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Women's and men's responses to in-work benefits: The influence of younger children

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Abstract

This study examines how the non-targeted earned income tax credit (EITC) introduced in Sweden in 2007 has affected the labor supply of men and women living together in two-adult households and the extent to which children affect related outcomes. Using a structural discrete labor supply model for two adult households, we estimate the impact of the EITC on both labor supply and disposable income separately for households with and without children. Our results suggest that wage elasticities differ for men and women with or without children, a result that is in line with earlier literature. However, women increased their labor supply by 0.9 percent regardless of children in the household, whereas men with children increased their labor supply by approximately 0.5 percent and those without children increased their labor supply by 0.7 percent.

Keywords: Structural discrete labor supply model, EITC, younger children, two-adult households.

1 Introduction

One notable trend within countries in the OECD has been the increasing popularity of "Making Work Pay" policies in the form of Earned Income Tax Credits (EITC) and similar in-work benefits, often targeted at low-income earners and/or families with children (Sørensen, 2010). For example, the EITC introduced in the United States in 1975 aimed to offset the adverse distributional and incentive effects of federal income and payroll taxes on low-income workers. Similarly, the Working Tax Credit (WTC) introduced in the United Kingdom in 2003 is a payment from the state to people who work for a low income.[1] These types of labor policies are designed to reduce the tax burden and are expected to raise the long-run level of employment rate but to decrease labor income taxes, which may be very costly for the government (Sørensen, 2010). The direct taxes on labor income account for more than half of the total tax revenue and approximately one-fourth of the GDP in Sweden. This policy was introduced in 2007 and was gradually expanded in 2008, 2009, and 2010. Surprisingly, the Swedish EITC is a *non-targeted* policy designed to provide incentives for working-age individuals outside the labor force to work at least part time and a higher labor supply, especially among low-income earners, by increasing their participation rate. The Swedish EITC is quite different from the EITC policies in other countries because it does not include a phase-out bracket in which marginal tax rates are increased.[2] Given that a phase-out bracket reduces work incentives, we can expect that the Swedish EITC would have stronger effects on work incentives than the EITC policies in other countries.

There have been some attempts to evaluate the effects of the EITC reform in Sweden. Edmark et al. (2012) concluded that the limited variation in the size of the tax deduction among individuals in combination with complex employment trends both before and after the EITC reform(s) presented a major challenge to attempts to evaluate the employment effects of the Swedish EITC. They attempted to exploit the fact that different people with a given earned income have tax reductions (EITC) that differ in size depending on the municipality in which they live. Their analysis focused on

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[1] The WTC replaced the Working Families Tax Credit (WFTC), which operated from April 1999 to March 2003. The WFTC was a transitional system from the earlier benefit for working families known as Family Credit (FC), which had been in operation since 1986. In addition to the WTC, people may also be entitled to the Child Tax Credit (CTC) if they are responsible for any children.

[2] The argument for this construction was to avoid the potential negativ effect that would arise from the induced marginal effects in the phase-out region of the income distribution. Because the wage distribution in Sweden is relatively compressed compared to other countries, this could be a problem.

evaluating the extent to which the tax credit actually increased employment. Their overall assessment was that their results could not credibly be interpreted as effects of the EITC.

Our paper examines how the EITC has affected individual commitment to work for men and women who live together in a two-adult household (with or without dependent children) and, in particular, the extent to which children in the household are important to the outcome. We estimate a structural discrete labor supply model using a representative sample of Swedish households. In a first step, we analyze the wage elasticity and present the simulated effects of a one percent increase in the gross hourly wages on worked hours and labor market non-participation. In a second step, the estimated labor supply preferences are used to simulate the EITC effects on labor supply and disposable income. Our wage elasticities are in line with estimates reported in other studies that use Swedish data, showing that the levels of wage elasticity differ between men and women in a two-adult household. Women increased their labor supply by 0.9 regardless of whether they had children, whereas men with children increased their labor supply by approximately 0.5 percent and those without children by 0.7 percent.

2 Earlier literature and the focus of our study

The earlier literature suggests that there are large variations in the labor supply, or working hours, across countries and over time. For example, at the beginning of 2000, Americans worked approximately as much as in 1970, whereas Europeans worked almost 50 percent less (Alesina et al., 2005). These differences might be explained by European labor market regulations, which do not seem to have increased employment but instead increased the returns to leisure as more people took longer vacations. These differences might also be explained by the generous social insurance systems in Europe, which cover absences from work due to sickness or parental leave, and/or other economic incentives (connected to the tax and transfer systems), which make labor market work less attractive (binding). Therefore, to implement relevant actions that increase incentives to work, we need to know more about individuals' preferences for work, how they differ between different groups, and how tax and benefit reforms actually affect households, their income distribution, and their employment behavior (Altman, 2001).

Based on a derivation of individual preferences, several previous studies that are relevant for our analysis evaluate the effects of changes in the tax and transfer system by simulating the effects of in-work tax subsidies reform on households' labor supply decisions (e.g., Aaberge et al. (1995), Aaberge et al. (1998), Aaberge et al. (1999), Aaberge et al. (2000), Blundell et al. (2000), Creedy and Kalb (2005), Immervoll et al. (2007), Kleven and Kreiner (2006), and Paulus and Peichl (2009)). These results add to a relatively large body of literature that focuses on tax credit reforms in the US and the UK and shows empirical evidence that for men, uncompensated labor supply elasticities are close to zero and compensated labor supply elasticities are relatively modest, whereas labor supply elasticities are much higher for women (Alesina et al., 2005). Male labor market participation does not respond substantially to changes in taxation, although female participation does. However, the traditional division of labor by gender in households appears to be an important factor in decisions related to female participation (James, 1992). The expansion of the EITC has increased employment, the labor supply, and earnings, especially for women who are household heads (e.g., Dickert et al. 1995; Eissa and Liebman, 1996; Ellwood, 2000; Meyer and Rosenbaum, 2001), and it has contributed to the decrease in welfare use (Grogger, 2003).

