The Australian National University

Centre for Economic Policy Research

DISCUSSION PAPER

Who Benefits from the Earned Income Tax Credit? Incidence Among Recipients, Coworkers and Firms

Andrew Leigh

DISCUSSION PAPER NO. 494
August 2005

ISSN: 1442-8636
ISBN: 0 7315 3564 2

Address for Correspondence: Andrew Leigh, Social Policy Evaluation, Analysis and Research Centre Economics Program, Research School of Social Sciences, The Australian National University, ACT 0200. Tel: (612) 6125 1374; Fax: (612) 6125 0182; Email: Andrew.Leigh@anu.edu.au; Website: www.andrewleigh.com

Acknowledgements
I am grateful to Anthony Atkinson, Jonathan Borck, David Cutler, David Ellwood, Doug Geyser, Richard Holden, Caroline Hoxby, Christopher Jencks, Lawrence Katz, Jeffrey Liebman, Adam Looney, Alexandre Mas, Casey Mulligan, Justin Wolfers and seminar participants at Harvard University, the Public Policy Institute of California, the Society of Labor Economists annual conference, and Tufts University for helpful comments and suggestions. Thanks to Raj Chetty, Dan Feenberg, Nicolas Johnson, Adam Looney, and Jesse Shapiro for advice in compiling federal and state policy parameters.

ABSTRACT

How are hourly wages affected by the Earned Income Tax Credit? Two strategies are utilized to determine the relationship between the credit and hourly wages. First, I use variation in state EITC supplements, which magnify the effect of the federal EITC. I find that a 10 percent increase in the generosity of the EITC is associated with a 4 percent fall in the wages of high school dropouts and a 2 percent fall in the wages of those with only a high school diploma, while having no effect on the wages of college graduates. Given standard estimates of labor demand, this is consistent with the common finding that the EITC boosts labor supply. Although workers with children receive a more generous tax credit than childless workers, and the effect of the credit on labor force participation is larger for those with children, the hourly wages of both groups are similarly affected by an increase in the overall generosity of the EITC. A second strategy is then implemented, based on the insight that the impact of the EITC on wages is determined by the typical EITC parameters in an employee's labor market, rather than by the individual's own EITC eligibility. Constructing a simulated instrument for the EITC parameters in an employee's labor market, I find that wages respond to variation in the fraction of eligible employees and the average EITC rate, but do not respond systematically to changes in the marginal EITC rate.

Keywords: taxation incidence, labor supply, simulated instrument
JEL Classification: H22, H23, J22, J30

1. Introduction

The Earned Income Tax Credit (EITC) is the largest cash assistance program for low-wage workers in the United States. In 2001, federal EITC claims totaled $33.4 billion, while state EITC claims amounted to $1.5 billion.[1] Yet its impact on equilibrium wages remains unknown. Substantial changes in EITC policy parameters over the past two decades provide a useful opportunity to answer this question. Better understanding how wages respond to the EITC is also relevant for the study of taxation incidence more generally.

Targeted at low-wage workers, the EITC has focused on achieving two major goals: distributing income towards low-wage workers, and increasing labor force participation rates. But there is most likely a tension between these objectives. If the EITC induces a net increase in labor supply, then unless labor demand is perfectly elastic, the equilibrium wage will fall. Furthermore, if EITC-eligible and EITC-ineligible employees compete in the same labor market, a fall in the equilibrium wage will affect both groups. On net, ineligible workers will therefore be worse off than if the EITC had not been increased.

Perhaps because of these complications, the incidence of the EITC is an under-explored area. Reviewing the body of research on the EITC, Hotz and Scholz (2003) conclude "We can think of no major EITC-related topic that has not had at least some attention from serious scholars, possibly with the exception of the economic incidence of the credit." The incidence of the EITC is important not only for understanding its impact on economic inequality in the U.S., but also for considering how negative income taxes might operate in other contexts. Since 1971, Britain has had some form of means-tested benefit for adults with children who worked more than a certain number of hours per week (Dilnot and McCrae 1999), while several other European countries have also introduced EITCs in recent years (Gradus 2001). In these countries, the main argument made in favor of negative income taxes is that they will help reduce unemployment – but the extent to which they succeed in this depends on the impact of EITCs on labor supply

[1] Federal data from Internal Revenue Service (2003). State data based on the federal amount, and on state EITC rates in 2001, weighted by population, and assuming that all those who claimed the federal EITC also claimed any state EITC to which they were entitled. Assigning non-refundable state EITCs a lower weight (eg. 2/3rds of the value of refundable credits) makes no tangible difference to the total value of state EITCs.

and hourly wages. Studying the incidence of the U.S. EITC may therefore assist with policy formulation in these and other countries.

Using variation in state EITC supplements, I find that a 10 percent increase in the generosity of the federal EITC is associated with a 4 percent drop in hourly wages for high school dropouts and a 2 percent fall in wages for those with only a high school diploma. The effect on hourly wages is similar for those with and without children, suggesting that what matters most is the mean eligibility in an individual's labor market, not an individual's own eligibility. To analyze this in more detail, I approach the problem using an entirely different source of variation – the average EITC parameters within an individual's labor market. Based on this, I conclude that labor supply and wages respond to the fraction of eligible employees, and to the average EITC rate, but not to the marginal rate. This indicates that EITC recipients may be systematically misperceiving the EITC schedule, and that the net welfare gain of the program is larger than conventional estimates would suggest.

