

# The Impact of the Earned Income Tax Credit on the Labor Supply of Married Couples: A Structural Estimation

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**Abstract.** This paper examines the effect of the Earned Income Tax Credit on married couples' labor supply. Using data from the 1985-2003 waves of the Current Population Survey, a model of joint family labor supply is estimated that accounts for the nonlinear and nonconvex budget constraints that arise due to the EITC. Husbands' estimated elasticities are close to zero, while wives' estimated wage elasticities are .18 on the intensive margin and .03 on the extensive margin. Simulations suggest that the EITC has a small negative effect on hours worked of both husbands and wives, but little effect on the participation margin.

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## **1. Introduction**

During the 1990's, the Earned Income Tax Credit (EITC) emerged as a fundamental part of the antipoverty effort in the United States. As evidence of the size to which the EITC has grown, the credit distributed an estimated \$30 billion to over 18 million families in 2000, an average of over \$1600 per family. As such, the EITC now constitutes the largest program for low income families, almost doubling the \$16 billion spent on the Temporary Assistance to Needy Families (TANF) program. This paper examines the extent to which the Earned Income Tax Credit affects the labor supply behavior of married couples.

The EITC functions as a wage bonus for low income workers. Initially, the credit increases at the phase-in rate with a couple's income, up to a maximum amount. The credit stays flat over an additional range of income, and beyond a certain amount of income the credit declines at the phase-out rate with income until it is completely taxed away. Although the EITC is generally thought of as a program that encourages work among the poor, the few studies that have examined the effect of the EITC on married couples have found that the EITC tends to dampen work effort among this subset of the population, suggesting that any thought of expanding the EITC to encourage work among single females with children would have to be balanced against the negative labor supply effects on married couples. As a result, it is important to examine the robustness of these findings to alternative estimation strategies.

This paper, then, extends a methodology first proposed by Heim (2008) to estimate a model of family labor supply that accounts for the joint choice of hours for the husband and wife. The method also accounts for the nonlinear and nonconvex budget constraint

that arises due to the income tax and EITC schedules, as well as macroeconomic conditions of the labor market. Estimated on data from the 1985-2003 waves of the Current Population Survey consisting of low educated married couples with children, the resulting estimates imply small labor supply elasticities for both husbands and wives in the sample, with overall wage elasticities for husbands positive but close to zero, and overall wage elasticities for wives of approximately .18. Consistent with previous findings in the literature, simulations suggest that the EITC has a small negative effect on hours worked of both husbands and wives, with average decreases for husbands of about 4 hours annually and of about 9 hours annually for wives. Contrary to the previous literature, however, participation effects are found to be small or nonexistent.

The paper proceeds as follows. In Section 2, the relevant literature is reviewed. Section 3 presents the model and econometric methodology, Section 4 describes the data used, and Section 5 presents the estimation results. In Section 6, simulations are performed to examine the effect of previous EITC expansions on the labor supply behavior of husbands and wives, and Section 7 presents the simulated effects of some counterfactual policies. Section 8 concludes.

## **2. Relevant Literature**

Several papers have examined the effect, both simulated and estimated, of the Earned Income Tax Credit and especially its expansions in the 1990's on the labor supply behavior of single women with children. Among them are Eissa and Liebman (1996),

Keane and Moffitt (1998), Meyer and Rosenbaum (2000, 2001), Ellwood (2000), Hotz et al (2002), Grogger (Forthcoming), and others. These papers have generally found positive, and sometimes substantial, effects of the EITC on employment of single women, but negative and generally small effects on the hours of work of single women that are working.

In comparison, the body of evidence on the effect of the EITC on the labor supply of married couples is currently much less developed. Dickert, Houser and Scholz (1995) use previous structural estimates to simulate the effects of the EITC on the labor supply of married couples, and find that the EITC expansion that was part of the Omnibus Budget Reconciliation Act of 1993 (OBRA93) would induce men to reduce their work hours by between 0% and 3.14%, and women to reduce their work hours by between .57% and 4.37%. They also perform an estimation of labor force and program participation, and find that the OBRA93 expansion would lead primary workers to increase labor force participation by .7 percentage points, and decrease the labor force participation of secondary workers. Ellwood (2000) uses difference in difference techniques to examine whether the EITC expansions in the 1990s discouraged labor force participation among married women, and finds evidence that the EITC discouraged labor force participation for low wage married women. Finally, Eissa and Hoynes (2004, 2006) use both difference in differences and reduced form methods to estimate the effect of the EITC expansions on labor force participation and hours of work. Among couples with children, they find that married men were .1 percentage points more likely to work and married women were .6 percentage points less likely to work after the 1993 EITC expansion. Further, they find that women's hours of work decreased by 1 to 4% due to

this expansion, and men's hours of work decreased by .5 to 1.5%.

Although the above studies provide some evidence on the labor supply effects of the Earned Income Tax Credit on married couples with children, some holes in our understanding remain. First, no study has looked at the response of husbands and wives on both the intensive and extensive margins using one comprehensive model of labor supply and labor force participation. Second, no study has examined the effects of the EITC in a behavioral model other than the wife as secondary earner model.

In this paper, a joint utility maximizing model of married couples is estimated, from which the responsiveness of both husbands and wives on both the extensive and intensive margins can be simulated. The data used span the large recent increases in the generosity of the EITC, and the model incorporates state level EITCs. As a result, identification comes not only from variation in wages and incomes across couples, but also from variation across states and across time in the structure of the income tax code and the EITC, both at the federal and state levels. Finally, state level unemployment rates are incorporated into the structural model as affecting the participation margins of the husband and wife.

There are several desirable features of this method. First, unlike the methods that allow for continuous hours choices in Hausman and Ruud (1984), Ransom (1986), Kapteyn et al. (1990), and Kooreman and Kapteyn (1990), it accounts for both heterogeneity in tastes for work and measurement or optimization error in hours of work, which have consistently been found to be important in labor supply estimation. In addition, since it allows for a continuous hours choice, simulations using estimates from the method can changes in hours that are smaller than those that are captured in a discrete

choice framework.<sup>1</sup> Finally, it incorporates the entire nonlinear shape of the budget constraint, including federal, state, and payroll taxes, and so can be used for simulations of complex changes in the form of the Earned Income Tax Credit.<sup>2</sup> However, these abilities come at a cost of having to make many more assumptions than in a reduced form or difference-in-differences estimation, including making assumptions about the decision-making process of the household, the form of preferences, exogeneity of wages and income, and the distributions of the stochastic elements.

### 3. Model and Estimation Method

To estimate the effect of the EITC on work behavior of married couples with children, this paper extends a methodology proposed in Heim (2008). Couples are modeled as maximizing a joint utility function,  $U(h_h, h_w, C, v)$ ,<sup>3</sup> over hours of work for the husband,  $h_h$ , hours of work for the wife,  $h_w$ , and total consumption,  $C$ , and where  $v$  denotes unobserved heterogeneity in tastes for work, subject to a joint budget constraint, given by

$$C \leq Y^G + W_h h_h + W_w h_w - \sum_{j=1}^J t_j (I_j - I_{j-1}) \mathbb{1}(Y^{TI} > I_j) - \sum_{j=1}^J t_j (Y^{TI} - I_{j-1}) \mathbb{1}(I_j \geq Y^{TI} > I_{j-1}), \quad (1)$$

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<sup>1</sup> A recent paper by Van Soest, Das and Gong (2002) estimates a discrete choice model of individual labor supply that allows for 360 hours choices, which comes close to approximating a continuous hours model. However, papers that have estimated family labor supply have allowed for far fewer hours choices (see, for example, Van Soest (1995) and Hoynes (1996)).

