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The Earned Income Tax Credit and the Labor Supply of Married Couples

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Abstract

Over 18 million taxpayers are projected to receive the Earned Income Tax Credit (EITC) in tax year 1997, at a total cost to the federal government of about 25 billion dollars. The EITC is *refundable*, so any amount of the credit exceeding the family's tax liability is returned in the form of a cash refund. Advocates of the credit argue that this redistribution occurs with much less distortion to labor supply than that caused by other elements of the welfare system.

This popular view that the credit "encourages work effort" is unlikely to hold among married couples. Theory suggests that primary earners (typically men) would increase labor force participation, but secondary earners would *reduce* their labor supply in response to an EITC.

We study the labor supply response of married couples to several EITC expansions between 1984 and 1996. Although our primary interest is the response to changes in the budget set induced by the EITC, our estimation strategy takes account of budget set changes caused by federal tax policy, and by cross-sectional variation in wages, income, and family size. We use both quasi-experimental *and* reduced-form labor supply models to estimate the impact of EITC-induced tax changes.

The results suggest that EITC expansions between 1984 and 1996 *increased* married men's labor force participation only slightly but *reduced* married women's labor force participation by over a full percentage point. Overall, the evidence suggests that family labor supply and pre-tax family earnings fell among married couples. Our results imply that the EITC is effectively subsidizing married mothers to stay at home, and therefore have implications for the design of the program.

The Earned Income Tax Credit and the Labor Supply of Married Couples

1. INTRODUCTION

After a decade in near total obscurity since its inception in 1975, the federal Earned Income Tax Credit (EITC) was expanded in the tax acts of 1986, 1990, and 1993 to become the largest cash-transfer program for lower-income families with children. Over 18 million taxpayers are believed to have received the EITC in tax year 1997, at a total cost to the federal government of about 25 billion dollars.[1] Just one decade earlier in 1986, only 7 million families received the EITC, at a total cost of 2 billion dollars.

The EITC is *refundable*, so any amount of the credit exceeding the family's tax liability is returned in the form of a cash refund. The maximum credit amount in 1997 was $3,656 for a family with two or more children, and $2,210 for a family with one child. Although the credit may be received as part of a worker's regular paycheck, very few taxpayers avail themselves of that option, choosing instead to receive the transfer in the form of a lump sum payment.[2]

Advocates of the credit argue that redistribution occurs with much less distortion to labor supply than that caused by other elements of the welfare system. In particular, the credit is said to encourage labor force participation. Critics point to the very high marginal tax rates in the phase-out of the credit to argue that the credit (when combined with federal, state, and payroll taxes) can impose very high marginal tax rates that may substantially reduce hours worked.

In this paper, we examine the impact of the EITC on the labor supply decisions of married couples. This group is particularly interesting for several reasons. First, the popular view that the credit

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[1]Federal spending on Temporary Assistance for Needy Families (TANF), which replaces Aid to Families with Dependent Children (AFDC) with block grants, is fixed at about 16 billion dollars per year through 2001 (U.S. House of Representatives, 1996).

[2]This feature of the transfer has implications for the interpretation of the labor supply responses. We discuss this later in the paper.

"encourages work effort" is unlikely to hold among married couples. Primary earners (typically men) may increase labor force participation slightly, but most secondary earners in recipient families are expected to *reduce* their labor supply. In fact, the EITC causes the budget constraint faced by many secondary earners to look striking similar to that faced by welfare (AFDC/TANF) recipients. In addition, empirical research suggests that the reduction in labor supply may be substantial for affected groups. That work finds that labor force participation of secondary earners, typically married women, is particularly sensitive to taxes (Triest, 1990). Finally, these incentives affect a significant portion of the EITC population: in 1994 one-third of all recipients and about 40 percent of the phase-out population were married couples (General Accounting Office [GAO], 1996).

We study the labor supply response of married couples to the recent expansions of the EITC using Current Population Survey data from 1984–1996. We examine standard measures of labor supply (labor force participation, total hours worked, and hours worked conditional on working) separately for husbands and wives. Whereas our primary interest is in the response to changes in the budget set induced by the EITC, our estimation strategy takes account of budget set changes caused by federal tax policy, and cross-sectional variation in wages, income, and family size.

The problems of estimating the impact of taxes on labor supply are well known in the literature, including the endogeneity of the net-of-tax wage to labor supply. We estimate the discrete work/no-work choice at fixed hours and use instrumental variables methods to correct for the joint determination of hours worked and tax rates. As a preliminary analysis, we evaluate the impact of the EITC expansion using quasi-experimental methods where we compare changes in labor supply among EITC-eligible and EITC-ineligible groups.

A number of papers have evaluated the EITC's effect on the labor supply of single women, but this is the first paper to examine both the participation and hours of work decisions of married couples using tax-reform variation. The paper also contributes to the empirical labor supply literature by

examining directly the impact of taxes on labor force participation, and by using a new instrument based on tax reforms that captures the individual's entire budget set to estimate the impact of taxes on hours worked.

Our main estimates are based on a sample of married couples with less than 12 years of schooling, chosen because they are most likely to be affected by the EITC. In 1996, almost 60 percent of less-educated married couples with children were eligible for the EITC. By comparison, only 20 (10) percent of couples with 12 (more than 12) years of schooling were eligible for the EITC. Our results suggest that married men's labor supply is little affected by taxes, while married women's labor supply is moderately affected by taxes. The elasticity with respect to the net-of-tax wage is about 0.3 for participation, and between 0.1 and 0.5 for hours worked.

Simulations based on our results suggest that the EITC expansions over the past decade *increased* the likelihood of married men's labor participation only slightly but *reduced* the likelihood of married women's labor force participation by over a full percentage point. Also, women in the phase-out are more than 2 percentage points (5 percent) less likely to work, and if in the labor force, work as much as 276 (20 percent) fewer hours per year after the EITC expansions. Overall, the evidence suggests that family labor supply and pre-tax earnings fell.

Our results imply that the EITC is effectively subsidizing married mothers to stay at home, and therefore have implications for the design of the program. If the main objective of the EITC is to encourage labor market participation, then an EITC that is based on individual earnings (as opposed to family earnings) would offset the incentive for secondary earners to leave the labor force.

Section 2 of this paper describes relevant features of the EITC, reviews the existing literature, and discusses the expected effects of the credit on family labor supply. Section 3 outlines our empirical methodology. Our data are summarized in Section 4. Section 5 presents our participation results, and Section 6 presents hours-worked results. We conclude in Section 7.

2. BACKGROUND

2.1 Operation and History of the EITC

The federal Earned Income Tax Credit began in 1975 as a modest program aimed at offsetting the Social Security payroll tax for low-income families with children. After major expansions in the tax acts of 1986, 1990, and 1993, federal spending on the EITC (including both tax expenditures and outlays) was expected to be 1.7 times as large as federal spending on Temporary Assistance for Needy Families (TANF) in 1996.

Eligibility for the EITC depends on the taxpayer's earned income (or in some cases adjusted gross income) and the number of qualifying children who meet certain age, relationship, and residency tests. First, the taxpayer must have positive earned income, defined as wage and salary income, business self-employment income, and farm self-employment income. Also, the taxpayer must have adjusted gross income and earned income below a specified amount (in 1996, maximum allowable income for a taxpayer with two or more children was $28,495). Second, a taxpayer must have a qualifying child, who must be under age 19 (or 24 if a full-time student) or permanently disabled and residing with the taxpayer for more than half the year.[3] Until 1991, the rules for EITC eligibility were more complicated and depended on the taxpayer's filing status.[4]

The credit is refundable so that a taxpayer with no federal tax liability, for example, would receive a tax refund from the government for the full amount of the credit. Taxpayers may also receive the credit throughout the year with their paychecks; however in 1989, less than 0.5 percent of all EITC recipients availed themselves of this early payment option (GAO, 1992).

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[3]Beginning in 1994, a small credit became available to low-income workers without children.

[4]See Eissa and Liebman (1996) for a more extensive discussion of EITC rules.

The amount of the credit to which a taxpayer is entitled depends on earned income, adjusted gross income, and, since 1991, the number of EITC-eligible children in the household. There are three regions in the credit schedule. The initial phase-in region transfers an amount equal to the subsidy rate times earnings. In the flat region, the family receives the maximum credit. In the phase-out region, the credit is phased out at a specified rate.

Table 1 summarizes the parameters of the EITC over the history of the program. The real value of the credit increased only modestly in the early years and was mostly due to inflation.[5] The 1987 expansion of the EITC, part of the Tax Reform Act of 1986 (TRA86), represents the first major expansion of the EITC. TRA86 increased the subsidy rate for the phase-in of the credit from 11 percent to 14 percent and increased the maximum income to which the subsidy rate was applied from $5,000 to $6,080. This resulted in an increase in the maximum credit from $550 to $851 ($788 in 1986 dollars). The phase-out rate was reduced from 12.22 percent to 10 percent. The higher maximum credit and the lower phase-out rate combined to expand the phase-out region. Taxpayers with incomes between $11,000 and $15,432 became eligible for the credit and faced its phase-out marginal tax rate for the first time in 1987. The constant or flat region was lengthened in 1988, further extending the phase-out region to $18,576.

The 1987 expansion of the EITC also interacted with other tax changes implemented after TRA86. The tax schedule was collapsed from eleven to two nominal brackets, and the marginal rates of some taxpayers at the bottom of the income distribution rose from between 0 and 11 percent to 15 percent, while the marginal rates for others fell from between 16 and 24 percent to 15 percent. TRA86 also increased exemption amounts and the standard deduction.

The 1991 expansion, contained in the Omnibus Budget Reconciliation Act of 1990 (OBRA90), increased the maximum credit and introduced separate credit rates for families with two or more

[5]The EITC was first indexed to inflation in 1987.

TABLE 1
Earned Income Tax Credit Parameters, 1975–1996

Year	Phase-In Rate	Phase-In Range	Maximum Credit	Phase-Out Rate	Phase-Out Range
1975–1978	10.0%	$0–$4,000	$400	10.0%	$4,000–$8,000
1979–1984	10.0%	$0–$5,000	$500	12.5%	$6,000–$10,000
1985–1986	11.0%	$0–$5,000	$550	12.22%	$6,500–$11,000
TRA86					
1987	14.0%	$0–$6,080	$851	10.0%	$6,920–$15,432
1988	14.0%	$0–$6,240	$874	10.0%	$9,840–$18,576
1989	14.0%	$0–$6,500	$910	10.0%	$10,240–$19,340
1990	14.0%	$0–$6,810	$953	10.0%	$10,730–$20,264
OBRA90					
1991[1]	16.7%[2]	$0–$7,140	$1,192	11.93%	$11,250–$21,250
	17.3%[3]		$1,235	12.36%	
1992[1]	17.6%[2]	$0–$7,520	$1,324	12.57%	$11,840–$22,370
	18.4%[3]		$1,384	13.14%	
1993[1]	18.5%[2]	$0–$7,750	$1,434	13.21%	$12,200–$23,050
	19.5%[3]		$1,511	13.93%	
OBRA93					
1994	26.3%[2]	$0–$7,750	$2,038	15.98%	$11,000–$23,755
	30.0%[3]	$0–$8,425	$2,528	17.68%	$11,000–$25,296
	7.65%[4]	$0–$4,000	$306	7.65%	$5,000–$9,000
1995	34.0%[2]	$0–$6,160	$2,094	15.98%	$11,290–$24,396
	36.0%[3]	$0–$8,640	$3,110	20.22%	$11,290–$26,673
	7.65%[4]	$0–$4,100	$314	7.65%	$5,130–$9,230
1996	34.0%[2]	$0–$6,330	$2,152	15.98%	$11,650–$25,078
	40.0%[3]	$0–$8,890	$3,556	21.06%	$11,650–$28,495
	7.65%[4]	$0–$4,220	$323	7.65%	$5,280–$9,500

Source: U.S. House of Representatives (various years) and authors' calculations from OBRA93.

[1]Basic credit only. Does not include supplemental young child credit or health insurance credit.
[2]Families with one qualifying child.
[3]Families with two or more qualifying children.
[4]Taxpayers with no qualifying children.

children. By 1993, a family with two or more children could receive a maximum credit of $1,511, $77 more than a family with one child.

The largest single expansion over this period was contained in the Omnibus Budget Reconciliation Act of 1993 (OBRA93) legislation. The 1993 expansion of the EITC, phased in between 1994 and 1996, led to an increase in the subsidy rate from 19.5 percent to 40 percent (18.5 percent to 34 percent) and an increase in the maximum credit from $1,511 to $3,556 ($1,434 to $2,152) for taxpayers with two or more children (taxpayers with one child). This expansion was substantially larger for those with two or more children. The phase-out rate was also raised, from 14 percent to 21 percent (13 percent to 16 percent) for taxpayers with two or more children (taxpayers with one child). Overall, the range of the phase-out was expanded dramatically, such that by 1996 a couple with two children would still be eligible at income levels of almost $30,000.

2.2 Expected Effects of the EITC on Family Labor Supply

To evaluate the impact of the EITC on married couples' labor supply, it is instructive to begin with the impact of the EITC on an unmarried taxpayer. Because the EITC is available only to taxpayers with earned income, standard labor supply theory predicts that the EITC will encourage labor force participation among single parents. Figure 1 shows how the introduction of an EITC shifts the budget constraint of an otherwise untaxed individual from ADE to ABCDE. The well-being of a taxpayer who does not work has not changed because the EITC is not available to a taxpayer with zero earnings. Thus any taxpayer who preferred working before will still prefer working, and some taxpayers may find that the additional after-tax income from the EITC makes it worth entering the labor force. The impact of the EITC on the labor force participation of unmarried taxpayers is therefore unambiguously positive.

But theory also predicts that the credit will reduce the number of hours worked by most eligible taxpayers already in the labor force. Although the credit initially increases with income, producing offsetting income and substitution effects on hours worked, over 70 percent of recipients have incomes in

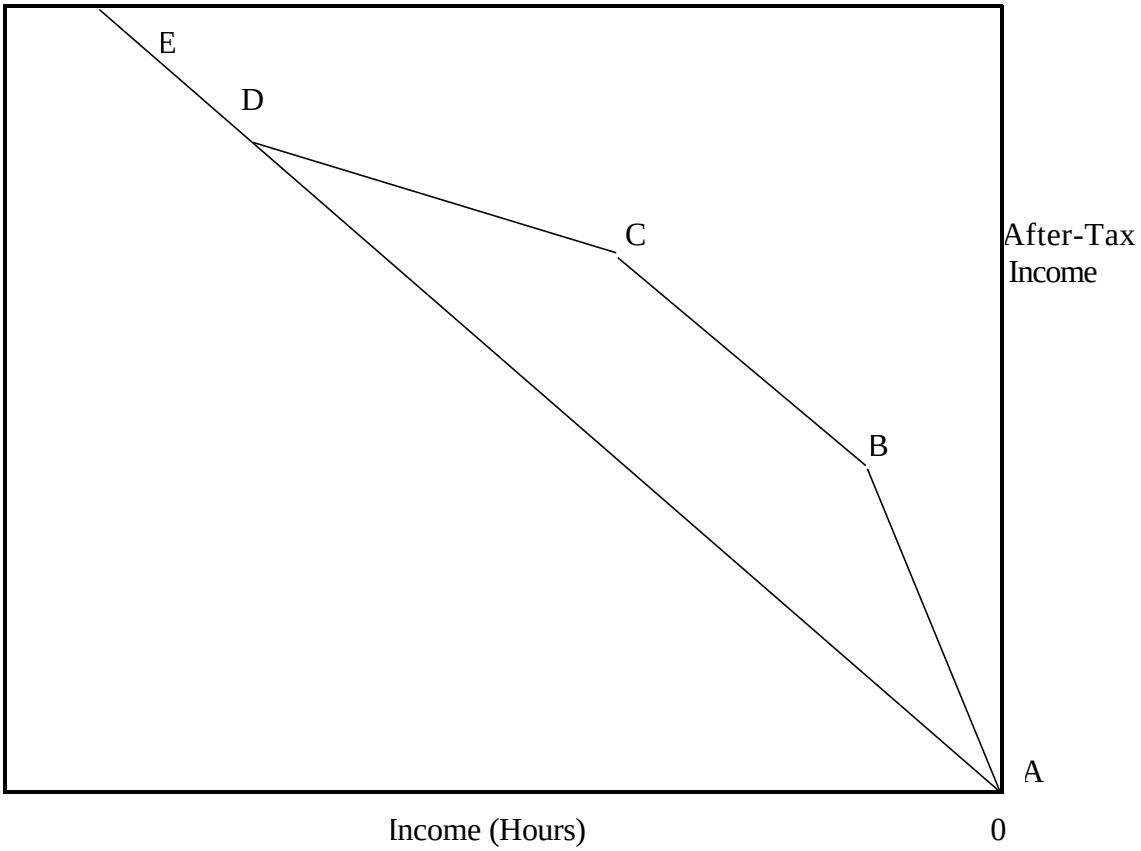

Figure 1: EITC Budget Constraint

regions in which the credit is constant (and therefore produces only a negative income effect on labor supply) or is being phased out (producing negative income and substitution effects). Moreover, the phase-out of the credit alters the budget set in such a way that some taxpayers with incomes beyond the phase-out region may choose to reduce their hours of work to take advantage of the credit. Therefore, the EITC's only unambiguously positive effect on labor supply occurs on the participation margin.