The remainder of this paper is organized as follows. Section 2 reviews the structure and development of federal and state EITCs. Section 3 discusses relevant literature on the EITC and taxation incidence. Section 4 sets out three possible models of EITC incidence. Section 5 considers the net effect of changes in the EITC on hourly wages, using variation in state EITC supplements. Section 6 presents a different empirical specification – exploiting variation in the average EITC parameters in an individual's labor market. The final section concludes.

2. EITC structure and history

Introduced in 1975, and significantly expanded in tax years 1987 and 1994, the EITC augments the earnings of low-wage workers. Based on family income, the credit has a phase-in range (in which the payment rises with earnings), a flat area (in which the dollar value of the credit remains constant), and a phase-out range (in which the value of the credit diminishes, until the credit phases out entirely). Prior to 1994, the credit was unavailable for taxpayers without dependent children, and remains substantially more generous for taxpayers with children.

Figure 1 shows the 2002 EITC parameters for families with no children, one child, and two or more children. In 2002, the maximum EITC payment for families with two children ($4140) was eleven times the size of the maximum payment for families with no children ($376). Table 1 shows the complete federal EITC rate schedule since 1984. Figure 2 shows the effect of the EITC on the budget constraint for one particular case – an unmarried taxpayer with one child in 2002.

Figure 1: Federal EITC Schedule - 2002

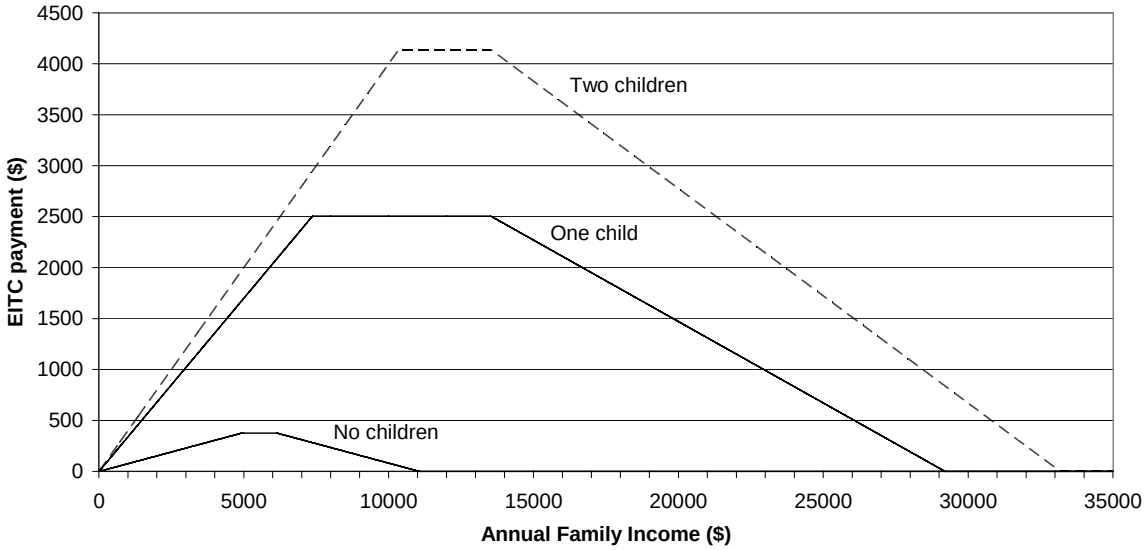
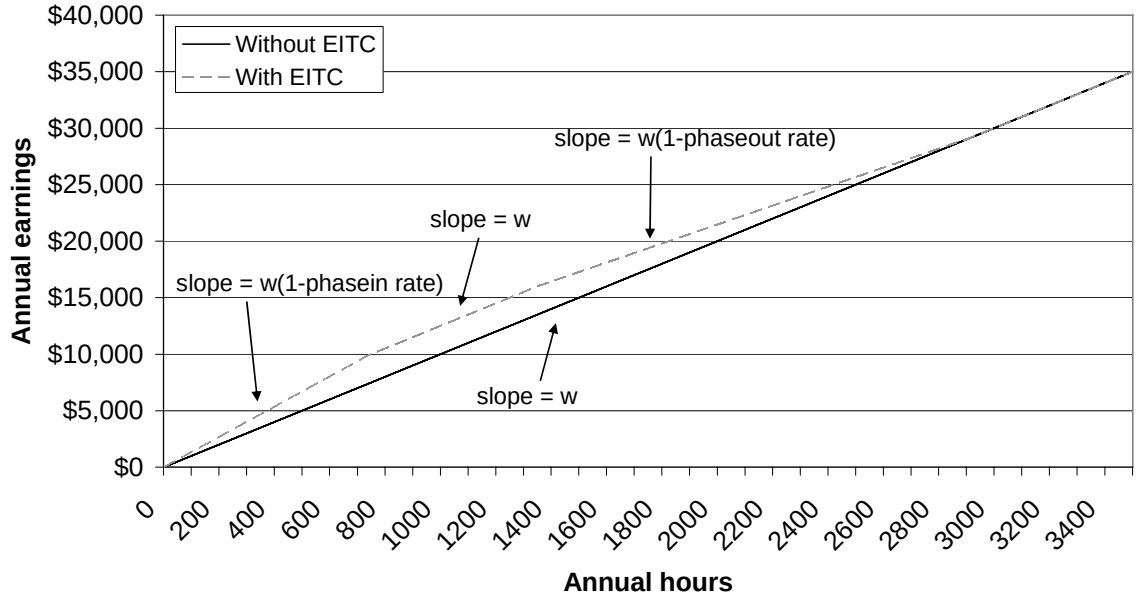


Figure 2: Budget Constraint - Single Taxpayer with One Child in 2002



Assumes a single taxpayer with one child and no investment income, earning $10 per hour. Calculations based on Taxsim, and ignore all other taxes and credits. Note that the phase-in rate is negative, and phase-out rate is positive.