<sup>2</sup> Results from several counterfactual simulations, including at third child EITC and a wage-based EITC, are available from the author.

<sup>3</sup> There has been a fair amount of criticism of this unitary model of labor supply. (See McElroy and Horney (1981), Chiappori (1988), Schultz (1990), and Fortin and Lacroix (1997).) Donni (2003) examines the collective model in the presence of taxes, but does not estimate a model. Blundell, Chiappori, Magnac and Meghir (2007) and Bloemen (2004) estimate collective models labor supply, but do not account for taxes. This approach could plausibly be adapted to estimate a collective model of labor supply in the presence of taxes, since implicit in the calculation of the likelihood is the explicit solution of the structural model, which could be done just as well for other assumed theoretical models. Such extensions are left for future work.

where  $W_h$  and  $W_w$  denote the husband's and wife's wages, respectively,  $Y$  denotes the family's nonlabor income,  $Y^{TT}$  denotes the family's taxable income (income less deductions and exemptions),  $\{I_j\}_{j=1}^J$  denotes income tax bracket endpoints,  $t_j$  denotes the tax rate on income between  $I_j$  and  $I_{j+1}$ , and  $1(\cdot)$  denotes the indicator function.

Estimation proceeds as follows. Given an hours finding algorithm, and given a draw from the couple's heterogeneity distribution (however specified), one solves numerically for the couple's utility maximizing hours conditional on parameters. With these hours having been solved for, given a stochastic structure of the model that maps these utility maximizing hours to observed hours, one calculates the likelihood. Estimation then proceeds by finding the parameters that maximize the likelihood function using standard maximum likelihood techniques.<sup>4</sup>

In this paper, the method is extended three ways. First, the Earned Income Tax Credit is incorporated into the budget constraint. Because the incorporation of the EITC creates a nonconvexity in the budget constraint, an alteration to the hours finding algorithm used in Heim (2008) is required. The modified hours finding algorithm searches for utility maximizing hours on two different budget constraints, the union of which constitutes the actual budget constraint that the couple faces. The first budget constraint accounts for the income tax without the EITC, and the second accounts for both the income tax and the EITC, but not the end of the phaseout range. After searching for utility maximizing hours on each of these budget constraints, the utility level corresponding to each of the locally optimal sets of hours to determine the global utility

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<sup>4</sup> Implicit in this model is this assumption that marital status, number of children, gross wages and nonlabor income are all exogenous. Although it may be desirable to weaken some of these assumptions, doing so would require a much more computationally complex model than that estimated here, and is beyond the scope of this paper.

maximizing hours. Further details of this algorithm are discussed in a working paper version of the paper available from the author.

Second, AFDC-UP benefits are incorporated into the budget constraint. As noted in Committee on Ways and Means (Various), starting in 1961, various states extended AFDC benefits to married couples with children in which both husband and wife were unemployed, a program which was denoted AFDC-UP. By 1990, all states were required to operate an AFDC-UP program, but had an option to limit benefits to as few as 6 months in any 12 month period.<sup>5</sup> The primary worker of a couple could work up to 100 hours a month and still be eligible for AFDC-UP benefits, but benefits were reduced according to a formula that was a function of earnings and which varied by state if the individual had positive earnings. To simplify the incorporation of these benefits into the estimation procedure, I assume that the couple only receives AFDC-UP benefits if neither member of the couple worked at all during the year. Thus, these benefits can be treated as if they were an addition to the couple's nonlabor income, with a fixed cost equivalent to this amount if either or both of the individuals work positive hours.<sup>6</sup>

Third, in the stochastic specification, I account for the possibility that individuals desired to work a positive number of hours, but could not find a job, and so were unemployed. Suppose that the unemployment rate in couple  $i$ 's state in the year in which they are observed is  $u_{si}$ . I assume that with probability  $u_{si}$ , an individual who desired to

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<sup>5</sup> However, takeup of benefits was less than perfect. For example, Hoynes (1996) estimates a takeup rate of 77%. So, it is unclear to what extent these benefits were taken into account among the individuals in this sample when choosing hours of work. Thus, I also estimated the model without accounting for AFDC-UP benefits. The results were qualitatively similar to those presented here, and are available from the author.

<sup>6</sup> As a result, the alteration to the hours finding method that allows for fixed costs described in Heim (2008) can be applied here. I also attempted to also estimate a term that represented either the stigma or transactions costs of the receipt of AFDC benefits (see Moffitt (1983)), but such a term was poorly identified, and so was left out of the specifications whose results are presented later.

work positive hours could not find a job, and with probability  $1 - u_{si}$ , the individual could find a job.<sup>7</sup> Formally, let  $e_{hi}$  and  $e_{wi}$  be draws from a Bernoulli distribution, where

$P[e_{hi} = 0] = P[e_{wi} = 0] = u_{si}$ . The assumed data generating process in this case is

$$\begin{aligned}
 h_{hi} &= \begin{cases} h_{hi}^*(\theta_0) + \varepsilon_{hi} & \text{if } h_{hi}^*(\theta_0) > 0, h_{hi}^*(\theta_0) + \varepsilon_{hi} > 0, \text{ and } e_{hi} = 1 \\ 0 & \text{if } h_{hi}^*(\theta_0) > 0 \text{ and } (h_{hi}^*(\theta_0) + \varepsilon_{hi} \leq 0 \text{ or } e_{hi} = 0) \\ 0 & \text{if } h_{hi}^*(\theta_0) = 0 \end{cases} \\
 h_{wi} &= \begin{cases} h_{wi}^*(\theta_0) + \varepsilon_{wi} & \text{if } h_{wi}^*(\theta_0) > 0, h_{wi}^*(\theta_0) + \varepsilon_{wi} > 0, \text{ and } e_{wi} = 1 \\ 0 & \text{if } h_{wi}^*(\theta_0) > 0 \text{ and } (h_{wi}^*(\theta_0) + \varepsilon_{wi} \leq 0 \text{ or } e_{wi} = 0), \\ 0 & \text{if } h_{wi}^*(\theta_0) = 0 \end{cases}
 \end{aligned} \tag{2}$$

Where  $h_{hi}^*(\theta_0)$  and  $h_{wi}^*(\theta_0)$  are the utility maximizing hours for the husband and wife given true parameters  $\theta_0$ , and  $\varepsilon_{hi}$  and  $\varepsilon_{wi}$  represent measurement or optimization error.

In this specification, there are three reasons why a husband might be observed to be not working. First, the individual may desire not to work ( $h_{hi}^*(\theta_0) = 0$ ). Second, the individual may desire to work, but due to a large negative draw of  $\varepsilon_{hi}$ , the individual reports working no hours ( $h_{hi}^*(\theta_0) > 0$  and  $h_{hi}^*(\theta_0) + \varepsilon_{hi} \leq 0$ ). Finally, the individual may desire to work, but cannot find a job ( $h_{hi}^*(\theta_0) > 0$  and  $e_{hi} = 0$ ). Similarly, a wife may be observed to be not working for those same three reasons.<sup>8</sup>

For the specification of the couple's preferences, I use a quadratic utility specification,<sup>9</sup> in which

<sup>7</sup> This is an admittedly simple way of accounting for macroeconomic factors, but one that is feasible given the available data. A more comprehensive specification might allow for the unemployment probability to depend on education, skills, job search, and other characteristics of the individual.