Among married couples, the effects of the EITC on labor supply are more complicated because even the labor force participation effect is ambiguous.[6] This occurs because the credit is based on *family* earnings. The simplest way to see how this effect operates is to assume that the family's labor supply decisions are made sequentially, with the husband as the primary earner and the wife as the secondary earner. In this model, the effect of the credit on the labor supply of primary earners is the same as that of single taxpayers. Labor force participation increases unambiguously. Secondary earners, however, receive the EITC even if they remain out of the labor force because of the husband's earnings. Suppose, for example, that the husband earns $11,650 (in 1997), thus placing the family at the beginning of the phase-out region of the credit. If the wife remains out of the labor force, her family receives the maximum credit of $3,656 if the couple has two children ($2,152 if one child). For each dollar of income she earns, however, the family's credit is reduced by 21 cents if the couple has two children (or about 18 cents if one child). Additionally, she pays the Social Security payroll and, possibly, state taxes. With marginal tax rates approaching 50 percent, the incentive not to participate in the labor force can be quite strong. For these women, the EITC creates a budget set similar to that faced by recipients of AFDC, a program criticized for generating adverse work incentives.

Of course, it is also possible for the wife's work effort to increase the family's credit if the husband's earnings are in the subsidy region (less than $6,500), but very few married couples can be found with such low incomes (see discussion of Table 2 below).

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[6]The hours of work effects are exactly the same as those for single parents.

Overall, the distribution of family income makes it unlikely that the EITC will have *any* positive effect on the labor supply of secondary earners. In fact, it is unlikely that the EITC will have any positive effect on the labor supply of married couples because, in addition to the impact on secondary earners, evidence suggests that married men's participation and hours worked are not affected by taxes (Heckman, 1983; Triest, 1990).

Table 2 presents the distribution of families in different regions of the EITC, based on IRS data (top panel), and Current Population Survey (CPS) data (bottom panel). The bottom panel is based on a sample of couples with less-educated (defined as less than 12 years of schooling) wives used in our analysis. IRS data show that married EITC recipients are much more likely than single recipients to have incomes in the phase-out range of the credit (73 vs. 53 percent) and therefore to face the high marginal tax rates in the phase-out. CPS data show in addition that a substantial share of *less-educated* couples are eligible for the EITC (almost 60 percent) and are affected by the high marginal tax rates (74 percent of eligible and 40 percent of all married couples have incomes that put them in the phase-out range of the credit).

2.3 Previous EITC Work

Several literatures are relevant to our study. Though only a limited amount of work has examined behavioral responses to the EITC, a substantial amount of work has examined the effects of taxes and transfer programs on labor market outcomes. Relevant to our work are studies on empirical tax and labor supply and the negative income tax (NIT) experiments of the 1970s (see the surveys by Moffitt, 1992, and Moffitt and Kehrer, 1981). Here we focus our review on studies that directly examine the EITC.

Because the EITC changes the budget set in a straightforward manner, its impact on labor supply can be imputed using static labor supply elasticities from the literature. Several studies have taken that approach and used standard elasticity estimates from the literature (Browning, 1995) and the NIT experiments (GAO, 1993; Hoffman and Seidman, 1990; Holtzblatt, McCubbin, and Gilette, 1994) to

TABLE 2
Distribution of Families by EITC Credit Range

	Married Couples	Single Parents
Distribution of EITC Recipients with Children, Tax Year 1994[1]		
Phase-in or flat	27%	47%
Phase-out	73%	53%
Total	100%	100%
Distribution of Low-Educated Families with Children, Tax Year 1996[2]		
Phase-in	9%	—
Flat	6%	—
Phase-out	43%	—
Above phase-out	42%	—
Total	100%	—

[1]U.S. General Accounting Office (1996).
[2]Author's calculations of March 1997 CPS. Sample includes married couples with children where the wife has less than 12 years of schooling.

predict the impact of the credit. Browning estimates that about half of the taxpayers in the phase-out region of the credit will reduce hours of work by enough that their total disposable income declines.

These simulations may be biased if labor supply responsiveness to taxes varies by income or over time. While no direct evidence supporting this hypothesis exists,[7] the large increase in participation by married women over the past three decades likely renders the early NIT estimates less applicable for the EITC population. In addition, extrapolating the NIT results to the more widely implemented EITC is difficult because the experiments took place for only a fixed time in a small number of cities (see Moffitt and Kehrer, 1981).

Several studies have directly examined the labor supply effects of the EITC (Dickert, Houser, and Scholz, 1995; Eissa and Liebman, 1996; Attanasio and MaCurdy, 1997; Meyer and Rosenbaum, 1998). Eissa and Liebman and Meyer and Rosenbaum examine the impact of recent EITC expansions on female household heads using quasi-experimental methods that compare changes in the labor force participation rates and hours worked of eligible (with children) and ineligible (without children) women. Eissa and Liebman find an increase in the rate of labor force participation but no evidence of a decline in hours worked by taxpayers in the phase-out region as predicted by economic theory. Meyer and Rosenbaum confirm the participation findings (they do not examine hours of work) and further conclude that the EITC explains over half of the substantial increases in the labor force participation of single women with children over the past decade.

The two studies that examine the response by married couples use very different empirical approaches but reach similar qualitative results. Using cross-sectional data from 1990, Dickert, Houser, and Scholz (1995) estimate a joint labor force and welfare participation model. Simulations from their

[7]Almost none of the labor supply research that examines the response of married couples focuses on lower-income individuals. One exception is Hoynes (1996), who estimates the effect of AFDC benefits on the labor supply of married couples. This work suggests that low-income couples may have higher wage and income elasticities than the overall population of married couples.

results suggest that the 1993 EITC expansion would raise (lower) labor force participation rates for men (women). The use of cross-sectional data, however, limits the EITC variation to demographics (family size) and income.

Attanasio and MaCurdy (1997) use the policy-driven EITC changes over the past decade to estimate a life-cycle consistent model of household labor supply. They estimate the EITC effect on couples in the labor market using an instrumental variables estimator where the instruments are polynomials in age and education, state dummies, and year dummies interacted with region. Their simulations suggest substantial effects of the credit expansion on hours worked. Their analysis, however, does not consider the participation effect.

We extend the work on married couples by examining both the participation and hours worked decisions, and by using a new instrument based on tax reforms that captures the individual's entire budget set to estimate the impact of taxes on hours worked.

3. METHODS

Estimating the effects of taxes on labor supply is notoriously difficult because of the joint determination of labor supply and taxes with nonproportional tax schedules, because of unobserved tastes for work, and because of measurement error in both the marginal tax rate and the wage. Labor supply estimates based on ordinary least squares (OLS) can therefore be severely biased.

Several methods have been used to address these problems. The most complete method for estimating labor supply responses is driven by the presence of several features of labor supply and taxes. The nonlinear budget set approach addresses several challenges noted extensively in the literature, including the presence of kink points and unobserved heterogeneity in work preferences. While constraints imposed to make nonlinear budget set models tractable appear to be binding and to heavily

influence the results (Heckman, 1983; MaCurdy, Green, and Paarsch, 1990), the expansions of the EITC and other tax policy reforms may actually allow us to relax some of the binding restrictions.

Because identification in nonlinear budget set models is tenuous, we choose instead not to implement this strategy. Instead we use two alternative strategies. First, we estimate the impact of the EITC using simpler and somewhat more transparent quasi-experimental methods. Second, we estimate standard reduced-form labor supply models, including instrumental variables (IV) methods for hours worked. The advantage of using two methods is that we can gauge the robustness of our estimates to alternative empirical models. Although neither of these approaches deals with the presence of kink points and unobserved preference heterogeneity, the IV approach provides "parameter estimates that are very similar on average" to the complete budget constraint (Triest, 1987) in hours-of-work models.[8]

Before discussing our methods, we mention several assumptions that are maintained throughout our empirical work. We assume a static model of household labor supply, in which the husband is the primary earner and the wife is the secondary earner.[9] Although the EITC expansions altered the incentives to marry and to have children (Dickert-Conlin and Houser, 1998), we allow no responses on those margins. Finally, we assume that the couple's unearned income is exogenous.[10] Because fully 60 percent of less-educated married couples in 1996 were eligible for the EITC, we concentrate our empirical analysis on that sample (defined more specifically in the data section).

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[8]Blomquist (1996) on the other hand argues that no estimator is uniquely best. In these models, it turns out that the form of measurement error in the data matters for the robustness of the estimator.

[9]CPS data show that less-educated women are predominantly secondary earners when measured by the share of family earnings they contribute. Overall, about 90 percent earn less than their husbands, while among working couples, that figure is 85 percent.

[10]Transfer income may not be exogenous to labor supply. Because we focus on lower-income families, we are especially concerned about the endogeneity of two types of transfer income—unemployment insurance and public assistance. We made two attempts to gauge the bias caused by ignoring this endogeneity: we dropped all couples that received unemployment insurance or public assistance, and we recomputed unearned income excluding these two sources. In neither case did estimates of the income effect change substantially. As a result, we present results that maintain the assumption of exogenous unearned income.

3.1 Tax Reforms as Quasi-Experiments

Our first estimation strategy considers how labor force participation and hours worked by eligible married couples with children change following OBRA93, the most recent and largest expansion in the EITC. Because the EITC depends on earnings (and therefore labor supply), we cannot use the actual credit amount to estimate its effect. In this first approach, we rely on time to identify the responsiveness to the EITC. Since underlying trends in participation or hours of work, as well as other policy or economic shocks, may affect labor market outcomes, we use control groups to isolate the impact of the increase in the EITC from the other factors.

Throughout the analysis, married couples with children are the treatment group and similar married couples with no children are the control group.[11] This approach is similar to that used by Eissa and Liebman (1996). By widening the credit gap between the first and second child, the 1993 expansion created different incentives for families of different sizes and allows an additional degree of variation to identify the EITC effect. The difference between the change in labor supply of eligible husbands (wives) with children and husbands (wives) with no children is our estimate of the EITC effect on participation. We therefore control for any contemporaneous shocks to eligible couples' labor supply through the change in the comparison groups' labor supply. The validity of the comparison groups, and the experiment, rests on fairly restrictive assumptions: no contemporaneous shocks (other than the expansion in the EITC) to the relative labor market outcomes over the period, and no underlying trends in participation or hours of work that differ between the two groups.

[11]We also explored using treatment groups defined by having predicted family income (based on exogenous characteristics such as age, race, state, and education) below the EITC maximum. In practice, it is hard to find models that predict family earnings with significant precision. No results are provided for this model.

3.2 Estimating Wage and Income Effects Using the EITC and Other Tax Changes

Labor Force Participation. Individuals make labor supply decisions by maximizing utility subject to a budget constraint that, by assumption, takes into account tax and transfer programs. Suppose that the choice is between not working and working at some fixed effort level. Individuals do not work if utility given after-tax income out of the labor force exceeds utility given after-tax income at the fixed effort level in the labor force. If working, individuals are assumed to normalize after-tax income by hours worked, and therefore it is the net-of-*average*-tax wage that matters for the discrete work decision.

We therefore estimate a model in which the work decision is a function of the net-of-average-tax wage and net nonlabor income. If we generate the average tax rate at observed earnings, it would depend on hours worked, creating an endogeneity problem. Instead, we assume that entry into the labor market is at fixed hours of work. We discuss identification in more detail below.

Hours of Work Conditional on Working. Once in the labor force, we assume the hours worked decision is continuous and therefore depends on the net-of-marginal-tax wage and virtual income.[12] Clearly, both the net wage and virtual income are endogenous, since they depend on hours worked. We use IV methods to address the endogeneity of the net wage and income to hours worked, and propose an instrument that has not been used in the literature.

Instrument sets used previously in the literature include the gross wage and taxable unearned income (Triest, 1987), demographic characteristics such as education, age, home-ownership, and region (Flood and MaCurdy, 1993), and tax parameters and demographics (Blundell, Duncan, and Meghir, 1998). Some of these instruments are not convincing. It is difficult to argue that transformations of observable characteristics, for example, are not correlated with the error term in the hours-worked

[12]Virtual income is the vertical intercept (e.g., after-tax income) at zero hours of work if the budget set is linearized through the person's observed budget segment.

equation. In addition, demographic variables have been rejected as valid instruments for wages and virtual income because the R^2's on the first stage are low (Blomquist, 1996).

We use two sets of instruments in our analysis. The first set, IV-1, includes the EITC tax parameters, a variable for the first federal income tax bracket, and EITC tax parameters interacted with cohort dummies. This instrument set is motivated by the approach of Blundell, Duncan, and Meghir (1998). Our second set, IV-2, maps out the individual's budget set. Specifically, IV-2 includes individual-specific marginal tax rates calculated at $5,000 earnings intervals, from $0 to $100,000, using current-year tax law and observed nonlabor income and family size. To be valid, these instruments must be correlated with the endogenous variables (net wage and virtual income), but not with the error in the hours-worked equation. The instruments depend only on year, number of children, and level of nonlabor income and are exogenous under the maintained assumptions in the paper. Nonetheless, to assess their validity, we present all relevant test statistics in the paper.

3.3 Identification

In this section, we briefly compare identification in each of our estimation approaches to clarify the different sources of variation that identify the EITC effect. This discussion is useful for interpreting and comparing the empirical results, to which we return later.

We discuss first the source of variation in individual tax rates. While all individuals face the same tax *schedule* at any point in time, they face different tax *rates* based on their family size, nonlabor income, and earned income (wages and hours worked). Additionally, tax rates vary over time as the tax schedule changes with policy reforms.

The main difference between the quasi-experimental approach and the standard labor supply equations is in the use of group- versus individual-level variation in taxes. The first approach assumes that all relevant wage and income changes are captured by *group*-level variation in family size (presence

and number of children) and time. The EITC effect is then contained in the relative (to childless) labor supply response of couples with children after the EITC expansion.

Our second approach expands that strategy by using *individual* variation in wages, income, and federal personal income taxes. It therefore relies on cross-sectional variation in family size, unearned income (including husband earnings for the wife), own gross wages, and time variation to identify the effect of taxes on labor supply. This approach recognizes that policy reforms have nonneutral effects within groups, such as couples with children. To the question of why it is useful to use the quasi-experimental approach at all, we note that it is a good starting point and has some appeal because of its simplicity and transparency.

4. DATA

Our data come from the 1985 to 1997 March Current Population Surveys. The March CPS is an annual demographic file of between 50,000 and 62,000 households. It includes labor market and income information for the previous year, so the data we have are for tax years 1984 to 1996, a period covering the three EITC expansions outlined in Table 1. We begin our analysis just before the TRA86 expansion because it represents the first major expansion since the EITC was introduced in 1975.

