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ABSTRACT

In-Work Benefits for Married Couples: An Ex-Ante Evaluation of EITC and WTC Policies in Italy*

This paper investigates labor supply and redistributive effects of in-work benefits for Italian married couples using a tax-benefit microsimulation model and a multi-sectoral discrete choice model of labor supply. We consider two in-work benefit schemes following the key principles of the Earned Income Tax Credit (EITC) and the Working Tax Credit (WTC) existing in the US and the UK, respectively. The standard design of these in-work benefits is however augmented with a new benefit premium for two-earner households in order to overcome the well-known disincentive effects that these welfare instruments may generate on secondary earners. In simulation, the proposed in-work benefits are financed through the abolition of Italian family allowances for dependent employees and contingent workers thus ensuring tax revenue neutrality. We show that our EITC and WTC reforms have strong positive effects on labor supply of wives, weak negative effects on labor supply of husbands, and strong positive effects on equity. The EITC is more effective than the WTC in boosting employment of wives, while the WTC is more effective than the EITC in fighting poverty. In both schemes, the trade-off between labor supply incentives and redistributive effects is crucially related to the new benefit premium for two-earner households. Other things being equal, tax revenue neutrality implies that a higher value of this policy coefficient yields stronger incentive effects and weaker redistributive effects.

JEL Classification: I38, H31, H53

Keywords: in-work benefits, multi-sectoral labor supply, poverty, microsimulation, married couples, Italian tax-benefit system

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1 Introduction

In-work benefits are typically promoted as welfare instruments that encourage employment in the low-skilled population, while also maintaining high levels of social protection. Unlike more traditional welfare instruments, they provide mean-tested transfers to low-income households with eligibility conditional on some employment requirement to avoid the harmful disincentive effects of the welfare trap. Pioneering in-work benefit schemes are the Earned Income Tax Credit (EITC) in the US and the Working Tax Credit (WTC) in the UK. In the last 20 years, similar policies have been also adopted by a number of OECD countries.

Despite the general consensus on effectiveness of in-work benefits for lone mothers, the popular view that these welfare instruments may encourage employment while still retaining a good targeting of redistributive effects is unlikely to hold for married couples. Economic theory and previous empirical evidence suggest that family-based schemes, where in-work benefits are mean-tested against household income, generally promote employment among eligible married men and lone mothers (see, for example, Eissa and Liebman 1996; Blundell 2000; Blundell and Hoynes 2004; Eissa and Hoynes 2004; Bargain and Orsini 2006). Such schemes are likely to create, however, perverse labor supply effects on second-earners as their earnings may move households in regions of the budget set where marginal tax rates are high (Eissa and Hoynes 2004). To contrast these unintended disincentive effects, some countries like Belgium, Finland, Hungary, the Netherlands and Sweden have experienced individual-based schemes where in-work benefits are mean-tested against individual income (Immervoll and Pearson 2009). In this case, however, the major concern is on a less efficient targeting of the redistributive effects because transfers may be also provided to low-income workers in well-off households. Whether these competitive objectives, namely labor supply incentives and redistributive effects, can be reconciled in a single policy instrument is still considered an open question.

The contribution of this paper to the existing literature on in-work benefits is threefold. First, we propose an innovative design of the EITC and the WTC for married couples aimed to overcome the disincentive effects that these family-based in-work benefit schemes may generate on secondary earners. Our strategy consists of introducing some additional labor supply incentive for secondary earners within an otherwise standard family-based scheme that by itself preserves an efficient targeting of redistributive effects in favor of poor working households. Thus, we augment the standard design of EITC and WTC schemes with a new benefit premium for two-earner households to handle one of the major drawbacks of these family-based welfare instruments.

Second, we provide an *ex-ante* evaluation on the likely impact of in-work benefits for married couples using a tax-benefit microsimulation model and a structural model of labor supply. Unlike most of the previous studies using a similar approach, our structural model of labor supply draws upon the multi-sectoral discrete choice framework by Dagsvik and Strøm (2006) which jointly accounts for nonlinear and nonconvex budget sets, hourly wage rate differentials among jobs in different sectors, observed and unobserved heterogeneity, and sector-specific quantity constraints. The original setup of the model for a single decision maker is extended, within a unitary framework, to the case of two decision makers to capture labor supply responses of both spouses. In this way, we avoid the critic by Keane (2011) on the conventional practice of considering husbands' labor supply as inelastic. In our empirical application, we also assess the implications of using alternative model specifications by comparing the results from our multi-sectoral model with those from a simpler model which ignores sector-specific attributes of the various job opportunities.

Third, we contribute to the policy debate surrounding effectiveness of in-work benefits for married couples by focusing on a country like Italy which is notoriously characterized by a low employment rate of married women, lack of employment support programs, high marginal tax rates on earned incomes, and a widespread cultural tradition of married couples with male breadwinner. As argued by Bratti et al. (2005), low-skilled married women with children are undoubtedly an important socio-economic group of interest and therefore one cannot ignore the undesirable disincentive effects that family-based welfare instruments may generate on this population group. Previous *ex-ante* evaluations of in-work benefits for Italy can be found in the recent studies by Figari (2011) and Colonna and Marcassa (2011). The former analyzes the effects of family and individual-based in-work benefits, while the latter compare a set of alternative policy reforms based on the British WTC, family-based taxation and gender-based taxation. In both studies, in-work benefits are simulated under tax revenue neutrality using the resources collected through the abolition of tax credits for dependent spouses. The aim of our study is different because we focus on EITC and WTC in-work benefit schemes by emphasizing the role of the new benefit premium for two-earner households. Simulations are carried out under tax revenue neutrality after taking into account possible labor supply reactions. Unlike previous studies, this desirable objective is achieved through the abolition of family allowances (FA) for dependent employees and contingent workers which are expected to contribute to the low employment rate of married women.

Our simulations show that the proposed EITC and WTC reforms may lead to sizeable labor supply and redistributive effects. The incentive effects for wives are positive, statistically different from zero, and mainly concentrated at the extensive margin, while the incentive effects for husbands are negative, not always statistically significant, and mainly concentrated at the intensive margin. The EITC is more effective than the WTC in boosting employment of wives, while the WTC is more effective than the EITC in fighting poverty. In both schemes, the trade-off between labor supply and redistributive effects is crucially related to the size of the benefit premium for two-earner households. Other things being equal, tax revenue neutrality implies that a higher value of this policy coefficient yields stronger incentive effects and weaker redistributive effects. According to our multi-sectoral model, most labor supply responses take place in the private sector where jobs are characterized by lower hourly wages than in the public sector. Further, ignoring sector-specific attributes of the various job opportunities may lead to an overly simplified representation of the choice set that does not allow to capture certain labor market transitions and thus results in lower labor supply responses.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the EITC in the US and the WTC in the UK. Section 3 describes the Italian FA and formalizes the EITC and WTC schemes simulated in our study. Section 4 presents our multi-sectoral discrete choice model of labor supply for married couples. Section 5 describes the data and the tax-benefit microsimulation model. Estimates of the labor supply model and predicted labor supply elasticities are presented in Section 6, while policy simulation results are presented in Section 7. Finally, Section 8 concludes.

2 In-work benefits in the US and the UK

The aim of in-work benefits is to create an attractive financial gap between paid work and being on welfare by enforcing some work-contingent eligibility rule. Low-income households are entitled to a refundable tax credit (or benefit) provided that at least one adult member works and other eligibility criteria are satisfied. In this section, we discuss briefly main features, potential incentive effects, and previous empirical findings of the in-work benefits existing in the US and the UK.

2.1 Earned Income Tax Credit

The EITC was introduced in the US in the 1970s as a sort of negative income tax program with eligibility conditional on employment. Although it started as a modest program aimed at offsetting the social security payroll tax for low-income families with children, the EITC went through several expansions in 1986, 1990, and 1993 and is now considered a key pillar of the welfare system in the US.

To be eligible for the EITC, the taxpayer needs meet two conditions: (i) positive earned income from employment or self-employment, and (ii) earned income, adjusted gross income and investment income below certain thresholds. Conditional on eligibility, the amount of the credit depends on family earned income according to separate tax credit schedules by filing status and number of eligible children. The right panel of Figure 1 illustrates the 2011 EITC schedule for married filers by number of eligible children. We can see that each schedule consists of a phase-in region where the credit is initially increased at a certain subsidy rate, a flat region where the credit is kept constant at the maximum amount, and a phase-out region where the credit is reduced at a certain tapper rate. Subsidy rate, maximum credit amount, and tapper rate vary with the number of eligible children to ensure a more generous scheme in favor of large households. In the tax credit schedule for single filers, flat and phase-out regions are reduced by about $5,000.[1]

As discussed at length in Eissa and Liebman (1996) and Eissa and Hoynes (2004, 2011), economic theory predicts an unambiguously positive effect of the EITC on labor force participation of unmarried taxpayers and primary earners of married couples due to the additional after-tax income provided when they are employed. The incentive effects on hours worked depend on which region of the EITC schedule the taxpayers are located. They are expected to be ambiguous for people in the phase-in region and unambiguously negative for people beyond the phase-in region. Secondary earners of married couples, many of whom are women, are expected to reduce both labor force participation and hours worked because their earning may move the household in the phase-out region where the credit is withdrawn with household income. Theoretical predictions are supported by a number of empirical findings from quasi-experimental studies using the various EITC expansions. For single parents, there is evidence of strong positive effects on labor force participation and small negative effects on hours worked (Dickert et al. 1995; Eissa and Liebman 1996; Liebman 1998; Meyer and Rosenbaum 2001). For married couples, Eissa and Hoynes (2004) find a reduction of total labor force participation due to a small rise in participation of husbands and a sizable reduction in participation of wives, while Neumark and Wascher (2001) find a negative effect on hours of work among poor households with a working adult.

2.2 Working Tax Credit

The UK has a long history of in-work benefits. The Family Income Supplement was introduced in 1971 and then replaced by the Family Credit in 1988. After a number of reforms during the early

[1] Further details on the EITC schedule can be found in the website http://www.irs.gov/publications/p596.

1990s, the Working Families' Tax Credit was introduced in 1999 and then replaced again by the Child Tax Credit (CTC) and the Working Tax Credit (WTC) in 2003. Below, we focus on the WTC which extended for the first time in-work benefits to childless households.