Table 1: Federal EITC parameters 1984-2002

	Marginal tax rate in phase-in range (%)			Top of phase-in range			Start of phase-out range			Marginal tax rate in phase-out range (%)		
Children:	0	1	2+	0	1	2+	0	1	2+	0	1	2+
1984		-10	-10		$5000	$5000		$6000	$6000		12.5	12.5
1985		-14	-14		$5000	$5000		$6500	$6500		12.22	12.22
1986		-14	-14		$5000	$5000		$6500	$6500		10	10
1987		-14	-14		$6080	$6080		$6920	$6920		10	10
1988		-14	-14		$6810	$6810		$9840	$9840		10	10
1989		-14	-14		$6,500	$6,500		$10,240	$10,240		10	10
1990		-14	-14		$6,810	$6,810		$10,730	$10,730		10	10
1991		-16.7	-17.3		$7,140	$7,140		$11,250	$11,250		11.93	12.36
1992		-17.6	-18.4		$7,520	$7,520		$11,840	$11,840		12.57	13.14
1993		-18.5	-19.5		$7,750	$7,750		$12,200	$12,200		13.21	13.93
1994	-7.65	-26.3	-30	$4,000	$7,750	$8,425	$5,000	$11,000	$11,000	7.65	15.98	17.68
1995	-7.65	-34	-36	$4,100	$6,160	$8,640	$5,130	$11,290	$11,290	7.65	15.98	20.22
1996	-7.65	-34	-40	$4,220	$6,330	$8,890	$5,280	$11,610	$11,610	7.65	15.98	21.06
1997	-7.65	-34	-40	$4,340	$6,500	$9,140	$5,430	$11,930	$11,930	7.65	15.98	21.06
1998	-7.65	-34	-40	$4,460	$6,680	$9,390	$5,570	$12,260	$12,260	7.65	15.98	21.06
1999	-7.65	-34	-40	$4,530	$6,800	$9,540	$5,670	$12,460	$12,460	7.65	15.98	21.06
2000	-7.65	-34	-40	$4,610	$6,920	$9,720	$5,770	$12,690	$12,690	7.65	15.98	21.06
2001	-7.65	-34	-40	$4,760	$7,140	$10,020	$5,950	$13,090	$13,090	7.65	15.98	21.06
2002	-7.65	-34	-40	$4,910	$7,370	$10,350	$7,150	$14,520	$14,520	7.65	15.98	21.06

Note: The EITC was unavailable for families without children prior to 1994.

Over the past two decades, sixteen states (primarily in the Midwest and Northeast) and the District of Columbia have implemented some form of state EITC supplement. Some provide a more generous state EITC supplement for larger families, and most are refundable for taxpayers with zero liability. All but one state EITC operated as a simple top-up to the federal EITC, such that the effective EITC rate was τ = (federal EITC rate)*(1+state EITC supplement).[2] For example, a single parent with one child who earned $7000 in 2002 would have been in the EITC phase-in range, and eligible for a federal EITC payment of $2380 (34 percent). If she lived in New York, which provided an EITC supplement of 27.5 percent, her effective rate would have been 43.4 percent (34*1.275), and she would have received an additional $654.50 ($2380*0.275) from the

[2] The only state with an EITC not based on the federal credit is Indiana. Since 1999, Indiana has had an EITC that was not based on the federal credit, but applied to families with children, where earned income exceeded 80% of total income, and total income was below $12,000. Indiana families that met these criteria received a refundable credit of 0.034*(12,000-total income). Since Indiana's credit does not "magnify" the federal EITC in the manner that other state EITC supplements do, I drop Indiana from the sample entirely. I also ignore local EITCs paid to residents of Montgomery County, MD (15% in 1999-2002) and Denver, CO (20% in 2002).

state government. A 10 percent state EITC supplement is equivalent to a 10 percent expansion of the federal EITC for residents of that state.

Table 2 provides details on state EITC supplements. While a few states provided EITC supplements in the 1980s, most were implemented in the mid to late 1990s. Johnson (2001) notes three factors that were important in the growth of state EITCs. First, under the Personal Responsibility and Work Opportunity Reconciliation Act of 1996, states were permitted to draw upon TANF block grants to partially fund an EITC. Second, welfare lobby groups pushed strongly for EITCs during this period. And third, state budget surpluses made EITCs fiscally feasible (indeed, Colorado and Maryland made expansions of their state EITCs contingent upon state revenue growth).