<sup>8</sup> The technical details of the estimation, as well as the likelihood functions, are described in the working paper version of this paper, and are available from the author upon request.

<sup>9</sup> For good descriptions of the properties of the quadratic utility function, see Stern (1986) and Goldberger (1987).

$$\begin{aligned}
U(h_h, h_w, C) &= \beta_{hh}h_h^2 + \beta_{ww}h_w^2 + \beta_{CC}C^2 \\
&+ \beta_{hw}h_hh_w + \beta_{hC}h_hC + \beta_{wC}h_wC \\
&+ \beta_hh_h + \beta_w h_w + \beta_C C
\end{aligned} \tag{3}$$

and where  $\beta_C$  is normalized to 1.

This functional form has the attractive feature that it easily allows for the incorporation of heterogeneity due to both observable and unobservable factors by specifying the coefficients on the linear terms as

$$\begin{aligned}
\beta_h &= X_h' \alpha_h + v_h \\
\beta_w &= X_w' \alpha_w + v_w
\end{aligned} \tag{4}$$

where the vectors  $X_h$  and  $X_w$  contain observable preference shifters, and  $v_h$  and  $v_w$  denote unobservable heterogeneity in taste for work.

Since this paper assumes a static model, there is no saving or borrowing. Hence, a couple's consumption,  $C$ , is calculated by figuring the couple's after tax income given the husband and wife's wages, their nonlabor income, their deductions and exemptions, their hours of work, and the amount of EITC and AFDC-UP for which they are eligible. To keep this measure of consumption comparable across years, the couple's after tax income is then inflated or deflated to real dollars from the year 2000, using the CPI-Urban Price Index.

## 4. Data

The data used for this study come from the 1985 to 2003 waves of the March Current

Population Survey. Following Eissa and Hoynes (2004, 2006)<sup>10</sup>, in order to focus on a sample of married couples who are likely to be eligible to claim the EITC, the sample was cut to include only married couples with children where the wife has less than a high school degree.<sup>11</sup> In addition, the sample was cut to include only those individuals who were part of the Outgoing Rotation Group during their March interview. This is done to facilitate the use of as close to a direct report of respondents' wages as possible, to minimize any possible division bias by constructing the wage variable by dividing labor income by hours of work.<sup>12</sup> Finally, I cut the sample to include only couples where both the husband and wife are between the ages of 25 and 55, in order to focus on labor supply behavior in the prime working years.<sup>13</sup> The sample sizes after various sample cuts are presented in Table 1.<sup>14</sup> In total, 3961 observations were used in the estimation.

[Table 1 about here]

The wage used in this study comes from questions in which respondents are asked to report their hourly, weekly, or monthly wages. If the individual is not paid hourly (for example, salaried workers), I calculate an hourly wage for them by dividing the income they report by either their usual hours over that time span (if reported), or by a standard

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<sup>10</sup> Eissa and Hoynes report that, as a robustness check, they selected their sample based on the husband's education, and found that the results were qualitatively similar.

<sup>11</sup> In addition, the resulting simulations represent the effects of the EITC (or changes in the EITC) on those who are most likely to claim the credit.

<sup>12</sup> See, for example, Eklof and Sacklen (2000). Note, however, that division bias isn't completely eliminated using this data, since some individuals report only monthly or weekly wages, which are then divided by usual monthly or weekly hours. However, the division bias that results is less than that which would result if annual income were divided by annual hours to generate wage variables.

<sup>13</sup> Several other sample cuts are made. I exclude the self employed, as well as those who are students, retired or disabled. I exclude those for whom I cannot create a valid wage measure, due either to nonresponse or to topcoding. In addition, I exclude a handful of observations who report working an extreme number of hours, over 4200 hours annually.

<sup>14</sup> Although it might be desirable to include couples with higher education levels that also might be relatively likely to claim the EITC, given the computationally intensive nature of the estimation method used here, expanding the sample size appreciably was not feasible.

number of hours worked during that time period if their usual hours are not reported.<sup>15</sup>

For a measure of nonlabor income, I use the reported asset income of the couple. To allow preferences to vary with observable demographic characteristics, I use information on the husband's and wife's age, education, race, number of children, and the presence of children under 6. In addition, I include region and year dummies in the observable demographic characteristics, to account for different tastes for work both across regions and across time.

Summary statistics for these variables are presented in Table 2.

[Table 2 about here]

In the estimation, I incorporate fairly detailed versions of federal and state tax systems. I incorporate the standard federal income tax schedule, assuming that everyone claims the standard deduction and takes the exemptions available given their family size. Budget constraints also reflect state income tax schedules, the employee's share of the payroll tax, and AFDC-UP benefits. Finally, both state and federal Earned Income Tax Credit schedules are incorporated, including the asset test (in applicable years) by which a couple is ineligible for the EITC if their asset income falls above a certain threshold.<sup>16</sup>

To account for the unobserved wages of individuals who do not work, I perform separate selection corrected auxiliary wage regressions for each year in the sample.<sup>17</sup>

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<sup>15</sup> The particular numbers are 40 hours if paid weekly and 160 hours if paid monthly.

<sup>16</sup> The major parts of the tax system that are not incorporated are the Alternative Minimum Tax and itemized deductions. However, neither of these is likely to apply to the sample of low educated married women and their husbands that is used in this sample.

<sup>17</sup> Another option for dealing with missing wages of nonworkers is to estimate them jointly with the labor supply model (as in Gong and van Soest (2002) in an individual labor supply model), where the likelihood of working 0 hours is the joint probability that the wage is low enough and the heterogeneity term is such that the individual desires to work zero hours. However, as noted in Heim (2008) this approach runs into some practical difficulties in this model. If the heterogeneity distribution is discrete, then the likelihood function would be flat in most regions of the parameter space and would have large discontinuities in others. If the distribution is continuous, one would need to solve for the two dimensional region in heterogeneity

Included in both the participation and wage equations are age, education, and ethnicity variables. I exclude the number of children and a dummy for the presence of young children from the wage equation so that identification does not come solely from functional form. The coefficients of the wage equations were generally of the expected sign, and were of plausible magnitudes. Results from these auxiliary regressions are available from the author.

## 5. Results

Estimation results are presented in Table 3.

[Table 3 about here]

The first panel of the table contains the estimated coefficients on the squared terms in the utility function. These estimates imply that the marginal disutilities of work for both husbands and wives are increasing in their own hours, and increasing in each others hours. In addition, the marginal utility of consumption is positive over the relevant range, and is estimated to be decreasing in consumption. Finally, preferences are quasiconcave for at least one type over the observed range of data.

The next three panels contain the estimated values of and probability weights for each of the nodes of the distribution of unobserved heterogeneity. A five heterogeneity node specification was used.<sup>18</sup> Given the quadratic utility specification, these  $\beta$ 's can

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space over which the desired hours are zero, which is computationally difficult.

