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Abstract

In-work benefits (IWBs) have become very common transfer programs that seek to meet both efficiency and equity targets. An expanding literature has assessed the effects of these policies on income distribution and labor supply. In this paper, we estimate the distributional and behavioral impacts of a simulated IWB in Spain based on the replacement of the existing working mother tax credit (WMTC). The US Earned Income Tax Credit (EITC) is used as a reference. We simulate the effects of the proposed scheme using EUROMOD and a discrete choice model of labor supply. Our results show that the enhancement of the proposed IWB would have significant and positive effects both in terms of female labor participation and inequality and poverty reduction.

Keywords: in-work benefits; labor supply; microsimulation; EITC; EUROMOD.

JEL: I38, H23, J22

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INTRODUCTION[1]

Policymakers try to prevent unemployed individuals from falling into poverty by offering unemployment benefits and other out-of-work transfers, including insurance and means-tested social assistance. A usual criticism is that traditional cash benefits might reduce unemployed individuals' incentives to work. In different countries, new policies that focus on low-income families with children have been put into effect, combining social assistance reforms with earned income tax credits. Regarding the latter, in-work benefits (IWBs) have become increasingly popular. In some countries, these schemes yield positive effects in terms of higher labor participation and lower poverty rates, leading to both efficiency and equity gains (Hotz and Scholz 2003; Nichols and Rothstein 2015). In their most basic form, IWBs are income tax credits that are available to low-income families—usually with children—that increase with earned income up to a certain point.

Many governments use tax credits and work-conditioned transfers as a means of providing cash assistance to low-income families with children (Brewer et al. 2009; Immervoll and Pearson 2009). An expanding literature has assessed the effects of these policies on incomes and hours worked. One strand of this literature has focused on optimal design issues (Saez 2002; Creedy 2005; Blundell and Shephard 2012). A number of studies have also evaluated the impact of IWBs on work incentives, generally finding positive and significant effects (Eissa and Hoynes 2004; Eissa et al. 2008; Blundell et al. 2013; Nichols and Rothstein 2015). More recent research has broadened the debate about IWBs from work incentives to wider questions, such as fertility decisions or household composition effects (Francesconi and van der Klaauw 2007; Dicker-Conlin and Baughman 2009; Chetty et al. 2013; Chetty and Saez 2013; Hoynes et al. 2015; Guyton et al. 2016; Fisher; 2016).

While IWBs have become a central component of the tax-benefit system in a number of countries—such as the UK and the US—the scope of these benefits is much more limited in other OECD countries. Paradoxically, some of these OECD countries face similar challenges to those that inspired the implemented reforms mentioned above. For instance,

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Spain stands out among industrialized countries because of its lower participation rates and the higher incidence of low-wage jobs (OECD 2008). Among other characteristic features that make a new IWB particularly attractive within the tax and benefit system in Spain are the following: i) the average age for having a baby has increased to 30 compared with the OECD average of 28.5; ii) despite remarkable growth in recent decades, activity rates for married women are substantially lower in Spain than in other OECD countries; iii) the scope of family benefits in Spain is much lower than in other European countries; iv) the proportion of low-wage workers and the share of working persons who are poor are among the highest in the EU.

Could an IWB help solve the problem of low wages? Could an IWB increase the labor participation of women? Could poverty and inequality be reduced? Given the extent of low and unequal wages and the insufficient coverage provided by social benefits, it seems reasonable that such a policy could simultaneously encourage many women to join the labor market and reduce the incidence of monetary poverty. Low-income earners in Spain have little support, apart from the existing working mother tax credit (WMTC)—i.e., a refundable tax credit (100 euros) for working mothers with children younger than 3 years old. The introduction of an IWB could thus improve the labor participation of married women with children and reduce income poverty in these households. To assess IWB effects, one promising approach involves the microsimulation of the likely impact of an IWB on labor supply and income using structural models.

In this paper, we estimate the redistributive impact of a simulated IWB in Spain based on the replacement of the current WMTC with a new IWB with a very similar structure to that of the US Earned Income Tax Credit (EITC). For this purpose, we use data from the Spanish version of the 2010 EU Statistics on Income and Living Conditions (EU-SILC) survey, which will be the input database for EUROMOD—the microsimulation tool for calculating disposable income before and after the reform. EUROMOD is the most important tax-benefit microsimulation model for the EU, enabling researchers and policy analysts to calculate, in a comparable manner, the effects of taxes and benefits on household incomes and work incentives of each country's population and for the EU as a whole. To evaluate labor responses, we use the discrete choice approach proposed by Aaberge et al. (1995) and Van Soest (1995). These models assume that individuals choose their working hours between a discrete set of possibilities rather than from a range between

0 and 24 hours. They simplify the representation of budgetary constraints, and the utility function must only be evaluated for a limited number of points. Our target group is the set of working mothers (ages 18–55) who are either married—cohabiting—or single and who are not self-employed.

Using our behavioral microsimulation model, we find that the proposed reform might produce significant efficiency and equity gains. The introduction of this IWB will generate a substantial increase in labor participation in the extensive margin (0 to 20 hours worked). Moreover, it will lead to a reduction in income poverty, with remarkable improvement in the poorest working households.

The structure of the paper is as follows. The opening section summarizes the particular design features of both the current system and the new IWB based on the EITC scheme. The second section introduces the structural discrete choice model of labor supply, which is used to estimate potential changes in the number of hours worked. In the third section, the data are presented. The fourth section shows the main results of the microsimulation analysis. The paper ends with a brief list of conclusions.

1. THE DESIGN OF THE NEW IN-WORK BENEFIT

1.1. The Working Mother Tax Credit (WMTC)

Spain's experience in the field of IWBs is limited. As in most Mediterranean countries, active employment policies have not generally targeted individuals who are already in the labor market. They have largely aimed to improve the employability of young people and other groups affected by unemployment. On the other hand, the most common strategies to support families have been incentives in the taxable base related to personal income tax, a birth allowance of 2,500 euros (lump sum) that was enacted in 2007 and subsequently suppressed, a very limited national child benefit, and some regional benefits for low-income families (Adiego et al. 2012).

Currently, the closest policy to an IWB in Spain is the WMTC, a fiscal benefit for working mothers with children younger than three years of age that was first implemented in 2003.