The CPS has information on households, families, and individuals. However, the relevant unit of analysis for this study is the tax-filing unit. Our tax-filing units are based on CPS families. Therefore, subfamilies (both related and unrelated) are allocated to separate tax-filing units from the primary family. We consider any member of the tax-filing unit who is under 19 years old (or under 24 and a full-time student) to be a dependent child for tax purposes. We do not impose the support test for dependents because we do not have enough information to determine the EITC 6-month residency requirement.

The sample includes married couples who reside in the same household and who are between 25 and 54 years old. We exclude those couples where one spouse is ill or disabled, in the military, or in

school full time during the previous year. We also exclude any couple with negative earned income (due to negative self-employment income), negative unearned income, or positive earned income but zero hours of work.[13] The resulting sample size, after pooling all 12 years and including all education groups, is 182,958 observations.

The main estimates in the paper are based on a sample of couples with less than a high school education, where the selection is based on the wife's education. We use this criterion to better select couples that are most likely to receive the EITC.[14] Evidence from an exact match between the 1990 CPS and IRS data shows that married couples with less than 12 years of schooling are twice as likely to be receiving the credit than couples with 12 years of schooling, and more than four times as likely to receive the credit than couples with some college (Liebman, 1996). Restricting the sample to less-educated couples reduces the sample size to 22,863 observations.[15]

Table 3 presents summary statistics of the less-educated sample of married couples by presence and number of children. Separate statistics are presented for husband and wife. The demographic variables used in the analysis are fairly standard and include age, race, education, number and ages of children, and the state unemployment rate.

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[13]We also exclude families with taxable unearned income in excess of $30,000 (in 1995 dollars). This group would not be eligible for the EITC in any year during this period. We drop couples where either the husband or wife has hourly earnings less than $2 or over $100 per hour (in 1995 dollars) or where the husband or wife derives more than half his (her) earned income from self-employment.

[14]Married females' education is highly correlated with their spouses' education (0.67 in our sample). We experimented with classifying groups based on the husbands' education, but the qualitative results were unchanged.

[15]For comparison, we refer in the text to results for higher-education groups (available on request).

TABLE 3
Summary Statistics
Sample: Wife's Education <12

		Married Couples		
	All	No Children	1 Child	2 or More Children
State unemployment rate	6.6 (1.7)	6.5 (1.7)	6.5 (1.7)	6.7 (1.7)
# of children	1.81 (1.51)	0	1	2.9 (1.1)
# of preschool children	0.44 (0.74)	0	0.21 (0.41)	0.72 (0.87)
Husband				
Nonwhite	0.13	0.14	0.11	0.13
Age	40.4 (7.8)	45.4 (7.4)	41.6 (7.7)	37.8 (6.7)
Education	9.7 (3.2)	10.2 (2.9)	10.1 (3.1)	9.4 (3.4)
Annual hours	1922 (718)	1937 (739)	1976 (675)	1895 (725)
Labor force participation	0.959	0.955	0.969	0.957
Unearned income	1669 (3767)	2046 (4452)	1658 (3897)	1513 (3364)
Average net wage (40 hours)	—	—	10.68 (5.14)	10.08 (4.90)
Net nonlabor income	—	—	1535 (3600)	1518 (3335)
Gross hourly wage[1]	12.09 (7.06)	13.08 (7.6)	12.6 (7.2)	11.44 (6.72)
ln(net wage)[1]	—	—	2.11 (0.50)	2.05 (0.48)
Virtual income[1]	—	—	4334 (3858)	4343 (3540)
Wife				
Nowhite	0.13	0.15	0.12	0.13
Age	38.0 (7.6)	43.8 (7.2)	39.2 (7.5)	35.1 (6.1)
Education	8.5 (2.5)	8.9 (2.2)	8.8 (2.2)	8.2 (2.6)
Annual hours	873 (932)	1040 (968)	993 (940)	756 (896)
Labor force participation	0.577	0.644	0.633	0.526
Unearned income	24,928 (16310)	27,312 (17925)	26,726 (17028)	23,206 (15047)
Average net wage (40 hours)	—	—	5.52 (3.21)	5.50 (3.63)
Net nonlabor income	—	—	23233 (12236)	21279 (11091)
Gross hourly wage[1]	7.56 (5.06)	7.87 (4.8)	7.63 (4.9)	7.37 (5.2)
ln(net wage)[1]	—	—	1.58 (0.46)	1.57 (0.48)
Virtual income[1]	—	—	23081 (12484)	20801 (11411)
Observations	22,863	5,493	4,868	12,502

Source: Authors' tabulations of March CPS for years 1985 to 1997.

Notes: Sample includes married couples where the wife has less than a high school education. See text for sample selection. Standard errors are in parentheses. All dollar amounts are in 1995 dollars.

[1]Wage is defined for workers only.

5. RESULTS FOR LABOR FORCE PARTICIPATION

5.1 Preliminary Analysis Using Comparison Group

Our preliminary analysis compares the labor force participation of married couples with and without children before and after the 1993 EITC expansion.[16] The 1993 expansion represents the largest expansion in the EITC since its introduction. Figure 2 plots the value of the EITC (in 1995 dollars) against family earnings by number of children in 1984, 1990, 1993, and 1996. OBRA93 raised the real value of the maximum credit and widened the gap between the credit for those with one versus two or more children.

Our sample includes all married couples from 1989 to 1996, where 1989–1993 defines the pre-OBRA93 period and 1994–1996 defines the post-OBRA93 period. The main results are for the low-education sample, which includes 12,944 couples. Because OBRA93 creates different incentives for families of different sizes, the tax act allows an additional degree of variation to identify the EITC effect. We therefore present separate statistics for couples with more than one child.

Summary statistics presented in Table 3 show that married men with children are younger, are slightly more likely to be white, and earn lower wages and nonlabor income than married men without children. Education and labor market attachment do not vary with family size for men, but vary substantially for women. Labor force participation and hours worked decline sharply as women have additional children. Like their husbands, married women with children are younger and have lower nonlabor income and wage levels than those without children.

Table 4 presents the unconditional difference-in-differences estimates separately for males and females. The first (second) column presents labor force participation before (after) the EITC expansion; the third column presents the change in labor force participation. The difference-in-differences estimate,

[16]OBRA93 supplanted expansions passed as part of OBRA90. We refer to the OBRA93 expansion for ease of exposition.

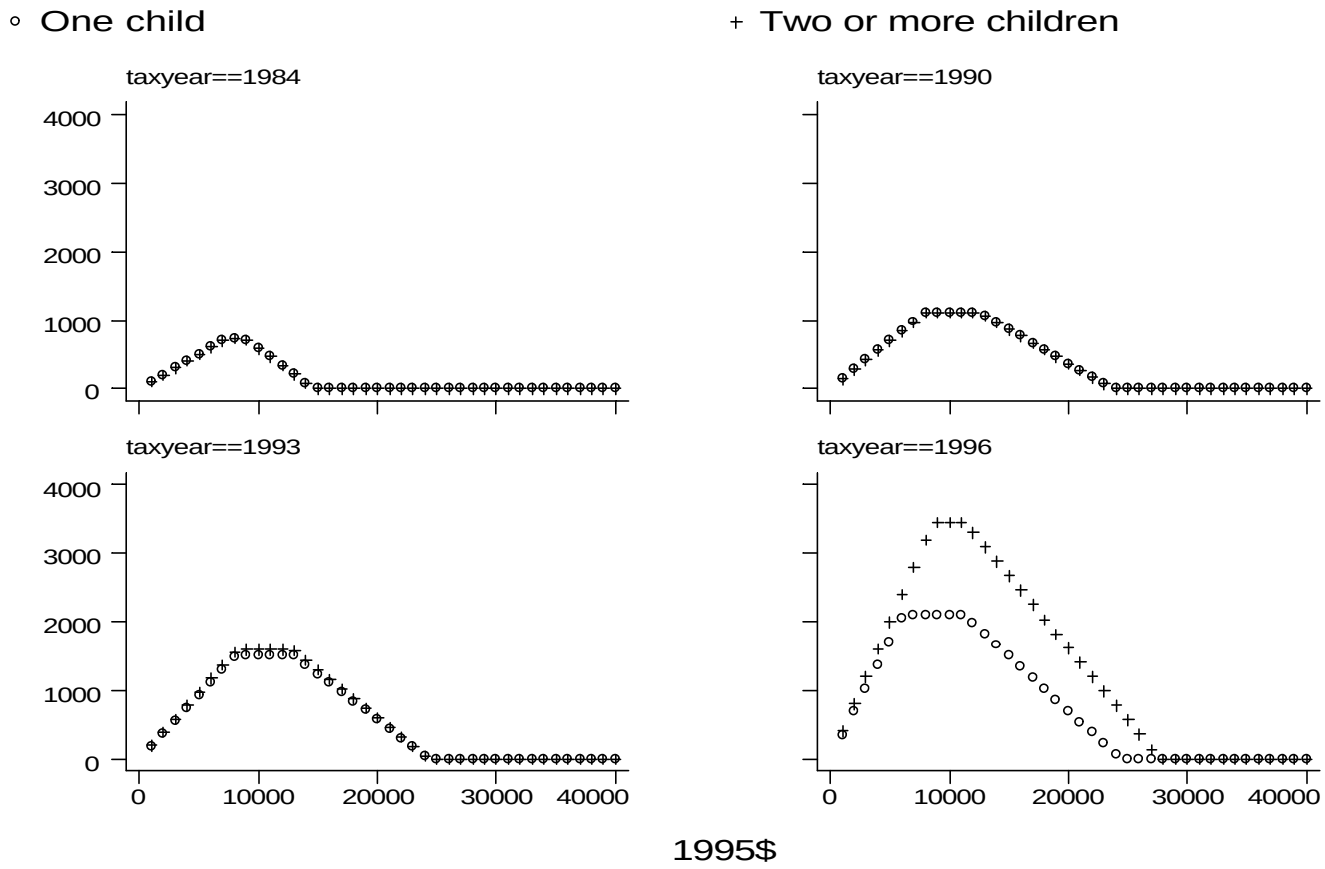
◦ One child
+ Two or more children
taxyear==1984
taxyear==1990
taxyear==1993
taxyear==1996
4000
3000
2000
1000
0
0
10000
20000
30000
40000
1995$
EITC benefit, by family earnings

Figure 2

TABLE 4
Labor Force Participation Rates of Married Couples,
Unconditional Means by Presence of Children and Pre-/Post-OBRA1993
Low-Education Sample

	Before Expansion (1989–1993)	After Expansion (1994–1996)	Change	Relative (to No Kids) Change
		Panel A: Married Men		
2+ kids (N=7276)	0.955 (0.003)	0.958 (0.004)	+0.003 (0.005)	**+0.016 (0.010)**
1 kid (N=2669)	0.967 (0.004)	0.961 (0.007)	-0.006 (0.008)	**+0.007 (0.012)**
No kids (N=2999)	0.957 (0.005)	0.944 (0.008)	-0.013 (0.009)	
		Panel B: Married Women		
2+ kids (N=7276)	0.533 (0.007)	0.507 (0.010)	-0.026 (0.012)	**-0.043 (0.022)**
1 kid (N=2669)	0.644 (0.011)	0.643 (0.017)	-0.001 (0.020)	**-0.018 (0.012)**
No kids (N=2999)	0.656 (0.010)	0.673 (0.015)	+0.017 (0.018)	

Source: Authors' tabulations of March CPS for years 1990 to 1997.

Notes: Sample includes married couples where the wife has less than 12 years of education. See text for sample selection.

the difference between the change in labor supply of those with and without children, is presented in the last column.

Overall these results suggest that the labor force participation response by married couples is consistent with the incentives of the EITC expansion. Married men with children increased their labor force participation relative to those without children, with larger increases for those with two or more children. Panel A in Table 4 shows that the participation rate rose by 0.3 of a percentage point for men with at least two children and fell by 0.6 of a percentage point for men with one child. Men with no children decreased their labor supply by 1.3 percentage points, leading to an estimated participation response of 1.6 percentage points (with a standard error of 1.0) for married men with more than one child and 0.7 of a percentage point for married men with one child (with a standard error of 1.2).

The pattern for married women is exactly opposite of that observed for their spouses. Married women with at least two children were 2.6 percentage points less likely to work, while women with one child were only 0.1 of a percentage point less likely to work after 1993. Relative to the *rise* of 1.7 percentage points on the labor force participation of childless women, these figures suggest a participation response of −4.3 and −1.8 percentage points (with standard errors of 2.2 and 1.2), respectively.[17]

Our participation estimates result in large part from the sizable changes for the comparison group. Clearly, these results should be interpreted with caution because the estimates will depend heavily on the quality of the comparison group.

To remove underlying observable differences that may confound our preliminary estimates of the EITC effect, we estimate regressions where we control for characteristics of couples with and without

[17]Appendix Table 1 shows that these labor force participation patterns are *not* observed for more-educated married couples. In fact, among more-educated women, those with more than one child increased labor force participation more than those with only one child.

children. Specifically, we estimate the following probit model of labor force participation separately for males and females:

$$P_{it}^{*} = \alpha + Z_{it}\beta + \sum_{y} d_{it}^{y}\delta_{1,y} + \sum_{s} d_{it}^{s}\delta_{2,s} + \gamma_0 d_j^{k} + \gamma_1 d_t^{t93} + \gamma_2 (d_j^{k} d_t^{t93}) + \varepsilon_{it}.$$

The controls in $\boldsymbol{Z}$ are quite standard and include family characteristics (family size, number of preschool children, and unearned income), individual characteristics (age, race, education), and area characteristics (state unemployment rate). The remaining variables are all dummies. We control for year effects through the variables $\boldsymbol{d}^{y}$, and for state effects through $\boldsymbol{d}^{s}$. Also, $\boldsymbol{d}^{k}$ is equal to 1 if the couple has a child while $\boldsymbol{d}^{t93}$ is equal to 1 for any tax year after 1993. We test the impact of the 1993 expansion of the EITC by determining whether eligible married men (women) with children changed their participation after 1993 relative to married men (women) in the control group; it is a test that γ_2, the coefficient on the interaction term between $\boldsymbol{d}^{k}$ and $\boldsymbol{d}^{t93}$, is different from zero.

The results for this model, presented in panel A of Table 5, suggest a story virtually identical to that in Table 4.[18] Therefore, differences in observable characteristics do not explain the labor force participation changes between 1988 and 1996. After controlling for differences in age, education, and other characteristics, we estimate that married men with children were 0.9 of a percentage point more likely to work (relative to married men without children) over this period; married women were 3.1 percentage points less likely to work relative to those without children (with standard errors of 0.7 and 2.2).[19]

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[18]We present here only the parameters of interest (EITC effect) and relegate the rest to Appendix Table 2.

[19]The probit is a nonlinear model; therefore, the coefficients cannot be directly interpreted as treatment effects. Since the treatment effect variable (kids*post93 interaction) is discrete, we calculate the effect of the OBRA93 by predicting two probabilities of participation, one with the interaction variable set equal to 1 and the other with the interaction term set equal to 0. The treatment effect is the average (over the sample of post-1993 men [women] with children) of the difference in the two probabilities of participation. We use the delta method to estimate standard errors.

TABLE 5
Difference-in-Differences Estimates of Labor Force Participation Rates, Married Couples with and without Children
Sample: Wife's Education <12

	Married Men (1) LFP (dp/dx)	Married Women (2) LFP (dp/dx)
	Panel A: Main Estimates	
Average EITC effect	**0.009 (0.007)**	**-0.031 (0.022)**
Log likelihood/R^2	-1,974	-8,189
Observations	12,944	12,944
	Panel B: Kids, 2+Kids	
Average EITC effect (any children)	**0.008 (0.010)**	**-0.016 (0.030)**
Marginal EITC effect (2+ children)	**0.007 (0.008)**	**-0.036 (0.025)**
Log likelihood/R^2	-1,960	-8,184
Observations	12,944	12,944
	Panel C: Cohort Dummies and Interactions	
Average EITC effect	**0.014 (0.008)**	**-0.042 (0.024)**
Log likelihood/R^2	-1,965	-8,187
Observations	12,944	12,944
	Panel D: Linear Time Trend for Kids	
Average EITC Effect (any children)	**0.012 (0.015)**	**0.031 (0.049)**
Marginal EITC Effect (2+ children)	**0.008 (0.008)**	**-0.037 (0.025)**
Time trend	-0.004 (0.003)	-0.006 (0.008)
Time trend*kids	-0.001 (0.003)	-0.010 (0.010)
Log likelihood/R^2	-1,961	-8,184
Observations	12,944	12,944
Mean of the dependent variable	0.96	0.58
Other controls (all specifications)	Demographics, state dummies, time dummies	

Source: Authors' tabulations of March CPS for years 1990 to 1997.