<sup>18</sup> In previous work on a simpler version of this model (Heim (2008)), one, six, and seven node specifications were also estimated. The one node specification yielded substantially higher elasticities, suggesting that accounting for unobserved heterogeneity has an important effect on the estimates.

be interpreted as the marginal utility of work for the husband or the wife at 0 hours of work. Thus, for all five of the groups, the marginal utility of work for the husband is initially positive. Most likely, this is an artifact of the functional form employed, in that to capture the clumping around full-time hours, the parameters are driven to exhibiting a positive marginal utility of work at 0 hours of work. The marginal utility of working at 0 hours for the wife, on the other hand, is negative for two of the groups, and positive for the other three.

Considering next the stochastic elements, the standard deviation of measurement or optimization error is estimated to be 257 hours for men, and 694 hours for women. These errors are estimated to be slightly positively correlated in all specifications.

The next panel presents the coefficients on the demographic variables that are entered as observable taste shifters. A number of the demographic variables in both the husband's and the wife's taste shifters enter significantly. To interpret these coefficients, note that a negative coefficient implies a greater marginal disutility of work at 0 hours, which in turn implies that (all else equal) the individual would work less. For husbands, husband's and wife's education, husband's and wife's age squared, and the husband being black are all estimated to have significant effects on the husband's preferences for work. For wives, own education, age squared, the number of children, the presence of young children, and being black or another nonwhite race all significantly affect preferences toward work.

To gauge the fit of the model, in Table 4 I present actual hours worked and labor force participation rates from the CPS sample used in the estimation. I then present the

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However, results from the six and seven node specification were qualitatively similar to five node specification.

simulated hours worked and labor force participation rates that are predicted given the estimated coefficients in the previous table.

[Table 4 about here]

Comparing the actual to the simulated sample statistics, the wife's annual hours are quite close, though mean annual hours of husbands are underpredicted by about 40 hours. Turning to labor force participation, the simulated sample statistics are quite close for both husbands and wives, with labor force participation rates predicted within 2 percentage points of the actual. In addition, when looking at husband-wife pairs of labor force participation rates, all simulated sample statistics are within 2 percentage points of the actual counterpart.

To further gauge the fit of these results, in Figure 1, I graph the actual and predicted hours distributions. In the top panel, I present actual hours from the CPS data. In the middle panel, I present simulated hours using estimated parameters and the estimated heterogeneity distribution, but not measurement or optimization errors. These graphs, then, gauge how well the model fits the data without recourse to the error terms. In the bottom panel, simulated distributions when these errors are taken into account are presented.

From these graphs, it appears that the model fits the data relatively well without recourse to error. The spike at 2000 hours is close to the actual spike for men, but it is only about a half of the actual size for women. On the other hand, the distributions that incorporate measurement or optimization error better match the distribution away from the peak.

[Figure 1 about here]

To provide a better interpretation of these parameters, in Table 5, I present the elasticities, both on the intensive and extensive margin, that are implied by these estimated parameters. These elasticities were calculated by taking the difference in mean simulated hours or labor force participation that resulted from a one percent change in wage or income variables. Husband's labor supply elasticities tend to be close to 0 overall, and this is true on both the extensive and intensive margins. The overall own wage elasticity for husbands is estimated to be .025, with the cross and income elasticities being fractions of this size.

[Table 4 about here]

As expected, the estimates elasticities for wives are larger than their husbands', but still quite small. The own wage elasticity is estimated to be .18, and the cross wage elasticity is estimated to be -.06. Wives are also found to be not very responsive to nonlabor income.

Looking at the extensive and intensive margins, the wives in this sample tend to have higher elasticities on the intensive than the extensive margins. On both of these margins, however, the elasticities are quite small, with elasticities of approximately .03 on the extensive margin, and of approximately .18 on the intensive margin.

It is interesting to note that these married women's elasticities, both on the extensive and intensive margin, are smaller than those estimated in Heim (2008), in which the same method was used to estimate labor supply elasticities for all married women in the 2001 wave of the PSID. In addition, they are smaller than the elasticities estimated when the 1986 PSID was used. Hence, it appears that married women with lower levels of education tend to have labor supply behavior that is much less responsive to wage and

income, both on the extensive and intensive margins, than that of women with higher levels of education. Given the tight clumping of hours around 2000 amount those who work in this sample, however, this may not be surprising.

## **6. Effects of EITC Expansion**

During the period under analysis, the Earned Income Tax Credit was expanded several times.<sup>19</sup> In 1986, for example, the EITC was expanded as part of the Tax Reform Act of 1986. It was further expanded over three years due the Omnibus Budget Reconciliation Act of 1990, including being made larger for families with two or more children in 1991. A sizable expansion of the EITC was contained in the Omnibus Budget Reconciliation Act of 1993, in addition to a large additional increase for families with two or more children. Finally, the Economic Growth and Tax Relief Reconciliation Act of 2001 expanded, in three increments, the amount of income that a married couple could earn before the EITC begins to phase out.

In this section, then, I use the estimation results presented above to simulate the effects of these expansions on the labor force participation rates and annual hours worked of the married men and women in this sample. To account for the effects of other tax policy changes during this period, I simulate labor supplies of husbands and wives both in the presence and in the absence of the EITC for each year in the sample. Thus, the difference between these two can be interpreted as the effect of the EITC in that particular year.

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<sup>19</sup> The literature contains several good descriptions of the history of the EITC. See Hotz and Scholz (2002), Meyer and Rosenbaum (2000), and Ventry (2000), for example.

To put the subsequent simulations in context, in Figure 2, I present sample statistics from the data used in this study. One should keep in mind, of course, that the sample size for each particular year is only about 200 couples, resulting in some noisiness in the trends in variables. That having been said, over the sample period, there seems to have been a general upward trend in annual hours of work for both husbands and wives. Of course, there is considerable variation around this trend. For example, husbands' hours of work decreased during the recession of the early 1990's, and also decreased during the downturn in 2002. Wives' hours of work exhibited a similar pattern, although less of a downturn is exhibited during the recession in the early 1990's.

Turning to labor force participation, husband's labor force participation rates are roughly constant over the time period, with well over 90% of the married men in the sample working in any given year. Wife's labor force participation rates are much lower, centering around 50% over the sample period, and display no obvious trend.

[Figure 2 about here]

Of course, these raw sample statistics confound the effects of a number of factors that are changing during the time period under analysis. In addition to the policy changes noted above, the macroeconomic environment is changing, as is the distribution of wages for both men and women. However, using the estimates above, I can simulate the effects of the EITC changes, while holding one or more of the other factors constant. In doing so, I can examine what the effects of the presence and expansion of the EITC would be under various scenarios.

In Figure 3, I simulate the annual hours of work for the husbands and wives in my sample, and the labor force participation rate of the wives, given the actual distribution of

wages, incomes, and state level unemployment rates in each year, using observations only for the year in which they were observed.<sup>20</sup> I perform the simulation both in the presence and absence of the Earned Income Tax credit, so that one can interpret the difference between the two lines as the effect of the EITC on the labor force behavior of these married men and women.

[Figure 3 about here]

In panel (a), I present the simulated annual hours of work for the husbands in the sample. These simulations look qualitatively similar to the actual trends with an increase in husband's hours of work over the sample period, as well as decreases in the early 1990's and 2002. Looking at the difference between these two lines, it appears that the EITC had a dampening effect on the annual hours of these men, accelerating after 1993, of about 4 hours annually.

