selection bias by computing the proportion of households that use formal child-care for both working and non-working mothers. We do not consider any other possible source of selection bias which implicitly means that households that are not observed buying formal child-care would be willing to pay exactly the same amount as households observed buying formal child-care⁹. We also estimate the statistical relationship between hours of work and hours of child-care for six groups of households defined according to the number of children and their age¹⁰. With this information on child-care costs and child-care usage it is possible to approximate the weekly cost of childcare for different alternatives of working hours in the original dataset. This cost is then subtracted from the net income at any possible choice of hours and the price of child-care is then integrated out from the likelihood. Formally, we define a child-care cost function as:

$$CC(hf_j, p_c, X) = E[h_{cc} | X, hf_j] \cdot p_c$$

Where p_c is the hourly price of child-care and $E[h_{cc} | X, hf_j]$ is the expected hours of child-care for a specific group of households given the choice hf_j . In order to compute this expectation, we assume a linear relationship between hours of work and hours of child-care:

$$E[h_{cc} | X, hf_j] = \varphi_0 + \varphi_1 hf_j$$

Like fixed costs of working, child-care costs enter in the model as a once off cost directly subtracted from income at any possible choice of hours. If we define a total cost function as:

⁸ ISTAT Multiscopo (1998). See below for details.

⁹ In principle it is possible to consider this other source of selection but this would have added stronger assumptions on the distribution of child-care costs. Using the procedure outlined in the text we actually adopt a non-parametric approach for the estimation of the child-care distribution.

¹⁰ See Pacifico(2009) for details on these first stage regressions.

$$TC = CC(hf_j, p_c, X) + FC(hf_j, Z)$$

the utility function changes as follows:

$$U_{H^j} = U(Y_{H^j} - TC, H^j, X) + \xi_{H^j}$$

Finally, the likelihood for observation i considering fixed costs and child-care demands becomes:

$$L_i = \sum_{s=1}^5 \Pr(p_c^s | X) \cdot \int \prod_{\zeta} \prod_{j=1}^K d_{ij} \left(\frac{\exp(U(Y_{H^j} - TC_{H^j}, H^j, X, \vartheta))}{\sum_{k=1}^K \exp(U(Y_{H^j} - TC_{H^k}, H^j, X, \vartheta))} \right) \phi(\zeta) d(\zeta)$$

Where ζ is a vector that collects all the random terms. As explained above, the integrals are approximated using simulation methods. The interested reader can find more information on the model and an overview of the STATA routine used to estimate this likelihood function in Pacifico (2009).

4. Empirical results.

4.1. Data and estimation

Our main source of data is the Survey on Household Income and Wealth (SHIW) that is conducted by the Bank of Italy every two years. The survey collects very detailed information on income as well as social and demographic characteristics. In the present study we use the cross sectional survey for the year 2002. The dataset is representative of the whole Italian population and contains about 21,000 observations and 8,000 households. Since the model presented in the previous section is not appropriate to describe the labour supply decisions of any kind of household, we model changes in labour supply only on a selected sub-sample of the whole population. In particular, as standard in the literature on labour supply, we do not consider couples with spouses who are aged over 60 years, self-employed, involved in a full time education program or serving the Army. Couples with self-employed spouses are omitted because it is difficult to estimate their budget constraint correctly. Couples with spouses who are enrolled in full time education programs or who are aged over 60 are excluded because they might have a behavior in the labour market that is not characterized by just the traditional trade-off between leisure and income. As explained in the previous section, we make use of another dataset to recover information about child-care costs and child-care usage. The source of data is the survey "MULTISCOPO" 1998 on Households and Childhood Conditions that is conducted by the Italian national institute of statistics (ISTAT). This survey is relatively old but it is the only one that contains detailed

information on child-care expenditure, hours of child-care and hours of work. Unfortunately, the information on child-care expenditures is registered only for children aged less than six so that we are able to compute child-care costs only for those couples who have very young children. Obviously, this represents a restriction due to the data but it must be pointed out that in Italy the school for kids is the most expensive one. Indeed, children that have turned six have access to the public school that is basically free. The discrete set of hours each spouse can choose from is mainly defined according to the empirical distribution observed in SHIW 2002. According to these distributions, women in a couple are restricted to choose from the discrete set $x=\{0, 10, 20, 30, 40\}$. These points correspond to the following categories: 0-5, 6-15, 16-25, 26-36, >36. For married men we selected the discrete set $y=\{0, 40, 50\}$ that corresponds to the categories 0-10, 11-42, >42. Since the labour supply for married women and men is estimated jointly, each couple has a choice set defined by the Cartesian product yx that leads to 15 possible combinations of discrete points. Table 1 summarizes the observed distribution of worked weekly hours according to these categories. The static tax-benefit simulator computes total benefit entitlements and total tax amounts for each of these 15 combinations of discrete points given gross hourly wages. The net incomes are then computed by subtracting taxes and adding benefits plus non-taxable incomes to the gross labour income. This amount is then added up over the two spouses to get the total net household incomes for each alternative.

Table 1. Observed distribution of workers by weekly hours .

	0 (6.36%)	40 (72.22%)	50 (21.42%)	Total
hours male/				
hours female				
0	71.65	48.58	50.47	50.45
10	1.57	2.08	0.93	1.80
20	3.94	10.88	12.38	10.76
30	3.15	6.44	6.07	6.16
40	19.69	32.02	30.14	30.83
Total	100	100	100	100

Source: our computations on SHIW data.

Note: sub-sample with flexible labour supply.

4.2. First-round distributive effects.

Fig. 1a shows the effects of the various reforms on average equivalent disposable incomes of households, ordered by deciles of gross equivalent income in 2002, i.e. equivalent income before the application of the personal income tax and of family benefits¹¹. In the figure we present changes in disposable equivalent incomes, due simply to the modification of fiscal parameters (in all reforms) and family benefits (only in 2007), without any behavioural reaction. The first reform, from 2002 to 2003, had a modest redistributive effect, with the third decile benefiting from the highest relative change in disposable income. The gain then declines smoothly for the richest deciles. It is very low also for the poorest 10% of households because many of them were already exempt from the personal income tax. The second reform, from 2003 to 2005, has completely different distributive effects, with percentage changes in income always increasing from the poorest to the richest deciles. Finally, the adjustments introduced by the centre-left coalition in 2007 resemble those of the first centre-right module: the highest gains are achieved by the third and fourth decile. Unlike that reform, however, this episode resulted in a reduction in disposable income for the richest households.

Focusing only on households with at least one child under 14 (Fig. 1b), the total effect of the three reforms is more generous with them than with the whole population mainly because of the 2007 reform, which turns out to have particularly benefited households with children and below median income. The income gains of the poorest households with children, however, have been very modest.

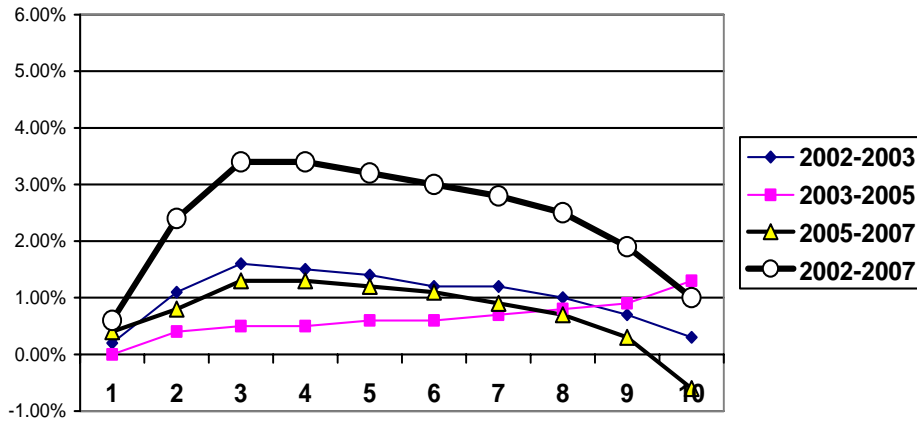
Finally, Fig. 1c presents income changes only for households for whom we have simulated the possibility of changing labour supply¹². The distributive effects are very similar to those of the other two figures.

Figure 1 - Percentage changes in equivalent disposable income

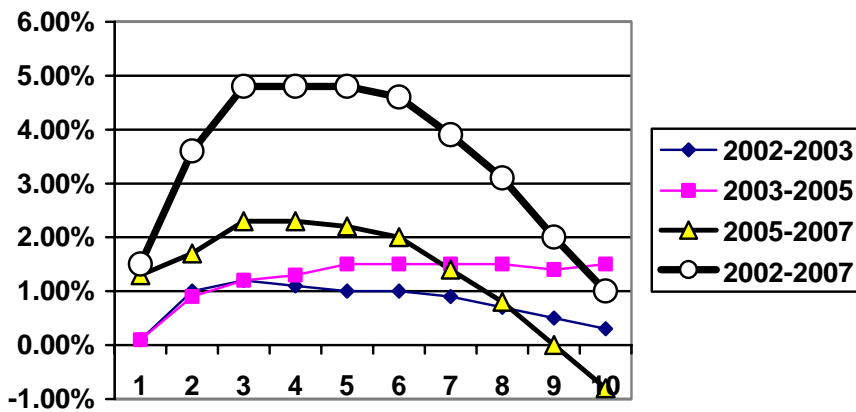
1a) entire population

¹¹ Equivalent household income is household disposable income divided by the square root of the number of members.

¹² As it has been clarified in section 4.1, the sub-sample with flexible labour supply corresponds to households of couples with both spouses in working age. From this sample are excluded households with self-employed spouses.



1b) households with at least one child under 14



1c) households with simulated labour supply effects

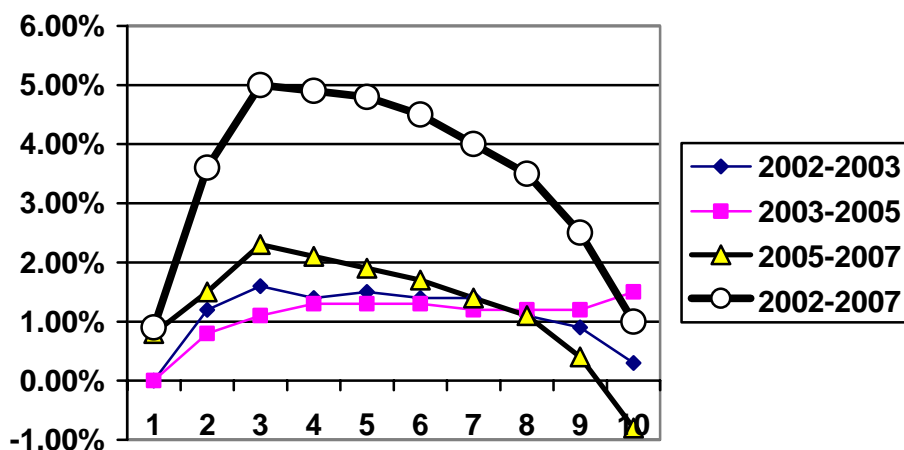


Table 2 shows the Gini indexes for disposable equivalent income, before and after each simulated reform, for the whole sample representative of the Italian population. The first reform module of 2003 reduced, as expected, inequality,

but has been followed by another reform that went in the opposite direction. The centre-left reform, on the other hand, has had a more significant effect in reducing inequality. At the end of the period, inequality has been very slightly reduced: the percentage reduction from Gini 2002 to Gini 2007 is -0.94%.

Table 2. Gini Index for the whole sample and percentage change with respect to the previous year.