Table 2: State EITC supplements 1984-2002 (%)

State:	**CO**	**DC**	**IL**	**IA**	**KS**	**ME**	**MD**	**MA**	**MN**	**MN**	**NJ**	**NY**	**OK**	**OR**	**RI**	**VT**	**WI**	**WI**	**WI**
# of children:							1+		0	1+		1+					1	2	3+
1984																	30	30	30
1985																	30	30	30
1986															22.21				
1987															23.46				
1988															22.96	23			
1989															22.96	25	5	25	75
1990				5											22.96	28	5	25	75
1991				6.5					10	10					27.5	28	5	25	75
1992				6.5					10	10					27.5	28	5	25	75
1993				6.5					15	15					27.5	28	5	25	75
1994				6.5					15	15		7.5			27.5	25	4.4	20.8	62.5
1995				6.5					15	15		10			27.5	25	4	16	50
1996				6.5					15	15		20			27.5	25	4	14	43
1997				6.5				10	15	15		20		5	27.5	25	4	14	43
1998				6.5	10		10	10	15	25		20		5	27	25	4	14	43
1999	8.5			6.5	10		10	10	25	25		20		5	26.5	25	4	14	43
2000	10	10	5	6.5	10	5	15	10	25	25	10	22.5		5	26	32	4	14	43
2001	10	25	5	6.5	10	5	16	15	33	33	15	25		5	25.5	32	4	14	43
2002	0	25	5	6.5	15	5	16	15	33	33	17.5	27.5	5	5	25	32	4	14	43
Refundable?	Y	Y	N	N	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y

Notes:

1. Maryland also had a non-refundable EITC of 50% for families with children from 1987-2002.
2. "Children" is the number of children the taxpayer had to have in order to be eligible for the state EITC supplement. It is left blank if the supplement applied irrespective of the taxpayer's number of children.
3. Supplement is the percentage top-up of the federal EITC payment provided by the state. I ignore local EITCs implemented by Montgomery County, MD and Denver, CO. From 1999-2002, Indiana had an EITC which was not based on the federal EITC, and I therefore drop respondents from Indiana in those years.

To see whether economic performance is associated with state EITC supplements, Table 3 shows the results from regressing the state EITC supplement for a person with one child on two measures of the performance of the state economy – unemployment and Gross State Product (GSP). Since GSP includes both government and personal income, tax rates should have no first order effect on GSP. I also investigate the extent to which changes in the EITC coincided with other state policies, by including in the regression the real minimum wage, top state income tax rate, and three variables measuring welfare reform and generosity. Results are presented for 1984-2002 and 1989-2002, since the latter is the period that will be used in specifications that rely only on variation in state EITCs. Both specifications include state and year fixed effects.

Table 3: Are state EITCs associated with differing economic performance?

Dependent variable: State EITC supplement for a family with one child		
	1984-2001	**1989-2001**
Log gross state product per capita	0.102***	0.141***
	(0.0260)	(0.0349)
Unemployment rate	0.667***	-0.0863
	(0.177)	(0.158)
Log real minimum wage	-0.0254	-0.0746
	(0.0503)	(0.0592)
Maximum AFDC/TANF benefit for a family of 3	0.00767	-0.0231
	(0.0201)	(0.0167)
Implemented welfare reform?	-0.00790	-0.00924
	(0.00765)	(0.00601)
Obtained an AFDC waiver?	-0.0142***	-0.0167***
	(0.00540)	(0.00506)
Top state income tax rate	-0.345	-0.0832
	(0.263)	(0.258)
State fixed effects?	Yes	Yes
Year fixed effects?	Yes	Yes
Observations	918	663
Adjusted R^2	0.69	0.83

Notes:
1. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors in parentheses.
2. Sample covers up to 2001 only, since 2002 GSP figures have not yet been released.

Table 3 shows a positive relationship between state EITC supplements and unemployment for the 1984-2002 period, but no relationship in the 1989-2002 period. In both samples, there is a strong positive relationship between changes in state EITC supplements and changes in GSP.[3] A 10 percent increase in GSP is associated with a

[3] Table 3 shows the results from an OLS model. Using a tobit model, the results are qualitatively similar, with the exception of unemployment, which is not statistically significant for either 1984-2002 or 1989-2002.

1-1½ percentage point increase in the state EITC supplement. This indicates that fast-growing states are more likely to introduce EITC supplements or raise their EITC supplements. Were one not to control for GSP, this could potentially bias the results towards a finding that more of the incidence of the credit is on the employee.

Among the policy variables, I find that when states were granted a federal waiver to experiment with provisions of the Aid to Families with Dependent Children program (AFDC), their state EITC supplement tended to fall by 1½ percentage points. I find no significant relationship between state EITC supplements and minimum wages, between state EITCs and top state income tax rates, or between state EITCs and welfare generosity. With the exception of the negative relationship between AFDC waivers and state EITCs, there appears to be a general absence of coordination between state EITCs and other poverty, tax and welfare policies.

Unlike payroll taxation rates, which are directly visible to employers, a worker's EITC entitlement is essentially unobserved by employers. To determine eligibility, an employer would need to know the worker's number of children, their estimated annual earnings from all jobs, and (if the worker is married) their spouse's estimated annual earnings. This situation contrasts with the U.K., where the default payment option for the Working Families Tax Credit is via the pay packet, and both employers and workers can observe the value of the credit on a month-by-month basis. Although U.S. EITC recipients can also receive the credit in their pay packet, this option is utilized by less than 1 percent of recipients (U.S. Treasury 2003).

3. Previous research on the EITC and taxation incidence

3.1 EITC research

Past analyses of the labor supply effects of the EITC have tended to use discrete policy changes in the federal EITC as the primary source of variation. Eissa and Liebman (1996) use a differences-in-differences approach to analyze the 1987 increase in the EITC, and find that it led to a significant increase in the labor supply of single women. Eissa and Hoynes (2004) analyze the effect of EITC changes from 1984-96 on the labor supply of married couples where both are high school dropouts, and conclude that raising the EITC

had a small positive impact on husbands' labor supply, and a larger negative impact on wives' labor supply, due to the marginal rate in the phase-out range. This finding accords with the results of the negative income tax experiments carried out in the 1970s, which had suggested that the income effect was significant and could lead to a decrease in labor supply (Hausman 1985).