In Panel (b), the results from such a simulation for the wives in the sample are presented. In this panel, the upward trend in annual hours that was seen in the actual data is apparent. The EITC is simulated to have a much larger effect on the annual hours of these women than in the base specification. Prior to the 1993 expansion, the EITC had a minor negative effect on annual hours, but after the expansion the simulated effect on annual hours widens considerably. As a result, these simulations suggest that the EITC dampened the hours worked of married women by around 9 hours a year later in the sample, or about 1%. The effect of the EITC on labor force participation, however, appears to be negligible in panel (c), as the EITC and no EITC trends lie on top of one

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<sup>20</sup> Since the husbands' estimated labor force participation elasticity is zero in both specifications, I do not present a graph depicting the effect of the EITC on male labor force participation, since that graph is simply a flat line at zero.

another.<sup>21</sup>

These estimates of the effects of the 1993 EITC expansions on hours of work of married couples fall within the range of estimates that were found in Dickert, Houser, and Scholz (1995) and in Eissa and Hoynes (2006). Dickert, Houser, and Scholz found predicted negative hours effects ranging from 0%-3.14% for husbands, and of .57%-4.37% for wives using estimates from the kinked budget constraint literature, and negative effects of around 1% using estimates from the NIT experiments. Eissa and Hoynes estimated hours of work decreased about 1 to 4 percent for married women. Thus it appears that this result is also robust to different estimation methodologies. A caveat to this observation is that I do not find the participation effects of the EITC expansion that have been found in previous studies of married family labor supply, including Dickert, Houser and Scholz (1995) and Eissa and Hoynes (2004).

It is important to note, however, that in all of these graphs I am plotting mean hours and labor force participation. As a result, even though little effect of the EITC was found in these graphs, such graphs could be masking interesting and important effects that differ among subsets of the population. This is especially true in light of the fact that the EITC has differential incentives for work depending on the region of the EITC (phase-in, plateau, or phase-out) in which one is located.

To examine whether this is the case, in Table 6, I present the percent of individuals in the sample simulated to increase or decrease their hours due to the EITC, and the mean

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<sup>21</sup> One factor confounding these simulations, however, is the fact that as the years pass, the wage distribution of those observed in my sample changes. Thus, the effects confound somewhat the policy driven effects with the effects of the changes in the wage structure over this period. In results not presented here, I have simulated the annual hours of the husbands and wives, and the labor force participation rate of the wives, holding the wage distribution constant. When this is done, the graphs look remarkably similar to those presented here, and so the changing wage distribution is not the primary driver of these results.

hours of this increase or decrease. The sample is also broken out by age group and number of children to examine whether the effects of the EITC differ along these lines.

[Table 6 about here]

From this table it appears that, especially in the post-1993 period, the vast majority of individuals are simulated to decrease their hours in response to the EITC, with less than .4% of both husbands and wives simulated to increase their hours. Looking at the subgroups, these decreases tend to be larger for younger individuals, though by a small amount. In addition, the decrease in hours is larger for couples with two or more children, which is to be expected, given the larger EITC available to these families.

## **7. Policy Simulations**

Using the estimates presented above, I perform some counterfactual policy simulations to examine the extent to which proposed changes in the structure of the EITC would affect the labor supply of the married couples in this sample. To do so, I first inflate each individual's wages and incomes to 2002 dollars and simulate the mean annual hours and labor force participation rates of the husbands and wives under the actual policy environment.

I then simulate the annual hours and labor force participation rates under four alternative policies. In the first, the phase-in rate, plateau, and phase-out rate are all increased by 10%. This increases the generosity of the EITC, without changing the range of incomes over which the EITC applies. The second policy simulates the effect of expanding the EITC for those couples with 3 or more children. To do this, I set the

phase-in rate for those with three or more children at .46, the plateau at \$5775 in 2002 dollars, and the phase-out rate at .26. The plateau is specified to be \$3000 wide. In the third policy, I roll back the EITC parameters to their 1992 levels, inflated to 2002 dollars. This, then, examines the effect of rescinding the 1993 expansions of the EITC. Finally, in the fourth policy, I simulate the effects of moving from the current EITC to a wage based EITC. Such a policy has been proposed at the state level in MaCurdy (2004). Under this policy, an individual's maximum EITC benefit is that which they would receive under the current schedule if they were to work full time. Beyond full time, the benefit schedule stays the same, but if the individual works less than full time, their benefit is prorated according to the proportion of full time hours that they work. By having the EITC increase over all hours short of full time, this policy is intended to eliminate the work disincentive effects that can occur if the phaseout range begins at a lower levels of hours.

The simulated effects of these policies are presented in Table 7. The first policy is simulated to have very small effects on the labor supplies of married couples. These policies decrease annual hours by less than one for the husband and slightly over one hour for the wife, and participation effects are nonexistent.

[Table 7 about here]

The expansion for families with three or more children is also simulated to have very small effect on the labor supplies of married husbands. However, hours of wives are dampened by about 3 hours on average by this policy.

For the final two policies, which both decrease the generosity of the EITC, larger effects are found. In both specifications, husbands' hours are simulated to increase by about 4 hours, and wives' hours are simulated to increase by about 10 hours. Thus, it appears that cutting back the generosity of the EITC by either rolling back the clock or by instituting a policy that is aimed at increasing hours like the wage based EITC would indeed increase the work hours of this population. Such an increase, however, would have to be weighed against the decreased benefits available for this subset of the population.

## **8. Conclusion**

This paper provides new evidence on the effect of the EITC on the labor supply of married couples. Using a method in which labor supply responses on both the extensive and intensive margins could be estimated in one comprehensive model, and using data that span the largest expansions of the EITC, the estimates that resulted suggest modest effects of these changes in EITC policy.

In particular, the resulting estimates implied small labor supply elasticities for both husbands and wives in the sample, with elasticities for husbands positive but close to zero, and elasticities for wives of approximately .18. Simulations suggested that the EITC has a very small negative effect on hours worked of both husbands and wives, with up to a 1% decrease in wives' hours worked.

In addition, these results suggest that previous findings on the effect of the EITC on annual hours of work of married couples are largely robust to alternative behavioral

models and sources of variation, as well as to using data from a different time period.

However, previous findings of participation effects of the EITC were largely not reflected in this study.

The evidence provided by this study, then, provide policymakers with additional information that may be used to predict the effects that future possible changes to the EITC may induce. These results suggest that the EITC does have a negative effect on the labor supply of married couples, but that they tend to be on the intensive rather than extensive margin. Hence, these results suggest that the EITC is not subsidizing married women to stay out of the work force, but rather on average subsidizes their ability to stay at home some additional hours during the year. As a result, reasonable changes to EITC parameters are likely to have small effects on the labor supply of married couples overall.