	Gini index	% change
2002	0.34644	
2003	0.34467	-0.51%
2005	0.34617	0.44%
2007	0.34318	-0.86%

Source: our computations on SHIW

4.3. Accounting for labour supply changes.

This section and the next one consider the changes in labour supply that, according to the behavioural microsimulation model, have been induced by each reform of the personal income tax. In this paper we present the estimates of the structural microeconomic model only and omit other first stage regressions¹³. Table A1 in the appendix shows the estimates of the utility parameters. As it can be seen, most of the signs are in line with expectations one could derive from standard economic theory. In particular, preferences for work increase with age at a decreasing rate for both wives and husbands. Moreover, these preferences are lower for both spouses when the couple lives in Southern Italy. Education increases preferences for work. Children have a non-clear effect on labour supply behavior. In particular, women have decreasing preferences for work when the number of young children increases. The opposite is true for the man partner. On average, preferences for joint consumption decrease with the number of young children. Finally, our check for quasi-concavity shows that the estimated preferences are convex for 99% of our sample¹⁴.

In order to summarize the characteristics of labour supply behavior simulated by the model, Table 4 presents average own-wage and cross-wage elasticities

¹³The interested reader can find the full set of estimates in Pacifico (2009).

¹⁴ The check for quasi-concavity of the utility function is done by computing the conditions illustrated in Van Soest (1995).

for both women and men by deciles of gross equivalent household income. These elasticities are computed as the percentage variation in the labour supply of both wife and husband derived from a 1% increment of her/his hourly gross wage¹⁵. Low-income households have higher elasticities and, on average, own-wage elasticities are much higher for women. The labour supply of men does not actually depend on the wage level of wives. Interestingly, there is a clear interchangeability in spouse's labour supply, in particular for the highest deciles.

Table 3. Elasticities of Labour supply for both women and men in a couple.

Deciles of gross equivalent income	<i>wife's wage +1%</i>		<i>husband's wage +1%</i>	
	own elast	partner	own elast	partner
1	1.10	0.00	0.26	-0.19
2	1.02	-0.01	0.19	-0.12
3	1.00	0.00	0.18	-0.04
4	1.00	0.00	0.16	-0.06
5	0.97	0.00	0.16	-0.06
6	0.90	-0.01	0.13	-0.08
7	0.84	-0.01	0.13	-0.08
8	0.67	-0.01	0.12	-0.11
9	0.66	-0.01	0.11	-0.15
10	0.49	-0.01	0.02	-0.28
total:	0.87	-0.01	0.15	-0.12

Source: our computation based on SHIW data.

Some disaggregations of such elasticities for women by individual characteristics (Tab. 4) show that labour supply responses are higher for women living in Southern Italy and with low education. Women own-wage elasticities are relatively small for those living in couples with a child aged less than six.

Table 5. Elasticities of women labour supply by household characteristics.

Southern Italy	1.240
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¹⁵ It is worth to notice that these elasticities have to be interpreted carefully and cannot be easily compared with other studies. They just summarize the average behavior implied in our model, *given* our definition of the discrete choice set and our specification of the tax-benefit system. Indeed, such elasticities could change if we had specified a different tax-benefit system, say less complete, and/or if we had chosen different hours brackets when we discretized the worked hours variable. See Creedy and Kalb (2005) for a discussion of such elasticities in this context.

Middle/Northern Italy	0.788
Wife with high education	0.622
Wife with low education	1.113
Wife without children	0.896
Wife with children >=6	0.885
Wife with youngest child <6	0.731

Source: own computations based on SHIW 2002.

Note: High education corresponds to secondary (5 years) or tertiary education.

4.4. Simulation results

Using our behavioral model, we can study which changes in labour supply can be associated to the PIT reforms under analysis. Table 5 summarizes the (expected) distribution of women and men by classes of worked hours under the 2002 legislation and after each reform.

Table 5. Distribution of women and men by groups of weekly hours of work

Women				
	2002%	2003%	2005%	2007%
0 hours	0.506	0.497	0.494	0.499
10 hours	0.015	0.015	0.015	0.015
20 hours	0.107	0.108	0.109	0.105
30 hours	0.067	0.068	0.069	0.068
40 hours	0.306	0.312	0.313	0.313
Total	1	1	1	1
Men				
	2002%	2003%	2005%	2007%
0 hours	0.064	0.061	0.06	0.058
40 hours	0.722	0.726	0.723	0.725
50 hours	0.214	0.213	0.217	0.217
Total	1	1	1	1

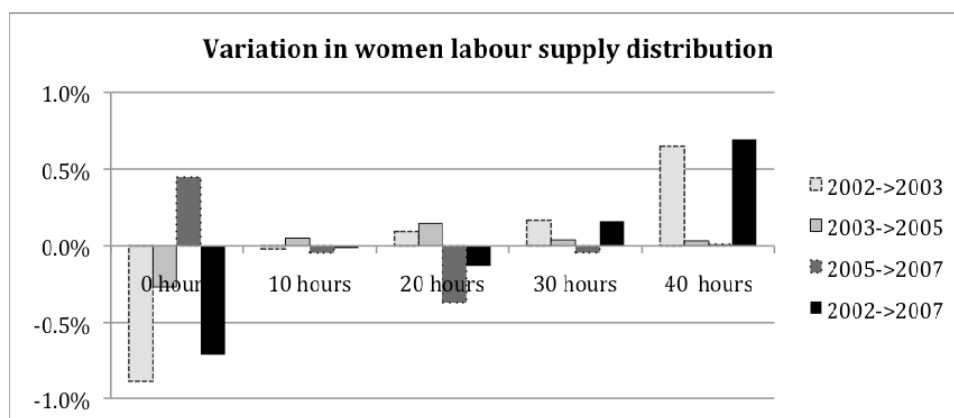
Source: our computations based on SHIW

The changes induced by the modifications of PIT and child benefits are quite small. Focusing on the extensive margin, female labour supply increases after the first two reforms, but decreases slightly in 2007. Grossing up our results, we can estimate an increment of about 47,900 workers among women in couples for the 2003 reform. The 2005 module implies another increment of about 14,500 units, while the last reform reduced female participation by

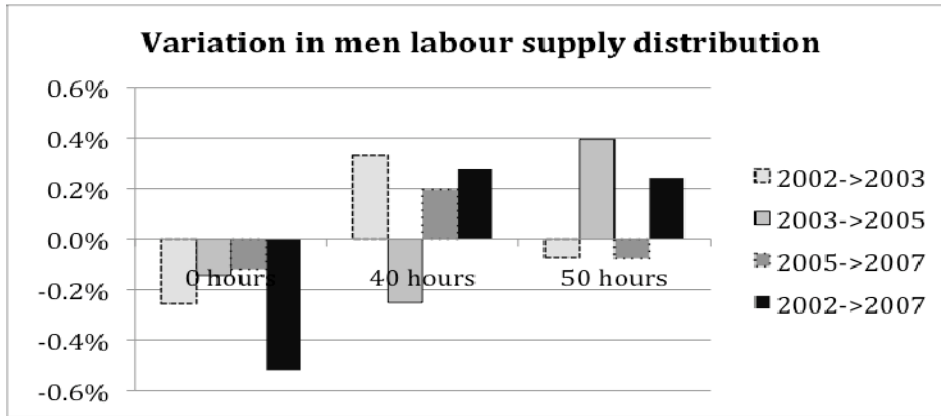
almost 24,000 units. During the whole period 2002-2007, women labour supply is then expected to have risen by about 38,400 units¹⁶. For men in couples the corresponding changes are smaller. All the three reforms increase men participation rates, in particular the last two. Grossed-up effects for men correspond to +13,000 between 2002 and 2003, +7,700 between 2003 and 2005, +6,000 between 2005 and 2007. At the end of the overall period, men’s labour supply is expected to have increased by about 26,700 units due to tax and benefit reforms. If we now focus on the intensive margin, the 2003 reform increases in particular full-time jobs for women in couples. The 2005 module has effects on the number of part-time jobs instead. Finally, the 2007 reform reduces part-time jobs and does not change incentives for full-time work. For men the pattern is quite different. The only reform that actually produces changes at the intensive margin is the 2005 one. In 2007 there are no significant effects with respect to the preceding reform.

Fig. 2 shows each variation in both women and men labour supply with respect to the previous reform. The number shown are simply the differences between the percentages contained in table 5. The graphs provide also the overall variations with respect to the baseline year.

Figure 2 – Changes in the distribution of workers by classes of weekly hours.



¹⁶ It is worth to stress again that our results account for just a pure labour supply effect and cannot be compared with “real” employment data.



From the first graph a complementarity between the 2003 and 2005 reforms emerges. Both these reforms increase participation, but the second module of the centre-right coalition increases part-time jobs while the first one provides incentives for full-time jobs for women. Instead, the 2007 reform reduces participation and part-time work and does not have significant effects on full time work with respect to the 2005 reform. The second of the two graphs presents the same computations for men. As it can be seen, the changes are smaller than those for women. In general, all the reforms increase men participation with respect to the baseline year. Analyzing the intensive margin, we observe opposite patterns in 2003 and 2005. In particular, the 2003 reform slightly reduces over-work incentives and stimulates full-time jobs. However, the 2005 reform increases over-work incentives to the detriment of full-time jobs. Finally, the 2007 reform acts in the same direction of the 2003 one, increasing the incentive to work full-time and reducing over-work slightly.

Similarly to Fig. 2, Table 6 contains the differences in the labour supply distributions by classes of weekly hours worked for the sub-samples of women with and without dependent children.

Tab. 6 – Changes in the distribution of women by classes of weekly hours worked.

Hours	<i>Couples without dependent children</i>			<i>Couples with dependent children</i>		
	var 02-03	var 03-05	var 05-07	var 02-03	var 03-05	var 05-07
0	-0.91	-0.10	0.29	-0.87	-0.43	0.6
10	-0.02	0.04	-0.04	-0.02	0.06	-0.05
20	0.12	0.05	-0.24	0.07	0.24	-0.5
30	0.17	0.00	-0.01	0.16	0.07	-0.08
40	0.63	0.01	-0.01	0.66	0.06	0.03

Source: our computations based on SHIW data

Interestingly, the variation in the labour supply distributions across hours points is significantly different in the two sub-samples, in particular for the

last reform. Indeed, comparing the variations from 2005 to 2007 in the two sub-samples we observe very different magnitudes, in particular for the extensive margin (.3 versus .6) and part-time alternatives (-.24 versus -.50). Hence, we could conclude that the 2007 reform has had a negative impact on participation incentives and on part-time jobs in particular for women with young children. A possible explanation could be that the income effect produced by the increase in child benefits and family-based tax credits has been stronger than the substitution effects determined by changes in tax brackets and rates.

4.5. Labour supply and income distribution

In this section we perform a distributive analysis of the effects of the reforms allowing for changes in labour supply behavior. This kind of analysis is complicated by the probabilistic nature of the labour supply model. In other words, the couples that in our dataset are allowed to change their labour supply have a positive probability of choosing any of the labour supply categories. Hence, if we categorize K possible alternatives of worked hours and there are N observations, we have K^N possible income distributions and hence K^N possible measures of the selected inequality index. In theory, the best choice would be to consider all these possible distributions and compute a particular inequality measure K^N times. Then, the correct statistic would be a weighted average of all these inequality indexes with weight equal to the probabilities of each income distribution. Of course, this approach is not practicable even with very few hour categories and few observations in the sample. Different approaches have been proposed in the literature to solve this computational problem¹⁷. Here we adopt the pseudo-distribution technique proposed by Creedy et al. (2003). In practice, consider a sample of N couples allowed to have K possible labour supply alternatives. Then, we create a nk income vector with the nk^{th} row representing the income that the n^{th} couple would have if she chose the k^{th} alternative. Each unit is weighted by the probability of observing that particular labour supply choice to create the pseudo-distribution. Creedy et al. (2003) show that standard inequality indexes computed using this pseudo-distribution converge to the real values quicker than other methods, in particular when the number of observation increases¹⁸. In our model there are households of singles and particular households of couples that have a fixed labour supply. In these cases, the probability attached to these records is set equal to 1. Any possible

¹⁷ See Creedy et al. (2003) for a review.