To be eligible for the WTC, the claimant is required to fulfill one of the following conditions: (i) working 30 hours or more per week and being aged 25 or over; (ii) working 16 hours or more per week and being responsible for a child; (iii) working 16 hours or more per week and having a disability; (iv) working 16 hours or more per week, being aged 50 or over, and returning to work in the previous three months after receiving unemployment benefits for at least six months; or (v) working 16 hours or more per week and being aged 60 or over. The maximum credit entitlement is made up of building blocks, called elements, each reflecting particular circumstances of the claimant and her family. In 2011-12, the basic element amounts to £1,920. Additional elements include second adult and lone parent elements (both equal to £1,950), 30 hour element (£790), basic and severe disability elements (£2,650 and £1,130), and 50 plus element (either £1,365 or £2,030 depending on whether working time is lower or grater than 30 hours per week). The WTC schedule also includes a childcare element to subsidize up to 70% of formal childcare costs with a maximum of £175 per week for one child and £300 per week for two or more children. The effective credit amount is mean-tested against gross annual income before tax and national insurance contributions, jointly assessed in the case of couples. It is equal to the maximum award if income does not exceed a disregard of £6,420 and is reduced at the taper rate of 41% above this disregard.[2]

The left panel of Figure 1 illustrates the 2011 WTC schedule for households who are entitled to the basic and the second adult elements, assuming that the claimant's hourly wage is equal to 6 Euro and non-labor household income is equal to zero. As the claimant works 30 hours or more per week, we observe an upward shift in the WTC entitlement due to the 30 hour element. The figure also shows the impact of an additional WTC element considering the subsidy received for formal chilcare cost of 2000 Euro. In this case, we observe an upward shifts in the overall WTC profile and hence a larger phase-out region. Notice that, in this figure, a direct comparison between the WTC and the EITC can be misleading because we are ignoring the CTC and other minor differences in the eligibility criteria.

Theoretical predictions and empirical findings on the incentive effects of the British in-work benefits line up with those discussed above for the EITC. There is evidence of strong incentives on employment of single mothers, weak disincentive effects on employment of married women whose

[2] Additional details on the WTC schedule can be found in the website: http://www.litrg.org.uk/low-income-workers/tax-credits/tax-credits-advisers/working-tax-credit.

husbands work (see Blundell et al. 2000, Brewer et al. 2006, and Francesconi and van der Klaauw 2007, among others), and positive effects on hours worked by those in employment (Leigh 2007) and lone mothers working part-time (Gregg et al. 2009). As noticed by Blundell et al. (2002), the British tax credits have two distinguishing features. First, the minimum hours limit placed on eligibility may weaken the expected incentive effects on labor force participation. This conjecture is supported by a difference-in-difference analysis of the 1992 reform to the Family Credit which reduced the minimum hours limit from 24 to 16 hours per week. Second, the additional credit provided to encourage full-time work may help offset the expected disincentive effects on hours of work. Although there is little empirical evidence on this feature of the WTC schedule, there are reasons to believe that these effects are not negligible because of the conspicuous financial returns to full-time work.

3 Policy reforms

An attractive feature of the in-work benefit schemes discussed so far is that, being family-based (i.e. assessed on the basis of household income), they are generally well targeted to poor working households. For the same reason, however, they are likely to create disincentive effects on secondary earners and hence are not advisable in circumstances where married women are the target group of interest. In this section, we formalize a new version of the EITC and WTC in-work benefit schemes which allow to address this issue. Since our EITC and WTC policies also involve abolition of FA for dependent employees and contingent workers, in what follows we first describe the main features of this Italian welfare program.

3.1 Italian FA

Italian FA were introduced in October 1934 as a contingent welfare measure for blue collar workers of the private industrial sector. Nowadays, this program also covers workers in other sectors, other categories of workers, unemployed and pensioners, and is considered an important element of the Italian welfare system to alleviate poverty (Biase 2010; Naldini 2003).

FA are family-based benefits exempt from taxation and mean-tested against number of eligible household members, household composition and gross household income. Overall, there are 15 household typologies depending on the number of adult members, their civil status, and the presence of children and disabled individuals. Here, we focus on four standard household typologies consisting of a married couple, no disabled member and (i) no children, (ii) one child, (iii) two children, and (iv) three children. People entitled to claim for FA are dependent employees, contingent workers, unemployed covered by the unemployment benefit system, and former-employees pensioners. Self-employed workers are excluded from the program and at least 70% of gross household income is required to be from wages, salaries, former-employee pensions and other social benefits granted to dependent employees. Gross household income is defined as the sum of earnings from employment and self-employment (net of social security contributions), non-labor incomes subject to the personal income tax, and other non-taxable incomes if above $1,033$ Euro.

Figure 2 illustrates the 2008 FA schedule for the four household types of interest. We can see that the benefit amount is a strictly increasing function of household size and a non-increasing step function of gross household income. With the exception of childless couples, each schedule is defined by an initial flat region where poor households receive the maximum benefit and three subsequent phase-out regions where the benefit is reduced at certain tapper rates. The yearly maximum benefit ranges between 552 Euro for childless couples to $4,500$ Euro for couples with three children. Although this is usually considered a welfare program to alleviate poverty, one can notice that the income cut-off points after which the benefit expires are rather generous. The basic idea of our revenue neutral in-work benefit reforms consists of imposing moderately lower income limits to collect resources from the right-hand-side of the gross household income distribution. These resources are then used to finance a suitable scheme of incentives for secondary earners of low-income households.

3.2 The EITC policy reform

Our EITC policy reform grants a benefit exempt from taxation which is mean-tested against gross household income and household size (as defined in the FA program). Eligibility to the EITC is restricted to households with positive earnings and the underlying policy coefficients are determined to ensure tax revenue neutrality for each household type after taking into account both the abolition of FA and the potential labor supply responses. Accordingly, there is no variation of the public budget and no transfer of resources across different household types.

We assume that the EITC schedule for one-earner households has the standard form

$$\begin{aligned} E_c = E_c^* &- \max\{0, \min\{E_c^*, t_{1c}\,(G_{1c} - G)\}\} \\ &- \max\{0, \min\{E_c^*, t_{2c}\,(G - G_{2c})\}\}, \qquad c = 1,2,3,4, \end{aligned}$$

where E_c^* is the maximum benefit provided in the flat region, $t_{1c} = E_c^*/G_{1c}$ is the subsidy rate of the phase-in region, $t_{2c} = E_c^*/(G_{3c} - G_{2c})$ is the tapper rate of the phase-out region, G_{tc}, $t = 1,2,3$, are the income cut-off points, and G is gross household income. The EITC schedule for two-earner households has two worth innovative features. First, it provides a higher maximum benefit $\bar{E}^*_c = (1 + p_c)\, E^*_c$, with $p_c \geq 0$ denoting the size of benefit premium for two-earner households, to encourage labor force participation of secondary earners. Second, it extends the phase-in and phase-out regions to avoid too binding constraints on gross household income. Assuming that the length of the flat region, the subsidy rate and the tapper rate do not change, the income cut-off points of the schedule for two-earner households are $\bar{G}_{1c} = (1 + p_c)\, G_{1c}$, $\bar{G}_{2c} = G_{2c} + p_c\, G_{1c}$ and $\bar{G}_{3c} = (1 + p_c)\, G_{3c} - p_c\, (G_{2c} - G_{1c})$.

Figure 3 illustrates the EITC schedule used in the first scenario of our simulations where the benefit premium for two-earner households is fixed to $p_c = 0.75$ for all household types. The income cut-off points G_{1c}, G_{2c}, and G_{3c} are fixed to 50%, 100% and 150%, respectively, of the poverty line in the baseline tax-benefit system and are allowed to vary across household types according to the coefficients of the Carbonaro equivalence scale.[3] In this scenario, revenue neutrality is achieved for values of E^*_c equal to 756 Euro for childless households, 1,780 Euro for households with one child, 2,210 Euro for households with two children, and 3,482 Euro for households with three children. Compared to FA, our EITC policy imposes more binding income cut-off points for gross household income. Poor working households at the bottom of the gross household income distribution are likely to receive a lower benefit. However, as gross household income increases, the EITC schedule generally provides a higher benefit, especially when both spouses work.

3.3 The WTC policy reform

Our WTC policy reform grants a benefit exempt from taxation which is mean-tested against hours of work, gross household income and household size. Eligibility to the WTC is restricted to households with at least one adult person working 16 hours per week or more. The maximum benefit entitlement is determined as the sum of three elements: the basic element W^*_{1c}, the second adult element W^*_{2c} and the 30 hour element W^*_{3c}.[4] We assume that W^*_{1c} is provided to all eligible households, W^*_{2c} is provided to households where both spouses work at least 16 hours per week, and W^*_{3c} is provided to households where both spouses work at least 30 hours per week. As for the EITC,

[3] The poverty line, computed as 60% of the median of equivalized disposable household income, is equal to 11,692 Euro. Coefficients of the Carbonaro equivalence scale are equal to 1 for couples with no children, 1.335 for couples with 1 child, 1.632 for couples with 2 children and 1.905 for couples with 3 children.

[4] The lone parent element of the British WTC schedule is ignored since it is irrelevant for the aim of our analysis. We also ignore disability element, 50+ element and childcare element due to lack of adequate information on the underlying eligibility criteria.

we determine the basic element W^*_{1c} to guaranty tax revenue neutrality for each household type. The other two elements are specified as $W^*_{2c} = p_c\, W^*_{1c}$ and $W^*_{3c} = q_c\, W^*_{1c}$, where $p_c \geq 0$ is the size of the benefit premium for two-earner households and $q_c \geq 0$ is the size of the benefit premium for working full-time.

The WTC schedule for households who are only entitled to the basic element has the standard form

$$W_c = W^*_c - \max\{0,\, \min\{W^*_c,\, t_c\,(G - G_{2c})\}\}, \qquad c = 1, 2, 3, 4,$$

where $W^*_c = W^*_{1c}$ is the maximum benefit provided in the flat region, $t_c = W^*_c/(G_{3c} - G_{2c})$ is the tapper rate of the phase-out region, and G_{2c} and G_{3c} are the income cut-off points delimiting the phase-out region. Notice that, in this schedule, the income cut-off point for the beginning of the flat region is defined implicitly by the eligibility condition on minimum hours of work and it varies across households with the hourly wage of both spouses and non-labor household income. Households who are entitled to the second adult element face a similar WTC schedule with maximum benefit equals to $\bar{W}^*_c = W^*_{1c} + W^*_{2c}$ and income cut-off points equal to $\bar{G}_{2c} = G_{2c}$ and $\bar{G}_{3c} = G_{3c} + p_c\,(G_{3c} - G_{2c})$. For households who are entitled to the 30 hours element, the maximum benefit is $\tilde{W}^*_c = W^*_{1c} + W^*_{2c} + W^*_{3c}$ and the income cut-off points are $\tilde{G}_{2c} = G_{2c}$ and $\tilde{G}_{3c} = G_{3c} + (p_c + q_c)\,(G_{3c} - G_{2c})$. These additional elements of the WTC schedule then increase the maximum benefit entitlement and allow to expand the length of the phase-out region. The length of the flat region and the tapper rate of the phase-out region are instead kept constant.