The wage elasticity estimated using Swedish data from the 1990s and 2000s (Table A1 in the Appendix) varies by household type, from 0.05 for married/cohabiting men and foreign-born single women to approximately 0.10 for married/cohabiting women and single men and 0.77 for single mothers. However, Blomquist and Hansson-Brusewitz (1990) suggest that the estimation of the labor market participation response to changes is sensitive to the use of restrictive functional forms and the practice of evaluating female and male wage rate elasticities at different points on the labor supply functions.[3]

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[3] Blomquist and Hansson-Brusewitz (1990) estimate labor supply functions for married men and women in Sweden using data from 1980, taking account of the complete form of individuals' budget constraints. Using a quadratic supply function, they evaluated the female wage rate elasticity at the mean male sample values and reported a wage rate elasticity of 0.10 for women and approximately 0.12 for men. The linear supply function with random preferences yields a wage rate elasticity of approximately 0.45-0.80 and an income elasticity of approximately -0.04 to -0.06. The quadratic supply function with fixed preferences yields a wage rate elasticity of 0.37 if calculated at the mean sample values for working women and only considering the responses for working females. Evaluating elasticity at the mean sample values for the full sample and taking into account the labor-leisure choice, they obtain an elasticity of 0.58.

Another aspect relevant to our analysis is that most earlier findings suggest that EITC policies have been particularly successful in increasing the labor supply along the extensive margin (i.e., the choice to participate in the labor force) without analyzing or reporting results about the intensive margin (number of hours worked). When Saez (2002) modeled labor supply responses along both the intensive margin and the extensive margin, he reported that the optimal transfer program is a classical Negative Income Tax program with substantial guaranteed income support and a large phasing-out tax rate when behavioral responses are concentrated along the intensive margin. When behavioral responses are concentrated along the extensive margin, the optimal transfer program is similar to the Earned Income Tax Credit, with negative marginal tax rates at low income levels and a small guaranteed income. When the labor supply is flexible only at the extensive margin, an egalitarian society will want to subsidize work at the low end of the wage distribution by allowing the effective marginal labor income tax rate to be negative for the lowest-paid workers. This can be achieved through a generous EITC for low-paid workers that is gradually phased out as earnings increase to reduce the budgetary cost. The optimality of this policy hinges on the fact that the subsidization of work at the bottom end of the pay scale encourages labor force participation, thereby reducing the fiscal cost of supporting the non-employed. Even if a work subsidy for low-income earners distorts labor supply, this distortion is justified by the desire to redistribute income in favor of persons with a low earning potential.

3 Empirical framework

Our empirical framework is based on Keane and Moffitt's (1998) structural model of multiple welfare program participation and labor supply, which is used to study the labor supply of single mothers and how it is affected by different types of welfare programs received simultaneously in the US. A similar model has been used to analyze the labor supply of single mothers in Sweden with a focus on the simultaneous use of paid (municipal) childcare and welfare benefits (Andrén, 2003).

3.1 A labor supply model for a two-adult household

The structural labor supply model in this study consists of an assumed utility function that captures the household's preferences for work and consumption and a budget constraint that represents the household's disposable income. The size of the household's disposable income depends on the choices the adults in the household make in terms of hours of work. A convenient yet flexible way of modeling household preferences is to use a quadratic direct utility function, which consists of the sum of two individual utility functions. In its most basic form, the utility function has three arguments: hours of work for men (H_m); hours of work for women (H_w); and the household disposable income (Y). It is expressed in the following way:

$$U(H_m, H_w, Y) = \beta_m H_m + \beta_w H_w + \beta_y Y + \\ + \alpha_m H_m^2 + \alpha_w H_w^2 + \alpha_{my} H_m Y + \alpha_{wy} H_w Y + \alpha_{wm} H_w H_m \tag{1a}$$

The model is discrete because hours of work for men and women take a finite number of discrete alternatives from which individuals can choose rather than a continuum of hours.[4] It is not obvious how many alternatives constitute an acceptable approximation. The empirical literature consists of examples of three or more alternatives. In this application, seven discrete work hour alternatives per adult household member are used: $H \in$ {0, 12, 27, 35, 38, 41, 50}.[5]

Because not all individuals are working, some individuals in the sample have wages that are unobserved (i.e., the individual's labor supply is zero because he or she has not been offered a wage that exceeds the corresponding reservation wage). This is a problem because the estimation method used requires the existence of numerical values for all individuals. This problem is often solved by replacing the unobserved wages with a prediction based on those that have observable wages (controlling for sample selection).[6] However, it has been shown that mixing observed and predicted wages produces a meaningless statistical specification (MaCurdy et al., 1990). An alternative would be to replace all wages, observed as well as unobserved, with predicted wages (Meghir, 2009). This would make the statistical specification correct, but it causes the

[4] The choice of the number of worked hours is limited by a given number of discrete alternatives. This approach, introduced by Van Soest (1995), has been frequently used in the context of structural labor supply models because the econometric application is greatly simplified compared to the choice of hours worked on a continuous variable. This is especially true when the budget amount takes complex statements as a result of the interaction of tax and benefit systems. With the discrete approach, it is generally very easy to determine whether the empirical model is economically grounded and meets the requirement of utility-maximizing individuals.