¹⁸ Convergence gets very fast when there are more than 50 observations.

distributive analysis allowing for labour supply behavior is implemented in this paper using this pseudo-income distribution. Figure 3 shows the absolute variations in the labour supply distribution from one reform to the other along the various deciles of gross equivalent income and for each category of worked hours¹⁹. For example, the dotted line in the top-left graph shows the absolute variation in the participation rates of married women between the 2003 reform and the baseline year for each decile of equivalent income. As this line shows, married women in the first decile are those that increase participation the least with respect to the participation rate of the 2002 distribution (0.8% more). Deciles from the fourth through the seventh one increase the participation rate the most (about 1.5% more). The continuous line in the same graph shows the variations in each decile between the participation rates implied in the 2005 and in the 2007 reform, while the remaining line contains the variations between the participation rates of 2003 and 2005. We present four graphs constructed in this way, three for women in couples and the last one for men in couples. Each graph focuses on a particular hour category. For women in couples we show results for participation (zero hours of work), part-time jobs (from 10 to 20 hours per week) and full-time jobs (from 30 to 40 hours per week) while for men in couple we present only the variations in the participation rates. Focusing on the extensive margin for women in couples, we can see that the 2003 and 2005 reforms have increased women participation, in particular for the middle class. The 2005 reform has had negative effect on work incentives for women in couples in the ninth decile if compared with the 2003 reform. The 2007 reform has had a negative impact on female participation, in particular for the third and fourth deciles, perhaps due to the income effect of child benefits. This latter reform has had better incentives with respect to the 2005 reform for the top two deciles.

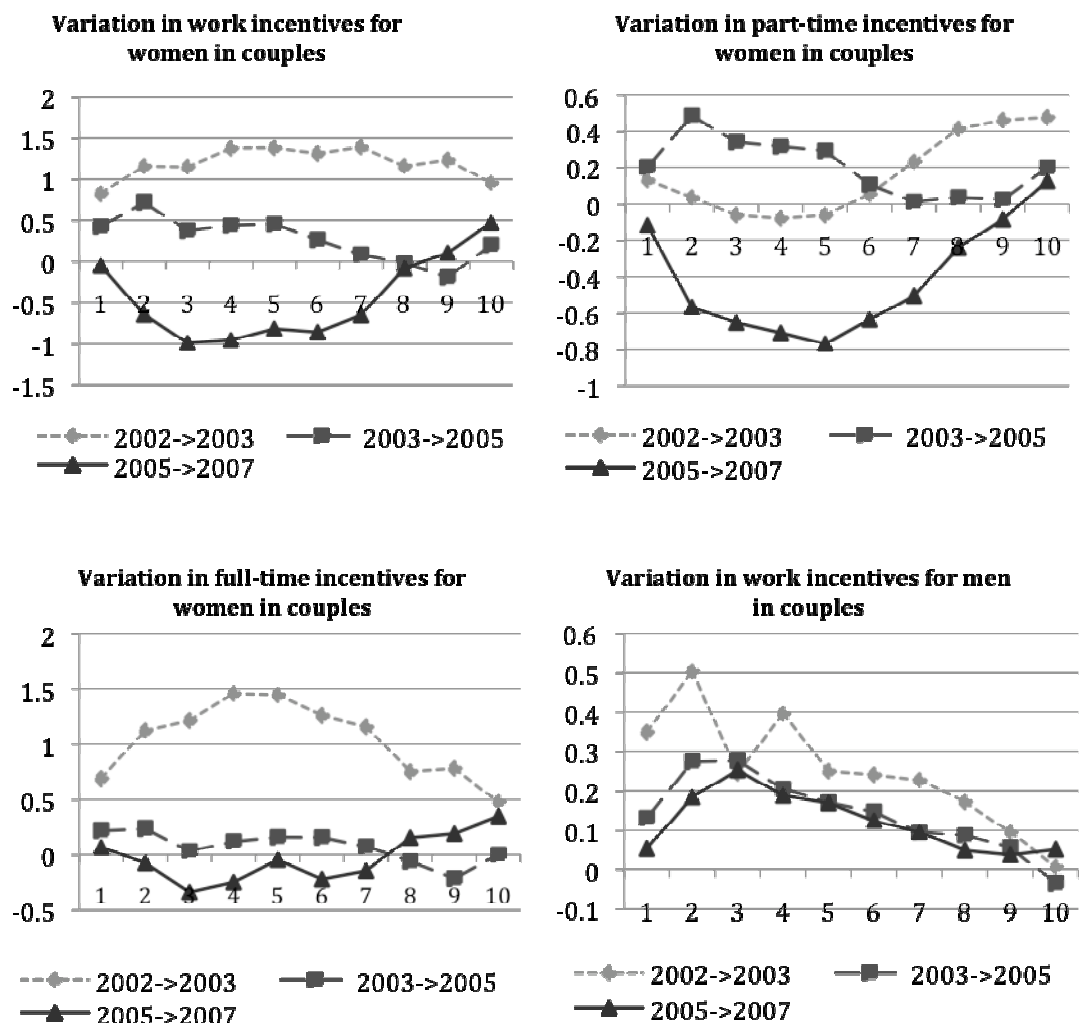
Turning to the intensive margin, the 2003 reform has strongly raised part-time jobs in the top deciles, while it has had a low negative effect for the middle deciles. The 2005 reform has had exactly the opposite pattern with respect to the 2003 one. Indeed, this reform has increased part-time jobs for the middle class with almost no impact in the highest deciles but the very last one. The 2007 reform has had a completely different impact with respect to the 2005 reform. In particular, it has reduced part-time work incentives for almost all the deciles with the exception of the very last one. The highest reduction is registered for the third, fourth and fifth deciles. Full-time incentives for

¹⁹ Deciles are computed using the pseudo-distribution methods either. This means that (equivalent) gross incomes are obtained for each alternative available to each couple and the vector so computed is weighted by the probability of choosing each alternative.

women in couples (third graph) have increased after the 2003 and 2005 reforms. Again, this is true in particular for the middle deciles. It is worth to notice that the 2005 reform has not had significant effects in the top deciles and had a negative impact for the ninth one if compared with the 2003 distribution. With respect to the 2005 reform, the 2007 one has had a slightly negative impact on female full-time incentives till the seventh decile.

For men in couples (fourth graph), the analysis of the extensive margin shows that work incentives are positive for all the reforms in almost all the deciles even though the magnitudes of these incentives are smaller compared with those of women. As for women, the highest changes are registered for the middle-low income classes. Interestingly, the 2005 reform reduces men participation in the top decile with respect to the 2003 reform.

Figure 3 - Changes in the distribution of workers by deciles of family income and types of work effort



Source: own computations based on SHIW data.

We now turn to synthetic measures of income inequality to assess the overall distributive effect of each reform. The next table shows the static Gini indexes of the whole income distribution, and the percentage changes in the Gini with respect to the previous year, computed both with and without the consideration of labor supply changes.

Table 7. Gini index of household disposable income before and after the reforms.

Year	2002	2004	2006	2008
Static Gini	0.3464	0.3447	0.3462	0.3432
% Variation:				
Static Gini		-0.51%	0.44%	-0.86%
Gini with labour supply effects		-0.68%	0.32%	-0.91%

Source: our computations based on SHIW

The 2003 reform reduces inequality even more when labour supply is accounted for. The percentage increment of the Gini index in 2005 is smaller with respect to the static case while the 2007 reform produces a percentage reduction in inequality substantially similar to that of the static case. The principal reason of these patterns has to be found in the labour supply dynamics determined by each reform. The 2003 reform produces greater incentives for participation and full-time jobs in the low and middle deciles. This reinforces the reduction in inequality. After the 2005 module, we observe more increments in both participation and part-time jobs for the middle deciles; this contrasts with the rise in the Gini index due to the lower redistribution properties of the income tax. Finally, the 2007 reform slightly reduces participation and part-time incentives for the middle deciles. However, the behavioral Gini index is marginally lower when behavior is accounted for. A possible explanation could be found both in the reduction of part-time jobs and in the lower participation rate of women in couples. This could imply an increased homogeneity in the middle part of the income distribution that is captured by the Gini index. The combination of income effects, homogeneity in the central section of the income distribution and pure redistributive effects explain why the static Gini index is not significantly different from the behavioral one for this reform.

Conclusions

The simulation of distributive and efficiency effects of “real” reforms, when compared with the results that could be obtained working on hypothetical systemic reforms, inevitably tends to produce small changes, in particular

when revenue loss is not particularly strong. In order to make them politically acceptable, periodic adjustments to the real tax-benefit system are designed also so as to reduce the possibility that many households may lose from them. Our results actually show small changes both in the inequality measure and in labour supply, but can signal important aspects of the reforms that have been already implemented, and that have, for the simple reason of having actually taken place, a special importance in themselves. More than on the magnitude of the behavioural changes, attention should focus on the sign of their direction.

The two centre-right modules had a total cost of about 13 billion euros, with very small distributive impacts, while the subsequent reform by the centre-left government produced a greater amount of redistribution, since it actually increased the tax burden for high incomes, with no revenue loss. From a distributive point of view, therefore, the difference between the two approaches is clear, although in all cases the changes in the Gini index have been quite modest.

The adjustment in the tax structure with the most significant consequences in terms of labour supply incentives in the extension of the no-tax area in 2003. This reform produced an increase in female labour supply for low and middle deciles. As a consequence, the behavioural reactions to this reform increased real incomes at the bottom of the distribution, therefore further reducing the Gini index. This effect could not be observed using a static tax-benefit model (see fig. 1, where the effect on the first decile of the 2003 reform is negligible). The 2003 module, therefore, produced both a reduction in inequality and an increase in labour supply. In this case, we do not observe a trade-off, but complementarity, between equity and efficiency.

The 2005 module, the most apparent step towards the flat rate model, increased inequality but had a (smaller) additional positive impact on labour supply, that slightly reduced the tendency for inequality to rise. Interestingly, the behavioral contribution that in part counterbalanced the rise in inequality comes from the lower deciles since the behavioral impact of this reform in the top deciles is absolutely negligible. Indeed, husbands in the top decile reduced their labour supply while their wives slightly increased participation. The overall effect is almost zero. However, in the middle decile we observe increments in participation for both wives and husbands.

The 2007 reform, finally, has had a clear equity effect, further reducing inequality, but with a reduction in efficiency, particularly among low-income women. This could derive from the expansion of cash transfers, that are decreasing with family income and therefore produce both an income and a substitution effect on the choice between leisure and consumption, in

particular for women in couples with children. The 2007 reform actually presents the traditional trade-off between efficiency and equality since it concentrates more public funds towards low and middle-income households, that have a relatively elastic labour supply. However, it is more and more difficult for reforms that come later to further improve on both the distributional and incentive effects produced by previous modifications of the tax-benefit system, in particular when the various reforms attempt to share the same broad aims, e.g. reducing inequality and/or increasing participation. Actually, the 2007 reform preserves most of the improvements contained in the past reform as the 2005 reform did with respect to the previous one. Hence, if we compare the last situation with that of the baseline year we could see that several steps forward have been done. Overall work incentives have improved for both women and men in couples and the inequality determined by the personal income tax is slightly lower than at the beginning of the decade. The broad lesson that the experience of these three reforms leaves is that it is possible to adjust the structure of the Italian tax-benefit system so as to improve both equity and efficiency. If we want to make further steps in this direction, it would be advisable to reduce tax rates on low incomes, while child benefits should not be too rapidly decreasing with the level of family income.