Figure 4 illustrates the WTC schedule used in the first scenario of our simulations assuming that hourly wages of both spouses are equal to 6 Euro and non-labor household income is equal to zero. For comparability with the EITC, we set the benefit premium for two-earner households to $p_c = 0.75$, the benefit premium for working full-time to $q_c = 0.5$, and the income cut-off points G_{2c} and G_{3c} to 100% and 150% of the poverty line in the baseline tax-benefit system multiplied by coefficients of the Carbonaro equivalence scale for household type c. In this policy reform, revenue neutrality is achieved for values of W^*_{1c} equal to 1,017 Euro for childless households, 2,490 Euro for households with one child, 2,883 Euro for households with two children, and 4,080 Euro for households with three children. Compared to the EITC, the WTC is more closely targeted to poor working households with particularly low wage rates and it includes special incentives to encourage full-time work.

4 Structural model of labor supply

To provide an *ex-ante* evaluation of our in-work benefit reforms, we need a structural model of labor supply to simulate the potential labor supply reactions as the tax-benefit system changes. Our structural model of labor supply is a simple generalization to the case of married couples of the multi-sectoral discrete choice model for a single decision maker originally developed by Dagsvik and Strøm (2006).

Like standard discrete choice approaches to labor supply modeling (van Soest 1995), our model assumes that the choice sets available to the two spouses consist of a predetermined finite set of job opportunities. Utility maximization can then be done by comparing the utility function across the alternative points of their choice sets without performing marginal calculations. This attractive feature of the model allows to handle nonlinear and nonconvex budget sets, while also accounting for a flexible utility function, observed and unobserved heterogeneity, and unobserved wage rates of non-workers. Our modeling framework differs from a standard discrete choice approach in that the set of available job opportunities is allowed to vary across agents to capture rationing effects that typically lead to full-time and part-time peaks in the distribution of working hours.[5] Following Dagsvik and Strøm (2006) and Dagsvik et al. (2011), labor supply behavior is viewed as an outcome of agents choosing from a set of jobs, each of which is characterized by offered hours of work, wage rate, and other nonpecuniary (qualitative) job attributes. The set of available job opportunities, which is observable to the agent but not to the researcher, can be constrained because it is determined by market equilibrium conditions and by negotiations between unions and employers. Unlike previous studies, our modeling framework explicitly considers the choice of jobs in different sectors (i.e. public and private sector) without taking the husband labor market behavior as given. This allows us to also account for individual and sector-specific hourly wages and sector-specific constraints in the distribution of working hours of both spouses.

4.1 A multi-sectoral model for married couples

Like the bulk of the labor supply literature, we rely on a unitary framework where husband and wife maximize a common utility function which depends on their own leisure, their spouse leisure,

[5] An alternative approach would be modeling fixed costs of working (see, for example, Blundell et al. 2000 and Callan et al. 2009).

and disposable household income.[6] The utility of the couple is assumed to be

$$U = V(l_m,\, l_f,\, y)\; \epsilon(s, k),$$

where $V(l_m,\, l_f,\, y)$ is a systematic component, l_m is the husband's leisure, l_f is the wife's leisure, y is disposable household income, $\epsilon(s, k)$ is a positive random taste shifter, and $s = (s_m, s_f)$ and $k = (k_m, k_f)$ index, respectively, the sector combination and the combination of jobs for the husband and the wife. The random error $\epsilon(s, k)$ accounts for unobservable heterogeneity in preferences and it is assumed to be identically and independently distributed across households, sectors and jobs with distribution function

$$Pr\{\epsilon < x\} = \exp(-1/x), \qquad x > 0.$$

The budget constraint of the couple, which incorporates earnings of the husband and the wife, non-labor household income, taxes and benefits, is represented by

$$y = \psi\left(h_m\; \omega_m(s_m),\, h_f\; \omega_f(s_f); I\right),$$

where h_m and h_f are the hours of work of the husband and the wife, $\omega_m(s_m)$ and $\omega_f(s_f)$ are their sector-specific hourly wages, I is non-labor household income, and ψ is a tax-benefit function mapping gross incomes of the various household members into disposable household income. Provided that utility is increasing in disposable household income, one can substitute the budget constraint into the utility function to obtain

$$U = \nu(z_m, z_f;\, I)\; \epsilon(s, k),$$

where $z_i = (h_i,\, s_i)$, $i = m, f$, and $\nu(z_m, z_f;\, I) = V\left(l_m,\, l_f,\, \psi(h_m\; \omega_m(s_m),\, h_f\; \omega_f(s_f);\, I)\right)$. Notice that, in a discrete choice framework, we do not need to impose coherency conditions about monotonicity and quasi-concavity of preferences that may limit the flexibility of the utility function. As argued by van Soest (1995), these conditions can be tested *ex-post* avoiding in this way the critique of MaCurdy et al. (1990).

We assume that the choice sets of jobs offered to the husband and the wife are independent from each other. Each of them consists of a finite number of alternatives including non-participation and several job opportunities in different sectors. The hours of work associated to each alternative of the

[6] A more general approach would be a collective model where the two spouses have their own preferences and they are involved in an intra-household bargaining process. This approach implies weaker behavioral restrictions than the unitary approach and allows investigating intra-household welfare allocation (Vermeulen 2006; Francesconi et al. 2009). However, model identification requires additional assumptions or specific data.

choice sets are assumed to be fixed. However, there can be a number of job opportunities with the same working requirement that differ because of other unobservable nonpecuniary characteristics. The size of the choice sets is unknown to the researcher. Let $Q(z_m, z_f)$ denote the set of job pairs with hours of work (h_m, h_f) in sectors (s_m, s_f), and $q_i(z_i)$ denote the number of jobs with hours of work h_i in sector s_i available to spouse $i = m, f$. From standard results in discrete choice models (McFadden 1984), the probability $\pi(z_m, z_f)$ that the husband and the wife select a specific job pair $k = (k_m, k_f)$ with characteristics (z_m, z_f) is equal to the sum of the probabilities of all jobs within the set $Q(z_m, z_f)$ with the same observable characteristics (z_m, z_f). For job pairs with $h_m > 0$ and $h_f > 0$, this gives

$$\pi(z_m, z_f) = \sum_{k \in Q(z_m, z_f)} \frac{\nu(z_m, z_f;\, I)}{P} = \frac{\nu(z_m, z_f;\, I)\, q_m(z_m)\, q_f(z_f)}{P}, \tag{1}$$

where P is a normalization constant of the form

$$\begin{aligned} P =& \nu(0,0,0,0;I) + \sum_{x_m>0} \sum_{s_m} \nu(x_m, s_m,\, 0,0;I)\, q_m(x_m, s_m) + \sum_{x_f>0} \sum_{s_f} \nu(0,0,\, x_f, s_f;I)\, q_f(x_f, s_f) \\ &+ \sum_{x_m>0} \sum_{x_f>0} \sum_{s_m} \sum_{s_f} \nu(x_m, s_m,\, x_f, s_f;I)\, q_m(x_m, s_m)\, q_f(x_f, s_f). \end{aligned}$$

The choice probabilities of alternatives in which one or both of the spouses do not work have similar forms. The reduced form of the model is then analogous to a multinomial logit model where the systematic component of the utility function is weighted with the number of jobs available to the two spouses. Following Dagsvik and Strøm (2006), we use an alternative parametrization of the number of available jobs to foster interpretation. For alternatives with $h_i > 0$, we write $q_i(z_i) = \theta_i(s_i)\, g_i(z_i)$ with $\theta_i(s_i) = \sum_{x_i>0} q_i(x_i, s_i)$. For alternatives with $h_i = 0$, $\theta_i(s_i)$ and $g_i(z_i)$ are both normalized to one. The job availability measure $\theta_i(s_i)$ denotes the number of job opportunities relative to nonworking opportunities that are available in sector s_i to spouse i, whereas the hours of work density $g_i(z_i)$ denotes the share of jobs with h_i working hours that are available in sector s_i to spouse i.

4.2 Empirical specification and estimation

The empirical specification of our model distinguishes between jobs in the public and private sectors because Italy is known to be one of the European countries exhibiting large public-private wage differentials (Giordano et al. 2011).

The husband's choice set consists of 15 alternatives (non-participation plus 7 job opportunities for each sector with hours of work in the intervals 1-25, 26-32, 33-37, 38-42, 43-47, 48-55, 56+), while the wife's choice set consists of a finer grid of 19 alternatives (non-participation plus 9 job opportunities for each sector with hours of work in the intervals 1-15, 16-22, 23-27, 28-32, 33-37, 38-42, 43-47, 48-55, 56+). The hours of work associated with each job opportunity are selected by the sampling procedure of Aaberge et al. (1995).[7] For the job opportunity corresponding to the actual choice of each agent, we always take the observed hours of work. For the other job opportunities, hours of work are instead sampled from the sector-specific empirical density functions of each spouse in the underlying intervals. The choice set of the couple, defined as the Cartesian product of the choice sets available to the two spouses, thus includes $15 \times 19 = 285$ alternatives.

The logarithm of the systematic component of the utility function is specified as a quadratic function of the form,

$$\ln V = v^\top A\, v \,+\, b^\top v,$$

where $v^\top = (l_m,\, l_f, y)$, and A and b are a symmetric 3×3 matrix and a three-dimensional vector, respectively, of unknown parameters. This functional form is a good compromise between flexibility and ease of estimation as it is locally second order flexible and linear in its parameters (Callan et al. 2009). Preferences variation across couples is introduced through the linear coefficient of each spouse's leisure (i.e. the coefficients on l_m and l_f)

$$b_i = X_i^\top \beta_i + \zeta_i, \qquad i = m, f,$$

where X_i are vectors of exogenous individual and household characteristics, β_i are vectors of unknown parameters, and ζ_i are random errors accounting for unobserved individual heterogeneity in the preferences. The covariates included in X_i consist of a second-order polynomial in age of spouse i, number of children and an indicator for children aged less than 3 years. The errors ζ_m and ζ_f are assumed to be mutually independent, independent of other errors in the model, and normally distributed with mean zero and constant variance.