# Tables

**Table 1**  
Sample Sizes after Sample Cuts

<u>Year</u>	<u>1985</u>	<u>1986</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>	<u>1992</u>	<u>1993</u>	<u>1994</u>
Married couples in the CPS	35,614	34,642	34,141	34,236	31,931	34,431	34,095	33,418	33,403	32,103
Drop if self-employed	35,552	34,579	34,071	34,188	26,307	28,528	28,189	27,764	27,751	26,502
Keep if ages between 25 and 55	23,184	22,552	22,401	22,353	16,774	18,464	18,182	18,054	18,033	17,298
Drop if retired, disabled, or student	22,133	21,585	21,411	21,362	15,929	17,475	17,207	17,040	16,931	16,070
Keep if in Outgoing Rotation Group	4,243	4,062	3,955	3,991	3,548	4,083	3,891	3,874	3,850	3,530
Keep if wage and hours variables valid	3,598	3,456	3,420	3,416	3,162	3,602	3,468	3,448	3,477	3,169
Keep if wife's education < high school	433	417	400	395	365	465	454	447	369	268
Keep if at least one child	298	256	250	238	226	300	296	295	241	170

<u>Year</u>	<u>1995</u>	<u>1996</u>	<u>1997</u>	<u>1998</u>	<u>1999</u>	<u>2000</u>	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>Total</u>
Married couples in the CPS	31,837	27,446	27,496	27,561	27,708	27,968	26,905	43,912	43,650	622,497
Drop if self-employed	26,434	22,834	22,801	22,888	23,187	23,473	22,741	36,823	36,280	540,892
Keep if ages between 25 and 55	17,338	14,953	15,068	15,090	15,225	15,439	14,837	26,020	25,359	356,624
Drop if retired, disabled, or student	16,046	13,850	13,982	13,998	14,050	14,230	13,719	24,251	23,465	334,734
Keep if in Outgoing Rotation Group	3,445	2,915	2,974	3,085	3,099	3,063	2,951	3,943	3,883	68,385
Keep if wage and hours variables valid	3,092	2,594	2,676	2,765	2,818	2,768	2,671	3,539	3,503	60,642
Keep if wife's education < high school	252	222	221	233	251	240	209	262	243	6,146
Keep if at least one child	147	143	151	139	154	167	146	181	163	3,961

**Table 2**  
Sample Statistics

	<u>Mean</u>	<u>St. Dev.</u>	<u>Min</u>	<u>Max</u>
Annual Hours of Work of Husband	1972.04	663.76	0	4160
Annual Hours of Work of Wife	840.63	939.30	0	4160
Husband Annual Hours Positive?	0.95	0.21	0	1
Wife Annual Hours Positive?	0.51	0.50	0	1
Wage of Husband	9.75	4.90	3.35	47.1
Wage of Wife	7.71	3.47	3.35	77.25
Other Income of Couple	1603.12	5121.71	0	204167
Age of Husband	38.35	7.41	22	55
Age of Wife	35.73	6.88	25	55
Number of Children	2.27	1.20	1	7
Children Less Than 6?	0.43	0.50	0	1
Years of Education of Husband	9.87	3.18	1	18
Years of Education of Wife	8.58	2.44	1	12
Husband Black	0.07	0.26	0	1
Husband Other Race	0.07	0.25	0	1
Husband Hispanic	0.42	0.49	0	1
Wife Black	0.07	0.25	0	1
Wife Other Race	0.07	0.26	0	1
Wife Hispanic	0.42	0.49	0	1
N	3961			

**Table 3**  
Estimation Results

<u>Squared and Interacted Terms</u>		<u>Heterogeneity Weights:</u>	
$\beta_{hh} \times 10^2$	-6.790 (0.505)	$\pi_1$	0.080 (0.005)
$\beta_{ww} \times 10^2$	-0.898 (0.079)	$\pi_2$	0.476 (0.009)
$\beta_{CC} \times 10^5$	-0.240 (0.089)	$\pi_3$	0.391 (0.009)
$\beta_{hw} \times 10^4$	-1.230 (0.220)	$\pi_4$	0.023 (0.003)
$\beta_{hc} \times 10^4$	-0.120 (0.132)	$\pi_5$	0.030
$\beta_{wc} \times 10^4$	-0.242 (0.139)		
<u>Husband Nodes:</u>		<u>Wife Nodes</u>	
$\beta_h^1$	111.909 (8.602)	$\beta_w^1$	11.880 (1.413)
$\beta_h^2$	283.229 (21.097)	$\beta_w^2$	29.272 (2.441)
$\beta_h^3$	283.260 (21.173)	$\beta_w^3$	-37.782 (164.562)
$\beta_h^4$	438.734 (32.810)	$\beta_w^4$	-45.130 (42501.090)
$\beta_h^5$	439.471 (32.471)	$\beta_w^5$	29.361 (2.679)
<u>Demographic Characteristics:</u>			
$\alpha_h$ :		$\alpha_w$ :	
Husband's Education	0.694 (0.136)	Husband's Education	-0.112 (0.105)
Wife's Education	0.493 (0.138)	Wife's Education	-0.320 (0.118)
Husband's Age	-0.014 (0.086)	Husband's Age	-0.016 (0.061)
Wife's Age	0.137 (0.089)	Wife's Age	0.083 (0.065)
Husband's Age Squared/1000	0.346 (0.147)	Husband's Age Squared/1000	-0.210 (0.177)
Wife's Age Squared/1000	0.273 (0.151)	Wife's Age Squared/1000	-0.329 (0.174)
Number of Children	-0.444 (0.145)	Number of Children	-1.738 (0.189)
Children Less Than 6	-0.062 (0.216)	Children Less Than 6	-0.897 (0.249)
Black	-6.235 (1.940)	Black	2.534 (0.790)
Other Race	-0.797 (0.502)	Other Race	1.796 (0.690)
Hispanic	0.339 (0.225)	Hispanic	-0.061 (0.267)
Region Dummies	yes	Region Dummies	yes
Year Dummies	yes	Year Dummies	yes
<u>Stochastic Elements:</u>		<u>Summary Statistics</u>	
$\sigma_h$	257.27 (2.61)	Log Likelihood	-47623.960
$\sigma_w$	694.48 (14.39)	N	3961
$\rho$	0.039 (0.025)		

**Table 4**

Estimation Results - True versus Simulated Data

<u>Sample Statistic</u>	<u>Actual</u>	<u>Simulated</u>
Mean Annual Hours - Husband	1972.04	1931.89
Mean Annual Hours - Wife	840.63	845.04
Labor Force Participation - Husband	0.955	0.938
Labor Force Participation - Wife	0.513	0.533
Both Working	0.498	0.500
Husband Working, Wife Not	0.456	0.438
Wife Working, Husband Not	0.015	0.033
Both Not Working	0.031	0.029

**Table 5**

Estimation Results - Implied Elasticities

<u>Overall Elasticities</u>		<u>Extensive Margin Elasticities</u>		<u>Intensive Margin Elasticities</u>	
<u>Husband Hours w.r.t.</u>		<u>Husband LFP w.r.t.</u>		<u>Husband Hours w.r.t.</u>	
Husband's Wage	0.0247 (0.0065)	Husband's Wage	0.0000 (0.0000)	Husband's Wage	0.0247 (0.0065)
Wife's Wage	-0.0030 (0.0035)	Wife's Wage	0.0000 (0.0000)	Wife's Wage	-0.0030 (0.0035)
Nonlabor Income	-0.0005 (0.0002)	Nonlabor Income	0.0000 (0.0000)	Nonlabor Income	-0.0005 (0.0002)
<u>Wife Hours w.r.t.</u>		<u>Wife LFP w.r.t.</u>		<u>Wife Hours w.r.t.</u>	
Wife's Wage	0.1796 (0.0588)	Wife's Wage	0.0279 (0.0340)	Wife's Wage	0.1796 (0.0563)
Husband's Wage	-0.0585 (0.0210)	Husband's Wage	-0.0059 (0.0071)	Husband's Wage	-0.0585 (0.0210)
Nonlabor Income	-0.0046 (0.0017)	Nonlabor Income	-0.0011 (0.0009)	Nonlabor Income	-0.0046 (0.0017)

Note: Elasticities were calculated by taking the difference in mean simulated hours or labor force participation that resulted from a one percent change in wage or income variables. All elasticities take into account the estimated measurement or optimization error distribution.