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Appendix.

The table shows the structural model estimates for Italian couples. The interested reader can find an overview of the STATA routine and a detailed explanation of the model in Pacifico (2009).

Table A1. Utility parameters for Italian couples

		Coef.	Coef./St.Err
α_1 :	Constant	-0.084	-7.480
α_2 :	Constant	-0.175	-3.330
α_3 :	Constant	-0.384	-25.380
α_4 :	Constant	0.559	3.030
α_5 :	Constant	-0.160	-9.100
α_6 :	Constant	0.033	1.720
β_1 :	Constant	2.571	12.610
	Wife's age [†]	-0.039	-0.450
	Husband's age [†]	0.131	2.300
	Southern Italy [§]	0.220	1.910
	Wife's education (high) [§]	-0.247	-2.500
	Husband's education (high) [§]	-0.016	-0.340
	Number of children	-0.087	-1.160
	Youngest child 0-6 [§]	-0.030	-0.190
	σ_1	0.157	2.432
β_2 :	Constant	2.112	6.430
	Wife's age [†]	0.713	3.610
	Wife's age squared [†]	-0.092	-4.060
	Southern Italy [§]	-0.189	-2.030
	Wife's education (high) [§]	0.027	0.340
	Number of children	-0.152	-2.650
	Youngest child 0-6 [§]	-0.076	-2.547
	σ_2	0.043	0.748
β_3 :	Constant	1.386	13.260
	Husband's age [†]	0.544	2.200
	Husband's age squared [†]	-0.079	-2.800
	Southern Italy [§]	-0.248	-3.990
	Husband's education (high) [§]	0.011	0.210
	Number of children	0.065	1.530
	Youngest child 0-6 [§]	0.055	0.620
	σ_3	0.024	0.168
FC ₁ :	Θ_{11} (Constant)	2.667	10.680
FC ₂ :	Θ_{21} (Constant)	1.161	9.800

Log-Likelihood: -3348.3188

Observations: 2002 couples

Note: model estimated by Simulated Maximum Likelihood using Halton sequences (50 draws). Annual household income divided by 1000; Women and men's worked hours divided by 10; Random terms divided by 10; α_2 and α_3 divided by 100; α_4 divide by 1000. § denotes dummy variables and † denotes that variables are measured in terms of deviation from their means. σ coefficients are estimated standard deviations. FC₁ represent fixed costs of working. FC₂ represents additional fixed costs of working for full-time jobs.

**The recent reforms of the Italian personal income tax:
distributive and efficiency effects**

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March 2009

Abstract

The aim of this paper is the study of three reforms of the Italian personal income tax that have been implemented over the past six years. The analysis is carried out in three stages. In the first stage we study their distributive effects using a static microsimulation model. In the second stage we focus on the labour supply effects by means of a structural microeconomic model of household labour supply; finally, we analyze the distributive effects of the reforms accounting for labour supply reactions. Our findings confirm that the extension of the no-tax area had positive effects in terms of both redistribution and work incentives, while greater benefits for households with children improved income distribution but with negative effects on the labour supply of married women.

JEL: J22, H24, H31

Keywords: microsimulation, labour supply, income distribution, income tax.

Introduction

The reform of the personal income tax and more generally of the tax-benefit system has recently become a very controversial topic in Italy. In the last 15 years any new government, either from the left or from the right, has started its mandate with the intention of implementing some radical reform, but it has always ended with small adjustments with respect to the announced claims. However the tax-benefit structure has significantly changed over the last six years, possibly creating important effects in terms of redistribution and labour supply incentives.

Many studies have examined the theoretical problems inherent in the design of a consistent reform of the Italian personal income tax (for example, De Vincenti, Paladini and Pollastri, 2005). Others have focused on the distributive impacts of some of the recent reforms, considering their social welfare implications and changes in effective marginal tax rates (Baldini and Bosi 2002, Gastaldi and Liberati 2005).

The empirical papers that have considered specific cases of reform of the Italian tax-benefit system have so far made use of static microsimulation models, without consideration for possible labour supply effects, apart from calculating changes in effective marginal rates. A given modification of the structure of marginal tax rates, however, can be followed by very different efficiency consequences, depending on the magnitude of labour supply elasticities and on their distribution across the population.

Many recent papers focus on the possible equity-efficiency trade-offs implicit in any tax or benefit reform, and introduce in traditional static microsimulation models reaction functions by taxpayers and other family members. These studies have been applied to the equity and efficiency effects of the implementation, in Italy, of some basic structural reforms of the tax-benefit system, for example the switch to a negative income tax (Aaberge et al., 2000) or the introduction of a guaranteed income scheme (Berliri and Parisi, 2001; Mancini, 2008).

In this paper we use a structural microsimulation model that allows to consider both the distributive and the efficiency effects of a given reform. We focus not on hypothetical general reforms of the whole system of personal taxation, but on three adjustments of the structure of the Italian personal income tax that have actually taken place in the last few years. The results show what would have happened to income distribution and labour supply if the only change in the economic environment was represented by the modifications in the personal income tax and, in one case, in family benefits. In this sense, they do not correspond to what has actually taken place, because changes in the tax-benefit system are only one of the many factors that can influence variations in inequality and labour supply during a given period of time. These simulations capture the “pure” effects of the reforms, something that cannot be easily observed in cross-sectional data.

The model that we use integrates a detailed static tax-benefit simulator with a household labour supply model based on the Bank of Italy Survey on household income and wealth (SHIW). We study the effects of the three most recent reforms of the personal income tax on income distribution and on incentives, and show whether and in which occasions equity and efficiency moved in the same direction or followed different paths.

The next section describes the evolution of the Italian personal income tax over the past six years. In section 3 we introduce the empirical framework for our analysis. Section 4 contains the results and section 5 concludes.

2. The recent evolution of the Italian personal income tax

We simulate the effects of three subsequent reforms of the personal income tax (*Irpef*, i.e. *Imposta sul reddito delle persone fisiche*) that have taken place in Italy over the last few years. These changes were inspired by very different intellectual benchmarks, but none of them has come close to a complete and consistent reform. They are mainly partial attempts that have left the most important component of the Italian tax system in what is now an uncertain and unstable equilibrium.

The starting point of our analysis is the structure that *Irpef* had before all the reforms we simulate. Since the first of them come into force in the fiscal year 2003, we must adopt as a base case for our simulations the characteristics of *Irpef* in 2002. Here we sketch the main traits of the personal income tax before and after each of the reforms.

Irpef 2002. Individual taxable income is subject to five brackets, with the lowest rate at 18% and the highest at 45% (starting from 70000 euros).

Progressivity is realised also through a series of tax credits, all piecewise decreasing with respect to income, so as to further strengthen the rise in the effective average tax rate: for dependent spouse, for children (starting at about 500 euros for each child for middle-low income levels), for dependent workers and pensioners (decreasing with respect to income from 1150 to 52 euros), and for the self-employed (from 573 to 52 euros). The presence of these tax credits produces a minimum level of income that is exempt from the tax. This no-tax area corresponds to 6200 euros for dependent workers and pensioners, and to 3100 euros for independent workers.

Irpef 2003. The first of the two reforms operated by the centre-right government became effective in the fiscal year 2003. The number of rates was maintained at 5, but with changes in the first three rates. This reform had effects for low and middle incomes, and replaced the tax credits for earned incomes and pensions with deductions. The tax credits for dependent family members were maintained. The new deductions had therefore the main aim of guaranteeing a no-tax area, whose levels were also raised from 6200 to 7500 euros for dependent workers and pensioners, and from 3100 to 4500 euros for the self-employed. To further enhance the progressivity effect, the tax deductions were defined as a linearly inverse function of income, falling to zero for incomes greater than 33500 euros for dependent workers, 30500 for the self-employed and 33000 for pensioners. The reduction in tax revenue from these changes has been estimated in 6 billions euros.

Irpef 2005. The second module of reform accomplished by the centre-right government replaced also the family-related tax credits with deductions (linearly decreasing with income like the no-tax area deductions) and reduced the number of brackets from 5 to 4. The highest tax rate has been cut by two percentage points, from 45% to 43%. This top rate applies to the income share exceeding 100.000 euros. Under Irpef 2003, the 45% rate applied instead to incomes starting from 70000 euros. While the 2003 reform benefited middle and low incomes, this reform provided tax rebates for the highest deciles of the income distribution. The reduction of the top rate and its application to a narrower bracket were steps that the government took along a path that had, as a final objective, a structure of the personal income tax based on only two brackets: the first one up to 100000 euros, taxed at 23%, and the rest subject to the 33% rate. Progressivity would have been further enhanced by a deduction decreasing with income. The intellectual reference point of the whole reform action of the centre-right government in this context is clearly the flat-rate tax, with a limited degree of progressivity and the application of the same legal tax rate (23%) to the great majority of taxpayers. The cost of this second piece

of reform has been broadly similar to that of the first one, around 6 billion euros.

Irpef 2007. The flat-tax plan could not be completed because of fears of excessive revenue losses, and above all because the objective of a two-rate scheme was not shared by the centre-left government that took power in 2006. In the budget law for 2007 the new coalition introduced a deep change in the structure of the personal income tax, which is still basically effective. The top rate has been kept at 43%, but now applies to incomes above 75000 euros. The main deductions have been replaced by tax credits, all linearly decreasing with respect to income. Formal tax rates have been reduced for middle-low incomes, but raised for those earning more than 40000 euros (or more, if the taxpayer has dependent family members). Unlike the two previous reforms, this one accounted for a deep restructuring in cash transfers for households with children (*Assegno al nucleo familiare*). Before the reform, this benefit decreased in a piecewise way with respect to family income, therefore producing high marginal effective tax rates and risks of poverty traps. Now its amounts have been increased, and its structure is linearly decreasing with respect to family income. According to official estimates, this complex reform has had a very limited cost: the reduction of the tax burden and the rise in family benefits for middle and low incomes have been financed by taxpayers with higher incomes or without children. The intellectual paradigm of the centre-left coalition was completely different from that of the preceding government: the Prodi government tried to move the first steps towards a negative income tax scheme, integrating together in a consistent scheme the personal income tax and cash transfers to families with children, so as to guarantee an income support to taxpayers with family burdens and low incomes. This objective, however, had a life even shorter than the flat-rate tax scheme, given the rapid fall of the government and its replacement with a new centre-right coalition, in power since May 2008. The new government has not introduced any relevant modification in the personal income tax so far.

3. Empirical Methodology.

In order to evaluate the distributive effects and the work incentives produced by the last three reforms of the Italian personal income tax, we make use of a behavioral microsimulation model based on the Survey on Household Income and Wealth conducted every two years by the Bank of Italy. The model has two main parts: a static detailed simulator of the Italian tax-benefit system for

each reform and a microeconomic labour supply model based on utility maximizing agents. The static model recovers gross earnings from net earnings provided in the survey. In this way, it is possible to compute net household income for each possible tax-scenario so as to analyze the changes in the income distribution from one reform to the other. However, any conclusion based on the static distributional analysis is partial because it does not take into account efficiency considerations. In order to consider this latter aspect, we make use of the second part of our model that allows us to compute labour supply changes from one reform to the other. In this paper we allow for flexible labour supply only for couples and consider singles as being fixed on the observed labour supply behavior. In particular, we focus on married/*de facto* couples and use a unitary model of labor supply¹. Given the unitary framework, we consider the couple as the decision maker. This means that the two spouses choose simultaneously a combination of hours of work for each of them in order to maximize a joint utility function defined over the net household income and the hours of work of both partners. The labour supply model we develop is based on a discrete choice framework. In other words, we treat the number of average weekly worked hours contained in our dataset as a category variable and consider the couple as a utility maximizing agent who chooses the combination of both worked hours and income that gives the highest utility. As it will be clarified later, the main advantage of the discrete choice framework is its versatility in dealing with problems like joint labour supply and non-convex budget sets. Indeed, continuous structural models of labour supply have the main drawback in the burden of computing net household incomes for each possible hour of work. This is necessary to recover the budget constraint used in the estimation process. However, possible non-convexities in the budget set require sophisticated algorithms to create piecewise linear budget constraints and to maximize between each couple of kinks in the piecewise linear budget constraint². The discrete approach avoids all these procedures because net incomes for each possible alternative of worked hours enter in the utility function directly. Hence, the only computational burden lies in recovering net household incomes for the (few) categories of possible hours of work. Moreover, the discrete approach allows for important extensions that are difficult to incorporate in the standard continuous model. Indeed, fixed costs of working, child-care costs, unobserved heterogeneity and joint labour

¹ Collective models of labor supply are much more appealing but the literature has not developed a well-accepted framework to work with. In particular, the model has to be simplified in other parts and discountable assumptions are needed for the identification of the sharing rule. See Chiappori (2005).