The hours of work densities of the husband $g_m(z_m)$ are assumed to be uniform with peaks at full-time jobs involving 36-40 weekly hours of work, while the hours of work densities of the wife $g_f(z_f)$ are assumed to include an additional peak at part-time jobs involving 18-30 weekly hours of work. The baseline levels of these uniform densities must be normalized to ensure that they are proper density functions. The logarithm of the job availability measures $\ln \theta_m$ and $\ln \theta_f$ are specified as a linear function of gender-specific regional unemployment rates, two indicators for

[7] Unlike the common approach of using a fixed set of alternatives for all agents, this procedure has the advantage of reducing prediction errors when simulating policy reforms (Aaberge et al. 2009).

education attainment, plus interactions with the corresponding education scores.[8]

Wage rates are allowed to vary across jobs in different sectors but not across jobs within the same sector. The hourly wages of individuals employed in the public and private sectors are computed as the ratio between annual earning and annual hours of work. To deal with the issue of unobserved wages, we estimate a wage equation for each sector in an early stage before estimating remaining parameters of the labor supply model. Estimation is done separately for husbands and wives using a variant of the Heckman two-step procedure to account for the selection bias, as discussed in Dagsvik and Strøm (2006). In the first step, we estimate a multinomial choice model with three alternatives: non-participation, working in the public sector and working in the private sector. In the second step, we estimate the hourly wage equation for a certain sector including the logarithm of the probability of working in that sector (with negative sign) as bias correction term. Identification of the wage equation parameters is attained imposing a set of exclusion restrictions, namely a second-order polynomial in non-labor income, number of children, and indicators for children aged less than 3 years and working status of the spouse. The covariates included in the second step consist instead of a second-order polynomial in age, a second-order polynomial in experience, two indicators for education attainment plus interactions with the corresponding final grades at school, gender-specific regional unemployment rates, and two indicators for leaving in the Center and the South of Italy.

Conditional on $\zeta = (\zeta_m, \zeta_f)$, the reduced-form of the model is equivalent to a multinomial logit model with 285 alternatives. As we do not observe ζ, these error terms must be integrated out by taking the expectation of the conditional likelihood contributions $\pi(z_m, z_f \mid \zeta)$ with respect to ζ. If $\{\zeta^r : r = 1, \ldots, R\}$ denote R draws from the distribution of ζ, then model parameters can be estimated via simulated maximum likelihood (SML) approximating the unconditional likelihood contributions by simulated means of the conditional likelihood contributions $\pi(z_m, z_f \mid \zeta^r)$ across the R draws. Provided that the number of draws R goes to infinity faster than the square root of the number of observations, the SML estimator of the model parameters is asymptotically equivalent to the exact maximum likelihood estimator (Hajivassiliou and Ruud 1994).

[8] In addition to unobserved heterogeneity in preferences, we have tried to capture unobserved heterogeneity in the sector-specific measures of job availabilities by including four additional random effects. Similarly to Dagsvik and Strøm (2006), we were not able to estimate however this more sophisticated specification of the model due to convergence problems.

4.3 Simulating labor supply responses

Estimated parameters of the labor supply model can be used to predict labor supply responses such as elasticities to exogenous variations of the hourly wages and the impact of policy reforms to the baseline tax-benefit system. Following Creedy and Duncan (2002), these labor supply responses are estimated by a four-step simulation procedure which accounts for the unobserved components of the model. Firth, we draw 50 realizations from the Extreme value distribution and the estimated asymptotic distribution of the parameter estimates such that, under the baseline tax-benefit system, predicted probabilities are optimal at the observed choices.[9] Second, we use the maximum probability rule to allocate each sample observation to the alternative with the highest predicted probability. Third, we repeat the first two steps after a policy reform and create simulated transition frequencies using the same random draws selected in the first step. Forth, we compute point estimates and standard errors of labor supply responses taking the mean and the standard deviation of the simulated transition frequencies across the 50 replications.

5 Data and microsimulation model

Our data are from the 2008 wave of the Survey on Household Income and Wealth (SHIW), a biannual household survey carried out by the Bank of Italy which collects information on socio-demographic characteristics, family composition, education, labor force status, hours of work, income, savings and wealth. The complex set of accounting rules defining the Italian tax-benefit system in 2008 and our set of in-work benefit policies are simulated numerically through EconLav, a national microsimulation model which covers the computation of social security contributions, direct taxes and public transfers. For any tax-benefit system under consideration, this model is used iteratively to compute disposable household income for each alternative of the choice set and each household of the sample.

The 2008 wave of the SHIW covers about 8,000 households and 19,000 individuals. Our working sample consists of 1,982 married couples in which husband and wife are both aged between 20 and 65 years and none of them is neither disabled, retired, in education, nor engaged in farming or other self-employment activities. Of these, 39% have no children, 31% have one child, 24% have

[9] For each couple, we continue drawing until the optimal choice under the baseline tax-benefit system corresponds to the observed choice. If after $1,000$ trials a successful realization cannot be found, then labor supply is considered inelastic and hence kept fixed at the observed choices. In our model, this occurs for about 5% of the couples in the sample. We do not increase further the number of trials because the procedure is computationally demanding. Using a desktop computer with two quad-core Intel Xeon E5504/2 GHz processors and Stata/MP4 version 11, the computing time is about 4 days.

two children, and 5% have three children. Mean and standard deviation of the main variables and histograms of sector-specific hours of work are presented in Appendix A, separately by gender. Labor supply is higher for husbands than for wives due to the higher participation rate (93% and 53% respectively) and the larger number of worked hours among workers (40 and 32 hours per week, respectively). Differences in the participation rates of the two spouses are particularly striking within the private sector (70% for husbands and 32% for wives). Husbands' hourly wages are generally higher than wives' hourly wages (13.34 and 12.04 Euro, respectively) and we observe a public-private wage differential of about 4 Euro for both spouses. In the private sector, the peaks associated with full-time jobs are found at 40 hours per week for both spouses. In the public sector, the peaks at 40 hours per week are sizeable, but the mode of the distribution is equal to 38 hours for wives and 36 hours for husbands. In both sectors, we also see a relevant fraction of wives employed in part-time jobs with 18-30 hours of work per week.

6 Estimation results

This section presents estimates of our multi-sectoral model of labor supply and predicted labor supply elasticities. Estimates of our multi-sectoral labor supply model (labeled as Model 2) are compared with those of a benchmark model (labeled as Model 1) which ignores sector-specific attributes of the job opportunities available for the two spouses and thus is similar to the labor supply model analyzed by Aaberge et al. (1999). Estimated coefficients of both models are conditional on preliminary two-step estimates of the sample selection models for hourly wages which are presented in Appendix B.

6.1 Structural model of labor supply

Table 1 shows the SML estimates of Models 1 and 2 based on $R = 150$ draws from the distribution of $\zeta = (\zeta_1, \zeta_2)$. The upper panel gives estimated coefficients on the terms of the utility function, including those on the interactions between the linear coefficient of each spouses's leisure and socio-demographic characteristics. For this set of coefficients, we find that standard errors are remarkably small and thus several coefficients of the utility function are significantly different from zero. Estimates of Models 1 and 2 do not differ much. This suggests that the assumed structure of the preferences is hardly affected by the existence of specific attributes in the private and the public sectors. In both models, the first and the second order conditions in van Soest (1995) implies that the deterministic part of the utility function is increasing in disposable household income and quasi-concave for all sample observations. A positive coefficient on the interactions between leisure terms and socio-demographic characteristics can be interpreted as a positive effect on the marginal utility of leisure or, equivalently, as a negative effect on labor supply. Accordingly, labor supply has an inverted U-shaped age profile with a maximum at 39 years for husbands and 43 years for wives. The number of children has a negative and statistically significant impact on the wife's labor supply, while the negative effect due to the presence of young children is not significantly different from zero. Most of these findings line up closely with earlier results in Aaberge et al. (1999) and Figari (2011) and partly reflect a widespread cultural tradition of Italian married couples with breadwinner men and women taking care of children. The random effects introduced to account for unobservable heterogeneity in the preferences do not seem to play an important role.[10] Thus, similarly to van Soest et al. (2002) and Dagsvik and Strøm (2006), we find that SML estimates of our mixed logit models are not statistically different from standard ML estimates of multinomial logit models which ignore unobserved heterogeneity in the preferences.

Estimated peaks on the hours of work densities suggest that job opportunities are mainly concentrated around full-time jobs involving 36 and 40 hours of work. The full-time peak at 36 hours is statistically significant in the public sector only, while the full-time peak at 40 hours is statistically significant in both sectors and is generally higher in the private sector. Estimated peaks on part-time jobs (i.e. jobs involving 18-30 hours of work) are not significantly different from zero. One can also notice that estimated peaks in Model 1 are always in the range of the corresponding sector-specific estimates from Model 2.

Estimated coefficients on the job availability densities confirm that couples living in regions with high unemployment rates face a less favorable labor market environment, especially in the private sector. Except for husbands in the private sector, job availabilities are positively affected by having a secondary or tertiary education degrees. The quality of education, as measured by the interactions between indicators for educational attainment and final grade, has a positive and statistically significant effect only for job availability of wives in the public sector.

6.2 Labor supply elasticities

Our multi-sector model of labor supply allows to compute different types of uncompensated labor supply elasticities for each spouse: along the extensive and intensive margins (i.e. elasticities of the

[10] Following Breunig et al. (2008), we have tried to relax the assumption that ζ_1 and ζ_2 are independent to capture unobservable factors affecting the marginal utility of leisure of both spouses. However, it turned out to be difficult to obtain an accurate estimate of the underlying correlation coefficient. The point estimate was close to -1 with a rather large standard error.

participation probability and the unconditional hours of work), with respect to either an increase in own hourly wages or spouses' hourly wages (i.e. own or cross elasticities), as well as with respect to an increase in hourly wages in all sectors or a specific sector. Table 2 compares estimates from Models 1 and 2 focusing on own and cross elasticities of the participation probability (PP) and the hours of work (HW) after increasing by 1% the gross hourly wages of all job opportunities. Estimates are presented separately for husbands and wives and by decile of disposable household income. According to our estimates, elasticities from Model 2 are generally higher than those from Model 1 mainly because of differences at the bottom of the disposable household income distribution. This result may be due to the fact that our multi-sectoral framework provides a finer representation of the choice sets available to the two spouses, where each job opportunity is characterized by a certain number of hours of work, a sector-specific wage and other nonpecuniary sector-specific attributes. As a consequence, Model 2 allows to capture labor market transitions towards job opportunities that are indeed excluded from the choice sets of Model 1. Consistently with previous findings on elasticities of Italian married couples (Aaberge et al. 1999, 2004), we find that estimated elasticities are considerably higher for wives than for husbands and are mainly driven by changes at the extensive margin. In Model 2, for example, own elasticities of the participation probability are equal to 0.05 for husbands and 0.23 for wives, whereas own elasticities of unconditional hours of work are equal to 0.05 and 0.27, respectively. For poor couples at the bottom of the disposable household income distribution, we find considerably higher own elasticities of both participation probability (0.19 for husbands and 1.25 for wives) and hours of work (0.21 for husbands and 1.56 for wives). Cross elasticities are generally negative and considerably smaller in absolute value than own elasticities (−0.04 for husbands and −0.05 for wives).