**Table 6**  
Heterogeneous Treatment Effects - Changes in Annual Hours

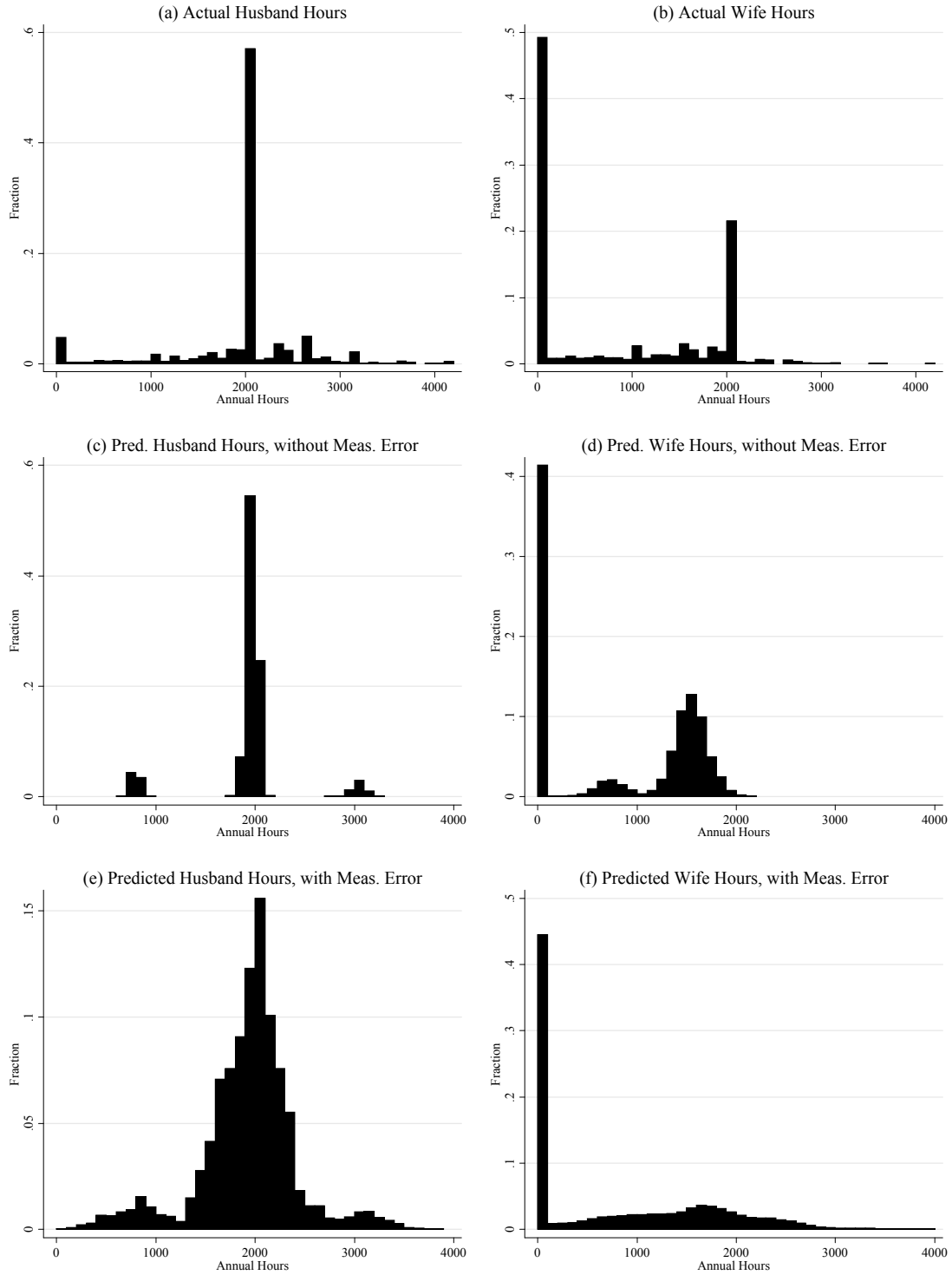
	Pre 1993 Expansion				Post 1993 Expansion			
	% Increased	Mean Increase	% Decrease	Mean Decrease	% Increased	Mean Increase	% Decrease	Mean Decrease
<u>Overall</u>								
Husbands	0.2%	0.26	75.4%	-2.00	0.00%	0.00	82.17%	-5.28
Wives	0.4%	2.16	74.2%	-4.65	0.00%	0.00	81.31%	-12.40
<u>By Age:</u>								
Under 40								
Husbands	0.2%	0.08	79.0%	-2.01	0.00%	0.00	86.66%	-5.33
Over 40								
Husbands	0.1%	0.83	69.5%	-1.97	0.00%	0.00	75.18%	-5.20
Under 40								
Wives	0.6%	2.16	76.6%	-4.72	0.00%	0.00	83.75%	-12.87
Over 40								
Wives	0.0%	0.00	67.3%	-4.41	0.00%	0.00	73.75%	-10.77
<u>By Number of Children:</u>								
One Child								
Husbands	0.1%	0.83	68.1%	-1.99	0.00%	0.00	75.85%	-3.96
Two or More Children								
Husbands	0.2%	0.08	78.8%	-2.00	0.00%	0.00	84.81%	-5.78
One Child								
Wives	0.2%	2.80	66.7%	-4.39	0.00%	0.00	73.17%	-7.54
Two or More Children								
Wives	0.5%	2.02	77.7%	-4.75	0.00%	0.00	84.71%	-14.16