Notes: See text for sample selection. Parameter estimates for labor force participation are probability derivatives (dp/dx) from a probit estimation where dummy variables are measured as the change in predicted probability from going from 0 to 1. Each equation also includes controls for demographic variables, state dummies, and time dummies.

To exploit the variation in incentives by the number of children, we next estimate a model that allows the EITC effect to vary with the number of children (panel B of Table 5). This amounts to adding two variables to the regression: a dummy for two or more children ($\boldsymbol{d^{k2}}$), entered separately and interacted with the *post93* dummy ($\boldsymbol{d^{t93}}$).

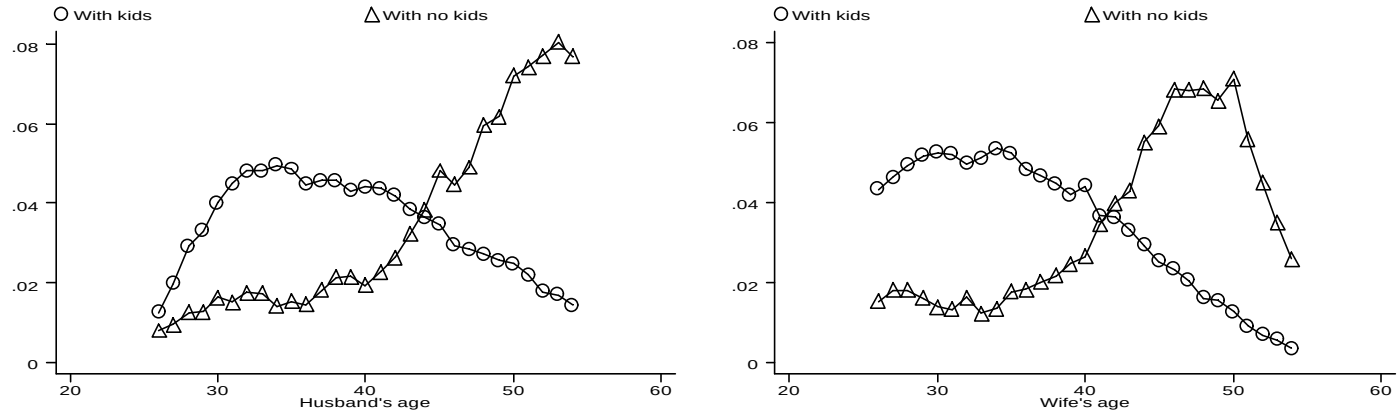
The resulting specification is:

$$P_{it}^{*} = \alpha + Z_{it}\beta + \sum_{y} d_{it}^{y}\delta_{1,y} + \sum_{s} d_{it}^{s}\delta_{2,s} + [\gamma_{0,0}d_{j}^{k} + \gamma_{0,1}d_{j}^{k2}] + \gamma_{1}d_{t}^{t93} + [\gamma_{2,0}(d_{j}^{k}d_{t}^{t93}) + \gamma_{2,1}(d_{j}^{k2}d_{t}^{t93})] + \varepsilon_{it}.$$

The first row of panel B presents the average EITC expansion effect on all couples with children ($\boldsymbol{\gamma_{2,0}}$), and the second row presents the marginal response of families with two or more children ($\boldsymbol{\gamma_{2,1}}$). The total increase in labor force participation of husbands with two or more children is 1.5 percentage points. The results for wives are striking and show that almost all the response is on the second child margin.

Testing the Validity of the "Experiment." If this policy reform provided a valid "experiment," our results would imply substantial responses to the OBRA93 EITC expansion. The validity of the experiment depends on the identifying assumptions that there are no contemporaneous shocks to the relative labor market outcomes of the affected and comparison groups over the period, and no underlying trends in participation that differ between the two groups.

Several features of our sample and of the labor market during that period suggest that this assumption may be violated. More careful examination of the data shows that average differences in observable characteristics, such as age, can mask substantial variation. Married couples with children tend to be older than couples without children (see Figure 3). The fact that these two groups are at very different points in the life cycle may confound the results if there are cohort-specific labor supply trends. Second, between 1989 and 1995 the national unemployment rate varied between 3.0 and 5.1 percent for married men and 8.0 and 10.0 percent for women maintaining families. Business cycles are a concern in



Families w/ wives w/ less than HS degree

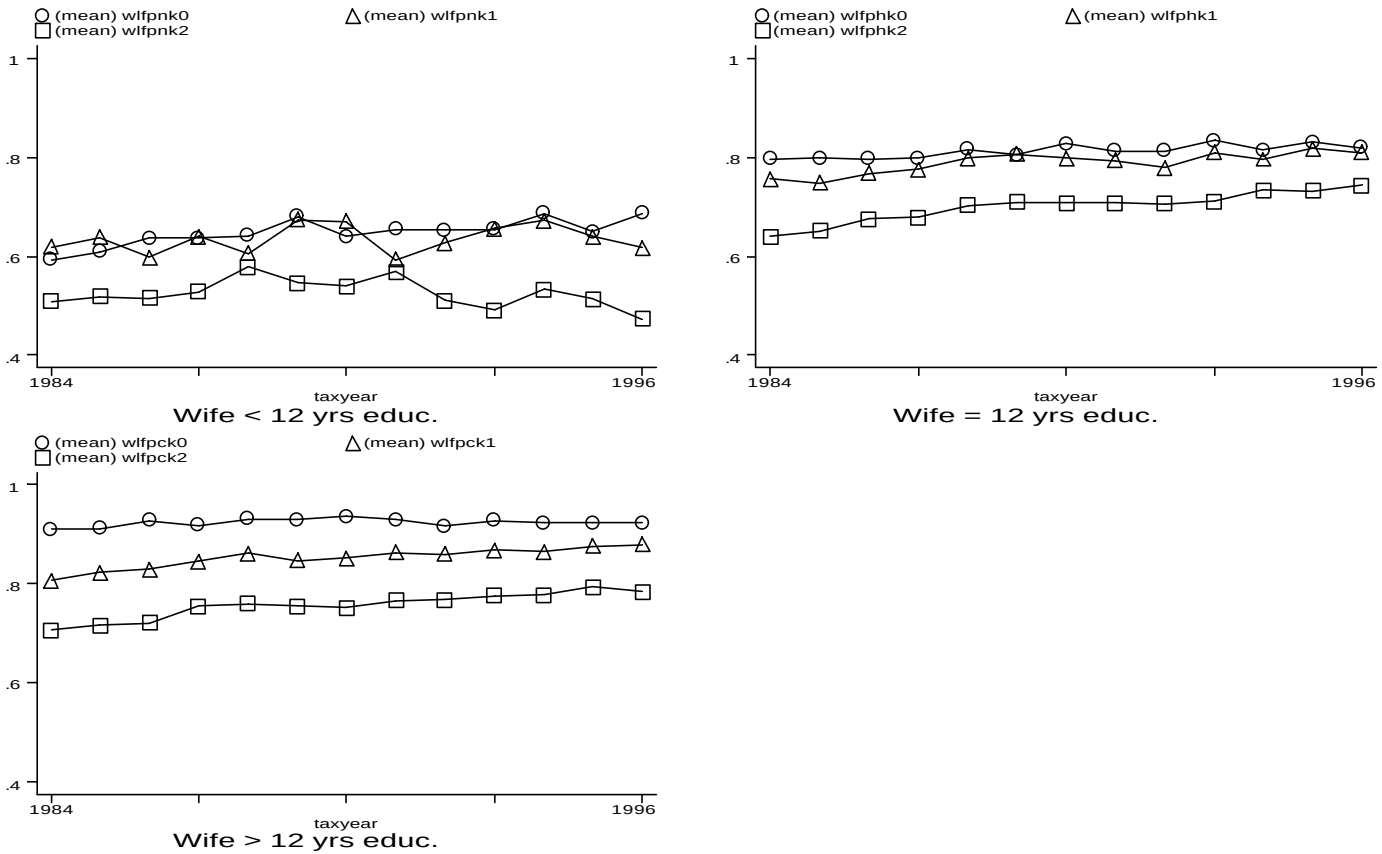
Age Distributions by Presence of Children

Figure 3

the difference-in-differences approach because married couples with children may respond differently to labor market conditions than those without children, and because the choice of years before and after the policy expansion is somewhat arbitrary. Third, labor supply among married women has been increasing steadily over the past three decades (Council of Economic Advisers, 1998). If this trend varies by the presence of children in the household, then the identification of the estimated EITC effect will be confounded by the differential trends. Our raw data do not show evidence of consistent longer-term trend by the presence or number of children among less-educated wives (Figure 4). The figure plots participation rates for women with no children (wlfpnk0), one child (wlfpnk1), and at least two children (wlfpnk2), and shows that among women with less than 12 years of schooling and at least two children, participation starts declining after 1991. No such evidence exists for more-educated (and ineligible) women.

We address these points with extensions to the basic model in Table 5. The table shows that most of our concerns have little effect on the basic results. Adding birth cohort dummies and interacting them with the kids dummy increases the estimated EITC effect slightly (panel C of Table 5). In results not reported in the paper, we find that allowing for separate responses to the business cycle by interacting the state unemployment rate with the kids dummy does not affect the estimated EITC effect. Changing the pre-OBRA93 period to 1989–1990 (instead of 1989–1993) leads to somewhat stronger participation responses in the direction predicted by the EITC expansion for both men and women.

We explore the potential importance of differential underlying labor supply trends in two ways. We first restrict the time trend to be linear and allow separate trends for couples with and without children, and find different results for men and women (panel D of Table 5). Whereas the participation response of men remains largely unchanged (although less precisely estimated), the labor force participation response of married women is quite sensitive to the inclusion of trend variables. Allowing for different time trends, women with one child are 3 percentage points *more* likely, while women with



Wife's labor force participation

Figure 4

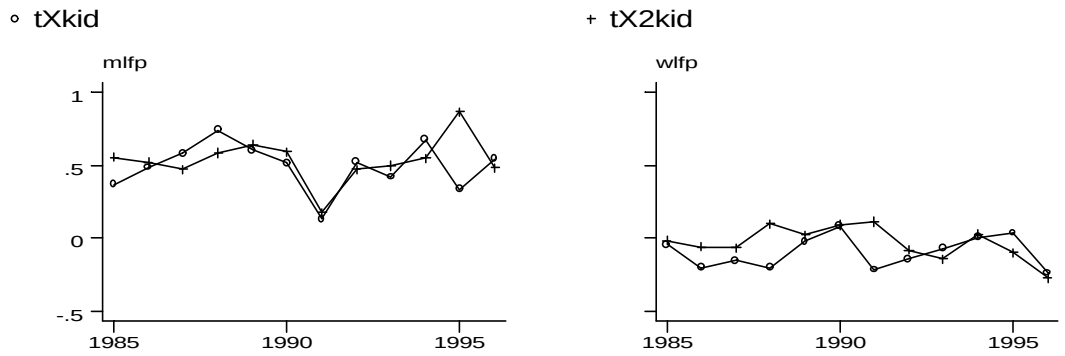
two or more children are a statistically insignificant 0.6 of a percentage point *less* likely, to enter the labor force after the EITC expansion. These results are driven by the estimated trend decline of 1 percentage point per year between 1989 and 1993. We find this estimate surprisingly large and believe it to be a feature of the linear specification. Because time is a source of identification in this model, however, we are limited in how finely we can specify time trends in outcome variables.

Our second method of estimating the EITC effect controlling for differential time trends is more flexible. We estimate a regression that includes 12 year dummies entered separately, and interacted with the kids and the 2+ kids dummies, using data from 1984 to 1996. Figure 5 plots the coefficients on the interactions of the year dummies with the child dummies for the sample of married women. The figure shows that the participation rate of women with two or more children rose from 1985 to 1991 and then started to decline. It is possible that the initial decline from 1991 to 1993 is a residual business cycle effect not reflected in the controls we use (state unemployment rate), but the decline starting in 1994 is very consistent with the timing of the EITC expansion for families with two or more children.

We conclude from the results in this section that the EITC expansion had some impact on the labor force participation of married couples. The quasi-experimental approach suggests that married men were 1 to 1.4 percentage points more likely to participate, and married women were 3.1 to 4.2 percentage points less likely to participate after 1993. The estimates for women are sensitive to the specification of time trends, but our most flexible approach (using year dummies) showed patterns very much consistent with EITC incentives. In results not reported here, we find that total family labor force participation (either worked) also fell with the EITC expansion.

5.2 Reduced-Form Labor Force Participation

The estimates in the previous section are identified by time and the presence (and number) of children. The results in this section exploit individual-level tax variation to estimate the impact of the EITC. Three tax acts passed between 1986 and 1993 substantially reduced tax liabilities of lower-income



Wife < HS ed & husband < $30,000 ($1996)

Coefficients on year dummies

Figure 5

families with children (see Section 2 for a discussion of the tax acts). The statutory federal marginal tax rate on the first dollar of taxable earnings fell from 1 percent to –40 percent for EITC-eligible taxpayers (with two or more children) between 1984 and 1996. In addition to the tax schedule changes, more generous and indexed personal exemptions and standard deductions also altered tax liabilities substantially for some families. In this section, we use the implied variation in tax liability to identify the impact of taxes (and the EITC) on labor force participation.

We expand the sample to include all years between 1984 and 1996 for reasons noted above. Because we are concerned that changes in after-tax wages may be correlated with underlying preferences or trends that vary by the presence of children, we restrict the sample to include only couples with children.[20] The resulting sample is 17,370 couples with less than 12 years of schooling. Summary statistics for the sample are in columns 3 and 4 of Table 3. Mean net (of average tax) wages are about $10 for men and $5.50 for women; mean net (of tax) nonlabor income is about $1,500 for men and $22,000 for women (1995 dollars). We introduce these variables in our probit model in the following specification:

$$P^{*}_{it} = \alpha + X_{it}\beta + \sum_{y} d^{y}_{it}\delta_{1,y} + \sum_{s} d^{s}_{it}\delta_{2,s} + \gamma_1 y^{n}_{it} + \gamma_2 w_{it}(1-\tau^{a}_{it}) + \varepsilon_{it}$$

where $\mathbf{y}^{n}$ is net nonlabor income (at 0 hours), $\boldsymbol{w}$ is the gross hourly wage rate, and $\boldsymbol{\tau}^{a}$ is the *average* tax rate. $\boldsymbol{X}$ is a vector of family and state characteristics (age, number of children, education, race, unemployment rate) used in the previous section. We also include unrestricted time and state effects in the regression. The time effects control for any secular trends in labor supply for married couples with children that may be correlated with trends in wage opportunities or tax changes. The parameters on the

[20]Married couples without children could easily be added to this analysis and would have the advantage of providing additional variation in net wages.

net wage (γ_2) and on net income (γ_1) are used to simulate the impact on labor force participation of changes in the EITC.

We evaluate τ^a at full-time (40 hours per week), full-year work, and hence the net-of-average-tax wage reflects the returns to entering the labor force at full-time level. To estimate gross wages for nonworkers, we estimate log wage equations for husband and wife accounting for sample selection. To maintain a consistent stochastic specification, predicted wages are used for both workers and nonworkers.[21] In extensions to the main estimates, we estimate alternative models where we evaluate τ^a assuming entry at part-time, full-year work, and where we use actual wages for nonworkers.

We simulate federal income taxes, tax liability, and Social Security payroll taxes using a tax calculator.[22] Taxes are calculated using the secondary earner model assumption. The practical implications of this assumption, other details on the tax calculator (including variable construction), and wage equation estimation are discussed in Appendix A.