7 Simulation of EITC and WTC reforms

This section presents simulated labor supply and redistributive effects of our EITC and WTC reforms. As discussed in Section 3, these reforms involve the abolition of FA from the Italian tax-benefit system and coefficients of the underlying in-work benefit schedules are determined to guarantee tax revenue neutrality for each household type after taking into account predicted labor supply responses. Labor supply effects are measured by the average relative variations (with respect to the baseline tax-benefit system) of participation probabilities and unconditional hours of work, while redistributive effects are measured by the average relative variations of disposable household income, poverty head count ratio (HCR), and poverty gap ratio (PGR).[11]

Before discussing the effects of our policy reforms, we first analyze the magnitude of the disincentive and redistributive effects due to FA only.[12] As expected from the economic theory, the abolition of this family-based welfare program leads to a decrease of 0.11% in the participation probability of husbands, an increase of 1.02% in the participation probability of wives, and an increase of 0.11% and 1.18% in the unconditional hours of works of husbands and wives, respectively. Although FA contribute to the low participation rate of wives, the design of alternative welfare instruments cannot ignore the sizeable redistributive effects of the program to be abolished. The mean of disposable household income falls by 2.15%, while the HCR and the PGR increase by 31.81% and 31.36%, respectively.

Tables 3 and 4 show labor supply effects of our EITC and WTC reforms on participation probabilities and unconditional hours of work, respectively. These results are presented separately by gender, model specification, household type, decile of disposable household income and sector. Overall, we find that labor supply effects for wives are significantly grater than zero and mainly concentrated at the extensive margin, while labor supply effects for husbands are negative, although not always significant, and mainly concentrated at the intensive margin. According to the estimates of Model 2, for example, the participation probability of wives increases by 1.71% under the EITC reform and by 0.70% under the WTC reform. The variation of the participation probability of husbands is instead negligible. After accounting for labor supply responses at the intensive margin, the gap between the incentive effects of the two reforms is substantially lower due to the WTC benefit premium for working full-time (i.e. the 30 hour element). Unconditional hours of work range from -0.13% for husbands to 1.18% for wives under the EITC reform, and from -0.12% for husbands to 0.79% for wives under the WTC reform.

Heterogeneity in labor supply responses across population groups is substantial. There is a clear evidence that incentive effects of both reforms are increasing with household size and decreasing with disposable household income. For example, under the EITC (WTC) reform, the variation of unconditional hours worked by wives ranges from a minimum of 0.11% (0.07%) for childless couples to a maximum of 6.45% (6.65%) for couples with three children. Given that our in-work benefit

[11] The HCR is the proportion of households with disposable income below the poverty line, while the PGR is the mean gap between poverty line and disposable household income as a proportion of the poverty line, where the mean is taken over all households counting the non-poor as having zero poverty gap. When computing these poverty indicators across different policy scenarios, we use the poverty line of the baseline tax-benefit system to disregard changes in the median of disposable household income.

[12] Simulation results of this intermediate policy scenario are not presented for the sake of brevity, but they are available from the authors upon request.

schedules are designed to ensure no transfer of financial resources across household types, one can argue that the positive gradient with respect to household size simply reflects the generosity of FA in favor of large households. On the other hand, the negative gradient with respect to disposable household income reflects the redistributive nature of our reforms which impose more binding cut-off points for gross household income than those applied in the FA schedule. Accordingly, most labor supply responses are found at the bottom of the disposable household income distribution where wives increase their unconditional hours of work by 10.53% under the EITC reform and by 8.12% under the WTC reform.

The two structural models of labor supply lead to qualitative similar policy considerations, but the magnitudes of the estimated effects from our multi-sectoral model (Model 2) are generally higher than those obtained from the simpler benchmark model (Model 1) which ignores sector-specific attributes of the various job opportunities. These results are in line with our findings on estimated labor supply elasticities (see Section 6.2). In this case, the most striking discrepancies are found in the estimates of the participation probabilities of wives, especially those living in large households and at the bottom of the disposable household income distribution. For husbands, labor supply responses from the two models are quite similar due to the high participation rate in the baseline tax-benefit system.

As shown in Table 5, our EITC and WTC reforms also improve upon the baseline tax-benefit system in terms of redistributive effects. The mean of disposable household income increases by 0.23% under both reforms and the effects are clearly increasing with household size. Under the EITC reform, the effects on poverty are less clear-cut: the HCR decreases by 6.12% and the PGR increases by 2.28%. Thus, we find a reduction in the number of poor households and a deterioration in the living standard of those who remain poor (especially couples with two or more children). This undesirable effect on the PGR occurs because working households located at the beginning of the phase-in region and with disposable income far below the poverty line may receive considerably lower benefits than those received under the baseline tax-benefit system through the FA program. Under the WTC reform, the HCR and the PGR decrease by 9.28% and 3.90%, respectively. Accordingly, this reform has substantially stronger redistributive effects than both FA and EITC for all household types.

So far, we have analyzed labor supply and redistributive effects of our EITC and WTC reforms considering a single simulation design where the size of the benefit premium for two-earner households p_c is fixed at .75. In Table 6, we investigate the sensitivity of our estimates from Model 2 to the choice of this policy coefficient considering a set of nine simulation designs obtained by letting p_c vary from 0 to 2 with step .25. In each simulation design, the cut-off points G_{tc}, $t = 1, 2, 3$, for gross household income and the size of the WTC benefit premium q_c for working full-time are left unchanged, while the maximum benefit entitlements of the EITC and WTC schedules for one-earner households (E_c^* and W_c^*) are always determined to ensure tax revenue neutrality for each household type. Notice that this condition necessarily implies a negative relationship between the size of the benefit premium for two-earner households and the maximum benefit entitlements of the EITC and WTC schedules for one-earner households. Hence, for simulation designs with higher values of p_c, we always find lower values of E_c^* and W_c^*.

The results of this sensitivity analysis show that, for both in-work benefit schemes, the trade-off between labor supply incentives and redistributive effects is crucially related to the size of the benefit premium for two-earner households. Other things being equal, higher values of this policy coefficient yield stronger labor supply effects and weaker redistributive effects. The simulation design with $p_c = 0$ corresponds to standard EITC and WTC schedules with no premium to overcome the well-known disincentive effects on secondary earners. In this case, the participation probability of wives decreases by 0.91% under the EITC reform and by 0.69% under the WTC reform. For simulation designs with progressively higher values of p_c, the effects on the participation probability of wives are increasing and become positive for all designs with $p_c \geq .5$. Our findings also confirm that the EITC is more effective than the WTC in boosting employment of married women. On the other hand, we find progressively harmful effects on poverty indicators. Under the EITC reform, the variation of HRC (PGR) becomes positive for all designs with $p_c \geq 1$ ($p_c \geq .75$). Under the WTC reform, these perverse effects on poverty arise only for simulation designs with considerably higher values of p_c, thus confirming that the WTC is more effective than the EITC in reducing poverty.

8 Conclusions

In this paper, we investigate labor supply and redistributive effects of introducing EITC and WTC in-work benefits for Italian married couples using a tax-benefit microsimulation model and a multi-sectoral discrete choice model of labor supply. The proposed reforms involve the abolition of family allowances for dependent employees and contingent workers from the Italian tax-benefit system in 2008 and their policy coefficients are determined to guarantee tax revenue neutrality for different household types after taking into account potential labor supply responses. To overcome the well-known disincentive effects of these in-work benefit schemes, we augment the standard EITC and

WTC schedules with an additional benefit premium for two-earner households. This strategy allows us to boost labor supply of secondary earners, typically married women, while also retaining the redistributive objective pursued by in-work benefit schemes that are mean-tested against household income.

Our simulation results confirm that these in-work benefit reforms may improve incentive and redistributive effects of the Italian tax-benefit system, especially for couples with children and at the bottom of the disposable household income distribution. The main advantage of using a multi-sectoral model of labor supply is to capture labor market transitions towards jobs opportunities that would be otherwise excluded from the choice set. Hence, estimated labor supply effects are generally higher than those obtained in standard labor supply models which ignore sector-specific attributes of jobs available in the labor market. According to the in-work benefit schedules simulated in our study, the EITC is more effective than the WTC in boosting employment, while the WTC is more effective than the EITC in fighting poverty. However, as shown in our sensitivity analysis, the trade-off between incentive and redistributive effects is crucially related to the size of the benefit premium for two earner-households. Other things being equal, higher values of this policy coefficient yield stronger labor supply effects and weaker redistributive effects. The design of optimal in-work benefit schemes should then reflect the preferences of policy makers towards these two competitive objectives (see, for example, Blundell et al. 2009). We believe this is an important policy design issue which is left to future research.

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Table 1: SML estimates of discrete choice models of labor supply for married couples

Model component	Variable		Model 1	Model 2
Preferences	(DHI/1000)		0.0193	0.0022
	$(\text{DHI}/1000)^2$		-0.0004 **	-0.0003 **
	(Husband's leisure)^2		-0.0011 **	-0.0010 **
	(Wife's leisure) ^{2}		-0.0023 **	-0.0021 **
	(DHI/1000) × (Husband's leisure)		0.0008 **	0.0010 **
	(DHI/1000) × (Wife's leisure)		-0.0001	0.0002
	(Husband's leisure) × (Wife's leisure)		0.0004 **	0.0007 **
	(Husband's leisure)		0.1899 **	0.1497 **
	× (Age/10)		-0.0477 *	-0.0467 *
	× $(\text{Age}/10)^2$		0.0060 **	0.0060 **
	× No. children		0.0018	0.0018
	× Children aged (0,3)		-0.0020	-0.0032
	Standard deviation (ζ_m)		0.0004	0.0002
	(Wife's leisure)		0.4728 **	0.4211 **
	× (Age/10)		-0.0424 **	-0.0434 **
	× $(\text{Age}/10)^2$		0.0049 **	0.0051 **
	× No. children		0.0060 **	0.0056 **
	× Children aged (0,3)		0.0074	0.0071
	Standard deviation (ζ_f)		0.0008	0.0015
Hours of work densities	Husband	Full-time peak 36h	0.7018 **	
		Full-time peak 40h	1.7013 **	
	Wife	Part-time peak	-0.0626	
		Full-time peak 36h	0.9228 **	
		Full-time peak 40h	1.7343 **	
	Husband, public sector	Full-time peak 36h		1.7371 **
		Full-time peak 40h		1.5277 **
	Husband, private sector	Full-time peak 36h		0.0902
		Full-time peak 40h		1.7148 **
	Wife, public sector	Part-time peak		0.3336
		Full-time peak 36h		1.6885 **
		Full-time peak 40h		1.6451 **
	Wife, private sector	Part-time peak		-0.2422
		Full-time peak 36h		0.3042
		Full-time peak 40h		1.7860 **

Table 1: SML estimates of discrete choice models of labor supply for married couples (continued).