[5] These choices are discrete approximations of observed worked hours (h), with the following associations: $H = 0$ when $h = 0$; $H = 12$ when $1 \leq h \leq 20$; $H = 27$ when $21 \leq h \leq 30$; $H = 35$ when $31 \leq h \leq 37$; $H = 38$ when $38 \leq h \leq 39$; $H = 41$ when $40 \leq h \leq 43$; and $H = 50$ when $h \geq 44$. Accordingly, in our model, we use $H_m \in \{0,12,27,38,41,50\}$ and $H_w \in \{0,12,27,38,41,50\}$. The specific alternatives have been choosen to make each work-hour group similar in size.

[6] This is a commonly used method proposed by Hausman (1981).

budget set to be miss-specified because it is based on predicted wages rather than observed wages.

A more interesting approach, suggested by van Soest (1995), is to estimate the wage equations simultaneously with the utility function and to integrate the unobserved wages for those who do not work. This method is efficient, leads to a correct stochastic specification for all individuals, and allows for the existence of a potential wage penalty due to part-time work. Because a significant share of women work part-time, this is a relevant issue.

Another relevant modeling aspect is related to the observed evidence that not all households eligible for social assistance are observed as recipients. This means that some households choose not to apply for social assistance even though the household is entitled to economic support. As a result, some households violate the assumption of maximizing their utility because the utility of a household is assumed to increase with the disposable income. In the economic literature, this behavior is explained by stigma effects associated with welfare use (Moffitt, 1983). To avoid this inconsistency, a flat component (ϕP_{SA}) is augmented additively to the utility function in the following way:

$$U = U\left(H_m, H_w, Y\right) + \phi P_{SA}, \tag{1b}$$

with ϕ representing the "stigma" parameter, a measure for the stigma effect in terms of (dis)utility associated with social assistance (SA), and P_{SA} representing a binary indicator that shows whether the household is an SA recipient or not. If social assistance is associated with a stigma effect, this coefficient is expected to be negative and significantly different from zero. Unfortunately, there are several reasons why individuals do not receive social assistance when they are eligible, which means that the estimated stigma parameter should be interpreted with caution.[7]

Another relevant aspect related to the labor supply is the fixed costs of work. Fixed costs of work refer to transportation costs, childcare costs, or any other costs initiated when beginning work. It can also refer to costs in terms of utility. We follow van Soest (1995) and control for these costs in terms of utility. Controlling for fixed cost of work in this way increases the precision of the labor supply predictions from the

[7] In practice, this situation may, in many cases, be a matter of lack of knowledge about eligibility for social assistance or a way of avoiding a demanding investigation that is expected to take too much time for too little financial outcome. In addition, it could partly result from measurement errors in the data.

model (compared to the basic model that does not control for fixed costs of work). Using this approach, the utility function is augmented by adding utility adjustment terms in the following way for men and women separately in the following way

$$U = U\left(H_m, H_w, Y\right) + \phi P_{SA} + \sum_{g=m,w} \sum_{i=1}^{r} \gamma_{ig}\delta_{ig}, \qquad (1c)$$

with δ_{ig} representing an indicator variable for labor supply choice *i* and gender *g* (i.e., *m* for men and *w* for women); γ_{ig} is the corresponding parameter, which represents the utility associated with a specific labor supply alternative *i* for the men or the women in the household. The number of parameters (*r*) does not need to coincide with the number of discrete labor supply alternatives per individual in the model and usually takes a much lower number. If the effect is associated with a disutility of work, the estimated parameters will take negative values and will be measured in relative terms to the no-work alternative.

The household's joint disposable income is determined using the following formula:

$$Y = Y_m + Y_w + B_{SA}(X_{SA})P_{SA} + B_{HA}(X_{HA})P_{HA} - C_{CC}(X_{CC})P_{CC} \qquad (2)$$

$$Y_m = H_m w_m + N_m - t_m \qquad \text{(Disposable income of the man)} \qquad (3)$$

$$Y_w = H_w w_w + N_w - t_w \qquad \text{(Disposable income of the woman).} \qquad (4)$$

Equations (3) and (4) represent the individual contributions of the adult household members to the household's disposable income in addition to the common household components included in equation (2). The first household component in equation (2) refers to potential social assistance (which could contribute to the household's disposable income if the household is a social assistance receiver ($P_{SA} = 1$)).[8] The second component, $B_{HA}(X_{HA})$, is a function of the potential housing allowance if the household receives a housing allowance (P_{HA}=1).[9] The third component, $C_{CC}(X_{CC})$,

[8] B_{SA} is a function of age of the children, the number of children, housing rent, and disposable household income.