Like Eissa and Liebman, Meyer and Rosenbaum (2001) attempt to determine the effect of the EITC on the labor force participation of single women. In addition, they model the impact of other tax and welfare changes, and include state EITCs (though these are not their only source of variation). Meyer (2002) charts changes in labor force participation over the period 1986-2000, and concludes that the credit boosted labor supply on the participation margin, but had no significant effect on the hours margins for low-wage workers. Meyer also concludes that the EITC primarily affected single women, as distinct from other demographic sub-groups. Both these studies find that the EITC increased the labor supply of women with children, and that its principal effect is on the participation margin, and not on the hours margin.

Neumark and Wascher (2001) use state EITCs as their primary source of variation, and model how they affect the income-to-needs ratio of low-income families. In order to avoid potential endogeneity, they control for the state unemployment rate and welfare generosity. They analyze 1985-1994, a period during which seven states implemented EITC supplements. Neumark and Wascher find that an increase in a state's EITC supplement significantly boosts the probability that a poor family will move from having no adult in the labor force to having one or more adults in the labor force.

EITC studies differ in the way that they model the EITC rate. Because an employee's precise EITC rate is endogenous to her earnings, an exogenous source of variation must be found. Neumark and Wascher (2001) deal with this by restricting their sample to families with an income-to-needs ratio below three and by assigning all workers the EITC rate in the phase-in range. Meyer and Rosenbaum (2001) estimate the variable "Income Taxes if Work", which is based only upon the employee's state, year, and family composition. Eissa and Hoynes (2004) adopt a similar approach, instrumenting for the employee's marginal EITC rate and virtual income with the prevailing EITC parameters.

Inherent in any model of how the EITC affects labor supply and equilibrium wages is a set of assumptions about how individuals view the credit and adjust their behavior in response. If individuals have full information about the schedule and full control over their hours, they will respond to the change in their marginal tax rate and virtual income induced by the EITC. However, while this might be a reasonable assumption for analyzing income taxes, there are several reasons why it might not hold for the EITC. First, the EITC is targeted at workers with low earnings, who tend to have lower levels of formal education and English language proficiency than other employees and may therefore be more poorly informed about the tax code. Second, due to the structure of the EITC, a small change in earnings from one year to the next will tend to produce a larger change in the marginal tax rate for EITC recipients than for non-recipients. Third, because nearly all recipients receive the credit at the end of the tax year, even taxpayers with perfect information about the tax code may find it difficult during the course of the year to predict where on the schedule they will eventually fall, particularly if they are married, work overtime or hold multiple jobs.

Research on how recipients view the EITC is severely limited – indeed, I am aware of no large-scale survey that has asked respondents how they perceive the relationship between the EITC and their earnings. However, two small-scale studies tend to suggest that misperception of the tax rate may be common. An ethnographic study of low-wage households in Wisconsin conducted by Romich and Weisner (2000) found that 36 out of 40 respondents had heard of the credit, but that only two respondents knew that they needed to earn a certain amount in order to maximize their credit. Few respondents in Romich and Weisner's sample appeared to know that the EITC would phase out, and recipients did not generally distinguish between the EITC and refunds for over-withholding of taxes. These findings accord with Liebman (1998), who spoke with EITC recipients in housing projects and reported that they tended to have no idea whether their tax refund would go up or down if their income increased. Finally, a factor which may affect knowledge of the parameters of the EITC is the high use of tax preparers. Berube et al (2002) find that 68 percent of EITC recipients use a tax preparer, rather than filling in their own paperwork, which may contribute to a lack of knowledge about the applicable rules.

3.2 Incidence of income taxation

Another relevant strand of research is on the incidence of income and payroll taxes. Using variation in state legislation over time, Gruber and Krueger (1991) found that 86 percent of a rise in workers' compensation premiums was borne by employees, while Gruber (1994) concluded that the full cost of mandated healthcare costs for childbirth was shifted on to wages. And, exploiting a different source of variation, Gruber (1997) used firm-level data in Chile to find that all of the benefit of a cut in payroll tax was passed on to employees, suggesting that payroll tax incidence was entirely on workers. These analyses did not take account of income effects, which are likely to be relatively insignificant for such policy changes. While these studies are illustrative of the incidence of workers' compensation benefits, maternity benefits, and retirement savings, they do not provide conclusive evidence on the incidence of income taxation.[4]

Studies of the incidence of personal income taxes are more limited. Kubik (2002) uses variation in the median marginal tax rate in an occupation before and after the Tax Reform Act of 1986. He finds that wages were lower in those occupations that saw the largest reductions in tax rates – with a 10 percentage point decrease in the median marginal rate associated with a 2.5 percentage point fall in wages of prime age males. In the Danish context, Bingley and Lanot (2002) estimate a higher incidence of income taxes on the employer. Using variation in local income taxes, they estimate that the elasticity of gross wages with respect to the income tax rate is -0.44. These findings suggest a reconsideration of the common assumption in the U.S. and elsewhere that employees bear the full incidence of income taxes.[5]

[4] One factor that might cause the incidence of mandated benefits to differ from the incidence of the EITC is that with taxes to fund mandated benefits, the benefits themselves must be taken into account. As a consequence, the imposition of a payroll-type tax will entail both a downwards demand shift and a downwards supply shift (Summers 1989). This dual effect is not present in the case of the EITC.