This credit can be received as an annual lump sum when filing a tax return or as a monthly tax-free subsidy. Because mothers must be employed to receive the benefit, its level depends on the social contributions that have been paid by both the employee and the employer. If the working mother's monthly social contributions are above 100 euros, this amount is the benefit that she will receive. If her social contributions are below that level, she will receive an amount equivalent to the amount paid. If this monthly benefit is postponed until the following year's tax return, the woman will receive 1,200 euros per year, according to the same rules associated with the social contributions paid. When the working mother has more than one child under the age of 3, proportional amounts are calculated to be added to her final disposable income.

< TABLE 1 around here >

The number of WMTC recipients—both the taxpayers who file a tax return at the end of the fiscal year and those who receive a tax-free subsidy of 100 euros per month—has increased. The ability to manage payments through income tax returns by the National Tax Agency has helped this scheme attract more participants than other family policies managed by regional administrations. The most outstanding trend has been the shift towards a higher proportion of women opting for the tax-free subsidy (Table 1).

Few analyses examine the impact of the WMTC. In general, it has been interpreted as a policy with small distributional effects because all women who pay at least 100 monthly euros in social contributions are entitled to receive it regardless of their income level. In addition, this low-level benefit does not seem to encourage work. Fuenmayor et al. (2006) reviewed the fiscal impact of this policy using microsimulation and a theoretical cost-benefit model of the labor market participation of married women. They found that the deduction for maternity substantially softens the undesirable impact of the personal income tax structure in Spain, which provides favorable treatment to families with one non-working spouse through the joint tax declaration. Although not specifically focusing on this measure, other papers have analyzed the relationship between tax reforms and female labor supply. Examining taxable income elasticities, Badenes (2001), Díaz (2004), and Sanmartín (2007) analyzed the changes in the behavior of the second earners in households—mostly women—due to the removal of the obligation to file taxes jointly. In general terms, their results were inconclusive.

1.2. General issues in the design of an earned income tax Credit

IWBs are essential in “making work pay” (OECD, 2005). They are employment conditional cash benefits that are paid to low-income families whose members have full- or part-time work. These programs focus on reducing benefit dependence, enhancing people’s willingness to work and reducing unemployment among less-skilled workers (Blundell 2006). After IWBs are implemented, the labor supply is expected to increase, making participation in the labor market higher. Nevertheless, they do not only focus on the efficiency side, as these benefits also aim to improve the redistribution of income by reducing poverty.

IWBs differ in terms of their benefit design and targeting. IWBs may take the form of tax credits, wage-related transfers or lump-sum payments. The chosen form largely depends on the target group. A very common target group is low-wage earners, particularly families with children. In this case, the main aim is to provide incentives to increase disposable income by extending the number of hours worked. Tax credits and wage-related transfers focus on low-income working families, whereas lump-sum payments focus on those who are not currently working. The optimal design for income transfer programs is unclear. Saez (2002) suggests that, when behavioral responses are concentrated along the intensive margin, the best scheme is a traditional means-tested benefit with a substantial guaranteed income support and a large phase-out tax rate. By contrast, when behavioral responses are concentrated on the extensive margin, the optimal scheme is a transfer program with negative marginal tax rates at low income levels and a small guaranteed income.

According to the analysis of labor incentives of the OECD (2005), a 20% reduction of marginal effective tax rates (METRs)—which is what some of the most ambitious reforms have sought to achieve— would imply an almost 10% increase in the probability of moving from unemployment to employment. This probability is about seven percentage points higher if the unemployed person has a working spouse. The likelihood of these transitions is not the same across demographic groups, with more significant effects among single women. Available evidence also suggests that reduced METRs allow part-time workers to work full-time and take better-paying jobs, especially second earners in couples without children. In the case of specific IWBs, most estimates that test individual responses to the incentives embedded in these schemes show that extensive margin elasticities are especially significant for low-wage workers. Eissa and Liebman (1996) and Meyer and Rosenbaum (2001) showed that the EITC increased important incentives for entering the labor market, but the effects in the intensive margin were not as obvious. These results were in line with those anticipated by Pencavel (1987) and Blundell and MaCurdy (1999), who predicted low elasticities for individuals who were already working.

A relevant issue that must be considered in designing this policy is the ways in which it complements other ongoing policies, such as active labor market policies, minimum wages, family programs or other social programs. Instead of being considered in isolation, the IWB should be regarded as a part of a strategy that helps the unemployed who are receiving benefits enter the labor market. For example, benefits for dependent children can be a way of supplementing an IWB, especially in single-parent households. Regarding these synergies, Blundell and Hoynes (2004) examined the impact of an IWB on efficiency in the UK, considering evidence of the effects of past reforms and similar reforms in the US. In the US, a large proportion of the dramatic increase in the labor force participation of single mothers with low educational levels in the 1990s could be attributed to the increased generosity of the EITC; however, the impact of ostensibly similar reforms in the UK seems to have been weaker for several reasons, including their interactions with other means-tested benefits.

In these schemes, eligibility is usually based on family income and typically requires the presence of children, meaning that IWBs and child benefits are closely connected. Working families with children face higher costs and have higher labor supply elasticities than those without children.[2] IWBs can be family or individually based. Family-based IWBs are more common in Anglo-Saxon countries, whereas Belgium and France have implemented individual IWBs. Family income-based eligibility rules and their interactions with other features of the tax-benefit system make the analysis of their impact on work incentives quite complex. Although both designs aim to enhance labor market participation, individual IWBs ultimately promote work incentives, whereas family-based IWBs tend to discourage the labor participation of second earners. For instance, the US EITC and the

[2] Considering children's ages is important in the design of IWBs, as households with younger children usually show stronger behavioral responses. Blundell and Shepard (2012) studied the optimal design of these policies for low-income families and highlighted the importance of including age in the design of the incentives.

British Working Family Tax Credit (WFTC) seemingly act as labor disincentives for second earners, most often women (Bargain and Orsini 2005). Nevertheless, empirical evidence suggests that the EITC promotes employment among eligible unmarried women with children, whereas it seemingly leads to traditional welfare-type disincentives for most eligible second earners (Eissa and Hoynes 2004).