It is instructive to discuss the source of identification in this model and to compare it to the quasi-experimental model. Clearly tax variation due to *own* earned income cannot be used for identification, although spouse's earned income represents valid identifying variation under some assumptions. More precisely, tax variation due to husband's earned income is useful if we assume a secondary earner model in which the wife takes her husband's earnings as given in her labor supply decision. We therefore partially rely on the number of children, unearned income, own predicted gross

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[21]Using actual wages of workers would reduce any measurement error induced by our predictions. However, this asymmetric treatment of workers and nonworkers may induce systematic differences in the distribution of wages across the two groups. In particular, among workers, our predicted wage distribution is more compressed than the actual distribution. Consequently, we overestimate wages at the low end of the distribution, and underestimate wages for those at the higher end of the distribution. Among those eligible for the EITC (e.g., low-wage earners) using actual wages for workers can result in higher predicted wages for nonworkers than for workers.

[22]The tax calculator we use does not yet include state taxes, and therefore does not account for state supplements to the federal EITC (available in nine states). Though growing in importance, these supplements were small during most of our sample period. In principle, these simplifications could lead to measurement problems. In practice, however, our estimated marginal tax rates are very highly correlated with those produced by NBER's TAXSIM model (which includes state taxes).

wages, and husband's earned income (for the wife) to identify the effect of taxes on the labor force participation decision. Additionally, we rely on time since the tax schedule changes with each policy reform considered.

The 1986, 1990, and 1993 tax acts created substantial changes in the tax liabilities of individuals with very high incomes and with low incomes.[23] We illustrate the extent of the tax reductions in our sample in Figures 6a and 6b, which plot average tax rates by gross hourly wages for sample members in 1984, 1990, and 1996. The figures present mean, minimum, and maximum average tax rates. For lower-income taxpayers, the OBRA93 expansion of the EITC is clearly the most significant tax act. In the cross section, Figure 6a illustrates one interesting feature of the federal income tax: most of the progressivity in the schedule is at the bottom of the income distribution. Average tax rates, calculated as tax liability as a share of total income, are fairly flat beyond some level of "income." Wives' average tax rates are different in a number of respects. Wives' incomes face husbands' marginal tax rate on the first dollar of income so that their average tax rates are higher, more dispersed, *and* flatter throughout the income distribution.

Table 6 presents the main labor force participation estimates for the probit model for husbands and wives. We present the marginal effects so that the parameters can be interpreted directly.[24] As expected, higher net-of-average-tax wages and lower nonlabor income are associated with higher labor force participation.[25] A $1 increase in the net wage raises the likelihood that a married man participates by 0.3 of a percentage point (or 0.29 percent), and that a married women participates by 2.9 percentage

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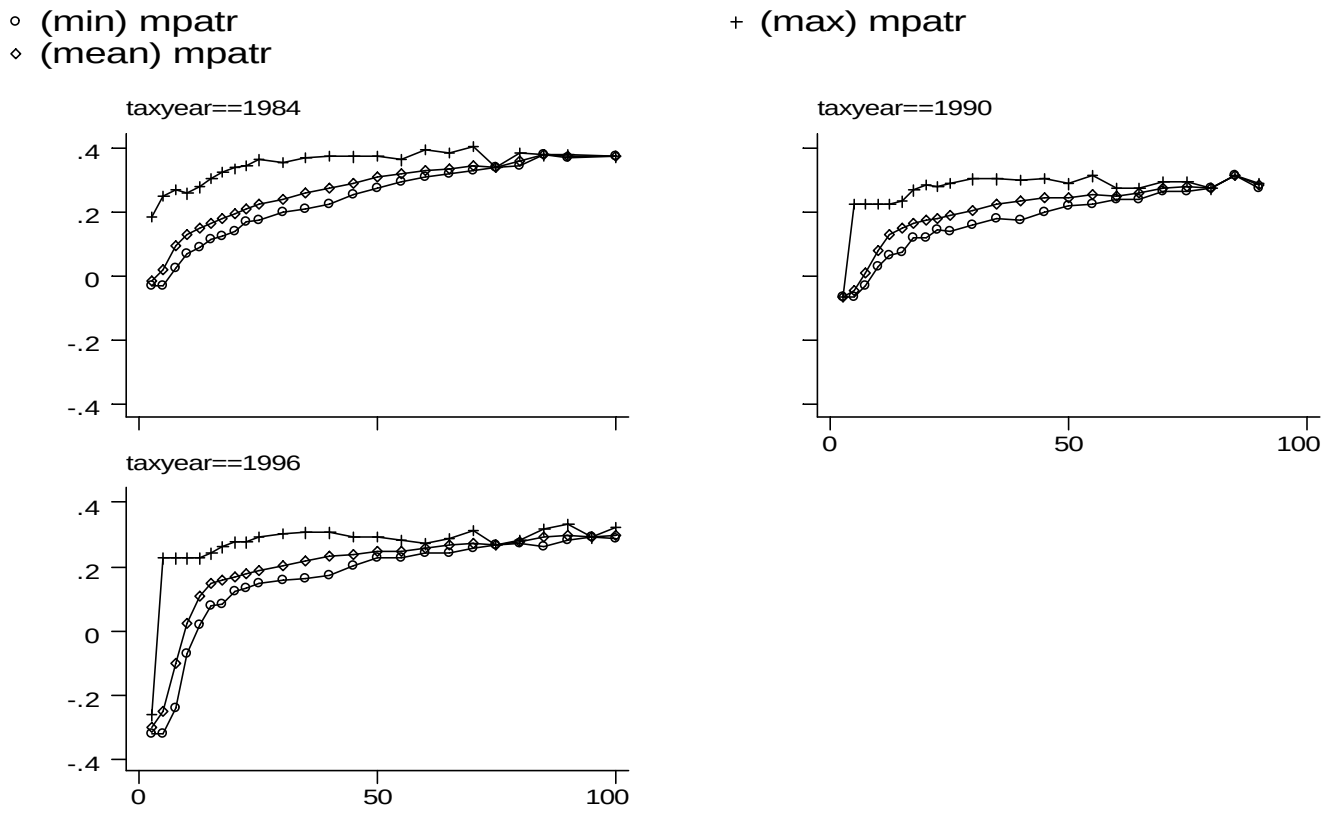
[23]See Hausman and Poterba (1987), Bosworth and Burtless (1992), and Auerbach and Slemrod (1997) for evidence and for discussions of the impact of the 1980s tax reforms on individual marginal and average tax rates.

[24]Specifically, the estimates can be interpreted as the effect of a unit change in continuous variables, and of a change from one to zero in discrete variables on the probability of working.

[25]All demographic variables have the expected effects. Married couples with more children and younger children, and living in areas with higher unemployment rates, are less likely to work. White women, ceteris paribus, are less likely to work than nonwhite women, whereas white men are more likely to work than nonwhite men.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taxyear==1990
taxyear==1996
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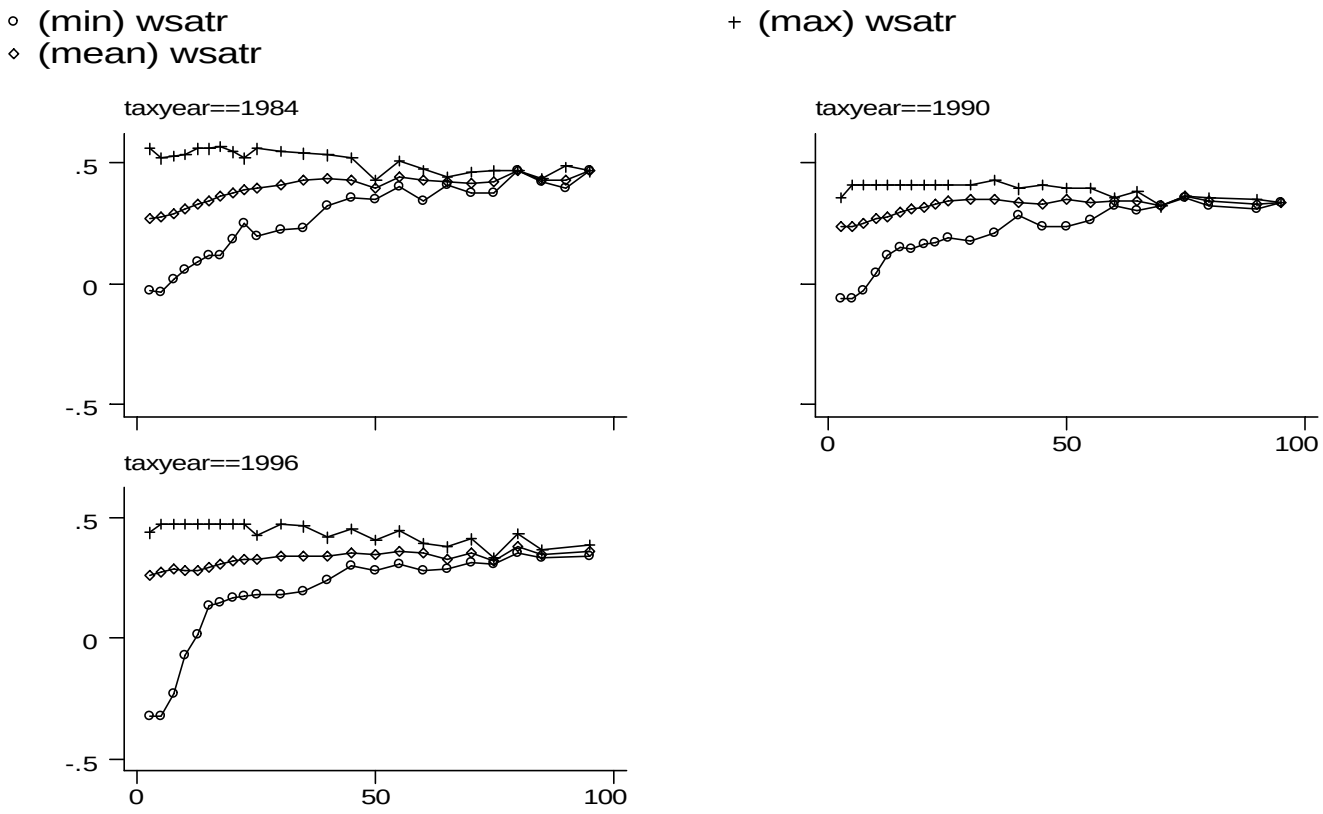
.2
0
-.2
-.4
0
50
100
By husband's hourly wage
Husband's average tax rates, 40 hrs/wk, actual wages

Figure 6a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◇ (mean) wsatr
+ (max) wsatr
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taxyear==1990
taxyear==1996
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0
-.5
50
100
By wife's hourly wage
Wife's average tax rates, 40 hrs/wk, actual wages

Figure 6b

TABLE 6
Parameter Estimates for Labor Force Participation Equation, Married Couples with Children, 1984–1996
Sample: Wife's Education <12
Specification: Average Tax Rate Evaluated at Full Time (40 hours)

Variable	Married Men		Married Women	
# of children	-0.003	(0.001)	-0.043	(0.004)
# of preschool children	-0.006	(0.001)	-0.093	(0.006)
Black	-0.021	(0.007)	0.084	(0.016)
Other race	-0.046	(0.008)	0.020	(0.017)
Age	0.001	(0.002)	0.046	(0.006)
Age squared /100	-0.001	(0.002)	-0.067	(0.008)
State unemployment rate	-0.004	(0.001)	-0.005	(0.004)
Average net wage	**0.003**	**(0.0005)**	**0.029**	**(0.005)**
Net unearned income (1000s)	**-0.005**	**(0.0003)**	**-0.001**	**(0.0004)**
Other controls	state & time dummies		state & time dummies	
Pseudo R^2	0.17		0.06	
Mean of dependent variable	0.960		0.556	
Observations	17,370		17,370	
Elasticity of participation				
Wage elasticity of participation	0.033		0.288	
Income elasticity of participation	-0.008		-0.038	

Source: Authors' tabulations of March CPS for years 1985 to 1997.

Notes: Average net wage is the gross predicted hourly wage times one minus the average tax rate from entering the labor market at full-time hours. Parameter estimates for labor force participation are probability derivatives (dp/dx) from probit estimation. Standard errors in parentheses.

points (or 4.2 percent). A $1,000 increase in net unearned income reduces husband participation by 0.5 of a percentage point (or −0.49 percent) and wife participation by 0.1 of a percentage point (or −0.2 percent). The implied elasticity for husbands is 0.033 with respect to the wage, and −.008 for income.[26] As expected, participation elasticities are higher for women (0.288 with respect to the wage and −.038 with respect to income).

Although these estimates seem reasonable, evaluating them is difficult because we have no benchmark from the literature. Triest (1990) concluded that married women's labor force participation is likely to be more responsive to taxes than their hours worked because he found larger labor supply elasticities when using *all* women as opposed to *working* women.[27] In his sensitivity analysis of married women's hours of work, Mroz (1987) also made a similar point with respect to wages in a footnote (drawn from a similar finding).

We conduct a number of sensitivity tests on these estimates. Calculating average tax rates for part-time work (20 hours) does not change the results for men but reduces the wage effect for women (panel B of Appendix Table 3). Using actual wages for workers and predicted wages for nonworkers lowers the estimated wage elasticities slightly for men and women (panel C of Appendix Table 3).

We use the estimates from Table 6 to simulate the labor force participation response to the EITC expansion using the sample of married couples in 1996. For the simulation, we calculate net-of-average-tax wages and incomes using the 1996 EITC parameters, and again using the 1984 EITC parameters. We then predict labor force participation under each set of parameters. Held constant in this calculation are all other tax parameters, gross wages, and family size (details of the simulation procedure are in Appendix B).

---

[26]Because participation rates are very high for men (about 96 percent), the elasticities of nonparticipation are substantially higher than elasticities of participation.

[27]No such finding occurred for married men in Triest's analysis.

Table 7 presents simulations of the combined effect of expanding the EITC through TRA86, OBRA90, and OBRA93. Overall, the EITC expansion between 1984 and 1996 had modest effects on the participation rates of married men and women. It raised the likelihood that married men work by 0.2 of a percentage point (or 0.2 percent) but reduced the likelihood that married women work by 1.2 percentage points (or 2.4 percent).

About half this total response can be attributed to the OBRA93 expansion. The estimated OBRA93 effect is 0.1 of a percentage point for men and 0.7 of a percentage point for women, substantially smaller than what is suggested by the quasi-experimental approach. One explanation for this difference traces the effect of childless couples as a comparison group in the quasi-experimental approach. Table 4 shows substantial changes in labor force participation by couples without children. For both men and women, the comparison groups suggest participation changes in the opposite direction of what is predicted by the EITC expansion. Because the comparison group generates the counterfactual "what would have happened to labor force participation without the EITC expansion" in this exercise, the net result of using childless couples is an implausibly large EITC effect. If we use only the participation changes by couples with children from Table 4, the simulated EITC effects explain about half of the observed labor force participation changes. The regressions controlling for group-specific time effects hint at this conclusion as well. Allowing a different time trend for couples without children reverses the estimated EITC effect for women with one child.

The participation responses in Table 7 may seem surprisingly small given the magnitude of the EITC expansions. It is important to remember, however, that the EITC operates primarily through the income effect for married women, which is very small indeed.[28] In addition, the overall EITC effect masks substantial heterogeneity across the income distribution. In Table 7, we present the simulated

[28]We return to this issue in the hours-worked section as well.