[5] In their review of tax incidence, Fullerton and Metcalf conclude: "Finally, for the personal income tax, applied studies have consistently assumed that economic incidence is the same as statutory incidence – on the taxpayer – even though this assumption has never been tested." (2002, 29)

4. Three models of EITC incidence

How should we expect the EITC to affect hourly wages? In this section, I outline three models of EITC incidence, given variation in EITC receipt and a single equilibrium wage. In the first model, employees are assumed to know the prevailing EITC schedule and respond to the marginal EITC rate and virtual income. However, as studies of how respondents view the credit have suggested, using the marginal rate may not be the appropriate assumption. A second model has employees instead responding to the average rate (that is, their EITC payment divided by their income). While the average rate and the marginal rate will be the same in the phase-in range, they will diverge sharply in the flat and phase-out range. A third possible model suggests that employees perceive the EITC merely as a lump sum payment, contingent upon working.

4.1 Model I: Employees respond to the marginal rate

To see the effect of a change in the EITC on wages if employees accurately perceive the EITC schedule, I assume a single labor market with one equilibrium wage and no other taxes. Suppose that there are two types of employees – those who are eligible for the EITC, and those who are ineligible, and that each group is homogeneous (this assumption will be relaxed later). Assume that employees place the same valuation on the EITC as they do on post-tax earnings.[6] Using a standard semi-log formulation for labor supply, tax changes affect labor supply in two ways – through the marginal tax rate (the substitution effect) and through virtual income (the income effect). Consider first the marginal tax rate effect. Assuming EITC-induced changes in wages have no effect on prices, we can write the relationship between the post-tax wage (w) and the pre-tax wage (W) as:

$$w = W(1 - \tau) \qquad (1)$$

[6] Within a rational framework, this will be true only if the discount rate and the interest rate both equal zero. However, Romich and Weisner (2000) posit a behavioral model, suggesting that most recipients prefer to receive the EITC annually rather than monthly because it acts as a form of forced savings, allowing them to accumulate for durable goods purchases.

Taking natural logs of both sides, and differentiating:

$$\frac{dw}{w} = \frac{dW}{W} - \frac{d\tau}{1-\tau} \tag{2}$$

Note that τ is expressed as a marginal tax rate, so it will be negative in the EITC phase-in range, and positive in the EITC phase-out range. Now, recalling the relationship between total labor supply (L_S), the uncompensated elasticity of labor supply (η_S), and the post-tax wage:

$$\frac{dL_S}{L_S} \equiv \eta_S \frac{dw}{w} \tag{3}$$

Equation (3) can be rewritten in terms of the pre-tax wage and the marginal tax rate:

$$\frac{dL_S}{L_S} = \eta_S \left(\frac{dW}{W} - \frac{d\tau}{1-t} \right) \tag{4}$$

Next, it is necessary to take account of the impact that virtual income has on labor supply. Virtual income is defined as $V \equiv (Y+U)-T-(1-\tau)Y$, where τ is the marginal tax rate, Y is annual earned income, T is total tax liability (note that tax liability will be negative for EITC recipients), and U is unearned income. This simplifies to $V = \tau Y - T + U$. Where ζ is the income elasticity, we can add in the virtual income effect:

$$\frac{dL_S}{L_S} = \eta_S \left(\frac{dW}{W} - \frac{d\tau}{1-\tau} \right) + \zeta \frac{dV}{V} \tag{5}$$

At this point, models of tax incidence typically assume that taxation revenue is returned to households in a lump sum fashion, and therefore that the income effect is zero. For payroll taxes and regular personal income taxes, this may not be an unreasonable assumption. However, because a negative income tax is a net transfer from the government to the individual (rather than the other way around), income effects are likely to be important. Moreover, while income and substitution effects operate in the same

direction with positive income tax rates, the phase-in and phase-out rates of the EITC are such that income and substitution effects may operate in opposite directions.

If all employees are *ineligible* for the EITC, the change in labor supply will be:

$$\frac{dL_S}{L_S} = \eta_S \frac{dW}{W} \tag{6}$$

If some fraction θ of the workforce is eligible for the EITC, the change in labor supply can be expressed as:

$$\frac{dL_S}{L_S} = \theta\left\{\eta_S\left(\frac{dW}{W} - \frac{d\tau}{1-\tau}\right) + \zeta\frac{dV}{V}\right\} + (1-\theta)\eta_S\frac{dW}{W} \tag{7}$$

Assuming that eligible and ineligible workers are perfectly substitutable, the relationship between total labor demand (L_D), the elasticity of labor demand (η_D), and the pre-tax wage will be:

$$\frac{dL_D}{L_D} \equiv \eta_D\left(\frac{dW}{W}\right) \tag{8}$$

Setting the change in labor supply equal to the change in labor demand shows how the equilibrium wage will be affected by the introduction or expansion of a tax credit.

$$\frac{dW}{W} = \theta\left(\frac{\eta_S\frac{d\tau}{1-\tau} - \zeta\frac{dV}{V}}{\eta_S - \eta_D}\right) \tag{9}$$

Generalizing to a continuum of types, with different marginal tax rates and virtual incomes, equation (9) can be rewritten in terms of the average marginal EITC rate ($\bar{\tau}$) and the average virtual income ($\bar{V}$):

$$\frac{dW}{W} = \frac{\eta_S \frac{d\bar{\tau}}{1-\bar{\tau}} - \zeta \frac{d\bar{V}}{\bar{V}}}{\eta_S - \eta_D} \tag{10}$$

Assuming that the elasticity of labor demand is negative, the elasticity of labor supply is positive, and the income elasticity is negative, we can predict the effect on wages for the three regions of the EITC (recall that all eligibles are assumed to be homogeneous, and therefore are in the same region of the EITC):

- Phase-in region: The substitution effect will reduce wages, while the income effect will increase wages – so the net effect is indeterminate;
- Flat region: The substitution effect is zero, while the income effect will increase wages – so the net effect is an increase in wages;
- Phase-out region: The substitution effect and the income effect will both increase wages – so the net effect is an increase in wages.