² Creedy and Duncan (2005) present one of these algorithms.

supply are all aspects that can be easily fitted in the discrete framework³. To compute net households incomes for each alternative we use our static microsimulation model. This model allows us to recover the gross hourly wages for those who are employed. Gross hourly wages correspond to gross weekly earnings from employment divided by average weekly hours of work declared in the dataset. For people observed as not employed, gross hourly wages are estimated controlling for sample selection. Once gross wage rates have been recovered for all the population of interest, *potential* gross earnings from employment for each hour category are obtained by multiplying gross hourly wages by the representative hours of work in each category⁴. Finally, the static tax-benefit simulator computes tax amounts and benefit entitlements for each potential gross annual income from employment given non-labour incomes. Net household incomes are the sum over the two spouses of the gross earnings from employment, non-labour incomes, benefits and taxes. Each couple has a choice set defined over net household incomes and hours of work and choose the alternative that produces the maximum utility given the actual tax-benefit system and individual characteristics. Under the assumption that utility is not deterministic, it is then possible to recover the probability of a given choice. Formally, let $H=[h_f, h_m]$ be a vector of hours of work for both wives and husbands. Let Y_{Hj} be the net household income when the vector H_j is chosen over J alternatives and let X be a vector of individual characteristics. Then the utility for this particular choice can be defined as:

$$U_{H^j} = U(Y_{H^j}, H^j, X) + \xi_{H^j}$$

Where the last term is a choice-specific random component that could be seen as an optimization error. The net household income Y_{Hj} when the vector H_j is chosen is defined as:

$$Y_{H^j} = \bar{w}_f \cdot h_f^j + \bar{w}_m \cdot h_m^j + Nly + TB(\bar{w}_f, \bar{w}_m, H^j, Nly, X)$$

Where Nly denotes the non labour income, $TB(w_f, w_m, H^j, Nly, X)$ defines the tax-benefit system and $w_{f,m}$ denote the (fixed) gross hourly wages for female and men, respectively. It is worth to notice that $Y=Y(H)$ is highly non-linear for most of the population of interest due to the presence of the tax-benefit

³ Blundell and MaCurdy (1999) in their review of microeconomic models of labour supply conclude that the discrete approach has to be preferred to other models given its versatility in accounting for many important aspects of any labour supply decision. See Creedy and Duncan (2005) for a review of labour supply models and microsimulation.

⁴ Notice the assumption that gross hourly wages do not depend on the amount of worked hours. See Brewer et al. (2004) for this point.

function⁵. Following Keane and Moffit (1998), Blundell et al. (2001) and Brewer et al. (2004) we assume the following quadratic utility function:

$$U(Y_{H^j}, H^j, X) = \alpha_1 y_{H^j}^2 + \alpha_2 h f_j^2 + \alpha_3 h m_j^2 + \alpha_4 y_{H^j} h f_j + \alpha_5 y_{H^j} h m_j + \alpha_6 h f_j h m_j \\ + \beta_1 y_{H^j} + \beta_2 h f_j + \beta_3 h m_j$$

Individual characteristics enter in utility through the linear term coefficients. In particular, we define the coefficients of the linear terms as follows:

$$\beta_m = \sum_{i=1}^{K_m} \beta_{m,i} x_{m,i} + \mathcal{G}_m \quad m \in \{1, 2, 3\}$$

The last term is assumed to be random with a normal independent distribution.

The presence of random coefficients is important for several reasons. In particular, they relax the IIA assumption that is implicit in the choice of the Gumble distribution for the random utility. Moreover, they allow for unobserved heterogeneity in preferences in the model. Under the assumptions that the couple maximizes her utility over a discrete set of alternatives and that utility follows a type one extreme value distribution, the probability of choosing the alternative H_j is given by⁶:

$$\Pr(H = H^j | X, \nu) = \Pr[U(Y_{H^j}, H^j, X, \mathcal{G}) > U(Y_{H^s}, H^s, X, \mathcal{G}), \forall s \neq j] \\ = \frac{\exp(U(Y_{H^j}, H^j, X, \mathcal{G}))}{\sum_{k=1}^K \exp(U(Y_{H^k}, H^k, X, \mathcal{G}))}$$

Given the presence of random coefficients it is necessary to integrate out these random terms when evaluating the contribution to the likelihood for each observation:

$$L_i = \int \prod_{j=1}^K d_{ij} \left(\frac{\exp(U(Y_{H^j}, H^j, X, \mathcal{G}))}{\sum_{k=1}^K \exp(U(Y_{H^k}, H^k, X, \mathcal{G}))} \right) \phi(\mathcal{G}) d(\mathcal{G})$$

Where d_{ij} is a binary indicator that takes value one for the observed choice and zero otherwise. Given that the integral above does not have a closed form solution, we follow Train (2003) and use simulation methods to approximate it. Since wages are not observed for non-workers, it is necessary to estimate

⁵ For models with a single choice maker, it could be possible to plot the function $Y(H)$ that defines the budget constraint. This is difficult in our case since we would need a three dimensional graph. Keeping fixed the husband labour supply we found a highly non-linear and non-convex budget set for most of the population of interest.

⁶ See McFadden 1973 for the proof.

them. Following Blundell et al. (1999), the estimation of the hourly gross wage for both the spouses is carried out *before* the estimation of the structural model and it is based on the standard Heckman procedure to take into account a possible selection bias.

Predicted wages for non-workers are estimated using the linear predictions of the estimated Heckman wage equations and their unobservable components are integrated out of the likelihood function by drawing from their estimated (truncated) distribution. More details on this procedure can be found in Pacifico (2009). If we define the wage error components as ε , we can rewrite the likelihood as:

$$L_i = \int_{\varepsilon} \int_{\nu} \prod_{j=1}^K d_{ij} \left(\frac{\exp(U(Y_{H^j}, H^j, X, \mathcal{G}))}{\sum_{k=1}^K \exp(U(Y_{H^k}, H^k, X, \mathcal{G}))} \right) \phi(\mathcal{G}) d(\mathcal{G}) \phi(\varepsilon) d(\varepsilon)$$

Where the integration over the unobserved components of wages takes place only when wages are not observed for one or both the spouses.

3.1 Extensions to the basic model

The model presented below can be easily extended to take into account two important dimensions in the choice of the number of worked hours. In particular, we account for unobserved fixed costs of working and child-care demand. Fixed costs of working are important for several reasons. Firstly, they allow for specific characteristics of each hour point and secondly they change the shape of the utility function increasing the likelihood of convex preferences⁷. Fixed costs are defined as a once off cost directly subtracted from net income at any positive hours of work and are estimated jointly with the other parameters of the structural model. Following Brewer et al. (2004), we assume unobserved positive fixed costs of working only for women and we allow for different fixed costs depending on whether the wife decides to work part-time or full-time. As Brewer et al. (2004) pointed out, letting fixed costs vary with full-time or part-time work gives the model more flexibility and it may serve to relax the assumption that gross hourly wages do not vary with the number of worked hours. Formally, fixed costs are defined as follows:

⁷ There are several ways to take into account specific characteristics of each discrete point of hours. Aaberge et al. (1999) introduce a number of job offers associated with each discrete hour point while Van Soest (1995) and Mancini (2008) introduce ad-hoc dummies in the utility functions. See Heim and Meier (2004) for the relationship between fixed costs of working and convex preferences.

$$FC(hf_j, Z) = Z_1 \theta_1 \cdot 1\{hf_j > 0\} + Z_2 \theta_2 \cdot 1\{hf_j \geq 30\}$$

Where $1\{.\}$ is a binary indicator that takes value one when the argument in the bracket is true. To take into account child-care costs we adopt a different strategy. As pointed out in Del Boca and Vuri (2005), Italy has a lack of data on child-care usage and child-care costs. In order to overcome this problem, we recovered information on child-care costs from another dataset⁸. Following Blundell et al. (2001), we computed the hourly price of child-care for eight groups of households and for each group we approximated the distribution of the hourly price of child-care by a 4 point mass distribution whenever the household is observed buying formal child-care. Given that households with working mother are more likely to buy formal child-care, we take into account a possible selection bias by computing the proportion of households that use formal child-care for both working and non-working mothers. We do not consider any other possible source of selection bias which implicitly means that households that are not observed buying formal child-care would be willing to pay exactly the same amount as households observed buying formal child-care⁹. We also estimate the statistical relationship between hours of work and hours of child-care for six groups of households defined according to the number of children and their age¹⁰. With this information on child-care costs and child-care usage it is possible to approximate the weekly cost of childcare for different alternatives of working hours in the original dataset. This cost is then subtracted from the net income at any possible choice of hours and the price of child-care is then integrated out from the likelihood. Formally, we define a child-care cost function as:

$$CC(hf_j, p_c, X) = E[h_{cc} | X, hf_j] \cdot p_c$$

Where p_c is the hourly price of child-care and $E[h_{cc} | X, hf_j]$ is the expected hours of child-care for a specific group of households given the choice hf_j . In order to compute this expectation, we assume a linear relationship between hours of work and hours of child-care:

$$E[h_{cc} | X, hf_j] = \varphi_0 + \varphi_1 hf_j$$

Like fixed costs of working, child-care costs enter in the model as a once off cost directly subtracted from income at any possible choice of hours. If we define a total cost function as:

⁸ ISTAT Multiscopo (1998). See below for details.

⁹ In principle it is possible to consider this other source of selection but this would have added stronger assumptions on the distribution of child-care costs. Using the procedure outlined in the text we actually adopt a non-parametric approach for the estimation of the child-care distribution.

¹⁰ See Pacifico(2009) for details on these first stage regressions.

$$TC = CC(hf_j, p_c, X) + FC(hf_j, Z)$$

the utility function changes as follows:

$$U_{H^j} = U(Y_{H^j} - TC, H^j, X) + \xi_{H^j}$$

Finally, the likelihood for observation i considering fixed costs and child-care demands becomes:

$$L_i = \sum_{s=1}^5 \Pr(p_c^s | X) \cdot \int \prod_{\zeta} \prod_{j=1}^K d_{ij} \left(\frac{\exp(U(Y_{H^j} - TC_{H^j}, H^j, X, \vartheta))}{\sum_{k=1}^K \exp(U(Y_{H^j} - TC_{H^k}, H^j, X, \vartheta))} \right) \phi(\zeta) d(\zeta)$$

Where ζ is a vector that collects all the random terms. As explained above, the integrals are approximated using simulation methods. The interested reader can find more information on the model and an overview of the STATA routine used to estimate this likelihood function in Pacifico (2009).