TABLE 7
Simulated Changes in Labor Force Participation Responses to EITC Expansion 1984–1996

	Percent of Sample	Married Men			Married Women			*Family*	
		Change in LFP	Percent Change in LFP	Change in Annual Earnings	Change in LFP	Percent Change in LFP	Change in Annual Earnings	Change in Gross EITC	Change in Net EITC
Overall	100	0.002	0.2	$37	-0.012	-2.4	$-136	$927	$828
Grouping by husband's predicted wage									
Decile 1	10	0.006	0.6	90	-0.018	-4.2	-196	1379	1273
Decile 2	10	0.004	0.4	69	-0.017	-4.2	-175	1349	1244
Decile 3	10	0.003	0.3	57	-0.015	-3.5	-155	1218	1121
Decile 4	10	0.003	0.3	52	-0.014	-3.3	-152	1087	987
Decile 5	10	0.002	0.2	33	-0.013	-2.2	-142	1019	910
Decile 6	10	0.002	0.2	32	-0.012	-2.1	-127	778	683
Decile 7	10	0.002	0.2	33	-0.007	-1.6	-90	736	679
Decile 8	10	0.000	0.0	0	-0.011	-1.6	-133	650	517
Decile 9	10	0.000	0.0	0	-0.010	-1.7	-116	642	525
Decile 10	10	0.000	0.0	0	-0.006	-1.0	-74	415	340
Grouping by location in 1996 EITC schedule									
Phase-in	9.0	0.005	0.6	53	0.011	9.0	121	1144	1318
Flat	5.8	0.002	0.2	25	-0.017	-6.6	-113	2424	2336
Phase-out	42.8	0.002	0.2	39	-0.023	-5.4	-207	1591	1423
Above phase-out	42.3	0.001	0.1	30	-0.006	-0.9	-82	0	-52

Notes: The simulations are based on estimates of the probit labor force participation equations reported in Table 6. The equations control for average net-of-tax wages, net nonlabor income, demographics, state dummies, and time dummies. The simulations are based on predictions of the labor force participation equations using 1984 followed by 1996 tax parameters. All other variables are held constant in the simulations. The change in labor force participation relates to a base rate of 0.96 for men and 0.56 for women. All dollar figures are in 1995 dollars.

responses by two groupings: predicted husband's hourly wage and regions of the 1996 EITC schedule (phase-in, flat, phase-out, above phase-out).

The response of married men is minimal across the wage distribution. Even men in the lowest decile are only one-half a percentage point more likely to participate. Further, we observe little change in the employment rate of men beyond the 40th percentile. Married women's labor force participation responses are far less concentrated because they depend on husband earnings (not just gross wages) and are as high as −1.8 percentage points. However, the largest responses are observed for women married to the lowest-wage men.

The more interesting simulation is at the bottom of Table 7, where we present responses by location along the 1996 EITC schedule (generated using actual family earnings in 1996). As predicted by theory, employment increases uniformly for men and for women in the phase-in region of the EITC, but falls for women beyond the phase-in region. Because the vast majority of married couples are located in the flat to phase-out regions of the EITC, the overall labor force participation of married women falls. In addition, the estimated effects here are substantial. Women in the phase-out region (43 percent of the sample) are more than 2.3 percentage points less likely to work after the EITC expansion.

The last two columns of Table 7 quantify the overall work disincentive effects of the EITC. The "change in gross EITC" represents the difference in the family's EITC under current (1996) law and 1984 law assuming no change in labor supply. The "change in net EITC" then adjusts the gross change by the value of the simulated changes in labor supply by both the husband and the wife. Overall, the expansions increased the average EITC transfer by $927. This amount is much less than the increase in the maximum credit because many families are in the phase-out region or are ineligible for the EITC. After accounting for higher husband earnings and lower wife earnings, the change in the net EITC transfer is $828. Only $99 or 10 percent of the transfer is lost through labor supply distortions. We should note that these calculations represent lower-bound estimates of the transfer lost through changes

in labor supply because they do not take account of the fewer hours worked by taxpayers remaining in the labor force. We turn next to that analysis.

6. RESULTS FOR HOURS OF WORK

6.1 Preliminary Analysis Using Control Group

In this section, we present hours-worked results from the quasi-experimental approach. First, however, we note two caveats. The EITC's effect on hours worked by individuals in the labor force depends on family earnings, and is positive only for very low earners. Grouping together all individuals with children mixes the response over different EITC regions. Though the overall hours worked response is of interest, the EITC's effect in individual regions, such as the phase-out, are ultimately important for thinking about the structure of the program. Second, evaluating the response of working couples requires correcting for any self-selection bias, which in this context is likely to be exacerbated by the EITC's effect on the labor force participation decision. Although selection correction methods are standard in the literature, they have been widely criticized for being dependent on functional form assumptions. Because this section is a preliminary view of the data, we choose not to estimate self-selection–corrected hours regression in this approach.

Because the majority of married couples are beyond the phase-in range, we expect that hours should fall for *working* men and women with children relative to those with no children, and that hours should fall more for taxpayers with more than one child. The net effect on total hours worked depends on the relative size of the responses of participation and hours worked by workers.

Controlling for demographics, business cycles, and state, we find that men with one child worked 115 more hours and men with at least two children worked 62 more hours per year than men without children after the 1993 EITC expansion. Their wives, on the other hand, worked 25 more, and 54 fewer

hours, per year, respectively. Overall, annual family labor supply (hours worked by husband and wife) rose by about 60 hours.

Although the EITC can raise total family labor supply if its effect on the participation decision is stronger than that on hours worked by workers, the family labor supply results are surprising for a number of reasons. First, they suggest stronger labor supply responses by men than by women. Second, results in the previous section show that only men increased their participation rates and not by enough to dominate the lower participation rates by women. The results for the sample of working individuals are even more implausible—they suggest that men worked up to 100 more hours, while women worked 67 more hours after the EITC expansion. Our explanation for these results is that childless married couples represent a poor comparison group for couples with children for this exercise.

6.2 Reduced-Form Annual Hours Worked – Instrumental Variables

In this section, we report IV estimates of the relationship between hours worked and after-tax wages and income. We use the sample of working men and working women in couples with children and where the wife has less than 12 years of schooling.

We specify an annual hours of work equation as

$$h_{it} = \alpha + X_{it}\beta + \sum_y d_{it}^{y}\delta_{1,y} + \sum_s d_{it}^{s}\delta_{2,s} + \gamma_1 y_{it}^{v} + \gamma_2 \ln(w_{it}^{n}) + \eta m_{it} + + \varepsilon_{it}$$

where ***h*** is annual hours worked and ***X*** is a vector of demographic controls. The net-of-marginal-tax wage ***(w^n)*** and virtual income ***(y^v)*** are evaluated at observed hours of work.[29] We use actual wages because we use the sample of workers. In the regressions using women, we correct for self-selection into the labor

[29]See Appendix A for further details on the construction of variables used in the hours-worked regressions.

force by standard methods (Mills ratio, ***m***) but find that the correction does not have substantive effects on the estimated wage and income elasticities.[30]

Figures 7a and 7b show marginal tax rates in 1984, 1990, and 1996 for the sample of working men and women, respectively, and illustrate the extensive variation in tax rates. The figures present minimum, mean, and maximum tax rates by gross annual earnings. At a particular earnings point for any given year, marginal tax rates vary by family size and nonlabor income, where nonlabor includes husbands' earnings for women. We note two interesting observations in our data. First, husband tax schedules broadly mimic the combined federal income and payroll tax schedules in any given year and therefore reflect the changes over time in tax law. By 1996, we observe substantial changes in marginal tax rates at the bottom of the income distribution. It is this variation that identifies our labor supply responses. Second, married women's tax schedules are flatter, and their marginal tax rates are everywhere higher and more dispersed than their spouses'. This occurs because we assume that couples file married-joint tax returns and that the wife is the secondary earner in the household. As a result, married women's earnings are taxed further up the schedule.

Table 8 presents OLS and IV results for the annual hours of work equation for men. IV-1 includes EITC parameters and interactions of those tax parameters with education and birth cohort, and a variable for the location of the first non-EITC kink in the budget constraint (column 2). IV-2 imputes marginal tax rates evaluated at $5,000 earnings increments from $0 to $100,000 (column 3). All specifications control for the number of children and preschool children, race, education, birth cohort

[30]The selection equation is estimated using full interactions between education, tax year, and birth cohort. As an alternative, we used estimates of the reduced-form labor force participation model in Section 5 to generate the Mills ratio. In theory, that model is attractive because it models the EITC's effect on participation. In practice, identification is tenuous at best since there are no valid exclusion restrictions. Surprisingly, the results are more sensitive for men than for women to the specification for the Mills ratio.

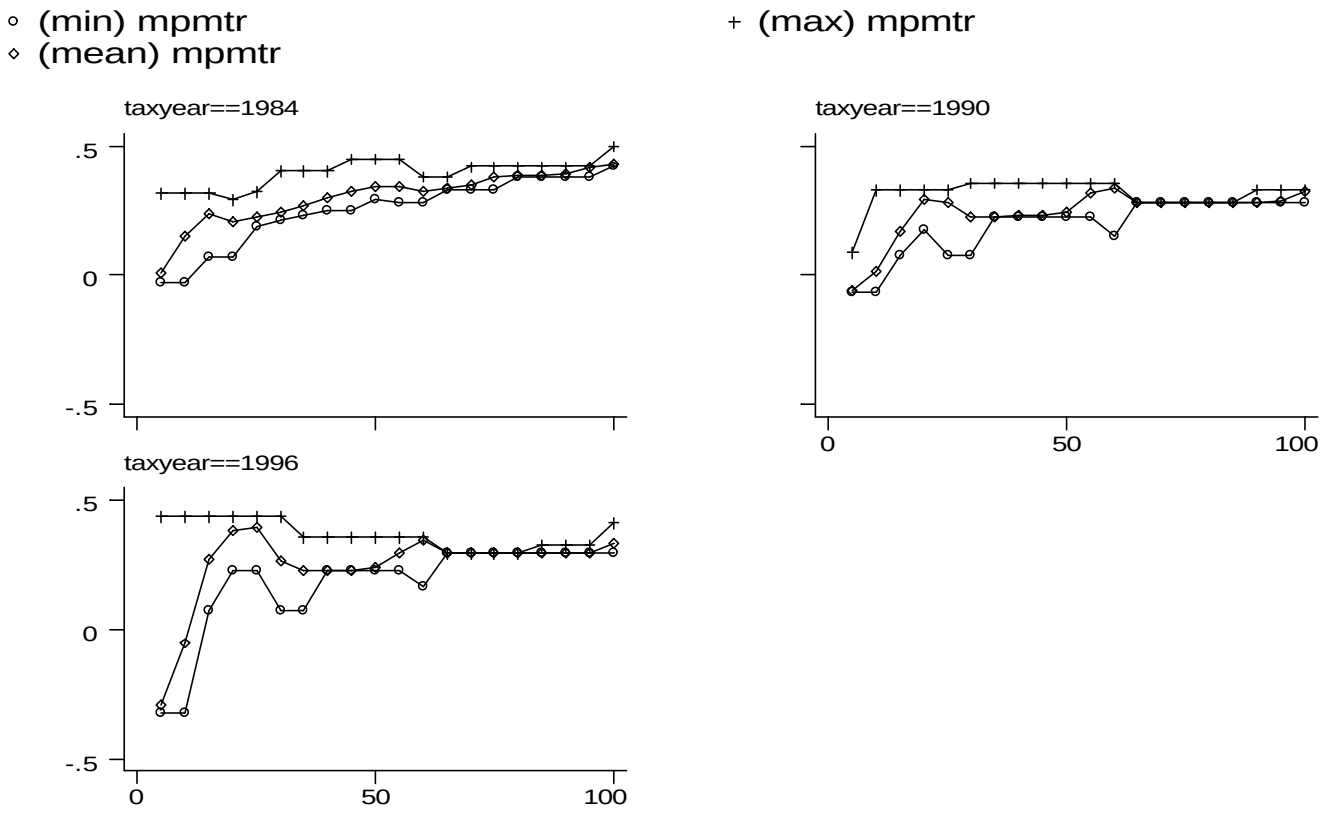
◦ (min) mpmtr
◇ (mean) mpmtr
+ (max) mpmtr
taxyear==1984
taxyear==1990
taxyear==1996
.5
0
-.5
0
50
100
By husband's earnings ($1000s)
Husband's marginal tax rates, actual hours

Figure 7a

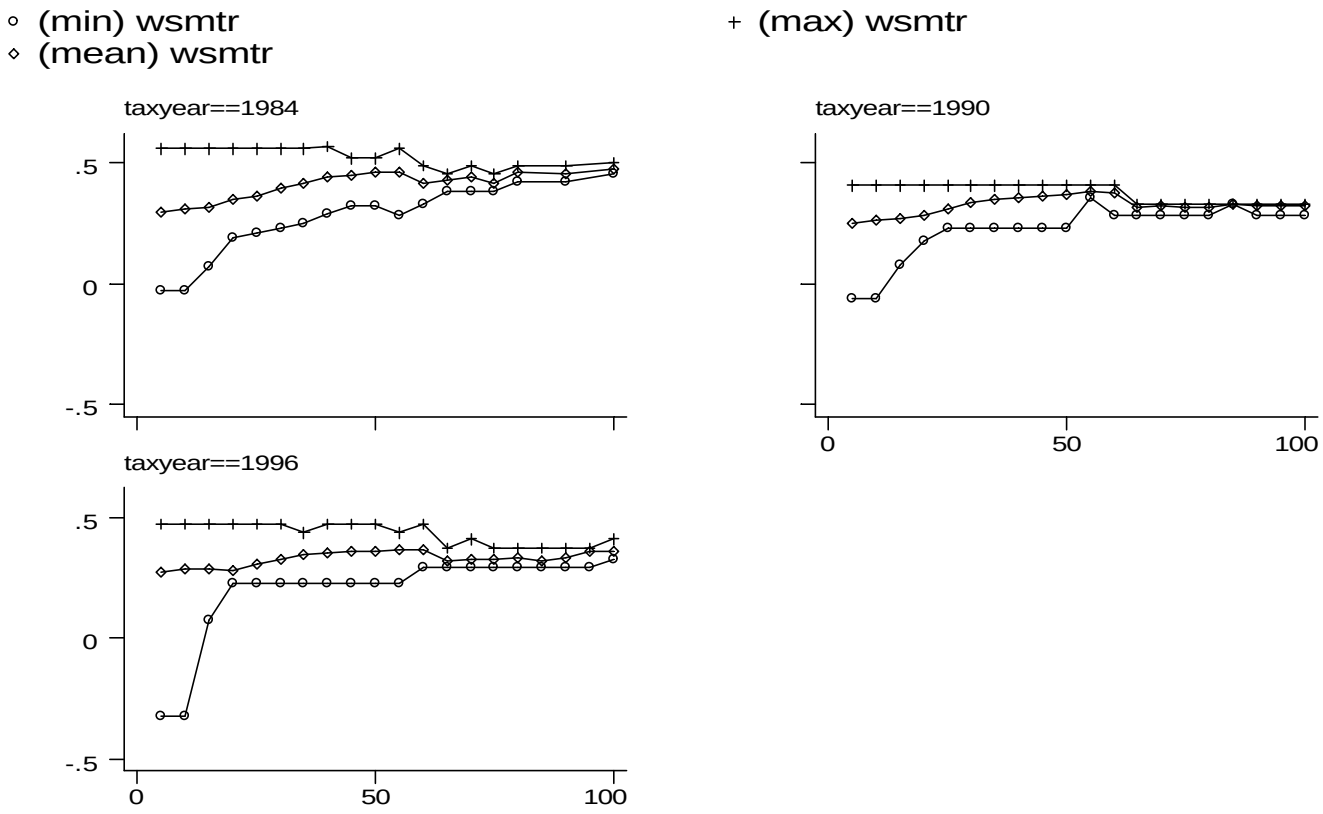
○ (min) wsmtr
◇ (mean) wsmtr
+ (max) wsmtr
taxyear==1984
taxyear==1990
taxyear==1996
.5
0
-.5
0
50
100
By wife's earnings ($1000s)
Wife's marginal tax rates, actual hours

Figure 7b

TABLE 8
Parameter Estimates for Annual Hours of Work Equation,
Married Couples with Children, 1984–1996
Sample: Wife's Education <12

	Married Men, Hours>0					
Variable	OLS		IV-1[1]		IV-2[2]	
Constant	2595.3	(73.29)	2085.9	(421.5)	2046.0	(284.3)
# of children	-22.12	(4.12)	-18.73	(4.76)	-18.51	(4.48)
# of preschool children	-24.23	(6.93)	-19.95	(8.51)	-19.55	(7.64)
Black	-123.23	(20.05)	-110.77	(26.75)	-109.43	(22.60)
Other race	-73.22	(21.61)	-57.57	(26.04)	-56.28	(23.88)
Cohort2	-6.12	(16.86)	-8.86	(18.24)	-8.79	(17.31)
Cohort3	-4.15	(17.18)	3.50	(23.23)	4.53	(19.06)
Cohort4	-61.83	(21.79)	-37.04	(33.51)	-34.81	(27.11)
State unemployment rate	-27.04	(4.70)	-26.31	(4.89)	-26.30	(4.82)
ln(net wage)	**-145.1**	**(10.1)**	**119.9**	**(191.0)**	**138.86**	**(129.9)**
Virtual income/1000	**+4.4**	**(1.39)**	**-12.8**	**(18.6)**	**-13.14**	**(3.40)**
Other controls	state & time dummies		state & time dummies		state & time dummies	
Mean of dependent variable	1,996		1,996		1,996	
Observations	16,681		16,681		16,681	
Uncompensated wage elasticity	**-0.07**		**0.06**		**0.07**	
Income elasticity	**+0.01**		**-0.03**		**-0.03**	
Test statistics						
1st-stage *F* stat, ln(w)	n/a		23.8 (p=0)		8.8 (p=0)	
1st-stage *F* stat, y	n/a		47.8 (p=0)		346 (p=0)	
Exogeneity test	n/a		14.5 (p=.07)		109 (fail)	

Source: Authors' tabulations of March CPS for years 1985 to 1997.