4.2 Model II: Employees respond to the average rate

An alternative model holds that employees respond not to the marginal EITC rate and virtual income, but to the average EITC rate. Such a model might occur through what Liebman and Zeckhauser (2003) describe as "ironing" – in which individuals facing a multi-part schedule respond to the average rate, rather than the marginal rate.[7] Using a natural experiment arising from a change in the child tax credit, Liebman and Zeckhauser estimate that about half of all taxpayers respond to the average rate.

Using the average rate, we can omit virtual income, and use ($\bar{\tau}$) to denote the average of the *average EITC rates* across the labor force:

$$\frac{dW}{W} = \frac{\eta_S \frac{d\bar{\tau}}{1-\bar{\tau}}}{\eta_S - \eta_D} \tag{11}$$

[7] Liebman and Zeckhauser (2003) look at two types of behavior - "ironing" (responding to the average rate) and "spotlighting" (only considering one segment of a schedule). They term these two responses "schmeduling", for instances in which individuals faced with a complex tax or pricing schedule operate on a smeared or inaccurately perceived version.

In equation (10), employees responded to mean virtual income, and the mean *marginal* EITC rate. In equation (11), they respond only to the mean *average* EITC rate. Assuming downward sloping labor demand and upward sloping labor supply, this model predicts that the EITC should boost labor supply for employees in all three regions of the credit. Therefore, the wage effect should be negative regardless of whether the average worker in the labor market is in the phase-in, flat, or phase-out range. This would be consistent with research that has shown that the EITC induces workers to enter the labor force, but inconsistent with the finding of Eissa and Hoynes (2004) that the EITC decreases labor force participation by low-income married women, who tend to be in the phase-out range.

4.3 Model III: Employees treat the EITC as a lump-sum payment

A third possibility is that employees respond simply to receiving the EITC – regarding it as a lump sum benefit provided to all workers who earn less than a given threshold. This could occur either because employees accurately perceive the EITC schedule but have little control over their hours, or because employees do not have sufficient knowledge about the applicable EITC rules. If such a model applied, wages would simply be proportional to the fraction of employees who are in receipt of the EITC:

$$\frac{dW}{W} = \alpha \frac{d\theta}{\theta} \qquad (12)$$

Note that while this model does not accord with the reality of how the EITC operates (in that it ignores both the phase-in and phase-out region), it appears to be the model that is reinforced by much of the advertising about the EITC. Publicity material from the IRS and non-profit organizations typically describes the EITC as a "boost" to earnings, and mentions only the earnings threshold and maximum EITC payment – which could give the misleading impression that the EITC is a lump sum, rather than a benefit which increases and then decreases with earnings.[8]

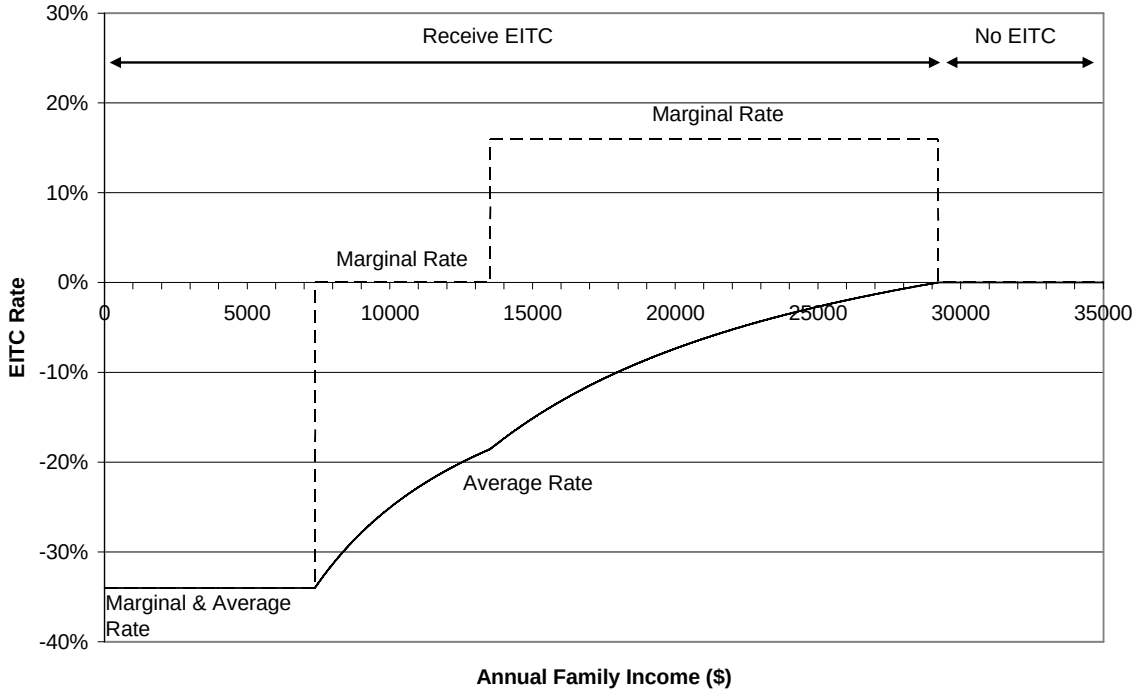
[8] See for example Internal Revenue Service, "Possible Federal Tax Refund Due to the Earned Income Credit (EIC)", Notice 797, November 2002; Center on Budget and Policy Priorities, "EITC Outreach Kit"; DC Fiscal Policy Institute, "EITC Outreach Materials".