Model component	Variable		Model 1	Model 2
Job availability measures	Husband	Constant	-1.6689 **	
		Secondary educ.	0.7275 **	
		Secondary educ. score	-0.7806	
		Tertiary educ.	0.9439	
		Tertiary educ. score	-1.3281	
		Reg. unemployment	-0.1417 **	
	Wife	Constant	-2.2137 **	
		Secondary educ.	0.9158 **	
		Secondary educ. score	1.0381	
		Tertiary educ.	1.9314 **	
		Tertiary educ. score	5.0353 *	
		Reg. unemployment	-0.1508 **	
	Husband, public sector	Constant		-4.2196 **
		Secondary educ.		1.2355 **
		Secondary educ. score		-0.8592
		Tertiary educ.		1.8197 **
		Tertiary educ. score		-0.8088
		Reg. unemployment		-0.0488
	Husband, private sector	Constant		-1.5852 **
		Secondary educ.		0.3740
		Secondary educ. score		-0.5720
		Tertiary educ.		-0.2178
		Tertiary educ. score		-3.2610
		Reg. unemployment		-0.1659 **
	Wife, public sector	Constant		-4.3616 **
		Secondary educ.		1.5244 **
		Secondary educ. score		1.3413
		Tertiary educ.		2.9401 **
		Tertiary educ. score		7.0222 **
		Reg. unemployment		-0.1085 **
	Wife, private sector	Constant		-2.0630 **
		Secondary educ.		0.5873 **
		Secondary educ. score		0.7894
		Tertiary educ.		0.7329 **
		Tertiary educ. score		1.2224
		Reg. unemployment		-0.1714 **

Notes: Model 1 ignores sector-specific attributes of the various jobs, while Model 2 distinguishes between jobs in the public and private sectors. DHI denotes disposable household income. SML estimates are based on $R = 150$ draws from the distribution of $\zeta = (\zeta_m, \zeta_f)$. Asterisks denote * a p-value between 5% and 1% and ** a p-value below 1%.

Table 2: Labor supply elasticities of husbands and wives by decile of disposable household income.

			Husbands			Wives		
Model	Outcome	Decile	Baseline	Own†	Cross†	Baseline	Own†	Cross†
1	PP	I-III	81.68	0.09 **	-0.02	13.95	0.70 **	-0.12
		IV-VII	98.11	0.00	-0.03 **	54.48	0.15 **	-0.01
		VIII-X	98.82	0.00	-0.03 **	91.41	0.02 **	-0.04 *
		Total	93.39	0.02 **	-0.03 **	53.38	0.13 **	-0.03 **
	HW	I-III	31.24	0.10 **	-0.02	3.81	0.84 **	-0.09
		IV-VII	39.34	0.00	-0.03 **	16.94	0.18 **	-0.02
		VIII-X	40.14	-0.02 **	-0.06 **	31.06	0.04 **	-0.05 **
		Total	37.15	0.02 **	-0.04 **	17.23	0.15 **	-0.04 **
2	PP	I-III	81.68	0.19 **	-0.01	13.95	1.25 **	0.05
		IV-VII	98.11	0.00	-0.04 **	54.48	0.25 **	-0.05 *
		VIII-X	98.82	0.00	-0.02 **	91.41	0.04 **	-0.05 **
		Total	93.39	0.05 **	-0.03 **	53.38	0.22 **	-0.04 *
	HW	I-III	31.24	0.21 **	0.00	3.81	1.56 **	0.05
		IV-VII	39.34	0.00	-0.05 **	16.94	0.33 **	-0.06 **
		VIII-X	40.14	-0.01	-0.04 **	31.06	0.06 **	-0.06 **
		Total	37.15	0.05 **	-0.04 **	17.23	0.27 **	-0.05 **

Notes: Elasticities are obtained increasing simultaneously by 1% the gross hourly wages in all job opportunities. PP and HW denote the participation probability (in percentage points) and the unconditional weekly hours of work, respectively. Symbols denote † a percentage variation with respect to the baseline tax-benefit system, * a p-value between 5% and 1% and ** a p-value below 1%.

Table 3: Effects of the EITC and WTC policy reforms on participation probabilities of husbands and wives by model specification, household type, decile of disposable household income and sector.

		Husbands			Wives		
Model	Variable	Baseline	EITC†	WTC†	Baseline	EITC†	WTC†
1	0 children	93.56	0.02	-0.00	54.18	0.27 **	0.06
	1 child	93.66	0.03	-0.09 **	56.26	0.92 **	0.13
	2 children	93.98	-0.05 *	-0.05 *	51.87	2.06 **	1.11 **
	3 children	87.96	0.15	-0.08	37.96	4.10 **	3.22 **
	I-III	81.68	0.09 *	0.07	13.95	6.67 **	4.36 **
	IV-VII	98.11	-0.01	-0.11 **	54.48	1.39 **	0.50 **
	VIII-X	98.82	-0.02	-0.05 **	91.41	-0.07 **	-0.18 **
	Total	93.39	0.01	-0.04 **	53.38	1.05 **	0.45 **
2	0 children	93.56	0.01	-0.00	54.18	0.30 **	0.11 **
	1 child	93.66	0.06 *	-0.02	56.26	1.39 **	0.12
	2 children	93.98	-0.11 **	-0.10 **	51.87	3.60 **	1.71 **
	3 children	87.96	0.25 **	0.11	37.96	7.22 **	5.51 **
	I-III	81.68	0.06	0.09 *	13.95	9.90 **	6.27 **
	IV-VII	98.11	0.01	-0.06 **	54.48	2.31 **	0.88 **
	VIII-X	98.82	-0.03 **	-0.08 **	91.41	-0.03	-0.29 **
	Public	23.31	0.33 **	0.31 **	20.99	1.25 **	0.46 **
	Private	70.08	-0.10 **	-0.14 **	32.39	2.00 **	0.86 **
	Total	93.39	0.01	-0.03	53.38	1.71 **	0.70 **

Notes: Symbols denote † a percentage variation with respect to the baseline tax-benefit system, * a p-value between 5% and 1% and ** a p-value below 1%.

Table 4: Effects of the EITC and WTC policy reforms on unconditional hours of work of husbands and wives by model specification, household type, decile of disposable household income and sector.

		Husbands			Wives		
Model	Variable	Baseline	EITC†	WTC†	Baseline	EITC†	WTC†
1	0 children	37.32	-0.04	-0.04	18.30	0.15 **	0.04
	1 child	36.95	-0.15 **	-0.22 **	18.01	0.50 **	0.16
	2 children	37.64	-0.19 **	-0.13 **	15.91	1.82 **	1.33 **
	3 children	34.85	0.24 *	0.01	10.99	3.74 **	4.11 **
	I-III	31.24	0.08	0.04	3.81	7.26 **	5.88 **
	IV-VII	39.34	-0.20 **	-0.25 **	16.94	1.09 **	0.58 **
	VIII-X	40.14	-0.09 **	-0.06 **	31.06	-0.28 **	-0.20 **
	Total	37.15	-0.10 **	-0.12 **	17.23	0.76 **	0.51 **
2	0 children	37.32	-0.06 **	-0.06 **	18.30	0.11 **	0.07 *
	1 child	36.95	-0.16 **	-0.17 **	18.01	0.68 **	0.12
	2 children	37.64	-0.31 **	-0.23 **	15.91	3.10 **	2.19 **
	3 children	34.85	0.32 *	0.14	10.99	6.45 **	6.65 **
	I-III	31.24	0.05	0.10 *	3.81	10.53 **	8.12 **
	IV-VII	39.34	-0.19 **	-0.24 **	16.94	1.82 **	1.07 **
	VIII-X	40.14	-0.20 **	-0.15 **	31.06	-0.43 **	-0.31 **
	Public	8.84	0.26 *	0.23 *	6.75	0.84 **	0.47 **
	Private	28.30	-0.26 **	-0.23 **	10.49	1.41 **	0.99 **
	Total	37.15	-0.13 **	-0.12 **	17.23	1.18 **	0.79 **

Notes: Symbols denote † a percentage variation with respect to the baseline tax-benefit system, * a p-value between 5% and 1% and ** a p-value below 1%.

Table 5: Redistributive effects of the EITC and WTC policy reforms by model specification and household type.

Model	Outcome	Household type	Baseline	EITC†	WTC†
1	DHI	0 children	27664	0.03 *	0.02 *
		1 child	28509	0.12 **	0.13 **
		2 children	28346	0.34 **	0.36 **
		3 children	25868	0.89 **	1.25 **
		Total	27994	0.18 **	0.20 **
	HCR	0 children	0.07	-14.59 **	-14.26 **
		1 child	0.13	-3.34 **	-11.52 **
		2 children	0.22	-4.79 **	-5.55 **
		3 children	0.43	1.30 **	-4.48 **
		Total	0.14	-5.26 **	-8.68 **
	IGR	0 children	0.03	-1.66 **	-3.15 **
		1 child	0.06	-1.13 **	-7.55 **
		2 children	0.07	7.53 **	-0.47 *
		3 children	0.15	6.17 **	-0.43
		Total	0.05	2.56 **	-3.36 **
2	DHI	0 children	27664	0.01	0.03
		1 child	28509	0.11 **	0.10 **
		2 children	28346	0.47 **	0.40 **
		3 children	25868	1.50 **	1.85 **
		Total	27994	0.23 **	0.23 **
	HCR	0 children	0.07	-13.85 **	-13.89 **
		1 child	0.13	-3.70 **	-11.32 **
		2 children	0.22	-6.28 **	-6.74 **
		3 children	0.43	-0.83	-6.26 **
		Total	0.14	-6.12 **	-9.28 **
	IGR	0 children	0.03	-1.06 **	-2.88 **
		1 child	0.06	-1.55 **	-8.38 **
		2 children	0.07	7.19 **	-0.87 **
		3 children	0.15	5.09 **	-1.65 **
		Total	0.05	2.28 **	-3.90 **