[9] B_{HA} is a function of the number of children and household disposable income.

represents a function for the potential cost for municipal childcare use if the household has younger children and uses municipal childcare ($P_{CC} = 1$).[10]

To allow different households with identical observable characteristics to make different choices of work hours, it is necessary to control for unobserved heterogeneity to allow for random influences (from the perspective of the researcher) on these decisions. This is accomplished by allowing the size of the labor supply parameters for men and women in the utility function to vary in terms of both observables and unobservables. Together with the wage equations for men and women, the structural labor supply model has four endogenous variables specified in the following way:

$\alpha_m = Z_m\gamma_m + \eta_m$	(Labor supply preferences for men)	(5)
$\alpha_w = Z_w\gamma_w + \eta_w$	(Labor supply preferences for women)	(6)
$\ln(w_m) = X_m\beta_m + \varepsilon_m$	(Wage equation for men)	(7)
$\ln(w_w) = X_w\beta_w + \varepsilon_w$	(Wage equation for women),	(8)

where θ=(η_m,η_w,ε_m,ε_w) captures unobserved heterogeneity and is assumed to be distributed jointly normal with mean zero and covariance Σ_θ. This design has the advantage of not imposing the assumption of independence from irrelevant alternatives because it allows for correlation among the unobservables.

3.2 Estimation

Because hours of work are modeled as a discrete variable, the estimation problem can be formulated as a multiple choice problem with seven labor supply alternatives for each adult in the household. This corresponds to a household choice set of 49 (7×7) different alternatives conditional on the wages of the household.

Let j = 1, 2, ..., 49 be the discrete choice alternatives for the household. The problem is to choose the household alternative that generates the highest utility. That is, the household will choose alternative j if and only if

$$U_j \geq U_k \text{ for all } k = 1, 2, ..., 49, k \neq j, \tag{*}$$

[10] B_{CC} is a function of the age of the children, the number of children, and the size of the gross houlsehold income.

where U_j represents the utility calculated using equation (1c) for alternative j, obtained by substituting equations (2), (3), and (4) in equation (1c) evaluated for alternative j.

Each household's contribution to the likelihood function is represented by a probability corresponding to the observed labor supply alternative. We therefore need to determine $P(U_j \geq U_k)$ for all k = 1, 2, ..., 49 for each household in the sample. The easiest way to find these probabilities is to use a so-called frequency simulator. However, this approach cannot be used in this application because it is impossible to use a gradient-based optimization method when maximizing the likelihood function because the frequency simulator is a step function. Additionally, it does not guarantee that the simulated probabilities for a given household add up to one. Instead, we follow Keane and Moffitt (1998), who use the so-called "Kernel Smoothed Frequency Simulator". This simulator is based on the extreme-value distribution function, which is used as a kernel for the frequency simulator. To obtain better precision in the simulation of the log-likelihood function, we use quasi-random numbers (using the random Halton sequence) instead of the standard pseudo-random numbers. The simulation noise is thereby reduced by a factor of 10, meaning that 10 Halton drawings have the same precision as 100 pseudo-drawings. In this study, 10 Halton draws are used per each adult in each household.[11]

Because it is a two-adult household rather than a single individual that contributes to the likelihood function, four different states are specified based on how many people in the household work and have observable wages: 1) households where both the woman and the man in the household work ($d_1 = 1$); 2) households where the man works and the woman does not work ($d_2 = 1$); 3) households where the woman works and the man does not work ($d_3 = 1$); and 4) households where neither the man nor the woman works ($d_4 = 1$).This gives the following log-likelihood function:

$$\begin{aligned}\ln(L) = &\sum_{i \in \Theta_1} \sum_{j=1}^{J} d_1 \ln P(j, w_m, w_w \mid \theta, X, Z) + \sum_{i \in \Theta_2} \sum_{j=1}^{J} d_2 \ln P(j, w_m \mid \theta, X, Z) + \\ &\sum_{i \in \Theta_3} \sum_{j=1}^{J} d_3 \ln P(j, w_w \mid \theta, X, Z) + \sum_{i \in \Theta_4} \sum_{j=1}^{J} d_4 \ln P(j \mid \theta, X, Z)\end{aligned}, \quad (9)$$

11 See Train (2003) for a detailed description of how to generate Halton random draws.

where i is an index of households, and j is an index of labor supply alternatives.

3.3 Simulated labor supply elasticity for men and women

The estimated parameters from the utility function are used to compute the impact of the change in an individual's disposable income on the labor supply. Using these parameters, we estimate the expected value of hours worked per week and the labor supply elasticity of wages for men and women using the following formulas:

$$E[H \mid Y, X] = \sum_{k=1}^{7} P(H_k \mid Y, X) H_k \qquad \text{(Average hours)} \qquad (10)$$

$$\varepsilon = \frac{E[H \mid Y_1, X] - E[H \mid Y_0, X]}{E[H \mid Y_0, X]} \times \frac{1}{0{,}01} \qquad \text{(Labor supply elasticity).} \qquad (11)$$

The average hours of work is determined using the standard formula for the expected value of a discrete random variable. Labor supply elasticity is simulated using the structural labor supply model by determining how the probabilities of the various labor-supply choices change when changing the hourly wage by one percent. That is, to find the labor supply response of a change in the tax system, the expected value is determined with and without EITC, which corresponds to two different disposable incomes (Y_0 and Y_1).