4. Empirical results.

4.1. Data and estimation

Our main source of data is the Survey on Household Income and Wealth (SHIW) that is conducted by the Bank of Italy every two years. The survey collects very detailed information on income as well as social and demographic characteristics. In the present study we use the cross sectional survey for the year 2002. The dataset is representative of the whole Italian population and contains about 21,000 observations and 8,000 households. Since the model presented in the previous section is not appropriate to describe the labour supply decisions of any kind of household, we model changes in labour supply only on a selected sub-sample of the whole population. In particular, as standard in the literature on labour supply, we do not consider couples with spouses who are aged over 60 years, self-employed, involved in a full time education program or serving the Army. Couples with self-employed spouses are omitted because it is difficult to estimate their budget constraint correctly. Couples with spouses who are enrolled in full time education programs or who are aged over 60 are excluded because they might have a behavior in the labour market that is not characterized by just the traditional trade-off between leisure and income. As explained in the previous section, we make use of another dataset to recover information about child-care costs and child-care usage. The source of data is the survey "MULTISCOPO" 1998 on Households and Childhood Conditions that is conducted by the Italian national institute of statistics (ISTAT). This survey is relatively old but it is the only one that contains detailed

information on child-care expenditure, hours of child-care and hours of work. Unfortunately, the information on child-care expenditures is registered only for children aged less than six so that we are able to compute child-care costs only for those couples who have very young children. Obviously, this represents a restriction due to the data but it must be pointed out that in Italy the school for kids is the most expensive one. Indeed, children that have turned six have access to the public school that is basically free. The discrete set of hours each spouse can choose from is mainly defined according to the empirical distribution observed in SHIW 2002. According to these distributions, women in a couple are restricted to choose from the discrete set $x=\{0, 10, 20, 30, 40\}$. These points correspond to the following categories: 0-5, 6-15, 16-25, 26-36, >36. For married men we selected the discrete set $y=\{0, 40, 50\}$ that corresponds to the categories 0-10, 11-42, >42. Since the labour supply for married women and men is estimated jointly, each couple has a choice set defined by the Cartesian product yx that leads to 15 possible combinations of discrete points. Table 1 summarizes the observed distribution of worked weekly hours according to these categories. The static tax-benefit simulator computes total benefit entitlements and total tax amounts for each of these 15 combinations of discrete points given gross hourly wages. The net incomes are then computed by subtracting taxes and adding benefits plus non-taxable incomes to the gross labour income. This amount is then added up over the two spouses to get the total net household incomes for each alternative.

Table 1. Observed distribution of workers by weekly hours .

	0 (6.36%)	40 (72.22%)	50 (21.42%)	Total
hours male/				
hours female				
0	71.65	48.58	50.47	50.45
10	1.57	2.08	0.93	1.80
20	3.94	10.88	12.38	10.76
30	3.15	6.44	6.07	6.16
40	19.69	32.02	30.14	30.83
Total	100	100	100	100

Source: our computations on SHIW data.

Note: sub-sample with flexible labour supply.

4.2. First-round distributive effects.

Fig. 1a shows the effects of the various reforms on average equivalent disposable incomes of households, ordered by deciles of gross equivalent income in 2002, i.e. equivalent income before the application of the personal income tax and of family benefits¹¹. In the figure we present changes in disposable equivalent incomes, due simply to the modification of fiscal parameters (in all reforms) and family benefits (only in 2007), without any behavioural reaction. The first reform, from 2002 to 2003, had a modest redistributive effect, with the third decile benefiting from the highest relative change in disposable income. The gain then declines smoothly for the richest deciles. It is very low also for the poorest 10% of households because many of them were already exempt from the personal income tax. The second reform, from 2003 to 2005, has completely different distributive effects, with percentage changes in income always increasing from the poorest to the richest deciles. Finally, the adjustments introduced by the centre-left coalition in 2007 resemble those of the first centre-right module: the highest gains are achieved by the third and fourth decile. Unlike that reform, however, this episode resulted in a reduction in disposable income for the richest households.

Focusing only on households with at least one child under 14 (Fig. 1b), the total effect of the three reforms is more generous with them than with the whole population mainly because of the 2007 reform, which turns out to have particularly benefited households with children and below median income. The income gains of the poorest households with children, however, have been very modest.

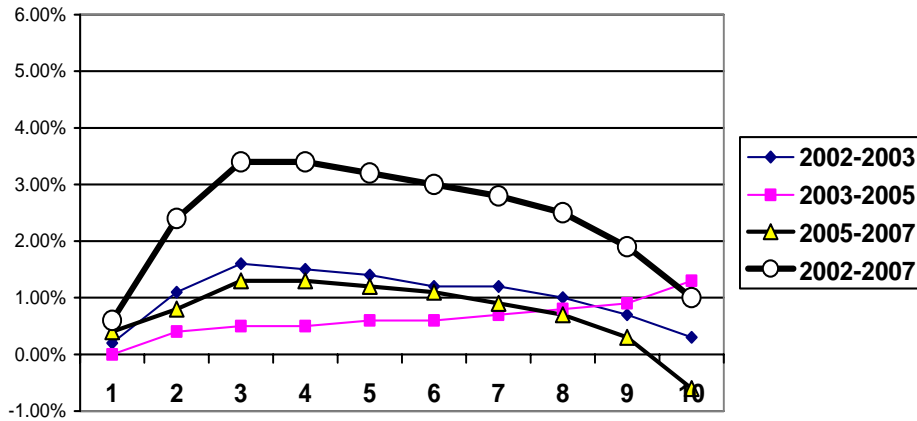
Finally, Fig. 1c presents income changes only for households for whom we have simulated the possibility of changing labour supply¹². The distributive effects are very similar to those of the other two figures.

Figure 1 - Percentage changes in equivalent disposable income

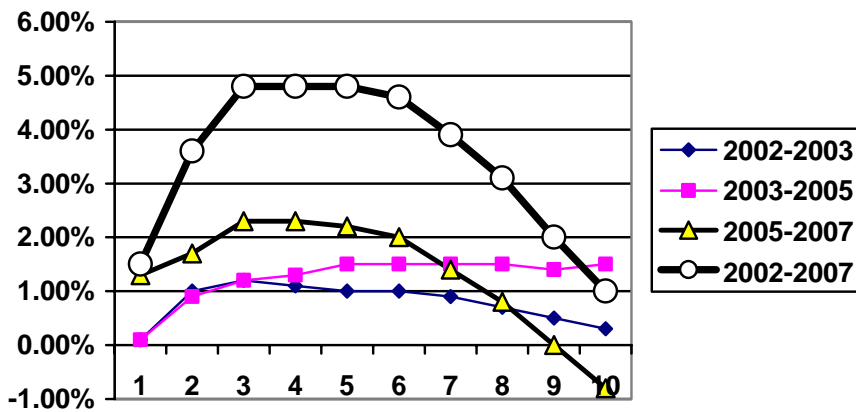
1a) entire population

¹¹ Equivalent household income is household disposable income divided by the square root of the number of members.

¹² As it has been clarified in section 4.1, the sub-sample with flexible labour supply corresponds to households of couples with both spouses in working age. From this sample are excluded households with self-employed spouses.



1b) households with at least one child under 14



1c) households with simulated labour supply effects

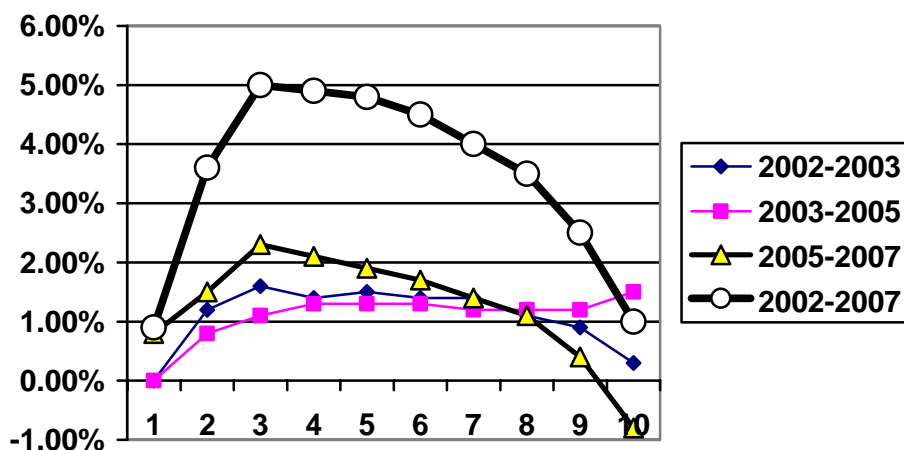


Table 2 shows the Gini indexes for disposable equivalent income, before and after each simulated reform, for the whole sample representative of the Italian population. The first reform module of 2003 reduced, as expected, inequality,

but has been followed by another reform that went in the opposite direction. The centre-left reform, on the other hand, has had a more significant effect in reducing inequality. At the end of the period, inequality has been very slightly reduced: the percentage reduction from Gini 2002 to Gini 2007 is -0.94%.

Table 2. Gini Index for the whole sample and percentage change with respect to the previous year.

	Gini index	% change
2002	0.34644	
2003	0.34467	-0.51%
2005	0.34617	0.44%
2007	0.34318	-0.86%

Source: our computations on SHIW

4.3. Accounting for labour supply changes.

This section and the next one consider the changes in labour supply that, according to the behavioural microsimulation model, have been induced by each reform of the personal income tax. In this paper we present the estimates of the structural microeconomic model only and omit other first stage regressions¹³. Table A1 in the appendix shows the estimates of the utility parameters. As it can be seen, most of the signs are in line with expectations one could derive from standard economic theory. In particular, preferences for work increase with age at a decreasing rate for both wives and husbands. Moreover, these preferences are lower for both spouses when the couple lives in Southern Italy. Education increases preferences for work. Children have a non-clear effect on labour supply behavior. In particular, women have decreasing preferences for work when the number of young children increases. The opposite is true for the man partner. On average, preferences for joint consumption decrease with the number of young children. Finally, our check for quasi-concavity shows that the estimated preferences are convex for 99% of our sample¹⁴.

In order to summarize the characteristics of labour supply behavior simulated by the model, Table 4 presents average own-wage and cross-wage elasticities

¹³The interested reader can find the full set of estimates in Pacifico (2009).

¹⁴ The check for quasi-concavity of the utility function is done by computing the conditions illustrated in Van Soest (1995).

for both women and men by deciles of gross equivalent household income. These elasticities are computed as the percentage variation in the labour supply of both wife and husband derived from a 1% increment of her/his hourly gross wage¹⁵. Low-income households have higher elasticities and, on average, own-wage elasticities are much higher for women. The labour supply of men does not actually depend on the wage level of wives. Interestingly, there is a clear interchangeability in spouse's labour supply, in particular for the highest deciles.

Table 3. Elasticities of Labour supply for both women and men in a couple.

Deciles of gross equivalent income	<i>wife's wage +1%</i>		<i>husband's wage +1%</i>	
	own elast	partner	own elast	partner
1	1.10	0.00	0.26	-0.19
2	1.02	-0.01	0.19	-0.12
3	1.00	0.00	0.18	-0.04
4	1.00	0.00	0.16	-0.06
5	0.97	0.00	0.16	-0.06
6	0.90	-0.01	0.13	-0.08
7	0.84	-0.01	0.13	-0.08
8	0.67	-0.01	0.12	-0.11
9	0.66	-0.01	0.11	-0.15
10	0.49	-0.01	0.02	-0.28
total:	0.87	-0.01	0.15	-0.12

Source: our computation based on SHIW data.

Some disaggregations of such elasticities for women by individual characteristics (Tab. 4) show that labour supply responses are higher for women living in Southern Italy and with low education. Women own-wage elasticities are relatively small for those living in couples with a child aged less than six.