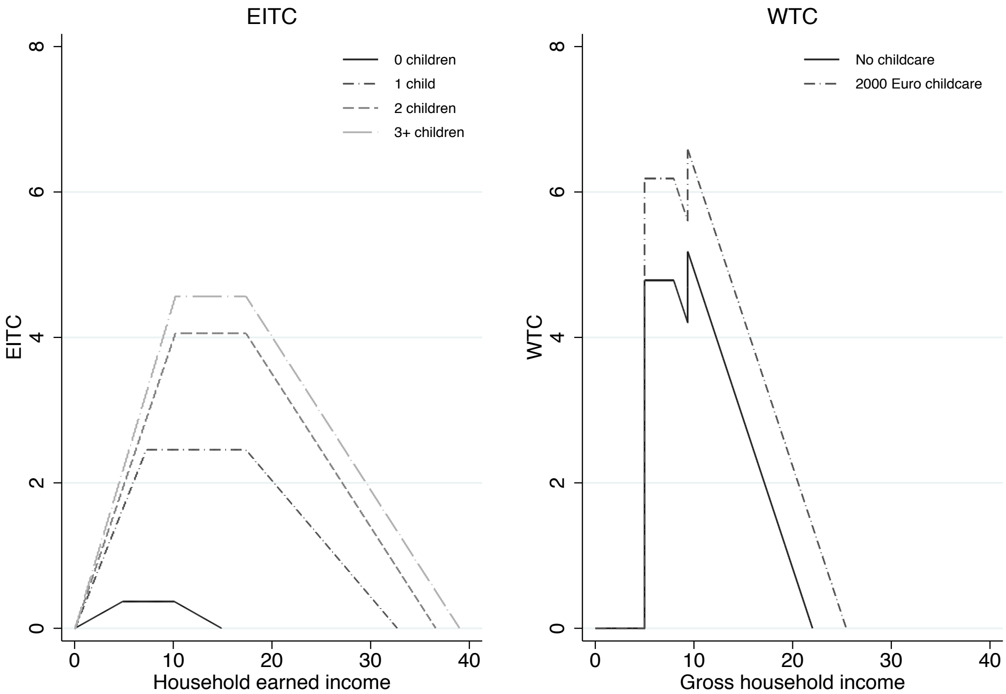
Notes: DHI denotes (mean) disposable household income, HCR denotes head count ratio, and IGR denotes income gap ratio. Symbols denote † a percentage variation with respect to the baseline tax-benefit system, * a p-value between 5% and 1% and ** a p-value below 1%.

Table 6: Labor supply and redistributive effects of the EITC and WTC policy reforms under alternative values of the benefit premium for two-earner households (Model 2 only).

		Husbands		Wives		Redistributive effects		
Policy	p_c	PP	HW	PP	HW	DHI	HCR	IGR
Baseline		93.39	37.15	53.38	17.23	27994	0.14	0.05
EITC†	0	-0.12 **	-0.24 **	-0.91 **	-0.96 **	-0.24 **	-18.59 **	-7.01 **
	0.25	-0.06 **	-0.20 **	-0.08	-0.35 **	-0.13 **	-13.36 **	-4.77 **
	0.50	-0.01	-0.18 **	0.86 **	0.41 **	0.04 **	-8.79 **	-1.54 **
	0.75	0.01	-0.13 **	1.71 **	1.18 **	0.23 **	-6.12 **	2.28 **
	1.00	0.03	-0.08 **	2.36 **	1.82 **	0.40 **	1.19 **	5.82 **
	1.25	0.04 *	-0.04	2.76 **	2.28 **	0.54 **	5.04 **	9.10 **
	1.50	0.05 **	-0.00	2.99 **	2.61 **	0.64 **	10.11 **	11.75 **
	1.75	0.05 *	0.02	3.12 **	2.83 **	0.71 **	14.36 **	13.96 **
	2.00	0.04 *	0.05	3.21 **	3.02 **	0.77 **	16.92 **	15.61 **
WTC†	0	-0.11 **	-0.18 **	-0.69 **	-0.67 **	-0.06 **	-17.20 **	-7.68 **
	0.25	-0.08 **	-0.17 **	-0.32 **	-0.30 **	0.01	-15.76 **	-6.81 **
	0.50	-0.05 **	-0.14 **	0.23 **	0.29 **	0.12 **	-13.05 **	-5.60 **
	0.75	-0.03	-0.12 **	0.70 **	0.79 **	0.23 **	-9.28 **	-3.90 **
	1.00	-0.00	-0.10 **	1.21 **	1.31 **	0.37 **	-8.70 **	-2.10 **
	1.25	0.01	-0.08 **	1.63 **	1.77 **	0.48 **	-8.55 **	-0.08
	1.50	0.02	-0.08 **	2.00 **	2.17 **	0.58 **	-4.97 **	1.84 **
	1.75	0.02	-0.06	2.40 **	2.58 **	0.69 **	-3.64 **	3.64 **
	2.00	0.03	-0.04 *	2.69 **	2.88 **	0.78 **	1.34 **	5.31 **

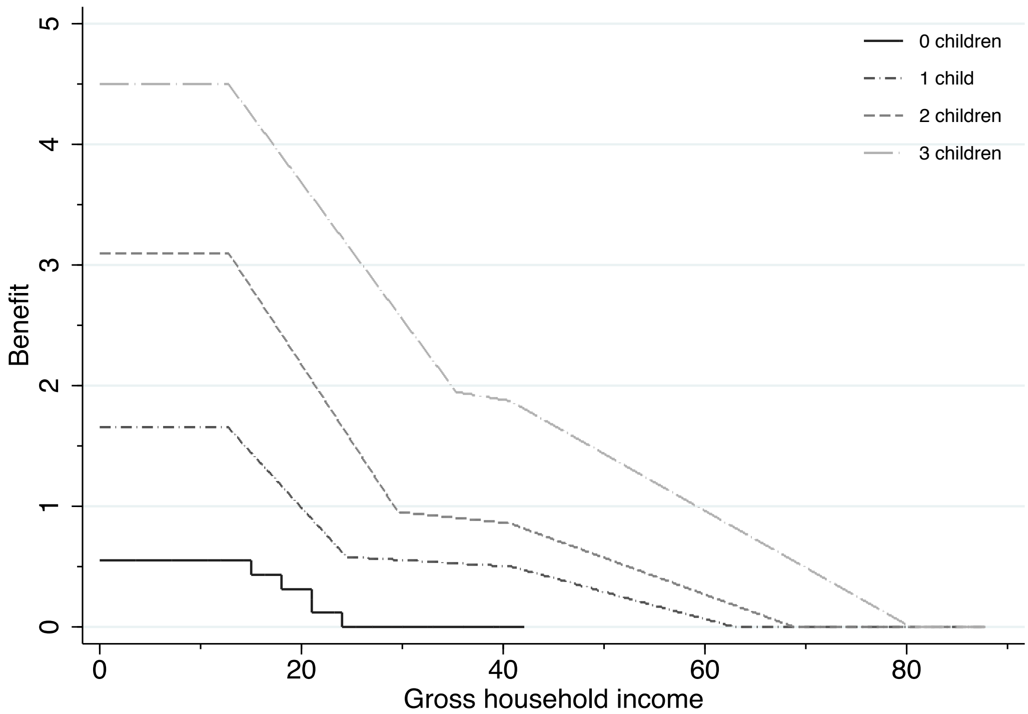
Notes: p_c denotes the size of the benefit premium for two-earner households. Symbols denote † a percentage variation with respect to the baseline tax-benefit system, * a p-value between 5% and 1% and ** a p-value below 1%.

Figure 1: The 2011 EITC and WTC schedules for couples.



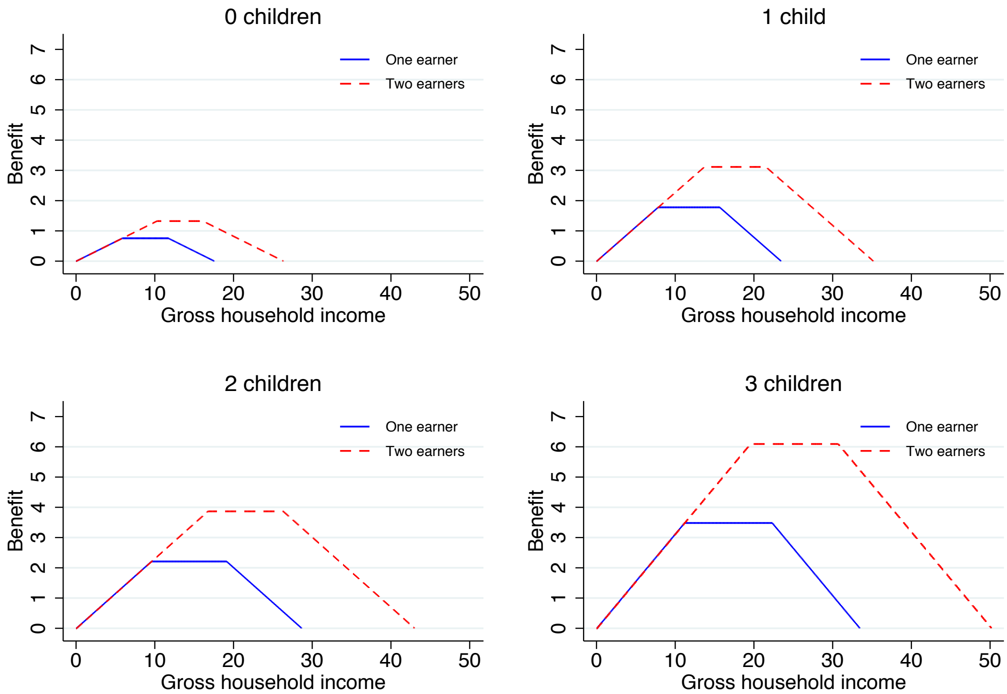
Notes: WTC is based on basic, second adult, and 30 hour elements only, assuming that claimant's hourly wage is equal to 6 Euro and non-labor household income is equal zero. EITC, WTC, household earned income, and gross household income are expressed in thousand Euro using an exchange rate of .7937 for dollars and 1.2367 for pounds.

Figure 2: The 2008 Italian family allowances by household type.