4 Data and institutional settings

In Sweden, the EITC is a non-targeted tax credit that depends on the taxpayer's labor income, which includes both earned income and taxable transfers. Earned income refers to wage income, and taxable transfers refer to indirect employment-related incomes, such as sickness parental leave benefits, unemployment benefits, and pension income. Labor income is taxed by a proportional local tax and, where appropriate, by a central government income tax. The local income tax rate is the sum of the income taxes set by the municipalities and the counties. The EITC was gradually expanded in four steps between 2007 and 2010 (presented in Table A2 in the Appendix). The size of the tax credit increases with earned income up to a certain level. Therefore, for taxpayers in these income ranges, the EITC reduces the marginal as well as the average tax rate on labor income. To estimate the impact of tax changes on labor force participation, we can estimate it for different income groups and calculate the appropriate weighted averages to estimate the degree of self-financing associated with alternative tax policy experiments such as an increase in the EITC. Such exercises require access to and handling of detailed micro databases (Sørensen, 2010).[12] In this study, we use a representative random sample of households in Sweden from 2007. The data were provided by Statistics Sweden (SCB) and contain information from the Household Economics (HEK) database, supplemented by individual information from other registers. The HEK is an annual sample survey designed to identify the income structure and disposable income distribution among different households and to describe living and housing costs for households by different types of housing.

Given the large difference in the labor supply of women across different types of households, we choose to analyze only two-adult households. However, given that the taxpaying unit in Sweden is the individual and not the household, we analyze women and men separately. The selection is limited to individuals aged 18-64 years who are not early retired, self-employed, or studying (full or part-time) and who belong to a two-adult household. This selection produces a sample of 1875 households of couples living together (1051 households with children and 824 households without children).

Two key variables of our analysis are the number of hours worked per week and the hourly wage rate. The data include information about individuals' employment. The degree of employment is calculated as a percentage of full-time working hours, where the numbers of hours worked each month are added over the year and divided by the standard of 2,080 hours per year. The variable for the number of hours worked per week is a construction based on the degree of employment taken from the HEK. An individual who has been unemployed or on parental leave throughout the whole year has an employment degree of zero and is therefore categorized as a non-participant in the labor force (i.e., his or her hours of work per week is zero). For individuals who have been unemployed or on parental leave for less than a year but reported during the interview that they worked full time, their hours of work were adjusted to less than full time.

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[12] Sørensen (2010) offers a general analysis of the Swedish tax system with a description and analysis of international competitiveness and capital income taxation.

The HEK includes information about hourly wage rates. However, a monthly earnings rule rather than exception is the case for many state and municipal employees. This means that the measure of hourly earnings in the HEK is based on the observed monthly salary and is altered to correspond to a full-time salary and, in some cases, is scaled down to represent an hourly wage.

Descriptive statistics for all variables used in the empirical analysis are presented in Table A3 in the Appendix.

5 Results

The estimated parameters of the labor supply equation, the wage equation, and the utility function by gender and type of household are presented in Tables A4–A6 in the Appendix. Using these parameters, we estimate the expected value of hours worked per week and the labor supply elasticity of wages for men and women separately and by type of household. Table 1 presents the simulated effects on the labor supply as a result of a one percent increase in hourly wage (w) and suggests a relatively different reaction from women and men: women's wage elasticity amounts to 0.22 percent, whereas men's wage elasticity is approximately half as large. The next step is to use labor supply preferences and disposable income, as predicted by the structural labor supply model developed for this study, to simulate the effects of the EITC on the labor supply and disposable income. It should be noted that even though the model contains exact rules for how the tax system looked in 2007 and the exact rules for the EITC's four different steps (i.e., 2007, 2008, 2009, and 2010), it is still an approximation of individuals' disposable income, which means that the disposable income levels might deviate from the true values. To some extent, this can affect the results (although the percentage changes in disposable income are affected to a lesser extent).

Table 1 The simulated effects (in %) of a one percent increase by gender and type of household

	Married/Cohabiting with children	Married/Cohabiting without children
Women		
Worked hours	0.07	0.07
Implicit elasticity	0.08	0.08
Not in the labor market	-0.26	-0.40
Men		
Worked hours	0.04	0.06
Implicit elasticity	0.05	0.06
Not in the labor market	-0.37	-0.37

Tables 2 and 3 present the effect of the EITC on both disposable income and labor supply (both weekly hours of work and changes in labor force participation) by gender and type of household for each step of the EITC reform. The effects are the percentage changes for each EITC step in relation to a tax system without an EITC. The descriptive statistics reported in Tables A3 and A7 show some differences in the worked hours between married/cohabiting women and men with and without children. The difference in the simulated EITC effects on the labor supply of women and men are relatively small. For married/cohabiting men and women with children, the difference in average worked hours was approximately nine hours per week (women's average working time was 28.8 hours per week, and men’s was 37.5), whereas for cohabiting/married men and women without children, the difference was approximately five hours per week (the average working time was 31.7 hours per week for women and 36.3 for men).

Regarding disposable income, our results show that the EITC has, on average, a greater effect for women. This result was expected because before the EITC reform, women's hourly wages were lower than men’s, and women worked less than men. Therefore, women’s earned income was significantly lower than that of men. Due to the EITC, women increased their disposable income by approximately 8 percent, whereas men decreased it by approximately one percentage point.