Individuals or households usually receive these benefits if the eligibility conditions are maintained. To analyze the effects of a time limit, Brewer et al. (2012) evaluated an IWB with special features, in which the benefit was received only for a limited time if it had not been received before. This scheme was applied for one year to a sample of single-parent households in the UK. Although these benefits were received for a short period, the authors found significant movements into the labor market, though they were unable to attribute 100% of these transitions exclusively to this special design. Notably, in these programs, the composition of the beneficiaries and their behavioral responses may have changed depending on macroeconomic conditions. Bitler et al. (2014) used administrative data from the IRS to examine the effects of economic cycles, showing that higher unemployment leads to more EITC recipients and increased spending among married couples. However, the effect of the business cycle on the EITC seems insignificant for single people, both in terms of the number of beneficiaries and spending.

Among the different IWBs enacted in OECD countries, the US EITC is one of the most popular schemes. It has become the largest benefit for low-income households in the US, and a rapidly expanding literature has focused on its impact on labor participation and redistribution. Because it seems to encourage work and promote redistribution, the EITC has become a very popular antipoverty program (Scholz 1996; Hoynes and Patel 2015; Nichols and Rothstein 2015), and it will be used as reference here. However, it is not the only successful IWB. In the UK, IWBs have a long history, although they have undergone several reforms. Over the past three decades, the UK has offered three different IWBs. Family Credit (FC) was introduced in 1988 and modified in 1992 and 1995. In 1999, FC was replaced by the Working Families' Tax Credit (WFTC); in 2003, the Child Tax Credit (CTC) and Working Tax Credit (WTC) replaced the existing WFTC; and, in 2014, a new national benefit system (Universal Credit) was launched, unifying Jobseeker's Allowance, income-related Employment and Support Allowance, Income Support, Working Tax Credit, Child Tax Credit and Housing Benefit, with a gradual transition to be completed by

2017. These family-based IWBs have turned into mechanisms that enhance efficiency and equity (Blundell 2006).

Similar evidence has been found in other OECD countries. Bargain and Orsini (2005) found that wage subsidies in Finland, Germany and France encourage married women to take jobs and that family-based tax credits and individual wage subsidies yield significant poverty reductions. Figari (2009) confirmed the possibility of enhancing both the redistributive and incentive effects of the Italian tax-benefit system through the introduction of different IWBs. In addition, for Italy, De Luca et al. (2014) analyzed the labor supply and redistributive effects of the EITC and the WTC in US and UK, respectively. Their results show that reforms in line with the WTC and the EITC would have a significant positive effect on the labor supply of married women, weak negative effects on that of married men, and a strong and positive impact on equity. The EITC would be more effective than the WTC in promoting employment for women, while the WTC would be more effective in reducing poverty. With a simulated IWB for Spain, Oliver and Spadaro (2012) show a potential increase in the percentage of the labor supply of working mothers and a small reduction in the number of hours worked by their partners. The latter result is in line with the main findings for other countries, where higher disposable incomes that result from IWBs seem to discourage second earners' incentives to work.

1.3. The proposed IWB for Spain

We propose the implementation of a new policy within the Spanish tax-benefit system—an IWB with the same structure as the EITC, following the optimal design proposed by Saez (2002). In this scheme, benefit levels depend on income, the number of children in the household and the most important parameters of an IWB: the minimum income level needed to receive the benefit, the phase-in rate, the maximum benefit level, the income level of the phase-out region, the maximum income to receive benefits and the phase-out rate. Although some changes have occurred since its inception, this basic structure has not substantially changed in the EITC. The credit equals a fixed percentage of earnings from the first dollar earned until the credit reaches its maximum. Both the percentage and the maximum credit depend on the number of children in the household. The credit then remains at that maximum as earnings continue to rise, but earnings eventually reach a phase-out range. At that point, the credit falls with each additional dollar of income until it disappears entirely.[3] In practice, the EITC phases in slowly, has a medium-length plateau, and then phases out more slowly than it has phased in. The credit is fully refundable: any excess beyond a family's income tax liability is paid as a tax refund.

Our proposal of an EITC for Spain consists of three thresholds: T1 (300 euros), T2 (700 euros), and T3 (1,000 euros). Working mothers with earnings below T1 will receive a subsidy that phases in with income. Individuals with earnings between T1 and T2 will receive a lump-sum benefit (320 euros). For those with earnings between T2 and T3, the benefit will phase out according to the program's implicit tax rate. Benefits will end when earnings are higher than 1,000 euros.

< FIGURE 1 around here >

In our simulated scenario, the new IWB replaces the existing WMTC so that a working mother who fulfills the requirements will receive the new IWB but not the WMTC. Figure 1 shows the design of the new policy, which differs in four fundamental aspects from the former credit. First, the IWB has a phase-out segment that does not exist in the current scheme. Second, the benefit level is much higher—320 euros instead of 100 euros per month. Third, in the new IWB, the income test considers earnings rather than contributions. Finally, only salaried women will have access to the IWB.[4]

A variety of determinants influence the amounts chosen for the IWB. On the one hand, the reform is assumed to be a zero-cost strategy with regard to the current WMTC. Second, because the general goal is to design a policy that mirrors the EITC, the IWB will have a similar relationship among its different parameters. Historically, the maximum amount to be paid by the EITC has been the same as the income level that determines the beginning of the plateau phase. Given that the EITC considers household income, some adjustments must be made using equivalence scales. We also assume that the amount

[3] The phase out begins at a higher income level for married couples than for single parents.

[4] Given their different labor behaviors, both women aged 18–55 and self-employed women are excluded from the scheme.

defined as the maximum benefit and the initial income of the plateau phase will be very similar.

In the EITC, incomes at the end of the phase out represent an increase of over 200%—depending on the number of children—compared with the income level at the beginning of the plateau phase. In the Spanish case, the "mileuristas"[5] are a special concern, so we decided to set the income limit at 1,000 euros to qualify for the benefit. Three hundred euros are 233% less than the 1,000-euros level, more or less in keeping with the relationship that exists in the EITC. The plateau phase has been defined more broadly than it usually is in the US scheme to ensure a relevant number of recipients in that segment. In other words, the goal is to have a greater number of people who receive benefits at the maximum amount, which is why we have set the beginning of the phase out at 700 euros—slightly above the minimum wage. Finally, choosing 320 euros per month as the benefit limit not only is similar to the 300 euros at the beginning of the plateau phase— ensuring that the reform is implemented at zero cost—but also is closely linked to the levels set in other schemes in the Spanish tax-benefit system.