Table 5. Elasticities of women labour supply by household characteristics.

Southern Italy	1.240
----------------	-------

¹⁵ It is worth to notice that these elasticities have to be interpreted carefully and cannot be easily compared with other studies. They just summarize the average behavior implied in our model, *given* our definition of the discrete choice set and our specification of the tax-benefit system. Indeed, such elasticities could change if we had specified a different tax-benefit system, say less complete, and/or if we had chosen different hours brackets when we discretized the worked hours variable. See Creedy and Kalb (2005) for a discussion of such elasticities in this context.

Middle/Northern Italy	0.788
Wife with high education	0.622
Wife with low education	1.113
Wife without children	0.896
Wife with children >=6	0.885
Wife with youngest child <6	0.731

Source: own computations based on SHIW 2002.

Note: High education corresponds to secondary (5 years) or tertiary education.

4.4. Simulation results

Using our behavioral model, we can study which changes in labour supply can be associated to the PIT reforms under analysis. Table 5 summarizes the (expected) distribution of women and men by classes of worked hours under the 2002 legislation and after each reform.

Table 5. Distribution of women and men by groups of weekly hours of work

Women				
	2002%	2003%	2005%	2007%
0 hours	0.506	0.497	0.494	0.499
10 hours	0.015	0.015	0.015	0.015
20 hours	0.107	0.108	0.109	0.105
30 hours	0.067	0.068	0.069	0.068
40 hours	0.306	0.312	0.313	0.313
Total	1	1	1	1
Men				
	2002%	2003%	2005%	2007%
0 hours	0.064	0.061	0.06	0.058
40 hours	0.722	0.726	0.723	0.725
50 hours	0.214	0.213	0.217	0.217
Total	1	1	1	1

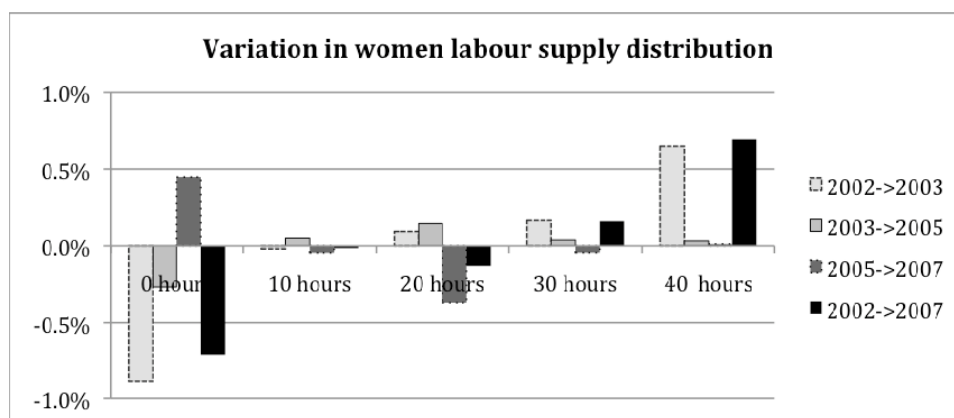
Source: our computations based on SHIW

The changes induced by the modifications of PIT and child benefits are quite small. Focusing on the extensive margin, female labour supply increases after the first two reforms, but decreases slightly in 2007. Grossing up our results, we can estimate an increment of about 47,900 workers among women in couples for the 2003 reform. The 2005 module implies another increment of about 14,500 units, while the last reform reduced female participation by

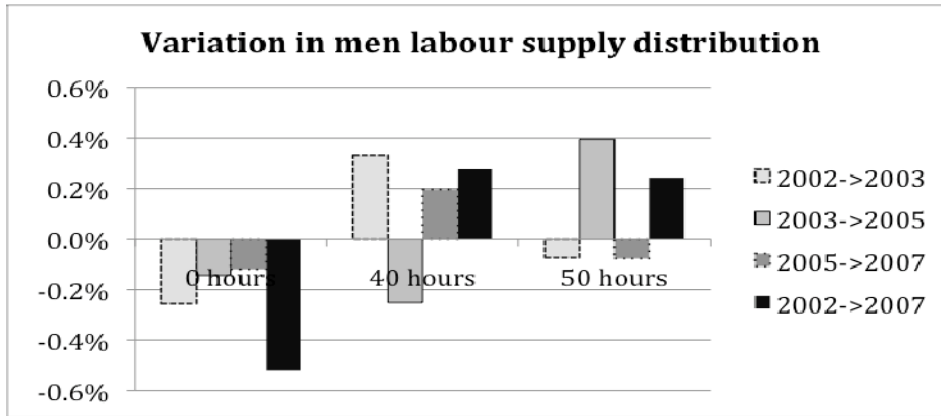
almost 24,000 units. During the whole period 2002-2007, women labour supply is then expected to have risen by about 38,400 units¹⁶. For men in couples the corresponding changes are smaller. All the three reforms increase men participation rates, in particular the last two. Grossed-up effects for men correspond to +13,000 between 2002 and 2003, +7,700 between 2003 and 2005, +6,000 between 2005 and 2007. At the end of the overall period, men’s labour supply is expected to have increased by about 26,700 units due to tax and benefit reforms. If we now focus on the intensive margin, the 2003 reform increases in particular full-time jobs for women in couples. The 2005 module has effects on the number of part-time jobs instead. Finally, the 2007 reform reduces part-time jobs and does not change incentives for full-time work. For men the pattern is quite different. The only reform that actually produces changes at the intensive margin is the 2005 one. In 2007 there are no significant effects with respect to the preceding reform.

Fig. 2 shows each variation in both women and men labour supply with respect to the previous reform. The number shown are simply the differences between the percentages contained in table 5. The graphs provide also the overall variations with respect to the baseline year.

Figure 2 – Changes in the distribution of workers by classes of weekly hours.



¹⁶ It is worth to stress again that our results account for just a pure labour supply effect and cannot be compared with “real” employment data.



From the first graph a complementarity between the 2003 and 2005 reforms emerges. Both these reforms increase participation, but the second module of the centre-right coalition increases part-time jobs while the first one provides incentives for full-time jobs for women. Instead, the 2007 reform reduces participation and part-time work and does not have significant effects on full time work with respect to the 2005 reform. The second of the two graphs presents the same computations for men. As it can be seen, the changes are smaller than those for women. In general, all the reforms increase men participation with respect to the baseline year. Analyzing the intensive margin, we observe opposite patterns in 2003 and 2005. In particular, the 2003 reform slightly reduces over-work incentives and stimulates full-time jobs. However, the 2005 reform increases over-work incentives to the detriment of full-time jobs. Finally, the 2007 reform acts in the same direction of the 2003 one, increasing the incentive to work full-time and reducing over-work slightly.

Similarly to Fig. 2, Table 6 contains the differences in the labour supply distributions by classes of weekly hours worked for the sub-samples of women with and without dependent children.

Tab. 6 – Changes in the distribution of women by classes of weekly hours worked.

Hours	<i>Couples without dependent children</i>			<i>Couples with dependent children</i>		
	var 02-03	var 03-05	var 05-07	var 02-03	var 03-05	var 05-07
0	-0.91	-0.10	0.29	-0.87	-0.43	0.6
10	-0.02	0.04	-0.04	-0.02	0.06	-0.05
20	0.12	0.05	-0.24	0.07	0.24	-0.5
30	0.17	0.00	-0.01	0.16	0.07	-0.08
40	0.63	0.01	-0.01	0.66	0.06	0.03

Source: our computations based on SHIW data

Interestingly, the variation in the labour supply distributions across hours points is significantly different in the two sub-samples, in particular for the

last reform. Indeed, comparing the variations from 2005 to 2007 in the two sub-samples we observe very different magnitudes, in particular for the extensive margin (.3 versus .6) and part-time alternatives (-.24 versus -.50). Hence, we could conclude that the 2007 reform has had a negative impact on participation incentives and on part-time jobs in particular for women with young children. A possible explanation could be that the income effect produced by the increase in child benefits and family-based tax credits has been stronger than the substitution effects determined by changes in tax brackets and rates.

4.5. Labour supply and income distribution

In this section we perform a distributive analysis of the effects of the reforms allowing for changes in labour supply behavior. This kind of analysis is complicated by the probabilistic nature of the labour supply model. In other words, the couples that in our dataset are allowed to change their labour supply have a positive probability of choosing any of the labour supply categories. Hence, if we categorize K possible alternatives of worked hours and there are N observations, we have K^N possible income distributions and hence K^N possible measures of the selected inequality index. In theory, the best choice would be to consider all these possible distributions and compute a particular inequality measure K^N times. Then, the correct statistic would be a weighted average of all these inequality indexes with weight equal to the probabilities of each income distribution. Of course, this approach is not practicable even with very few hour categories and few observations in the sample. Different approaches have been proposed in the literature to solve this computational problem¹⁷. Here we adopt the pseudo-distribution technique proposed by Creedy et al. (2003). In practice, consider a sample of N couples allowed to have K possible labour supply alternatives. Then, we create a nk income vector with the nk^{th} row representing the income that the n^{th} couple would have if she chose the k^{th} alternative. Each unit is weighted by the probability of observing that particular labour supply choice to create the pseudo-distribution. Creedy et al. (2003) show that standard inequality indexes computed using this pseudo-distribution converge to the real values quicker than other methods, in particular when the number of observation increases¹⁸. In our model there are households of singles and particular households of couples that have a fixed labour supply. In these cases, the probability attached to these records is set equal to 1. Any possible

¹⁷ See Creedy et al. (2003) for a review.

¹⁸ Convergence gets very fast when there are more than 50 observations.

distributive analysis allowing for labour supply behavior is implemented in this paper using this pseudo-income distribution. Figure 3 shows the absolute variations in the labour supply distribution from one reform to the other along the various deciles of gross equivalent income and for each category of worked hours¹⁹. For example, the dotted line in the top-left graph shows the absolute variation in the participation rates of married women between the 2003 reform and the baseline year for each decile of equivalent income. As this line shows, married women in the first decile are those that increase participation the least with respect to the participation rate of the 2002 distribution (0.8% more). Deciles from the fourth through the seventh one increase the participation rate the most (about 1.5% more). The continuous line in the same graph shows the variations in each decile between the participation rates implied in the 2005 and in the 2007 reform, while the remaining line contains the variations between the participation rates of 2003 and 2005. We present four graphs constructed in this way, three for women in couples and the last one for men in couples. Each graph focuses on a particular hour category. For women in couples we show results for participation (zero hours of work), part-time jobs (from 10 to 20 hours per week) and full-time jobs (from 30 to 40 hours per week) while for men in couple we present only the variations in the participation rates. Focusing on the extensive margin for women in couples, we can see that the 2003 and 2005 reforms have increased women participation, in particular for the middle class. The 2005 reform has had negative effect on work incentives for women in couples in the ninth decile if compared with the 2003 reform. The 2007 reform has had a negative impact on female participation, in particular for the third and fourth deciles, perhaps due to the income effect of child benefits. This latter reform has had better incentives with respect to the 2005 reform for the top two deciles.