Table 2 The simulated effects of EITC on worked hours, labor force participation, and disposable income of married/cohabiting with children

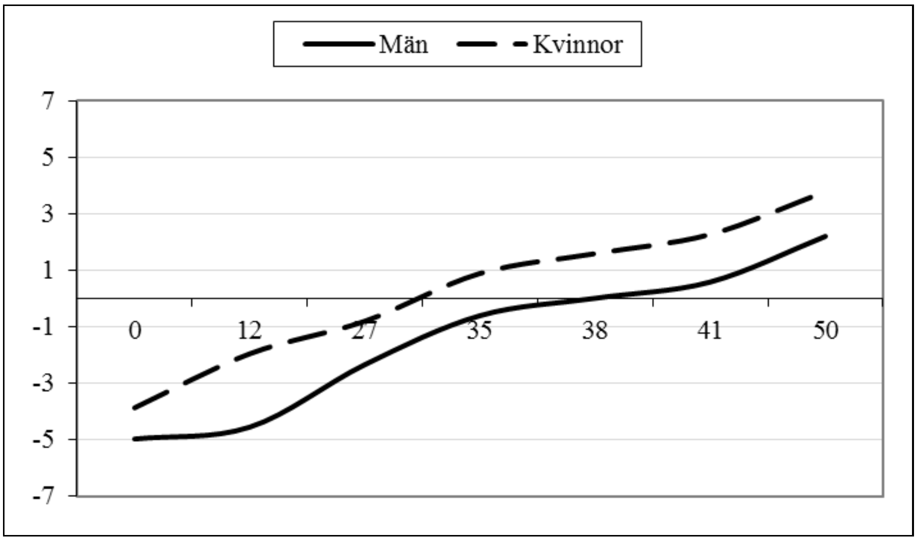
	Without EITC	Step 1	Step 2	Step 3	Step 4
Women					
Weekly worked hours	28.542	28.684	28.725	28.765	28.805
LFP (%)		0.496	0.639	0.800	0.921
Disposable income (%)		4.514	5.785	6.991	8.205
Men					
Weekly worked hours	37.359	37.455	37.481	37.507	37.533
LFP (%)		0.255	0.326	0.396	0.465
Disposable income (%)		4.004	5.113	6.118	7.239

Note: The change in disposable income is based only on information from those who worked in 2007.

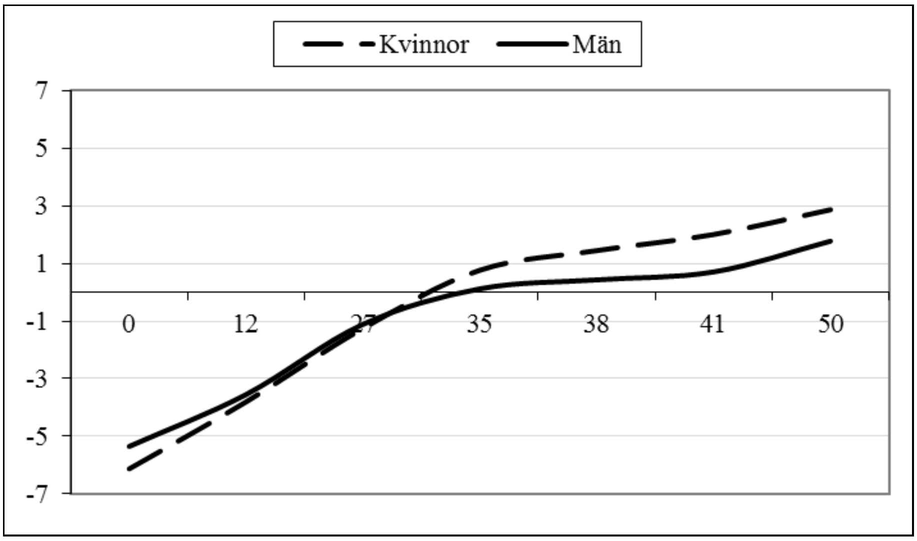
Table 3 The simulated effects of EITC on worked hours, labor force participation, and disposable income of married/cohabiting without children

	Without EITC	Step 1	Step 2	Step 3	Step 4
Women					
Weekly worked hours	31.382	31.538	31.584	31.629	31.675
LFP (%)		0.496	0.641	0.785	0.931
Disposable income (%)		4.602	5.902	7.143	8.384
Men					
Weekly worked hours	36.042	36.177	36.216	36.255	36.294
LFP (%)		0.374	0.483	0.590	0.698
Disposable income (%)		3.982	5.082	6.140	7.190

It is not clear a priori how an individual's transitions between the different labor supply alternatives (our seven discrete points) should look. This is because the incentive may differ for part-time and full-time workers, especially those who worked more than the usual 40 weekly hours before the introduction of the EITC reform. Part-time individuals will have a greater incentive to work; therefore, the share of those working a lower number of hours will decrease, and the share of alternatives with a higher number of hours will increase. It is possible that some individuals who worked a higher number of hours reduced their labor supply when the income effect exceeded the substitution effect (Figure 1).



a) Married/Cohabiting with children



b) Married/Cohabiting without children

Note: difference between the fourth step of EITC reform and the tax system without EITC

Figure 1 Percentage change in the worked hours by gender and household type

6 Conclusions

Using a representative sample of Swedish households supplemented with information about individuals' labor supply and earnings, we examined how the Swedish non-targeted EITC has affected individual commitment to work for women and men who live together in a two-adult household with or without dependent children. We estimated a static structural discrete labor supply model for two-adult households and then simulated how the EITC steps affected both the labor supply and disposable income of women and men by type of household. Our estimates are in line with the level of wage elasticity reported by other studies that used Swedish data, showing that the levels of wage elasticity differ between men and women who belong to a two-adult household. Women increased their labor supply by 0.9 percent regardless of whether they had children, whereas men with children increased their labor supply by approximately 0.5 percent and those without children by 0.7 percent. Our results show that work incentives increase significantly (particularly for individuals with low wages) and that household disposable income increases. Our results indicate that the effects of labor income tax cuts at different points on the income ladder depend substantially on the relative magnitude of labor supply responses on the extensive and the intensive margins (as noted by Saez, 2002).