Therefore, the chosen levels can be justified both in terms of the existing design of similar policies in other countries and as comparable amounts to those set in other policies that have already been implemented in Spain.

2. A DISCRETE CHOICE MODEL OF LABOR SUPPLY

The EITC scheme proposed for Spain seeks to improve both labor participation and incomes among low-wage women. Given the likelihood of significant behavioral effects on both the intensive and extensive margins, possible changes in individual labor supply decisions must be analyzed. To estimate Spanish women's reactions to the IWB, we follow the well-known literature of static structural discrete choice models of labor supply (Aaberge et al. 1995; Van Soest 1995; Creedy and Kalb 2005). These models are static because only current behaviors are considered—long-term reactions are not. An economic

[5] In social policy debates in Spain, "mileurista" is a popular neologism that refers to a person who earns 1,000 euros a month.

model makes them structural, and they are discrete because only a few hourly levels are considered in the budgetary constraint. This decision regarding the different alternatives for the number of hours included in the choice set is indeed relevant within the discrete choice setting. Some authors show that predicted errors are reduced when the alternatives are sampled from the original distribution rather than being imposed (Aaberge et al. 2009).

We focus on working women between the ages of 18 and 55 years who have children.[6] Figure 2 provides an indication of the weekly hours worked by the target group. As expected, Spain has a traditional Mediterranean distribution in the number of hours worked, with sizeable peaks corresponding to part- and full-time jobs, apart from the notable proportion of non-working mothers. Primarily civil servants and bank employees constitute the peak corresponding to jobs with 35-hour work weeks.

< FIGURE 2 around here >

We convert weekly work hours into a set of three possible alternatives: 0, 20 and 40 hours, where 0 is assigned to women who work fewer than 9 hours, 20 to those who work more than 9 but fewer than 30, and 40 to the remaining women who are considered full-time workers. Almost half of the women between 18 and 55 who have children do not work (27.4%), and nearly three times as many women have full-time jobs (55.5%) as have part-time jobs (17.3%).

We seek to determine whether a new IWB can encourage Spanish women to work—either by joining the labor force or by increasing the number of hours worked. Notably, prior evidence has shown that most transitions take place on the intensive margin, with fewer changes in the number of hours worked by part-time employees. In a groundbreaking study, Scholz (1996) found that most workers who receive the EITC have incomes that position them in the flat or phase-out region, whereas the unemployed are clearly incentivized to get a paying job when these schemes are implemented. Eissa and Hoynes

[6] Men's reactions have not been considered, as the proposed new policy does not apply to them. Regardless, we follow the conclusions of Bargain and Peichl (2013), who reviewed 282 estimated elasticities for OECD countries and found that elasticities are much higher for women than for men, which are positive but very small in most cases.

(2004) found that labor supply responds to this transfer program but these responses are concentrated along the extensive margin rather than the intensive one.

A basic model of labor participation may clarify these relationships. In this model, individuals have a limited amount of time to allocate to work and leisure.[7] The trade-off between leisure and income can be represented by the individual's utility function:

$$U=U(y,L) \quad [1]$$

where L is leisure and y is income, including labor and non-labor income. If personal characteristics (X) are considered, a more generalized expression of the direct utility function is as follows:

$$U=U(y,h;X) \quad [2]$$

where h is the number of hours worked. A usual functional form for this utility function is as follows:

$$U_i = \alpha y_i + \beta y^2_i + \gamma h_i + \delta h^2_i + \lambda y_i h_i \quad [3]$$

where $\alpha = \alpha_{0+}\alpha_1$ A and $\gamma = \gamma_0 + \gamma_1$, with A referring to the woman's age and γ to the number of children.

Apart from the aforementioned variables, fixed costs—such as childcare—are considered. In our model, they depend on the woman's age and the number of children under 3 years of age. They are subtracted from disposable income when individuals work part- or full-time. This issue is addressed in the maximization of the likelihood function by reducing income for women who work 20 or 40 hours. Fixed costs are usually related to expenses incurred through childcare services such as kindergartens. They thus depend on the woman's age and the number of children under three years of age.

[7] Leisure must be conceived as the counterpart of paid job. However, the allocation of the individual's time goes beyond the trade-off between earnings and leisure. There are several alternatives to not working like household production or personal wealth, among others.

The variables chosen for equation [3] are usually considered when assessing behavior in the standard theory of labor supply. The trade-off between income and work hours is affected by personal characteristics to such extent that they may determine the final number of hours offered. However, certain components that are linked to individual preferences cannot be modeled from a general perspective, which is usually assumed to be unobserved heterogeneity.

The proposed simulation is essentially probabilistic because the determinants of an individual's behavior cannot be known with any certainty. From a discrete choice perspective, individuals maximize their utility by selecting the number of hours they wish to work (h) subject to the constraint that only discrete numbers of hours, $h_i \quad i = 1,...,k$, are available. The utility associated with each level (U_i^*) is a function of $U(h_i / X)$ and ν_i, where ν_i is the error term:

$$U_i^* = U(h_i / X) + \nu_i = U_i + \nu_i \qquad [4]$$

A probability distribution over the available hours is influenced by the properties of $\nu_i : p_i = P(h = h_i)$ for i=1,…,k. Utility maximization implies that a level of hours i is chosen if $U_i^* \geq U_j^* \quad \forall j$ iff $U_i + \nu_i \geq U_j + \nu_j \quad \forall j$ iff $\nu_j \leq U_i - U_j + \nu_i \quad \forall j$.

For any given value of ν_i, probabilities are calculated as follows:

$$P(U_i^* \geq U^*{}_j \quad \forall j) = P(U_i + \nu_i \geq U_j + \nu_j \quad \forall j) = P(U_i + \nu_i - U_j \geq \nu_j \quad \forall j) =$$
$$P(\nu_i + U_i - U_1 \geq \nu_1, \nu_i + U_i - U_2 \geq \nu_2, ..., \nu_i + U_i - U_k \geq \nu_k)$$

that assuming independence leads to $\prod_{j \neq i} P(\nu_j \leq U_i - U_j + \nu_i)$.