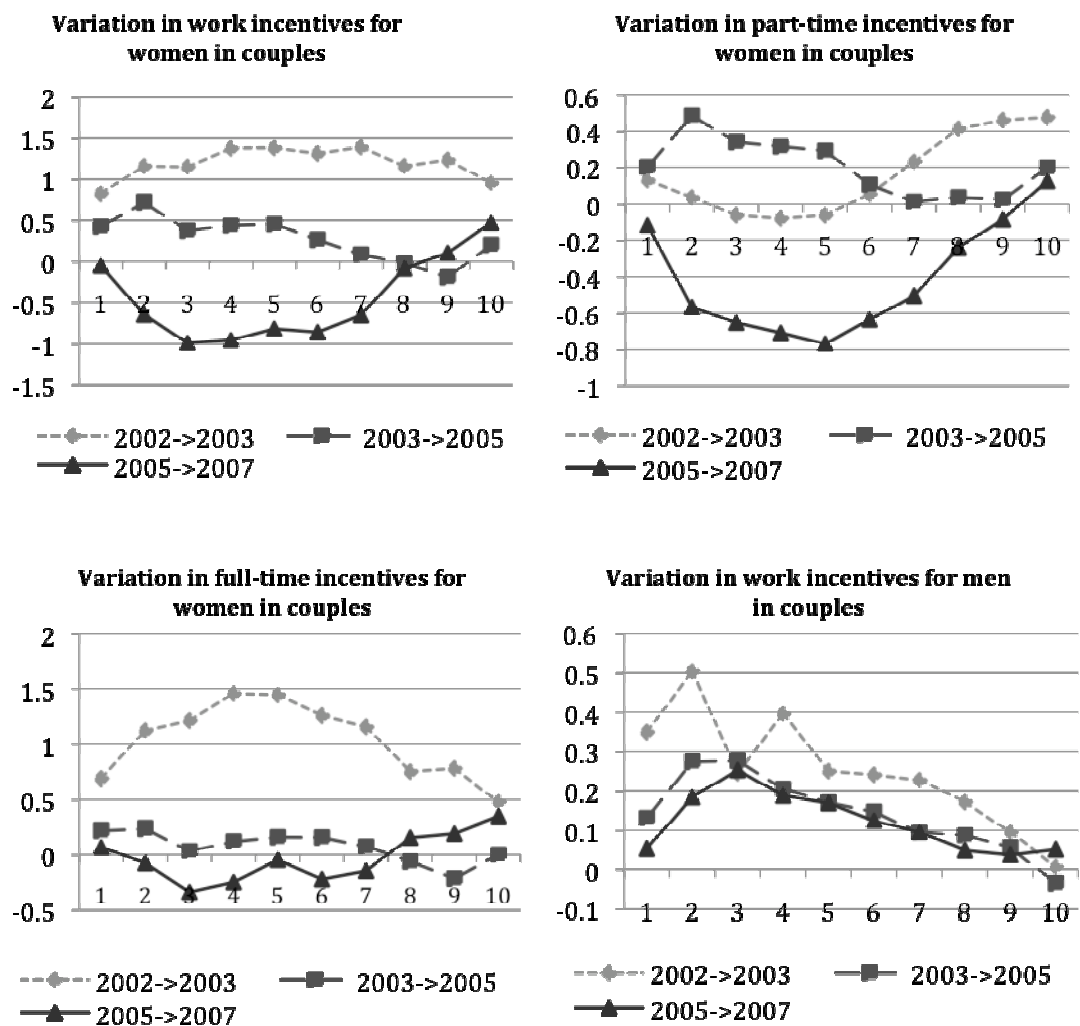
Turning to the intensive margin, the 2003 reform has strongly raised part-time jobs in the top deciles, while it has had a low negative effect for the middle deciles. The 2005 reform has had exactly the opposite pattern with respect to the 2003 one. Indeed, this reform has increased part-time jobs for the middle class with almost no impact in the highest deciles but the very last one. The 2007 reform has had a completely different impact with respect to the 2005 reform. In particular, it has reduced part-time work incentives for almost all the deciles with the exception of the very last one. The highest reduction is registered for the third, fourth and fifth deciles. Full-time incentives for

¹⁹ Deciles are computed using the pseudo-distribution methods either. This means that (equivalent) gross incomes are obtained for each alternative available to each couple and the vector so computed is weighted by the probability of choosing each alternative.

women in couples (third graph) have increased after the 2003 and 2005 reforms. Again, this is true in particular for the middle deciles. It is worth to notice that the 2005 reform has not had significant effects in the top deciles and had a negative impact for the ninth one if compared with the 2003 distribution. With respect to the 2005 reform, the 2007 one has had a slightly negative impact on female full-time incentives till the seventh decile.

For men in couples (fourth graph), the analysis of the extensive margin shows that work incentives are positive for all the reforms in almost all the deciles even though the magnitudes of these incentives are smaller compared with those of women. As for women, the highest changes are registered for the middle-low income classes. Interestingly, the 2005 reform reduces men participation in the top decile with respect to the 2003 reform.

Figure 3 - Changes in the distribution of workers by deciles of family income and types of work effort



Source: own computations based on SHIW data.

We now turn to synthetic measures of income inequality to assess the overall distributive effect of each reform. The next table shows the static Gini indexes of the whole income distribution, and the percentage changes in the Gini with respect to the previous year, computed both with and without the consideration of labor supply changes.

Table 7. Gini index of household disposable income before and after the reforms.

Year	2002	2004	2006	2008
Static Gini	0.3464	0.3447	0.3462	0.3432
% Variation:				
Static Gini		-0.51%	0.44%	-0.86%
Gini with labour supply effects		-0.68%	0.32%	-0.91%

Source: our computations based on SHIW

The 2003 reform reduces inequality even more when labour supply is accounted for. The percentage increment of the Gini index in 2005 is smaller with respect to the static case while the 2007 reform produces a percentage reduction in inequality substantially similar to that of the static case. The principal reason of these patterns has to be found in the labour supply dynamics determined by each reform. The 2003 reform produces greater incentives for participation and full-time jobs in the low and middle deciles. This reinforces the reduction in inequality. After the 2005 module, we observe more increments in both participation and part-time jobs for the middle deciles; this contrasts with the rise in the Gini index due to the lower redistribution properties of the income tax. Finally, the 2007 reform slightly reduces participation and part-time incentives for the middle deciles. However, the behavioral Gini index is marginally lower when behavior is accounted for. A possible explanation could be found both in the reduction of part-time jobs and in the lower participation rate of women in couples. This could imply an increased homogeneity in the middle part of the income distribution that is captured by the Gini index. The combination of income effects, homogeneity in the central section of the income distribution and pure redistributive effects explain why the static Gini index is not significantly different from the behavioral one for this reform.

Conclusions

The simulation of distributive and efficiency effects of “real” reforms, when compared with the results that could be obtained working on hypothetical systemic reforms, inevitably tends to produce small changes, in particular

when revenue loss is not particularly strong. In order to make them politically acceptable, periodic adjustments to the real tax-benefit system are designed also so as to reduce the possibility that many households may lose from them. Our results actually show small changes both in the inequality measure and in labour supply, but can signal important aspects of the reforms that have been already implemented, and that have, for the simple reason of having actually taken place, a special importance in themselves. More than on the magnitude of the behavioural changes, attention should focus on the sign of their direction.

The two centre-right modules had a total cost of about 13 billion euros, with very small distributive impacts, while the subsequent reform by the centre-left government produced a greater amount of redistribution, since it actually increased the tax burden for high incomes, with no revenue loss. From a distributive point of view, therefore, the difference between the two approaches is clear, although in all cases the changes in the Gini index have been quite modest.

The adjustment in the tax structure with the most significant consequences in terms of labour supply incentives in the extension of the no-tax area in 2003. This reform produced an increase in female labour supply for low and middle deciles. As a consequence, the behavioural reactions to this reform increased real incomes at the bottom of the distribution, therefore further reducing the Gini index. This effect could not be observed using a static tax-benefit model (see fig. 1, where the effect on the first decile of the 2003 reform is negligible). The 2003 module, therefore, produced both a reduction in inequality and an increase in labour supply. In this case, we do not observe a trade-off, but complementarity, between equity and efficiency.

The 2005 module, the most apparent step towards the flat rate model, increased inequality but had a (smaller) additional positive impact on labour supply, that slightly reduced the tendency for inequality to rise. Interestingly, the behavioral contribution that in part counterbalanced the rise in inequality comes from the lower deciles since the behavioral impact of this reform in the top deciles is absolutely negligible. Indeed, husbands in the top decile reduced their labour supply while their wives slightly increased participation. The overall effect is almost zero. However, in the middle decile we observe increments in participation for both wives and husbands.

The 2007 reform, finally, has had a clear equity effect, further reducing inequality, but with a reduction in efficiency, particularly among low-income women. This could derive from the expansion of cash transfers, that are decreasing with family income and therefore produce both an income and a substitution effect on the choice between leisure and consumption, in

particular for women in couples with children. The 2007 reform actually presents the traditional trade-off between efficiency and equality since it concentrates more public funds towards low and middle-income households, that have a relatively elastic labour supply. However, it is more and more difficult for reforms that come later to further improve on both the distributional and incentive effects produced by previous modifications of the tax-benefit system, in particular when the various reforms attempt to share the same broad aims, e.g. reducing inequality and/or increasing participation. Actually, the 2007 reform preserves most of the improvements contained in the past reform as the 2005 reform did with respect to the previous one. Hence, if we compare the last situation with that of the baseline year we could see that several steps forward have been done. Overall work incentives have improved for both women and men in couples and the inequality determined by the personal income tax is slightly lower than at the beginning of the decade. The broad lesson that the experience of these three reforms leaves is that it is possible to adjust the structure of the Italian tax-benefit system so as to improve both equity and efficiency. If we want to make further steps in this direction, it would be advisable to reduce tax rates on low incomes, while child benefits should not be too rapidly decreasing with the level of family income.

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Appendix.

The table shows the structural model estimates for Italian couples. The interested reader can find an overview of the STATA routine and a detailed explanation of the model in Pacifico (2009).

Table A1. Utility parameters for Italian couples

		Coef.	Coef./St.Err
α_1 :	Constant	-0.084	-7.480
α_2 :	Constant	-0.175	-3.330
α_3 :	Constant	-0.384	-25.380
α_4 :	Constant	0.559	3.030
α_5 :	Constant	-0.160	-9.100
α_6 :	Constant	0.033	1.720
β_1 :	Constant	2.571	12.610
	Wife's age [†]	-0.039	-0.450
	Husband's age [†]	0.131	2.300
	Southern Italy [§]	0.220	1.910
	Wife's education (high) [§]	-0.247	-2.500
	Husband's education (high) [§]	-0.016	-0.340
	Number of children	-0.087	-1.160
	Youngest child 0-6 [§]	-0.030	-0.190
	σ_1	0.157	2.432
β_2 :	Constant	2.112	6.430
	Wife's age [†]	0.713	3.610
	Wife's age squared [†]	-0.092	-4.060
	Southern Italy [§]	-0.189	-2.030
	Wife's education (high) [§]	0.027	0.340
	Number of children	-0.152	-2.650
	Youngest child 0-6 [§]	-0.076	-2.547
	σ_2	0.043	0.748
β_3 :	Constant	1.386	13.260
	Husband's age [†]	0.544	2.200
	Husband's age squared [†]	-0.079	-2.800
	Southern Italy [§]	-0.248	-3.990
	Husband's education (high) [§]	0.011	0.210
	Number of children	0.065	1.530
	Youngest child 0-6 [§]	0.055	0.620
	σ_3	0.024	0.168
FC ₁ :	Θ_{11} (Constant)	2.667	10.680
FC ₂ :	Θ_{21} (Constant)	1.161	9.800

Log-Likelihood: -3348.3188

Observations: 2002 couples

Note: model estimated by Simulated Maximum Likelihood using Halton sequences (50 draws). Annual household income divided by 1000; Women and men's worked hours divided by 10; Random terms divided by 10; α_2 and α_3 divided by 100; α_4 divide by 1000. § denotes dummy variables and † denotes that variables are measured in terms of deviation from their means. σ coefficients are estimated standard deviations. FC₁ represent fixed costs of working. FC₂ represents additional fixed costs of working for full-time jobs.

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