Our study confirms Aaberge and Colombino's (2012) highlight that when, considering the results from a methodological perspective, the importance of heterogeneous labor supply responses in shaping the optimal tax rules suggests that simulation based on microeconometric models is a useful tool for investigating optimal taxation issues.

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Appendix

Table A1 Uncompensated wage elasticity from Swedish research literature estimated using dicrete structural labor supply models (percent)

Study by household type	Wage elasticity	Data (year)	Selection
Married/cohabiting men			
Flood, Hansen, & Wahlberg (2004)	0.05 [a]	HINK (1993, 1999)	
Sacklén (2009)	0.06 [b]	HEK (2004)	
Finansdepartementet (2010)	0.13 [c]	HEK (2007)	
Married/cohabiting women			
Flood, Hansen, & Wahlberg (2004)	0.10 [a]	HINK (1993, 1999)	
Sacklén (2009)	0.10 [b]	HEK (2004)	
Finansdepartmentet (2010)	0.18 [c]	HEK (2007)	
Single women			
Andrén (2003)	0.77 [a]	HINK (1997, 1998)	Single mothers
Flood, Wahlberg, & Pylkkänen (2007)	0.62 [a]	LINDA (1999)	Single mothers
Andersson & Hammarstedt (2008)	0.05 [a]	LINDA (2004)	Foreign-born single wom-en
Finansdepartementet (2010)	0.21 [c]	HEK (2007)	
Single men			
Finansdepartementet (2010)	0.09 [c]	HEK (2007)	

Note: [a] Percentage change in hours worked divided by the percentage change in gross earnings. [b] Percentage change in hours worked divided by the percentage change in disposable income; it refers to the overall effect of cohabitation and single. [c] Percentage change in hours worked divided by the percentage change in disposable income, calculated by increasing the municipal tax of 10 percent.

Table A2 Formula for the Swedish EITC, by step

Earned Income (EI)	0 – 0.91 BA	0.91 BA – 2.72 BA	2.72 BA – 7.00 BA	7.00 BA –
Step 1 (2007)	(EI <0.79 BA)	(0.79 BA < EI < 2.72 BA)	(EI > 2.72 BA)	
	(EI – BD) * LITR	(0.79 BA + 0.200 * (EI – 0.79 BA) – BD) * LITR	(1,176 PBB – GA) * LITR	
Step 2 (2008)	(EI – BD) * LITR	(0.91 BA + 0.200 * (EI – 0.91 BA) – BD) * LITR	(1.272 BA + 0.033 * (EI – 2.72 BA) – BD) * LITR	(1.413 BA – BD) * LITR
Step 3 (2009)	(EI – BD) * LITR	(0.91 BA + 0.250 * (EI – 0.91 BA) – BD) * LITR	(1.363 BA + 0.065 * (EI – 2.72 BA) – BD) * LITR	(1.642 BA – BD) * LITR
Step 4 (2010)	(EI – BD) * LITR	(0.91 BA + 0.304 * (EI – 0.91 BA) – BD) * LITR	(1.461 BA + 0.095 * (EI – 2.72 BA) – BD) * LITR	(1.868 BA – BD) * LITR

Note: BA = basic amount, BD = basic deduction, LITR = local income tax rate. BA= 40,300 SEK in 2007 (39,700 SEK in 2006, 41,000 SEK in 2008).

Table A3 Descriptive statistics by gender and type of household, 2007

Variables	Women without children	Women with children	Men without children	Men with children
Individual characteristics				
Age(in years)	47.1	38.0	49.1	40.5
Educational level (%)				
Normal school	11.7	10.2	13.1	12.4
High school	42.7	47.0	46.8	51.5
University	45.6	42.8	40.1	36.1
Worked hour (%)				
H>34	65.7	46.2	80.7	82.5
0<H<34	25.9	38.8	12.0	12.6
H=0	8.4	15.0	7.3	4.9
Household characteristics				
Children 0-5 years (%)	-	78.6	-	78.6
Children 6-11years (%)	-	43.9	-	43.9
Received housing allowance (%)	1.0	2.4	1.0	2.4
Received welfare allowance (%)	0.4	4.9	0.4	4.9
Swedish born (both)	79.6	71.9	79.6	71.9
Swedish born (one of them)	11.2	14.9	11.2	14.9
Foreign-born	9.2	13.2	9.2	13.2
Number of observations	824	1051	824	1051

Table A4 Labor supply equation estimates by gender and type of household

a) Women

Variables	Married/Cohabitated without children PE		Married/Cohabitated with children PE	
	PE	SE	PE	SE
Constant	14.502 *	(1.359)	10.608 *	(1.198)
Age/10	-0.106	(0.459)	1.890	(0.996)
Educational level (CG: lower)				
Medium (high school)	1.729	(1.608)	5.277 *	(1.868)
Higher (university)	2.780	(1.761)	7.950 *	(2.152)
Stockholm's region	0.668 *	(1.543)	0.504	(1,382)
Swedish born	4.223	(1.681)	6.167 *	(1,546)
No children 0-5 year old			-4.377 *	(0.986)

b) Men

Variables	Married/Cohabitated without children PE		Married/Cohabitated with children PE	
	PE	SE	PE	SE
Constant	22.490 *	(3.217)	33.933 *	(2.333)
Age/10	-0.642	(0.514)	-2.067 *	(0.793)
Educational level (CG: lower)				
Medium (high school)	-0.956	(1.705)	3.043 *	(1.419)
Higher (university)	0.146	(1.888)	1.869	(1.546)
Stockholm's region	-0.566	(1.476)	0.372	(1.331)
Swedish born	2.738	(1.738)	5.111 *	(1.261)
No children 0-5 year old			-2.551 *	(0.797)

Note: * stands for statistical significance at the 5 percent level or better.