The overall probability can be obtained by aggregating the terms above over possible values of ν_i. Let us assume that the distribution of the error term ν is specified by its density function $f(\nu)$—in the continuous case—and its distribution function $F(\nu)$. Then,

$$p_i = P(h = h_i) = \int_{-\infty}^{\infty} \left(\prod_{j \neq i} F(\nu_i + U_i - U_j) \right) f(\nu_i) d\nu_i \quad [5]$$

where the distribution of ν in terms of its density function follows an extreme value distribution:

$$f(\nu) = \exp(-\nu - e^{-\nu}) \quad [6]$$

The extreme value distribution—also known as a Gumbel, double exponential, or Fisher-Tippett Type I—has a more general expression:

$$f(y) = \frac{1}{\beta} \exp(-\frac{y-\mu}{\beta}) \exp(-e^{-\frac{y-\mu}{\beta}}) \quad [7]$$

Equation [6] is obtained substituting $\mu = 0$ and $\beta = 1$ in [7]. Substituting [6] in [5] the probabilities turn into

$$p_i = P(h = h_i) = \frac{\exp(Ui)}{\sum_j \exp(Uj)} \quad \forall i \in J \quad [8]$$

which is a multinomial logit specification.

3. DATA

3.1. EU-SILC and EUROMOD data

The dataset for the simulation of income changes and labor supply responses comes from the Spanish sample of the EU-SILC, which is transformed into a EUROMOD format to follow the standard structure required to run the simulations. EUROMOD is a tax-benefit microsimulation model for the EU, which calculates the effects of tax-benefit reforms on household income, well-being, inequality and poverty on national and supranational levels (Sutherland 2007). Tax-benefit models are based on micro-data from statistical sources that cover national populations. EU-SILC is the input database for the majority of the countries included in EUROMOD. The Spanish version of EU-SILC (ECV) contains information on incomes from various sources, such as labor, pensions, social benefits, and property. EUROMOD calculates disposable income by defining the sources of disposable income. In general terms, disposable income is defined as market income plus social benefits minus income taxes and social security contributions.

Not all the sources of a tax-benefit model can be simulated because of missing information in the input dataset. For instance, the treatment of old-age pensions or unemployment benefits requires longitudinal data on individuals' working lives. In such cases, some imputations are performed so that the final disposable income can be known. The policy changes that EUROMOD simulates are national and local income taxes; social insurance contributions paid by employers, employees and the self-employed; family benefits; housing benefits; social assistance benefits; and other income-related benefits. As mentioned above, certain taxes and benefits, such as real estate taxes, pensions and survivor benefits, contributory benefits and disability benefits, are not generally simulated.

As in other microsimulation models, all the calculations are performed twice, first under the current system and then after each policy change is introduced. Both disposable incomes are compared to assess whether households are better off after the simulated reforms. Using a microsimulation model whose input database is a survey that contains information of household and individual incomes is advantageous because it captures distributive changes. As in many other countries, household income is underestimated in Spain because of the lack of information on certain sources of income and the need for imputations (Adiego et al. 2012). Microsimulation models use administrative data to compensate for the loss of accuracy.

Transformed into a EUROMOD format, the original sample from the EU-SILC 2010 includes 13,597 households and 36,922 individuals.[8] For our study, we have selected 6,039 women (ages 18–55) who have children and are not self-employed. Some of these women work, and others do not. Complete information on their gross wages is needed to assess their transitions into the labor market. In the case of working women, the standard practice is to assign them the data that are reported in the survey. For non-working women, a reservation wage needs to be estimated to control the likely selection bias associated with labor market decisions.

3.2. Missing wages

Labor supply models account for working and non-working individuals. We are interested in the transitions within the labor market of non-working individuals. Therefore, attributing a wage to non-working women is necessary. Among the different alternatives, we use Heckman's two-step sample selection correction. The two-step statistical approach starts by setting up a model for the probability of employment, usually following a probit regression framework. If X is a vector of explanatory variables and Y is a dummy variable that set to 1 when the individual works and 0 when she does not, the model can be written as follows:

$$P(Y=1/X) = \Phi(X'\gamma) \qquad [9]$$

where Φ is the cumulative distribution function of the standard normal distribution.

The variables that we include in X are educational attainment, work experience, age squared, other household income and two dummy variables that represent whether the woman has a partner and whether she has children between 3 and 6 years of age. Once the probit model has been estimated, the resulting estimators are used to predict the probabilities of employment for all the individuals—working and non-working. The predicted values will be introduced in the second equation—the wage equation—as an additional explanatory variable.

[8] We take 2009, a year severely affected by the economic crisis, as our reference. All analyses replicated for 2005 produce very similar results.

The wage equation can be specified as follows:

$$w = Z\delta + u \qquad [10]$$

where w represents wages, and u represents the unobserved determinants of wages. Z represents the set of explanatory variables for the wage equation, which consist of educational attainment and work experience in our data, apart from the probability of working that is derived from [9].

If ε represents the unobserved determinants of the propensity to work from equation [8], u represents the unobserved determinants of wages in [9], ρ is the correlation between ε and u, and these two errors are jointly normal distributed, then

$$E(w/Z, Y{=}1) = Z\delta + E(u/Z, Y{=}1) = Z\delta + \rho\sigma_u\lambda(X'\gamma) \qquad [11]$$

where λ is the estimated inverse Mills ratio; ε represents information on all the unobserved determinants in [9]; and u represents information on all the unobserved determinants in [10]. If ε and u are highly correlated, the unobserved variables might influence each other; therefore, individuals in equation [10] have not been randomly chosen.

< TABLE 2 around here >

Table 2 presents estimates of the probability of employment for the women in our sample, the wage equation and the self-selection bias. Most of the coefficients from the two-step estimation have the expected signs. On the one hand, having children between 3 and 6 years of age and cohabitating with a partner reduces the probability of employment, whereas higher educational attainment increases this probability. On the other hand, the wage equation shows that both work experience and educational attainment increase gross wages. Finally, the inverse Mills ratio is significant, indicating the need for selection bias correction.