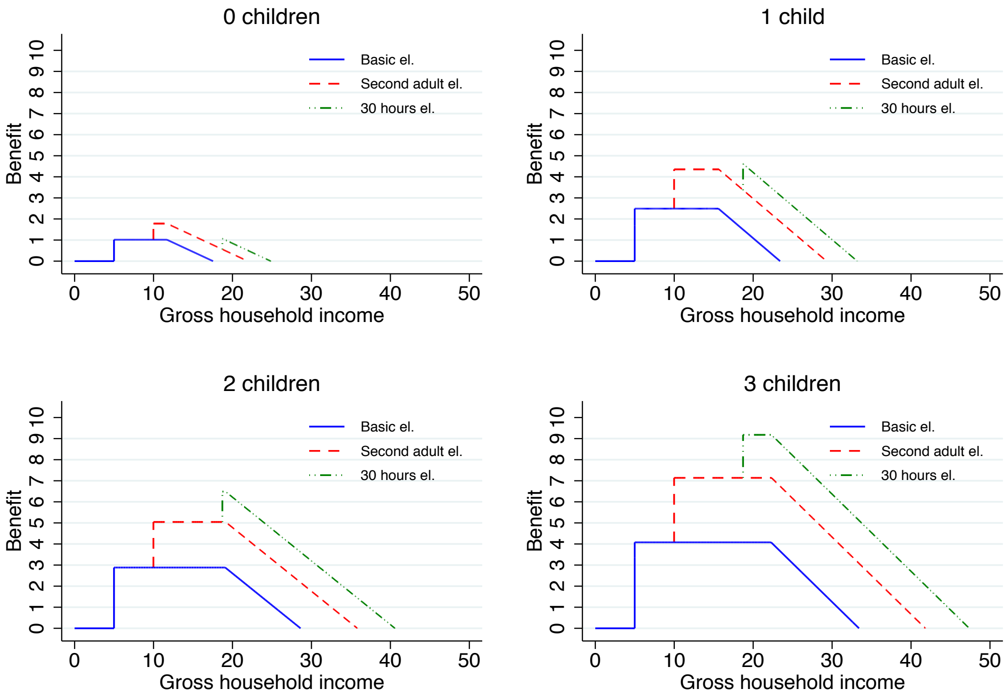
Notes: Benefit amounts and gross household income are expressed in thousand Euro.

Figure 3: Simulated EITC schedule by household type.



Notes: The benefit premium for two-earner households is equal to $p_c = .75$ for all household types. Benefit amounts and gross household income are expressed in thousand Euro.

Figure 4: Simulated WTC schedule by household type.



Notes: The benefit premium for two-earner households (second adult element) and the benefit premium for working full-time (30 hours element) are equal to $p_c = .75$ and $q_c = .50$, respectively, for all household types. The hourly wages of both spouses are fixed to 6 Euro and non-labor household income is fixed to zero. Benefit amounts and gross household income are expressed in thousand Euro.

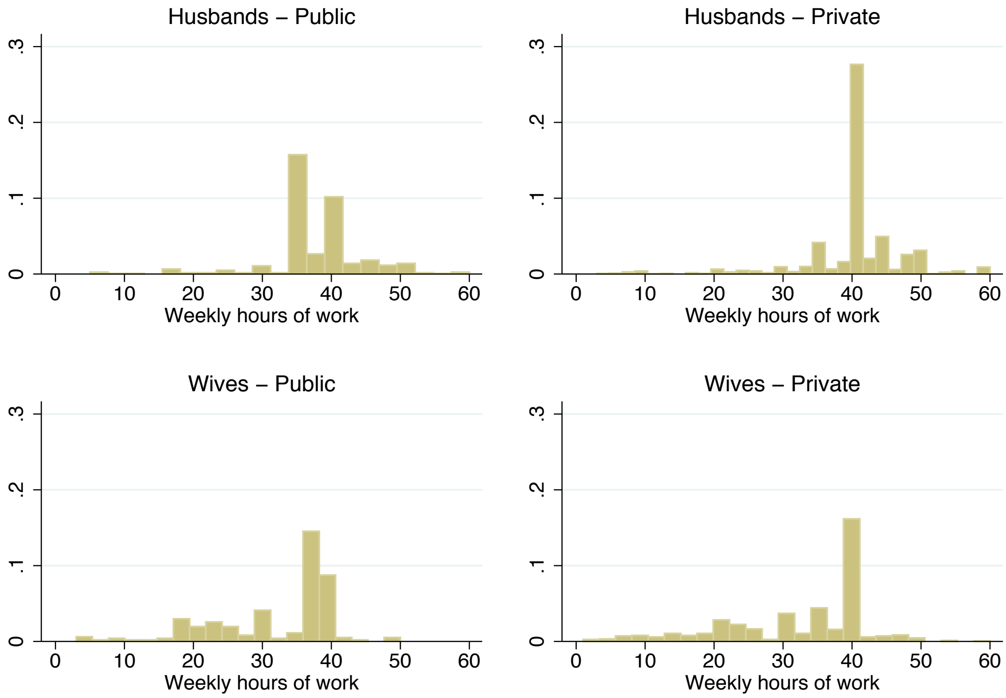
Appendix A: Summary statistics

Table 7: Mean and standard deviation (SD) of the main variables by gender.

	Husband		Wife	
Variable	Mean	SD	Mean	SD
Weekly hours of work	37.47	11.97	17.31	17.72
Participation rate				
- Public or private	0.93	0.25	0.53	0.50
- Public	0.23	0.42	0.21	0.41
- Private	0.70	0.46	0.32	0.47
Weekly hours of work (among workers)				
- Public or private	39.77	7.98	32.28	10.14
- Public	37.93	6.77	32.14	9.42
- Private	40.39	8.25	32.37	10.58
Gross hourly wage (among workers)				
- Public or private	13.34	10.21	12.04	22.26
- Public	16.11	11.94	14.21	8.31
- Private	12.42	9.39	10.63	27.70
Age	46.27	8.37	42.95	8.28
Education attainment				
- Primary	0.58	0.49	0.54	0.50
- Secondary	0.32	0.47	0.35	0.48
- Tertiary	0.10	0.30	0.11	0.31
Years of experience	26.69	9.54	15.09	12.66
Number of children				
- No children			0.39	0.49
- 1 child			0.31	0.46
- 2 children			0.24	0.43
- 3 children			0.05	0.23

Notes: Data are from the 2008 wave of SHIW. Our working sample consists of 1982 married couples.

Figure 5: Weekly hours of work distributions of husbands and wives by sector.



Appendix B: Hourly wage equations

Table 8: Two-step estimates of sample selection models for log hourly wages of husbands.

	Model 1		Model 2			
Variable	Sel. Part.	Wage	Sel. Part.	Sel. Pub.	Wage Pub.	Wage Pri.
Age	-0.0052	0.0074 *	0.0177	0.0921 **	0.0085	0.0066
Age squared	0.0018	0.0001	0.0030	0.0010	0.0007 +	-0.0002
Experience	-0.0447	0.0075 *	-0.0478	-0.0213	0.0033	0.0080 +
Experience squared	0.0026 *	-0.0004 **	0.0014	-0.0022 **	-0.0007 **	-0.0003
Secondary educ.	-1.2221 **	0.2665 **	-1.1083 **	0.5003 **	0.2583 **	0.2762 **
Secondary educ. score	0.5125	0.0223	-0.1243	-0.8509	-0.0504	0.0687
Tertiary educ.	-1.9633 **	0.6231 **	-1.2030 +	1.6608 **	0.7315 **	0.5629 **
Tertiary educ. score	-8.1173	1.3450 **	-6.1229	1.4956	0.5447	2.0177 *
Center	-0.2464	0.0242	-0.1994	0.3115 +	0.0570	0.0268
South	-0.0190	0.0406	0.0583	0.4441	-0.0547	0.0867
Unemployment	0.1926 *	-0.0234 **	0.2218 *	0.0868 +	0.0059	-0.0345 **
Non-labor income	0.1799 **		0.1767 **	-0.0162		
Non-labor income squared	-0.0083 **		-0.0076 *	0.0034		
Wife work	1.7869 **					
Wife public			2.1313 **	1.0766 **		
Wife private			1.8525 **	-0.0754		
Number of children	-0.0505		-0.0405	0.0683		
Child $<$ 3 yrs	-0.8777 +		-0.7974	0.2495		
$\ln(p_2)$		-0.3559			-0.1455 *	
$\ln(p_3)$						-0.3328
Constant	-2.8927 **	2.3507 **	-3.1509 **	-3.3491 **	2.0556 **	2.3748 **

Notes: Standard errors are computed using 500 nonparametric bootstrap replications. Asterisks * denote a p-value between 5% and 1%, and ** a p-value below 1%.

Table 9: Two-step estimates of sample selection models for log hourly wages of wives.

	Model 1		Model 2			
Variable	Sel. Part.	Wage	Sel. Part.	Sel. Pub.	Wage Pub.	Wage Pri.
Age	0.0192	0.0058	0.0512 **	0.0863 **	-0.0001	0.0018
Age squared	-0.0047 **	0.0009 **	-0.0036 **	0.0010	0.0003	0.0010 *
Experience	-0.0589 **	0.0103 *	-0.0627 **	-0.0056	0.0120 **	0.0099 +
Experience squared	0.0092 **	-0.0010 **	0.0090 **	-0.0003	-0.0008 *	-0.0012 *
Secondary educ.	-0.7320 **	0.2539 **	-0.3222 *	1.0485 **	0.1808 *	0.1624 **
Secondary educ. score	-0.7804	0.3356 *	-0.8713	-0.1435	0.0868	0.5212 *
Tertiary educ.	-2.1588 **	0.6358 **	-1.1088 **	2.2274 **	0.4254 **	0.5435 **
Tertiary educ. score	-6.8954 **	0.7632 +	-3.9486	5.0842 *	0.6073	0.3498
Center	0.4283 *	0.0525	0.3187	-0.4708 *	0.0926	0.0743
South	0.2840	0.0666	0.3114	-0.0357	0.0155	0.0955
Unemployment	0.0855 *	-0.0140	0.1043 *	0.0228	0.0002	-0.0307 *
Non-labor income	0.0920 *		0.0677	-0.0520		
Non-labor income squared	-0.0016		-0.0044	-0.0062		
Husband work	1.8175 **					
Husband public			1.8237 **	0.8466 *		
Husband private			1.9238 **	-0.3739		
Number of children	0.1589 *		0.1959 *	0.0819		
Child < 3 yrs	0.3373		0.4025 +	0.2667		
$\ln(p_2)$		-0.0939			0.0711	
$\ln(p_3)$						-0.1423
Constant	-3.0386 **	2.1528 **	-3.1909 **	-1.7859 **	2.3825 **	2.2265 **

Notes: Standard errors are computed using 500 nonparametric bootstrap replications. Asterisks denote a * p-value between 5% and 1%, and a ** p-value below 1%.