Table A5 Wage equation estimates by gender and type of household

a) Women

Variables	Married/Cohabiting without children PE	SE	Married/Cohabiting with children PE	SE
Constant	4.425 *	(0.052)	3.157 *	(0.109)
Age/10	0.141 *	(0.018)	0.690 *	(0.058)
Ageage/100	-0.014 *	(0.002)	-0.072 *	(0.008)
Educational level (CG: lower)				
Medium (high school)	0.032	(0.034)	-0.021	(0.031)
Higher (university)	0.191 *	(0.033)	0.136 *	(0.032)
Stockholm's region	0.159 *	(0.025)	0.134 *	(0.022)
Swedish born	0.050 *	(0.026)	0.071 *	(0.023)

b) Men

Variables	Married/Cohabiting without children PE	SE	Married/Cohabiting with children PE	SE
Constant	4.261 *	(0.101)	3.618 *	(0.078)
Age/10	0.231 *	(0.034)	0.473 *	(0.027)
Ageage/100	-0.021 *	(0.004)	-0.049 *	(0.003)
Educational level (CG: lower)				
Medium (high school)	0.051	(0.059)	0.136 *	(0.051)
Higher (university)	0.282 *	(0.060)	0.316 *	(0.048)
Stockholm's region	0.072	(0.037)	0.181 *	(0.031)
Swedish born	0.102 *	(0.041)	0.183 *	(0.029)

Table A6 Estimated utility function by gender and household type

	Married/Cohabiting Women Without Children		Married/Cohabiting Women With children		Married/Cohabiting Men Without Children		Married/Cohabiting Men With Children	
Utility function	PE	SE	PE	SE	PE	SE	PE	SE
α_k	-4.681*	(1.494)	-5.317*	(0.131)	-4.681*	(1.494)	-5.317*	(0.131)
α_m	-2.909	(8.248)	-4.468*	(0.598)	-2.909	(8.248)	-4.468*	(0.598)
α_y	5.359*	(1.623)	2.395*	(0.153)	5.359*	(1.623)	2.395*	(0.153)
α_{ky}	-0.775*	(0.389)	-0.135*	(0.059)	-0.775*	(0.389)	-0.135*	(0.059)
α_{my}	-0.875*	(0.369)	-0.134*	(0.033)	-0.875*	(0.369)	-0.134*	(0.033)
α_{mk}	2.272*	(0.573)	-0.053*	(0.073)	2.272*	(0.573)	-0.053*	(0.073)
ϕ (Stigma effect)	-48.661*	(4.330)	-38.869*	(2.356)	-48.661*	(4.330)	-38.869*	(2.356)
γ_1 (FC, $H \in \{12,27\}$)	-19.884*	(1.416)	-18.742*	(1.248)	-25.957*	(2.672)	-17.125*	(1.938)
γ_2 (FC, $H \in \{35\}$)	-7.911*	(2.582)	-1.531*	(0.227)	-16.424*	(1.154)	-3.347*	(0.837)
γ_3 (FC, $H \in \{38\}$)	15.883*	(2.928)	14.595*	(2.582)	-12.823*	(3.134)	-3.178*	(0.227)
γ_4 (FC, $H \in \{41\}$)	3.244	(3.009)	-5.238*	(2.653)	1.424	(6.763)	13.614*	(0.490)
γ_5 (FC, $H \in \{50\}$)	-1.920	(3.063)	-8.027*	(2.700)	-23.739	(4.536)	-4.901*	(0.329)
Number of individuals	1648		2102		1648		2102	
Loglikelihood/n			-3.805		-3.848		-3.805	

Table A7 Distribution (in percent) and mean value of worked hours (observed and predicted) by gender and type of household

	Married/Cohabiting with children		Married/Cohabiting without children	
	Observed	Predicted	Observed	Predicted
Women				
H = 0	15.0	15.3	8.5	10.8
H = 12	3.6	3.7	3.6	2.7
H = 27	23.7	15.1	12.7	7.5
H = 35	35.6	51.9	34.7	55.3
H = 38	11.5	6.2	24.3	13.2
H = 41	5.9	4.2	10.9	6.6
H = 50	4.7	3.5	5.2	3.9
E[H]	28.4	28.5	32.3	31.4
Men				
H = 0	4.9	5.4	7.3	10.1
H = 12	1.6	2.4	2.1	1.5
H = 27	6.6	3.2	5.9	2.5
H = 35	17.1	11.6	12.7	7.8
H = 38	15.9	11.3	20.0	12.2
H = 41	40.4	57.7	39.1	57.3
H = 50	13.4	8.4	12.9	8.6
E[H]	37.3	37.4	36.4	36