4. RESULTS

4.1. Labor market participation

We apply the labor supply model described in section 2 to the selected sample of women. We replicate the dataset comprising 6,039 women three times (0, 20 and 40 hours) because the model must have three possible states that women can choose—no work, part-time work or full-time work. The variables that we allow to change are the hours worked by mothers—men and the rest of the women in the survey are assumed to display inelastic behaviors—monthly gross wages and other labor variables, such as the number of months employed or unemployed.

This new dataset is used as the EUROMOD input to estimate behavior using equation [3]. For the initial estimates, no reform is considered, and the 2009 tax and benefit rules are applied to the new dataset. The output can be seen in Table 3. In general terms, the results of the utility function estimates are in line with standard economic theory. All the coefficients are significant—positive for income and negative for the number of hours worked.

< TABLE 3 around here >

These parameters determine the labor supply structure of our data according to the utility function chosen. However, as mentioned before, the simulation is not deterministic, and a stochastic component needs to be considered. We incorporate the random process using the so-called maximum probability rule (Bargain and Orsini 2006), which ensures that the optimal choice for each individual, given the estimated labor supply function, corresponds with the choice actually made. For its implementation, the observed distribution of the number of hours worked is replicated by drawing conditionally from the stochastic error structure, such that the predicted choice probability is maximized in the observed state. We then keep a number of draws that lead to predictions, where the predicted choice probability is maximized in the observed state. Using 100 draws, we apply the maximum probability rule to derive the preferred choice after the introduction of the new IWB. To calculate transition probabilities between states (0–20–40 hours) for all the women with children, we use the mean of the predicted transitions over the 100 repetitions.

< TABLE 4 around here >

Table 4 presents the estimates for the three possible transitions. The introduction of an IWB would reduce the proportion of non-working women from 27.4% to 3.4% and the proportion of women working full-time from 55.4% to 49.8%. Part-time jobs would more than double because of intensive margin transitions (0 to 20 hours) and extensive margin transitions (40 to 20 hours). The results mainly show an increase in the number of mothers who decide to join the labor market. This finding is in line with other studies in Italy (Figari, 2009) and Spain (Oliver and Spadaro 2012), where a somewhat similar IWB scheme increases the labor market participation of coupled women by 6.0% and 6.5%, respectively.

Although more than a third of these women would not alter their labor market participation, the new policy would foster substantial results on the extensive margin. Twenty-four percent of women who were not working before the reform would decide to enter the labor market, mostly in part-time jobs. This remarkable impact on the extensive margin requires arguments that would make such transitions realistic, given that public spending on childcare would not change. To do so, we estimated the effect of a variable representing the fixed costs associated with working and paying for childcare-related services. Fixed costs were introduced as a disposable income reduction when women decided to work 20 or 40 hours. In addition to the higher participation of women in the labor market, movements on the intensive margin would also occur, leading some women to reduce their work hours. They would do so by moving from full- to part-time jobs due to the phase-out effect. This result is in line with the IWB experience in other countries.[9]

Despite the very significant behavioral impact, the analysis of labor supply from the structural economic model in our microsimulation approach does not consider restrictions on the demand side. Our assessment of the proposed scheme largely depends on a partial analysis of the labor market, considering the possible behavioral changes of agents who

[9] To calculate the net employment created, we assume that two women who work part-time are equivalent to one woman who works full-time. Given the number of women analyzed in the sample (8,067,954 women) and the estimated transition probabilities, 1,118,420 women would move from not working to working part-time, and 1,062,935 women would take full-time jobs, a number equivalent to 1,622,145 new jobs. However, 17,871 women who were working part-time and 226,945 who were working full-time would no longer work; thus, 235,880 jobs would be lost. In short, the net number of jobs created would be 1,386,265.

traditionally have higher elasticities, such as women. The expected employment improvement would only be attainable in a framework in which an expansion of the labor demand could absorb the supply side growth.

4.2. Distributional effects

Apart from improving labor market participation, IWB schemes also aim to increase low-wage individuals' earnings, thereby producing changes in the income distribution. The goal of increasing incomes of women who could benefit from the new IWB —thereby increasing household incomes— introduces a wide range of possible distributional effects. To identify this impact, we analyze disposable household income in three different contexts: the baseline; Scenario 1, in which the possible changes in labor behaviors are not considered; and Scenario 2, in which these behavioral changes are considered. Household disposable income is calculated by adding the incomes of all individuals in the household and adjusting the resulting number by an equivalence scale —the so-called modified OECD equivalence scale. The baseline setting takes into account the tax-benefit system in force in 2009. In Scenario 1, the WMTC is replaced by the new IWB, but behavioral changes are omitted. In Scenario 2, these changes are considered. In the latter, given that what we know about is the probability of moving between the three states —not working, working part-time, and working full-time—, once we consider changes in labor supply households' disposable incomes are defined as the average incomes in each state multiplied by the corresponding transition probability.

To assess how the implementation of the new policy might affect the original distribution, we estimate a set of inequality measures. To identify the global effects of our IWB, we first present estimates that assume that no labor participation changes occur. Second, we allow individuals to change their behaviors according to the parameters of the estimated econometric model. We include confidence intervals in the estimates to assess whether changes in inequality caused by the reform will be significant.

< TABLE 5 around here >

Overall, the new IWB for Spain seems to reduce inequality in both scenarios, considering the reform without reactions and incorporating labor supply responses to the model (Table

5). However, the reduction of the Gini index in the former case is rather modest, whereas the reform leads to a 4.2% reduction in the second case. This difference is statistically significant and supports the consideration of behavioral reactions to correctly interpret inequality changes that result from the reform. The Theil index (c = 0) will decrease by almost 7.5%, and the Atkinson index (ε=1) will decrease by 8.5%.

< FIGURE 3 around here >

Further insights into the nature of inequality changes can be gained by disaggregating the effects of the new IWB by income deciles. As stated before, when the effects of the new scheme are estimated without considering labor reactions, the differences between the baseline results and the ones corresponding to the reform are very small (Figure 3). However, when labor responses are considered, income increases for all the deciles, except the top income levels. The most pronounced changes would occur in the poorest decile, where the average income would grow a 42.4% with the reform.