Notes: Sample includes married couples with children. See text for details.

[1]Instrument set 1 includes EITC tax parameters (phase-in rate, phase-out rate, kink points), kink point where federal taxes begin, and tax parameters interacted with education and birth cohort dummies.

[2]Instrument set 2 includes the marginal tax rate the individual faces at $5,000 earnings increments from $0 up to $100,000 (0, 5000, 10000, . . . 95000, 100000). The tax calculations account for the EITC, other federal taxes, and payroll taxes and condition on the person's level of unearned income.

(defined over 10 years), state unemployment rate, and time and state dummies.[31] All demographics show the expected signs, so we do not refer to them here. The results show the bias in using OLS and suggest that hours worked by men are not sensitive to taxes. Our estimates imply uncompensated wage elasticities of 0.06 (IV-1) to 0.07 (IV-2), and an income elasticity of −0.03.

The bottom three rows of Table 8 present the *F* statistic testing the joint significance of the set of instruments from the first-stage regression, and an overidentification test.[32] Although both instrument sets are highly correlated with the endogenous variables, only IV-1 passes the exogeneity test, but only marginally.[33] The sources of endogeneity are quite different in each of these instruments. Excluding demographics and including only EITC parameters from IV-1 generates an exogenous but weakly correlated instrument. Eliminating unearned income from the imputation of marginal tax rates in IV-2 also generates an exogenous but weakly correlated instrument. Neither adjustment matters for the estimated hours or work responses for married men. Another source of endogeneity may be presence of the taxpayer's actual marginal tax rate in the instrument set. We estimated the hours equation excluding various marginal tax rates (which seemed to be endogenous) and found little difference in the estimated responsiveness while passing the exogeneity test. We are therefore confident that IV-2 represents a valid and powerful instrument set for married men.

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[31]The 10-year birth cohorts are defined as 1930–1939, 1940–1949, 1950–1959, and 1960–1969. Because of the controls for time and cohort, we do not include any controls for age. The results are not sensitive to alternative specifications of age, time, and cohort.

[32]Specifically, we regress the residuals of the IV-estimated equation on all predetermined variables in the model, including both exogenous variables and the instruments. The statistic is distributed chi-square, where the number of degrees of freedom equals the number of overidentifying restrictions, which equal 28 for IV-1 and 19 for IV-2.

[33]We also estimated models with instruments used in the literature. We found demographic variables (education, education*age) to be substantially weaker in the first stage relative to IV-2. The estimates of the wage and income effects were quite unstable in these specifications, reflecting the weak first stage. We also used gross wages and nonlabor income as instruments. These were very strong in the first stage but failed the exogeneity tests. The estimated wage and income effects in this case were relatively stable and similar to those based on IV-2.

Table 9 presents the results for women. Because we use the sample of women with less than 12 years of schooling, we exclude education from the IV-1 set so that it includes only EITC parameters and cohort dummies. Consistent with existing empirical labor supply work, our estimated wage and income effects for married women are greater and more sensitive to specification than those of men. The uncompensated wage elasticity is between 0.52 (IV-1) and a statistically insignificant 0.08 (IV-2). The estimated income elasticity is between −0.41 (IV-1) and −0.04 (IV-2).

The bottom three rows of Table 9 present the *F* statistic testing the joint significance of the set of instruments from the first-stage regression, and an overidentification test. For women's hours worked, IV-1 seems to be a weak instrument. Although IV-2 is highly correlated with the endogenous variables, it fails the exogeneity test. IV-1 and IV-2 differ in two important ways. First, IV-1 uses statutory EITC and tax parameters up to the maximum EITC earnings limit ($30,000 in 1996$) and therefore varies only by family size and year. IV-2 calculates marginal tax rates at earnings levels up to $100,000 and accounts for husband earnings.

To reconcile the divergent results, we consider each of these differences in turn. To see the first point, consider that the instruments used affect workers at different points in the distribution. So, if labor supply elasticities of working women vary across the earnings distribution, we would expect different wage and income estimates.

To explore the impact of the instrument set, we reestimate the hours equation by limiting the instrument to lower points in the earnings distribution. Table 10 shows that the estimated wage effect progressively increases as we limit IV-2 to lower-earning workers. We refer to these estimates as local average treatment effects, or LATE (Imbens and Angrist, 1994). The wage effect rises to 0.11 while the income effect remains fairly constant at −0.05. Note also that the estimated standard errors do not change very much across specifications. One explanation for this modest change is that the marginal tax schedule is fairly proportional at the upper end of the income distribution. We observe a similar pattern for men's

TABLE 9
Parameter Estimates for Annual Hours of Work Equation,
Married Couples with Children, 1984–1996
Sample: Wife's Education <12

	Married Women, Hours>0					
Variable	OLS		IV-1[1]		IV-2[2]	
Constant	1877.4	(184.2)	1286.3	(667.1)	1735.3	(234.0)
# of children	-46.96	(6.93)	-50.89	(10.10)	-46.19	(6.98)
# of preschool children	-73.66	(11.91)	-119.55	(25.45)	-75.18	(12.14)
Black	79.83	(26.57)	-5.92	(56.12)	78.57	(29.75)
Other race	182.85	(31.60)	-131.19	(48.36)	183.36	(31.66)
Cohort2	92.34	(43.58)	101.49	(53.13)	90.34	(43.69)
Cohort3	24.15	(44.29)	20.16	(51.77)	23.62	(43.38)
Cohort4	4.24	(43.36)	9.75	(55.23)	8.48	(43.63)
State unemployment rate	-23.12	(7.45)	-28.25	(9.20)	-23.09	(7.46)
Mills ratio	-188.02	(180.1)	-87.58	(216.9)	-187.04	(180.4)
ln(net wage)	27.8	(15.7)	773.9	(394.7)	118.7	(99.8)
Virtual income/1000	-3.2	(0.67)	-28.5	(14.4)	-2.91	(0.73)
Other controls	state & time dummies		state & time dummies		state & time dummies	
Mean of dependent variable	1,480		1,480		1,480	
Observations	9,653		9,653		9,653	
Uncompensated wage elasticity	0.02		0.52		0.08	
Income elasticity	-0.05		-0.41		-0.04	
Test statistics						
1st-stage *F* stat, ln(w)	—		1.1 (p=.3)		12.4 (p=0)	
1st-stage *F* stat, y	—		1.2 (p=.2)		3558 (p=0)	
Exogeneity test	—		8.0 (p=.5)		50.8 (fail)	

Source: Authors' tabulations of March CPS for years 1985 to 1997.

Notes: Sample includes married couples with children. See text for details.

[1]Instrument set 1 includes EITC tax parameters (phase-in rate, phase-out rate, kink points), kink point where federal taxes begin, and tax parameters interacted with birth cohort dummies.

[2]Instrument set 2 includes the marginal tax rate the individual faces at $5,000 earnings increments from $0 up to $100,000 (0, 5000, 10000, . . . 95000, 100000). The tax calculations account for the EITC, other federal taxes, and payroll taxes and condition on the person's level of unearned income.

TABLE 10
Parameter Estimates for Annual Hours of Work Equation for Married Women Using Alternative Instrument Sets (LATE)

	Wage and Income Estimates	
	ln(net wage)	Virtual Income/100
Results for IV-2 (marginal tax rates at $5000 intervals) including husband earnings		
Basic results (0–100K)	118.7 (99.8)	-2.9 (0.7)
	[0.08]	[-0.04]
LATE — (0–60K)	131.6 (100.8)	-3.2 (0.7)
	[0.09]	[-0.05]
— (0–40K)	151.9 (102.0)	-3.3 (0.8)
	[0.10]	[-0.05]
— (0–25K)	162.4 (106.0)	-3.2 (0.8)
	[0.11]	[-0.05]
Results for IV-2 (marginal tax rates at $5000 intervals) excluding husband earnings		
Basic results (0–100K)	241.4 (358.2)	-9.1 (3.5)
	[0.16]	[0.16]
LATE — (0–60K)	773.6 (435.7)	-12.3 (4.0)
	[0.52]	[-0.18]
— (0–40K)	1039.1 (564.0)	-13.2 (4.5)
	[0.70]	[-0.19]
— (0–25K)	1303.4 (664.9)	-13.5 (4.9)
	[0.88]	[-0.20]
Results for IV-1 (EITC parameters)		
Basic results	773.9 (394.7)	-28.5 (14.4)
	[0.52]	[-0.41]

Notes: Each row of the table corresponds to estimates from an annual hours of work equation for married women. In each case, the estimates are from IV estimation. The rows differ only in the specification of the instrument sets. The specification of the equations is identical to that reported in Table 9 and includes net wages, virtual income, demographics, Mills ratio, state dummies, and time dummies. The table reports the parameter estimate, standard errors in ( ), and elasticities in [ ].

hours worked: limiting the instruments to the lower end of the earnings distribution increases the estimated elasticities (see Appendix Table 4).

Limiting the marginal tax rates to $25,000 in earnings begins to marginally close the gap between the estimates using IV-1 and IV-2 in the women's hours of work equations, but a substantial difference remains. Next, we exclude husband's income from the wife's calculated net wage and virtual income. The bottom panel of Table 10 shows that excluding husband earnings explains much of the divergence between the two instrument sets. The estimated wage and income responses become much larger and statistically not different from IV-1 estimates. Although the evidence presented explains the divergence between the estimated hours of work responses under IV-1 and IV-2, we do not conclude from it that one instrument set dominates another. Each set has its benefits and drawbacks, and we choose to use these results as bounds on the responsiveness of married women's hours of work.

Table 11 presents the simulated hours of work response to the 1984–1996 EITC expansion, based on the wage and income responses from IV-1 and IV-2. Because the sample includes working men and working women, the husband and wife samples are different. Overall, our results show that married men worked 45 (2 percent) fewer hours after the expansion. Men in the 1996 phase-in worked more hours, while men in the phase-out worked 73 (3.5 percent) fewer hours. Men in the middle of the wage distribution face the strongest disincentive effects (from the phase-out).

Reflecting the IV results, married women's simulated hours of work responses vary widely. Overall, married women worked between 13 (0.8 percent) and 93 (6 percent) fewer hours after the expansions. Women married to low-wage men reduced their work hours substantially more than women married to high-wage men. Further, women in the phase-in range increased their hours while those in the phase-out reduced their hours by up to 278 hours per year.

TABLE 11
Simulated Annual Hours of Work Responses to EITC Expansion 1984–1996

	Married Men				Married Women			
	IV-1 (EITC, Parameters)		IV-2 (MTR 0–100K)		IV-1 (EITC, Parameters)		IV-2 (MTR 0–100K)	
	Change in Annual Hrs	Change in Annual Hrs (%)	Change in Annual Hrs	Change in Annual Hrs (%)	Change in Annual Hrs	Change in Annual Hrs (%)	Change in Annual Hrs	Change in Annual Hrs (%)
Overall	-45	-2.2	-47	-2.3	-93	-5.9	-13	-0.8
Grouping by husband's actual wage								
Decile 1	6	0.29	9	0.44	-156	-10.03	-20	-1.29
Decile 2	-31	-1.55	-31	-1.55	-231	-14.04	-32	-1.95
Decile 3	-50	-2.59	-52	-2.69	-149	-9.47	-21	-1.33
Decile 4	-78	-3.74	-83	-3.98	-155	-9.35	-22	-1.33
Decile 5	-85	-3.96	-92	-4.29	-90	-5.42	-13	-0.78
Decile 6	-86	-4.10	-93	-4.43	-86	-5.24	-12	-0.73
Decile 7	-76	-3.67	-82	-3.96	-45	-3.23	-7	-0.50
Decile 8	-34	-1.69	-37	-1.84	-22	-1.47	-3	-0.20
Decile 9	-10	-0.48	-11	-0.52	-11	-0.71	-2	-0.13
Decile 10	-7	-0.35	-7	-0.35	-21	-1.35	-3	-0.19
Husband not working	—	—	—	—	-90	-5.28	-10	-0.59
Grouping by location in 1996 EITC schedule								
Phase-in	34	3.06	39	3.51	203	50.75	32	8.00
Flat	-1	-0.06	1	0.06	24	2.13	7	0.62
Phase-out	-73	-3.57	-78	-3.81	-278	-20.06	-39	-2.81
Above phase-out	-34	-1.52	-36	-1.61	0	0.00	0	0.00

Notes: The simulations are based on estimates of the annual hours of work equations reported in Tables 8 and 9. The equations control for the log of net wages, virtual income, demographics, state dummies, and time dummies. The simulations are based on predictions of the hours equation using 1984 followed by 1996 tax parameters. All other variables are held constant in the simulations. The change in annual hours relates to a base of 1996 for men and 1480 for women.

7. CONCLUSIONS

This paper examines the labor supply response of married couples to the expansions of the EITC using CPS data from 1984 to 1996. We investigate labor force participation and hours worked using both a quasi-experimental approach and reduced-form labor supply methods.

A number of papers have evaluated the EITC's effect on the labor supply of single women, but this is the first paper to examine both the participation and hours of work decisions of married couples using tax-reform variation. The paper also contributes to the empirical labor supply literature by examining directly the impact of taxes on labor force participation, and by using a new instrument based on tax reforms that captures the individual's entire budget set to estimate the impact of taxes on hours worked.

Our main estimates are based on a sample of married couples with less than 12 years of schooling, chosen because they are most likely to be affected by the EITC. Our results suggest that married men's labor supply is little affected by taxes, while married women's labor supply is moderately affected. The elasticity with respect to the net-of-tax wage is about 0.3 for women's participation, and between 0.1 and 0.5 for their hours worked. We present evidence that shows the hours worked elasticities for men and women are larger for individuals with lower earnings.

A large literature has pointed out the strong labor supply disincentives faced by low- income women from traditional welfare, and recent work has shown that the EITC offsets these distortions. This paper points out that traditional welfare-type disincentives exist for EITC-eligible married women. In the aggregate, these distortions are modest. We estimate that the EITC expansions between 1984 and 1996 *reduced* the likelihood of married women's labor force participation by more than a full percentage point. This modest effect, however, masks substantial heterogeneity across the population of married EITC-eligible families. Women in the phase-out of the EITC are more than 2 percentage points (5 percent) less

likely to work, and if in the labor force, work as much as 276 (20 percent) fewer hours per year. Overall, the evidence suggests that family labor supply and pre-tax earnings fell.

Our results, implying that the EITC is effectively subsidizing married mothers to stay at home, have implications for the design of the program. We make no value judgment about this feature of the credit, but note that the EITC incentives for single mothers are quite different. If the main objective of the EITC is to encourage labor market participation, then an EITC that is based on individual earnings (as opposed to family earnings) would offset the incentive for secondary earners to leave the labor force.