**Table 7**  
Policy Simulations

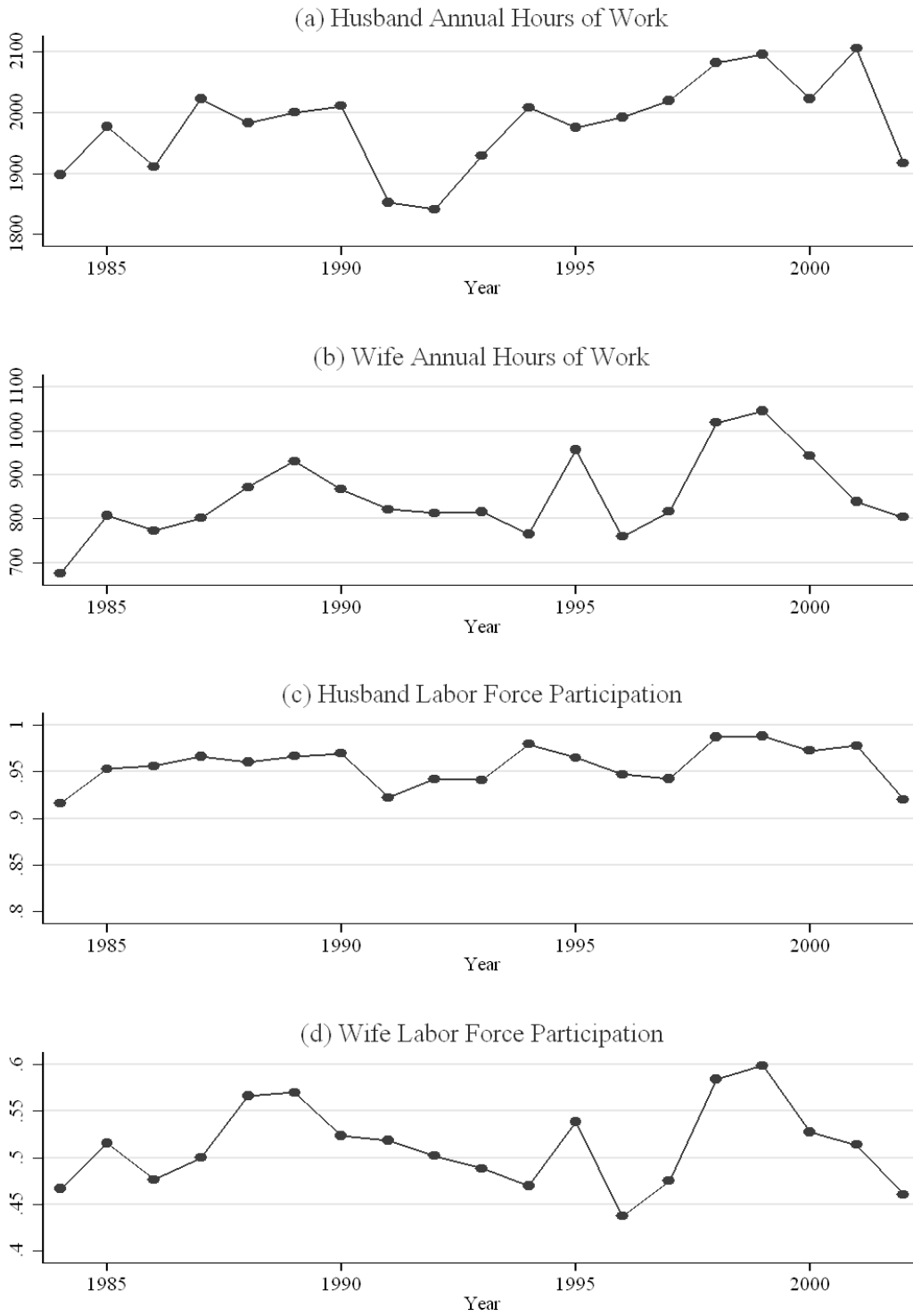
	Policy				
	<u>Actual</u>	<u>10% Increase</u>	<u>Addition of 3rd Child EITC</u>	<u>Rollback to 1992 EITC</u>	<u>Wage Based EITC</u>
Mean Annual Hours - Husband	1935.96	1935.47	1935.20	1939.95	1940.85
Mean Annual Hours – Wife	844.24	843.08	840.65	854.10	855.63
Labor Force Participation - Husband	0.941	0.941	0.941	0.941	0.941
Labor Force Participation - Wife	0.534	0.533	0.533	0.535	0.536

# Figures

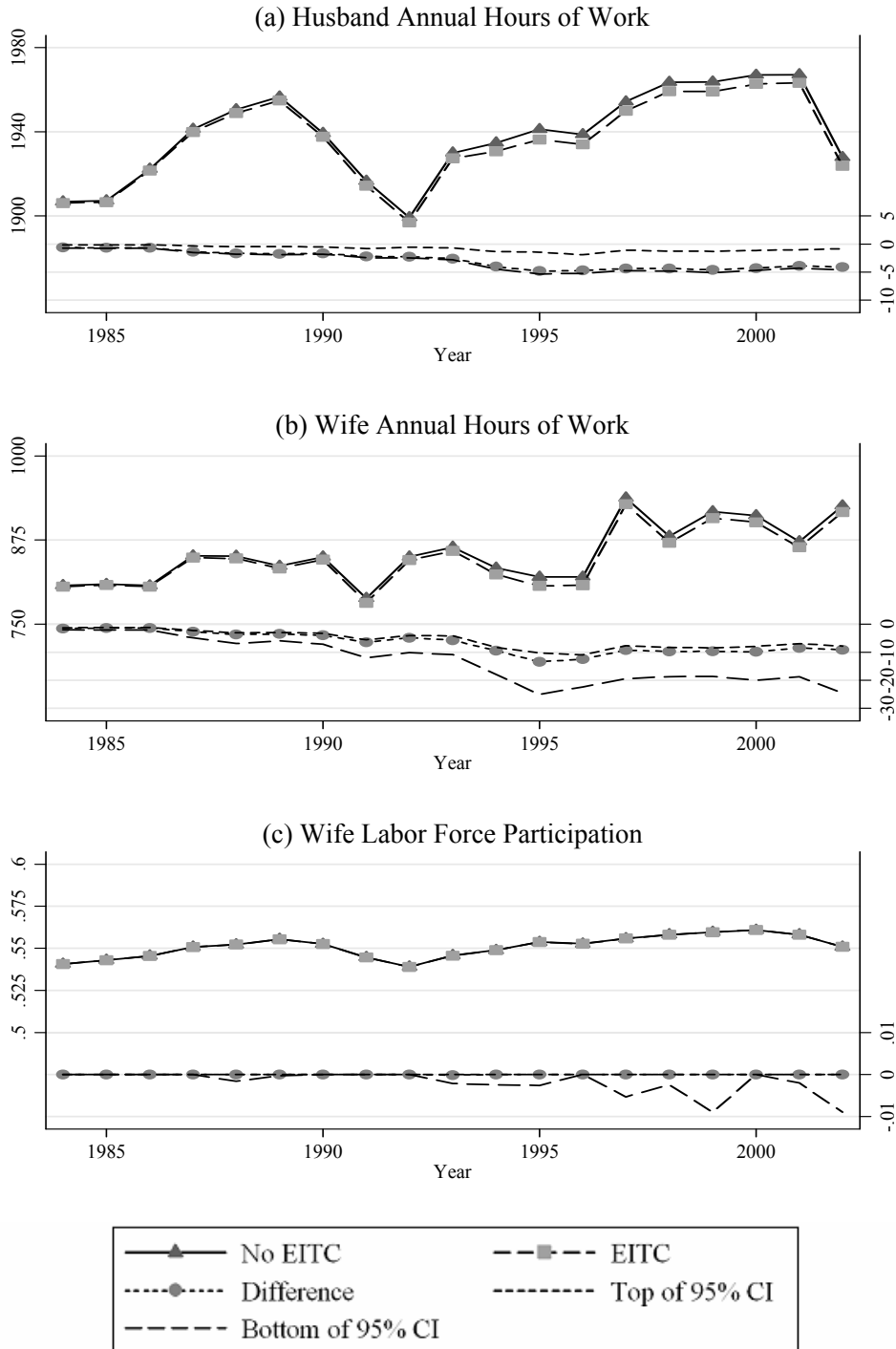
**Figure 1**  
Actual and Estimated Distribution of Hours



**Figure 2**  
 Labor Force Participation and Annual Hours Worked – CPS Sample



**Figure 3**  
 Labor Force Participation and Annual Hours Worked - Simulated Sample



Note: The top and bottom of the 95% confidence interval were calculated by bootstrapping using 1000 draws from the estimated distribution of parameters.

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