< TABLE 6 around here >

One of the IWB's main goals is to increase low-wage individuals' incomes. As such, one of the most relevant results to test is how poverty would change with implementation of the new policy. We use the index proposed by Foster, Greer and Thorbecke (FTG) (1984) as our poverty measure:

$$FGT(\alpha) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z - y_i}{z}\right)^{\alpha}, \text{ with } \alpha \geq 0 \qquad [12]$$

where z is the poverty threshold; q are households whose incomes are below that threshold; y_i denotes household income; and α measures inequality aversion. We use the most standard value of the index (α=0) that makes the FGT equal to the headcount ratio. As Table 6 shows, the poverty rate would slightly fall from 21.5% at baseline to 21.4% with the new IWB, assuming no behavioral reactions. However, when labor supply responses are considered, the effects of the new IWB on the incidence of poverty become remarkably stronger with a reduction of more than 10%. This decrease in the poverty rate is even greater with lower poverty lines, illustrating the potential of IWB schemes to reduce severe poverty.

An interesting question is how the IWB might affect the poverty structure by household type, especially when behavioral changes are included in the evaluation. Prior empirical findings show that family-based tax credits and individual wage subsidies both reduce poverty significantly and change the composition of poverty in some countries (Bargain and Orsini 2006). Our estimates show a greater reduction of poverty rates for single-mother households and couples with children after the introduction of the new IWB in the Spanish tax and benefit system.[10] This reduction is even larger when 30% of the median income is used to determine the poverty threshold. The FGT index can be used to break down the reform's potential effect on the contribution to total poverty of each category. Given a population divided into *k* = 1, 2, ..., *K* mutually exclusive groups, the index can be additively decomposed as follows:

$$FGT(\alpha) = \sum_{k=1}^{K} n_k \, FGT(\alpha)_k \qquad [13]$$

where $n_k = N_k/N$ represents the relative population of subgroup *k*, and $FGT(\alpha)_k$ represents the poverty index that corresponds to that subgroup.

< TABLE 7 around here >

As Table 7 shows, our estimates of the respective contributions to poverty confirm that households with dependent children would be the main beneficiaries of the reform, remarkably reducing their contribution to poverty rates. Single-parent households' contribution to total poverty would decrease 35%. Couples with children —whose contribution would decrease by 20%— would remain one of the household types that substantially contributes to total poverty, but they would cease to be the group to make the largest contribution.

10 The poverty rate of single-parent households would decrease from 41.5% to 24.1%, and that of couples with children would decrease from 24.0% to 17.5%.

In short, the enhancement of the proposed IWB would yield significant and positive effects in terms of inequality and poverty reductions and promote substantial labor incentives. These observed results are in line with previous findings for Spain associated with the impact of different tax reforms on the labor supply (Labeaga et al. 2008). Nevertheless, this remarkable twofold impact is largely dependent on the demand side of the labor market. For this distributional impact to be effective, a sufficient increase in demand is essential to absorb the increase in labor force participation due to the new policy.

5. CONCLUSION

IWBs have proven to be effective tools in reducing poverty and enhancing labor participation in many countries. Although the effects might not be optimal in some population groups, such as secondary earners, the overall assessment of their performance seems positive in terms of efficiency and equity gains in a number of countries. Furthermore, recent evidence also points to positive unintended effects in a variety of dimensions, including improvements in health status and social relationships.

In this paper, we offer evidence of the potential effects of the implementation of a specific IWB scheme in Spain. We define a standard IWB scheme that follows the optimal design proposed by Saez (2002), which includes three earnings thresholds, a subsidy that phases in with income, a lump-sum benefit for individuals with earnings between the two first thresholds and benefits that phase out from the second threshold up until a given level. We take the general characteristics of the EITC as a reference.

One of the contributions of this paper is its treatment of behavioral responses. To estimate Spanish women's reactions to the IWB, we have followed a specific approach within the framework of structural discrete choice models of labor supply. Compared with other behavioral microsimulation models that are non-structural, this approach has the advantage of resting on both an economic model and the current distribution of hours worked. The estimated parameters from the utility function are in line with the prototypical models of labor supply, with income positively affecting utility and working hours having the opposite effect.

One of the paper's main findings is the sizeable impact that the new scheme might have on women's labor market participation. Our estimates yield a substantial reduction of the proportion of non-working women. Nevertheless, this result is compatible with extensive margin movements, with a segment of working mothers moving from full- to part-time work. These results are somewhat similar to those of previous studies for other countries.

Taking into account behavioral reactions, the simulated results of the proposed IWB show unequivocal gains in terms of reducing inequality and poverty. However, these results do not hold when the reform is evaluated precluding the foreseeable changes in labor participation. When labor transitions are addressed, all the estimated inequality measures are remarkably lower after the simulated reform. Given that poverty reduction is one of the key targets of these reforms, the drastic decrease of poverty rates stand out. Our results unequivocally point to an especially marked reduction in the incidence of severe poverty. Furthermore, the introduction of an IWB like the simulated one would not only change poverty levels but also the composition of poverty in Spain. Families with children would particularly benefit from the new scheme.

Therefore, as in other countries, the proposed IWB might produce very positive equity effects without creating substantial labor disincentives. While the cost of the reform would not be negligible and the expected results should be subjected to the natural caveats that are implicit in this type of microsimulation models, the resulting efficiency and equity improvements would seemingly give rise to higher levels of social welfare.

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Table 1. Cost and number of recipients of the WMTC

COST	(Thousand euros) All WMTC	Monthly payment	Tax credit in the tax return
2003	607,237	231,000	376,237
2004	652,113	169,066	483,046
2005	721,001	162,200	558,801
2006	766,630	154,700	611,930
2007	827,633	130,800	696,833
2008	871,175	118,800	752,375
2009	871,049	100,209	770,840

BENEFICIARIES	Beneficiaries by filling the tax return
2003	424,630
2004	533,444
2005	611,342
2006	679,096
2007	764,678
2008	826,515
2009	843,851

Source: National Tax Agency.

Table 2. Wage equation

Hourly gross wage (ln)	
Educational attainment (medium)	0.062
Educational attainment (high)	0.406***
Work experience	0.029***
Work experience squared	-0.000***
Constant	1.827***
Selection equation	
Educational attainment (medium)	0.411***
Educational attainment (high)	1.124***
Age squared	-0.000***
Couple	-0.227***
Children, ages 3–6	-0.209***
Other household income	0.000***
Constant	-0.013***
Lambda	-0.425***
N	6039

* p < 0.10, ** p < 0.05, *** p < 0.01.