That option, however, could be quite costly: $11 billion per year at current EITC parameters, according to the Congressional Budget Office. Another option is to make the credit a wage (as opposed to earnings) subsidy, possibly implemented as an earnings subsidy with a minimum-hours requirement. Implementation of such a wage subsidy for married couples would be complicated by the need to take into account the spouse's hours and earnings. Evaluating these and other alternatives to the current setup of the EITC should be of high priority for economists interested in taxation or in transfer program design.

APPENDIX TABLE 1
Labor Force Participation Rates,
Unconditional Means by Presence of Children and Pre-/Post-OBRA1993

	Pre-OBRA 1993	Post-OBRA 1993	Change	Relative (to No Kids) Change
		Panel A: Male Labor Force Participation Rates		
Education=12				
2+ kids (N=20,844)	0.984 (0.001)	0.985 (0.002)	+0.001 (0.002)	+0.005 (0.004)
1 kid (N=10,922)	0.983 (0.002)	0.987 (0.002)	+0.004 (0.002)	+0.008 (0.004)
no kids (N=12,433)	0.975 (0.002)	0.971 (0.003)	-0.003 (0.003)	
Education>12				
2+ kids (N=28,224)	0.991 (0.001)	0.990 (0.001)	-0.001 (0.001)	-0.000 (0.002)
1 kid (N=14,737)	0.985 (0.001)	0.987 (0.002)	+0.002 (0.002)	+0.003 (0.003)
no kids (N=16,735)	0.985 (0.001)	0.984 (0.002)	-0.001 (0.002)	
		Panel B: Female Labor Force Participation Rates		
Education=12				
2+ kids	0.708 (0.004)	0.735 (0.005)	0.027 (0.007)	+0.024 (0.010)
1 kid	0.798 (0.005)	0.807 (0.007)	0.010 (0.008)	+0.007 (0.010)
no kids	0.818 (0.004)	0.821 (0.006)	0.003 (0.007)	
Education>12				
2+ kids	0.764 (0.003)	0.785 (0.004)	+0.021 (0.005)	+0.026 (0.007)
1 kid	0.858 (0.004)	0.873 (0.004)	+0.015 (0.006)	+0.020 (0.007)
no kids	0.927 (0.003)	0.923 (0.003)	-0.005 (0.004)	

Source: Authors' tabulations of March CPS for years 1990 to 1997.

Notes: Sample includes married couples. See text for sample selection. Pre-OBRA period is defined as 1989 to 1993 and post-OBRA as 1994 to 1996.

APPENDIX TABLE 2
Difference-in-Differences Estimates of Labor Force Participation Rates
Children vs. No Children

Variable	Married Men (1) LFP Probit (dp/dx)	Married Women (2) LFP Probit (dp/dx)
Constant	-0.499 (0.222)	-1.490 (0.637)
Unearned inc/1000	-0.004 (0.000)	-0.002 (0.000)
# of children	-0.002 (0.001)	-0.036 (0.005)
# of preschool children	-0.004 (0.022)	-0.092 (0.008)
Nonwhite	-0.034 (0.004)	0.019 (0.014)
Age	-0.028 (0.017)	0.112 (0.051)
Age^2	0.001 (0.000)	-0.002 (0.001)
Age^3	-0.0001 (0.000)	0.000 (0.000)
Education	-0.003 (0.002)	-0.005 (0.007)
$Education^2$	0.000 (0.000)	0.002 (0.001)
State unemployment rate	-0.006 (0.002)	-0.011 (0.005)
Kids (γ_0)	0.009 (0.005)	0.029 (0.017)
Post93 (γ_1)	-0.017 (0.008)	-0.006 (0.024)
Kids*post93 (γ_2)	0.009 (0.007)	-0.034 (0.023)
Other controls	time, state	time, state
Average EITC effect	**+0.009 (0.007)**	**-0.031 (0.022)**
Mean of dependent variable	0.96	0.58
Log likelihood/R^2	-1974	-8189
Observations	12,944	12.944

Source: Authors' tabulations of March CPS for years 1990 to 1997.

Notes: See text for sample selection. Parameter estimates for labor force participation are probability derivatives (dp/dx) from a probit estimation where dummy variables are measured as the change in predicted probability from going from 0 to 1.

APPENDIX TABLE 3
Parameter Estimates for Labor Force Participation Equation, Alternative Specifications
Sample: Married Couples with Children, 1984–1996

	Husband		Wife	
Panel A				
Sample: Education of wife <12				
Specification: Average tax rate evaluated at full-time (40 hours)				
Average net wage	0.003	(0.0002)	0.016	(0.003)
Net income at 0 hrs(1000s)	-0.002	(0.0001)	-0.003	(0.0001)
Other controls	demographic, state, time		demographic, state, time	
Pseudo R^2	0.13		0.08	
Mean of dependent variable	0.980		0.686	
Observations	74107		74107	
Panel B				
Sample: Education of wife <12				
Specification: Average tax rate evaluated at part-time (20 hours)				
Average net wage	0.003	(0.0005)	0.014	(0.004)
Net income at 0 hrs(1000s)	-0.005	(0.0003)	-0.001	(0.0004)
Other controls	demographic, state, time		demographic, state, time	
Pseudo R^2	0.17		0.06	
Mean of dependent variable	0.960		0.556	
Observations	17370		17370	
Panel C				
Sample: Education of wife <12				
Specification: Actual wages for workers				
Average net wage	0.0004	(0.0001)	0.018	(0.001)
Net income at 0 hrs(1000s)	-0.005	(0.0003)	-0.002	(0.0003)
Other controls	demographic, state, time		demographic, state, time	
Pseudo R^2	0.17		0.07	
Mean of dependent variable	0.960		0.556	
Observations	17370		17370	

Source: Authors' tabulations March CPS for years 1985 to 1997.

Notes: Average net wage is the gross hourly wage times one minus the average tax rate from entering the labor market at part-time or full-time work. Parameter estimates for labor force participation are probability derivatives (dp/dx) from a probit estimation. Standard errors in parentheses.

APPENDIX TABLE 4
Parameter Estimates for Annual Hours of Work Equation for Married Men
Using Alternative Instrument Sets (LATE)

	Wage and Income Estimates	
	ln(net wage)	Virtual Income/100
Results for IV-2 (marginal tax rates at $5000 intervals)		
Basic results (0–100K)	138.9 (129.9) [0.07]	-13.1 (3.4) [-0.03]
LATE — (0–60K)	236.5 (135.8) [0.12]	-14.1 (3.5) [-0.03]
— (0–40K)	451.2 (182.6) [0.23]	-17.0 (3.9) [-0.04]
— (0–25K)	396.9 (200.8) [0.20]	-13.9 (4.1) [-0.03]

Notes: Each row of the table corresponds to estimates from an annual hours of work equation for married men. In each case, the estimates are from IV estimation. The rows differ only in the specification of the instrument sets. The specification of the equations is identical to that reported in Table 8 and includes net wages, virtual income, demographics, state dummies, and time dummies. The table reports the parameter estimate, standard errors in ( ), and elasticities in [ ].

Appendix A
Data Construction

This appendix provides a description of the data used for the analysis of married couples with children. Specifically, it describes the tax simulator, the calculation of the after-tax wage and income variables, and the procedure for estimating missing wages for nonworkers.

Tax Calculator

Our tax model calculates federal taxes and payroll taxes and covers tax years 1984–1996. We assume that all married couples file jointly and take the standard deduction. At this time, our tax calculator does not include state income taxes. Therefore, we do not model the presence of the state supplements to the EITC, now available in nine states. These are growing in importance, but were small relative to the federal credit during most of our sample. While in principle these simplifications could lead to measurement problems, in practice our estimated marginal tax rates are very highly correlated with those produced by NBER's TAXSIM model (which includes state taxes and models itemizers).

Four tax variables are used in the estimation. The labor force participation equation includes net nonlabor income (*NetN*) and the net-of-average-tax wage (*w(1-ATR)*). The hours of work equation includes virtual income (*virtinc*) and net wages (*netwage*). The *ATR* is calculated as the change in net-of-tax income over the change in gross earnings that results from entering the labor force at some level. We consider entry at full-time (40 hours per week), full-year work and part-time (20 hours), full-year work. *NetN* is after tax nonlabor income. The net wage is the slope of the budget set at the observed level of hours of work and is equal to the gross wage times one minus the marginal tax rate (*MTR*). Virtual income is the vertical intercept (e.g., after-tax income) at zero hours of work if the budget set is linearized through the person's observed budget segment.

All of the tax calculations are made using the secondary earner assumption. Accordingly, the primary earner's (husband's) taxes are computed without taking account of the spouse's labor supply choice. For example, the husband's *NetN* is the family's after-tax nonlabor income, and *ATR* is a function of his hourly wage, nonlabor income, and tax parameters. All of the wife's calculations take the actual amount of the husband's earnings as given. Therefore, her *NetN* includes her husband's observed earnings and family nonlabor income, net of taxes. The wife's average tax rate (*ATR)* is determined by her hourly wage, nonlabor income, and tax parameters. Her average tax rate will therefore depend on which EITC region her husband's earnings place the family in.

Predicting Wages for Nonworkers

We assume that the labor force participation decision is a function of after-tax wages. The estimation sample, however, includes nonworkers for whom we do not observe a wage. We predict wages using estimates from a log wage equation, accounting for sample selection. The variables used to predict wages include characteristics of the individual (age, education, race), state labor market variables (unemployment rate and average hourly wage), and geographic identifiers (metropolitan status). The selection is identified by family characteristics (number of children, presence of young children). We estimate separate wage regressions in each year to allow for an unrestricted specification for changes in the wage structure. We estimate the equations using married couples of all education levels. We find that

having the full range of education levels leads to predicted wages that are closer to actual wages for workers. Because of skewness in the implied (log normal) distribution for wages, median as opposed to mean wages are predicted.

Appendix B
EITC Simulations

The goal of our simulations is to obtain estimates of the effect of the EITC on the labor supply of married couples. The simulations are based on our sample of less-educated married couples in 1996. We compare predicted labor supply based on tax laws in 1996 to what their labor supply would be if they faced a different EITC schedule. In particular, we consider two alternative simulations. We consider how labor supply would change if the household faces (1) the 1984 schedule for the EITC or (2) the 1993 schedule for the EITC. In each case, we assume that all other values remain fixed—in particular, there are no changes in gross wages, nonlabor income, family structure, and spouse's earnings (for the wife), and no other changes in taxes. That is, we do not apply all tax laws in 1984, but just the EITC schedule for 1984.

We use our tax calculator to generate values for the after-tax wage and income variables under 1996 law and the alternative simulation. Labor supply is predicted in each case, and the simulation tables present the change in labor supply. We present the results of the simulations for the full sample and for two different groupings of married couples: by deciles of the husband's gross hourly wage distribution and regions of the 1996 EITC schedule (phase-in, flat, phase-out, above phase-out). The regions of the EITC are assigned using the 1996 EITC schedule and are based on actual family earnings and adjusted gross income.

We translate changes in labor force participation into changes in annual earnings. We assume that each individual within a particular group (e.g., those in the lowest decile of the wage distribution) have the mean level of wages and annual hours among all *workers* in that group. To translate changes in annual hours into changes in annual earnings, we simply apply the mean hourly wage within that group.

References

Attanasio, Orazio, and Thomas MaCurdy. 1997. "Interactions in Family Labor Supply and Their Implications for the Impact of the EITC." Mimeo, Stanford University.

Blomquist, Sören. 1996. "Estimation Methods for Male Labor Supply Functions: How to Take Account of Nonlinear Taxes." *Journal of Econometrics* 70: 383–405.

Blundell, Richard, Alan Duncan, and Costas Meghir. 1998. "Estimating Labor Supply Responses Using Tax Reforms." *Econometrica* 66: 827–861.

Bosworth, Barry, and Gary Burtless. 1992. "Effects of Tax Reform on Labor Supply, Investment, and Savings." *Journal of Economic Perspectives* 6(1): 3–25.

Browning, Edgar K. 1995. "Effects of the Earned Income Tax Credit on Income and Welfare." *National Tax Journal* 48: 23–43.

Dickert, Stacy, Scott Houser, and John Karl Scholz. 1995. "The Earned Income Tax Credit and Transfer Programs: A Study of Labor Market and Program Participation." In *Tax Policy and the Economy*, edited by James Poterba. Cambridge, MA: MIT Press.

Dickert-Conlin, Stacy, and Scott Houser. 1998. "Taxes and Transfers: A New Look at the Marriage Penalty." *National Tax Journal* 51: 175–217.

Council of Economic Advisers. 1998. *Economic Report to the President*. Washington, DC: Government Printing Office.

Eissa, Nada, and Jeffrey B. Liebman. 1996. "Labor Supply Response to the Earned Income Tax Credit." *Quarterly Journal of Economics* 111: 605–637.

Flood, Lennart, and Thomas MaCurdy. 1993. "Work Disincentive Effects of Taxes: An Empirical Analysis of Swedish Men." Mimeo, Stanford University.

Hausman, Jerry A., and James M. Poterba. 1987. "Household Behavior and the Tax Reform Act of 1986." *Journal of Economic Perspectives* 1(1): 101–119.

Heckman, James. 1983. "Comment." In *Behavioral Simulation Methods in Tax Policy Analysis*, edited by Martin Feldstein. Chicago: University of Chicago Press.

Hoffman, Saul, and Laurence Seidman. 1990. *The Earned Income Tax Credit: Antipoverty Effectiveness and Labor Market Effects*. Kalamazoo, MI: Upjohn Institute for Employment Research.

Holtzblatt, Janet, Janet McCubbin, and Robert Gilette. 1994. "Promoting Work through the EITC." Mimeo, U.S. Department of the Treasury, June 4, 1994.

Hoynes, Hilary Williamson. 1996. "Welfare Transfers in Two-Parent Families: Labor Supply and Welfare Participation under AFDC-UP." *Econometrica* 64: 295–332.

Imbens, Guido W., and Joshua A. Angrist. 1994. "Identification and Estimation of Local Average Treatment Effects." *Econometrica* 62: 467–475.

Liebman, Jeffrey. 1996. "The Impact of the Earned Income Tax Credit on Labor Supply and Taxpayer Compliance." Ph.D. thesis, Harvard University.

MaCurdy, Thomas, David Green, and Harry Paarsch. 1990. "Accessing Empirical Approaches for Analyzing Taxes and Labor Supply." *Journal of Human Resources* 25: 415–490.

Meyer, Bruce, and Daniel Rosenbaum. 1998. "Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers." Mimeo, Northwestern University.

Moffitt, Robert. 1992. "Incentive Effects of the U.S. Welfare System: A Review." *Journal of Economic Literature* 30: 1–61.

Moffitt, Robert, and Kenneth Kehrer. 1981. "The Effect of Tax and Transfer Programs on Labor Supply: The Evidence from the Income Maintenance Experiments." In *Research in Labor Economics*, vol. 4, edited by R. G. Ehrenberg, pp. 103–150. Greenwich, CT: JAI Press.

Mroz, Thomas A. 1987. "The Sensitivity of an Empirical Model of Married Women's Hours of Work to Economic and Statistical Assumptions." *Econometrica* 55: 765–799.

Triest, Robert K. 1987. "A Monte Carlo Test of the Robustness of Alternative Estimators in Labor Supply Functions." Working Paper 198, Department of Economics, Johns Hopkins University.

Triest, Robert K. 1990. "The Effect of Income Taxation on Labor Supply in the United States." *Journal of Human Resources* 25: 491–516.

U.S. General Accounting Office. 1992. *Earned Income Tax Credit: Design and Administration Could Be Improved*. Washington, DC: GAO.

U.S. General Accounting Office. 1993. *Earned Income Tax Credit: Design and Administration Could Be Improved.* Washington DC: GAO.

U.S. General Accounting Office. 1996. *Earned Income Tax Credit: Profile of Tax Year 1994 Credit Recipients.* Washington, DC: GAO.

U.S. House of Representatives. 1996 and various years. *Green Book: Background Material and Data on Programs within the Jurisdiction of the Committee on Ways and Means*. Washington, DC: Government Printing Office.