Table 3. Estimates of the labor supply model

Income	
Age	0.237***
Educational attainment	-0.866***
Constant	4.355***
Income squared	
Constant	60.56***
Hours worked	
Number of children	-0.349***
Constant	-2.556***
Hours worked squared	
Constant	2.520***
Income * Hours	
Age	-0.313***
Number of children	1.804***
Constant	-116.1***
Fixed costs	
Number of children younger than 3	-0.104***
Constant	0.729***
N	6039
Log likelihood	-5832,5

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 4. Labor supply effects (transitions between states)

		After IWB			
	Number of hours	0	20	40	Total
Before IWB	0	0.4	13.9	13.2	27.4
	20	0.2	8.8	8.1	17.2
	40	2.8	24.1	28.6	55.4
	Total	3.4	46.8	49.8	100.0

Table 5. Distributional effects

	Baseline	Scenario 1	Scenario 2
Gini	0.3147 (0.3110, 0.3184)	0.3140 (0.3103, 0.3177)	0.3016 (0.2979, 0.3053)
Theil (c=1)	0.1632 (0.1576, 0.1687)	0.1625 (0.1570, 0.1681)	0.1510 (0.1455, 0.1565)
Theil (c=0)	0.2042 (0.1982, 0.2102)	0.2035 (0.1975, 0.2095)	0.1852 (0.1794, 0.1910)
Atkinson (ε=0.5)	0.0904 (0.0879, 0.0929)	0.0901 (0.0876, 0.0926)	0.0829 (0.0805, 0.0853)
Atkinson (ε=1)	0.1847 (0.1798, 0.1896)	0.1841 (0.1792, 0.1891)	0.1691 (0.1643, 0.1739)
Atkinson (ε=2)	0.6542 (0.5727, 0.7357)	0.6539 (0.5723, 0.7356)	0.6264 (0.5301, 0.7227)
P90/P10	4.53	4.50	4.17
P90/P50	1.90	1.89	1.85
P50/P10	2.38	2.37	2.25

[1] The numbers in parentheses represent the confidence interval at a 95% level.

Table 6. Changes in poverty rates after the reform
(threshold: 60 and 30% of median income)

	Baseline	Scenario 1	Scenario 2
$z = 0.6$	21.5	21.4	19.2
$z = 0.3$	6.0	6.0	5.0

Tabla 7. Relative contribution to poverty rates

z = 0.6	RELATIVE CONTRIBUTION		
Household type	Baseline	Scenario 1	Scenario 2
1 adult	0.10034 (0.0051)[1]	0.100761 (0.0051)	0.104541 (0.0054)
2 adults with no dependent children	0.176390 (0.0052)	0.177211 (0.0053)	0.191067 (0.0058)
Other households with no dependent children	0.218987 (0.0061)	0.220007 (0.0061)	0.244509 (0.0067)
1 adult with 1 or more dependent children	0.022639 (0.0019)	0.023045 (0.0019)	0.014604 (0.0017)
2 adults with 1 or more dependent children	0.271802 (0.0065)	0.268240 (0.0064)	0.222431 (0.0061)
Other households with 1 or more dependent children	0.209888 (0.0061)	0.210735 (0.0061)	0.222848 (0.0066)
z = 0.3	RELATIVE CONTRIBUTION		
Household type	Baseline	Scenario 1	Scenario 2
1 adult	0.106098 (0.0099)	0.106534 (0.0099)	0.112208 (0.0111)
2 adults with no dependent children	0.141637 (0.0098)	0.142220 (0.0098)	0.153046 (0.0112)
Other households with no dependent children	0.199412 (0.0111)	0.200231 (0.0112)	0.226793 (0.0129)
1 adult with 1 or more dependent children	0.034077 (0.0046)	0.033222 (0.0046)	0.008328 (0.0025)
2 adults with 1 or more dependent children	0.293279 (0.0122)	0.291368 (0.0122)	0.265954 (0.0134)
Other households with 1 or more dependent children	0.225497 (0.0114)	0.226425 (0.0115)	0.233671 (0.0129)

[1] Standard errors.

Figure 1. IWB proposal

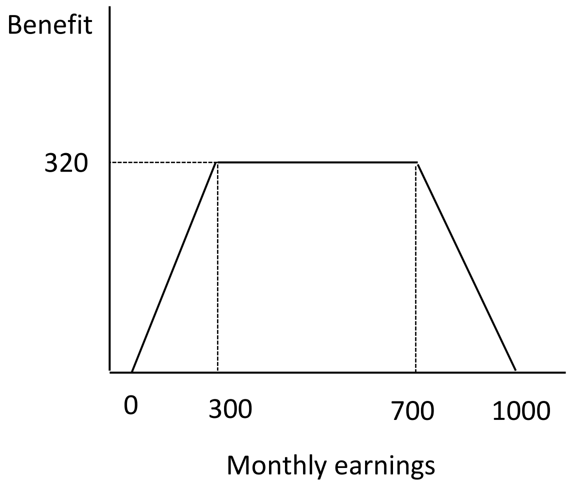

Figure 2. Number of hours worked per week

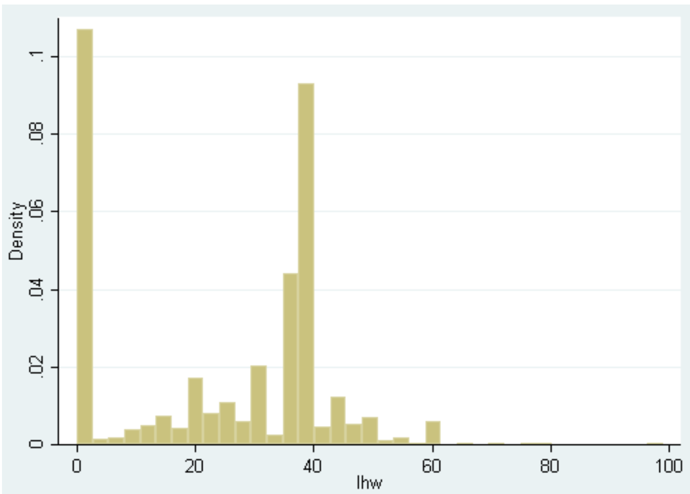

Figure 3. Mean income by deciles after the reform