This model of the EITC would also be consistent with most studies on the EITC, which have found a large positive effect on the participation margin, but smaller effects on the hours margin. It would also be consistent with Eissa and Hoynes (2004), since even if families regarded the EITC as a lump sum payment, the income effect of the credit might reduce hours worked for those already in employment, and lower participation rates for secondary earners.

4.4 Implications of the three models

Figure 3 allows a graphical comparison of the three models in the case of an unmarried taxpayer with one child in 2002. Models I and II are illustrated by the marginal rates and average rates on the vertical axis, while Model III is depicted by the two intervals along the top of the graph, denoted as "Receive EITC", and "No EITC". Note that in each of these models, the wage response does not depend upon employers discerning whether employees are eligible or ineligible. The EITC simply causes a shift in labor supply, which then has a corresponding impact on the equilibrium wage. The effect of a given change in labor supply on wages depends on the elasticity of labor supply and demand. However, as Katz (1998) points out, there is much uncertainty over the size of these two parameters. In particular, estimates of the elasticity of labor demand have tended to be larger in magnitude when estimated using an exogenous supply shock, such as immigration (eg. Borjas 2003) than the labor demand elasticities that have been found in the minimum wage literature (eg. Card and Krueger 1995).

Figure 3: Three Models of the EITC - Single Taxpayer with One Child in 2002



In general, the effect of an increase in the EITC on pre-EITC wages should be the same for eligible and ineligible employees within the same labor market. However, one could imagine exceptions to this, if employers had some information about EITC eligibility. Employers might seek to lower wages differentially if there was a prevailing belief that it would be "unfair" for eligibles and ineligibles to have their wages change by the same amount (Bewley 2002). Alternatively, if job turnover imposed a cost on employers, they might be more willing to reduce wages for eligibles than ineligibles, since an indiscriminate wage reduction would cause the after-tax wage of some ineligibles to fall below their reservation wage, and they would therefore quit.

Two other factors might affect the incidence of the EITC. First, if employees do not respond to EITC rates until the following year, or if wages are sticky in the short term, it is possible that the correct independent variable should be some lag of the EITC rate. Second, although the preceding specifications control for the minimum wage, they do not take account of the possible interaction between the EITC and the minimum wage. It is

possible that a higher minimum wage might limit the extent to which the equilibrium wage can fall when the EITC is increased.[9]

5. What is the net effect of the EITC on wages?

5.1 Evidence from state EITCs

In assessing the incidence of the EITC, I first analyze the net impact of increasing the generosity of the EITC, before turning in the next section to considering more precisely how employees respond to the credit. Although looking at the net effect does not allow one to explicitly separate the effect on wages in the phase-in, flat, and phase-out regions, it is still possible to make some theoretical predictions of the expected net effect under the three models, based on the observed distribution of EITC recipients across the EITC schedule. If employees respond to the marginal EITC rate and virtual income (as Model I suggests), labor supply will fall for those in the flat area and phase-out region, and may rise or fall in the phase-in region. Since only about one-quarter of EITC recipients are in the phase-in region (Hoffman and Seidman 2003, 49), and the average marginal EITC rate is negative (Table 4), the net effect on labor supply will be negative, and thus the net effect on wages will be positive.

Alternatively, if employees respond to the average EITC rate (Model II), the net effect on labor supply will be positive, and therefore the average effect on wages will be negative – since the average EITC rate is negative at all points on the schedule. And lastly, if employees respond to the EITC as a lump sum work benefit (Model III), the net effect will also be ambiguous – depending upon the effect that it has on the employment decisions of those considering entering work and those near the phase-out point. Looking at the effect on net wages will therefore allow us to distinguish between the marginal rate model (which predicts that wages should rise when the EITC becomes more generous) and the average rate model (which predicts that wages should fall when the EITC

[9] Bluestone and Ghilarducci (1996) are of the view that a higher minimum wage will increase the incidence of the EITC on the employee, and argue that the EITC and the minimum wage should therefore be raised together. The same argument has been made in Australia (from the opposite perspective). The chief proponents of introducing an Australian EITC have argued that it should be accompanied by a three-year freeze in minimum wage rates, in order to lower real pre-tax wages (see for example Dawkins 2000).

becomes more generous), but will not provide useful evidence on the lump sum work benefit model.

As a prequel to analyzing the wage effect, I first look at the impact of boosting the generosity of state EITCs on two measures of labor supply – participation and hours worked. Data are from the Current Population Survey Merged Outgoing Rotation Group, with the sample restricted to those aged 25-55 and not self-employed. When looking at hours worked and wages, the sample is further restricted to those in the labor force. More detail on the wage data is provided in the Data Appendix. Table 4 presents summary statistics for the sample of earners.

Table 4: Summary Statistics

	Obs	Mean	Std. Dev.
Log real hourly wage	1,614,107	2.699	0.533
Male	1,614,107	0.540	0.498
Age	1,614,107	38.304	8.487
Black	1,614,107	0.109	0.311
Hispanic	1,614,107	0.0759	0.264
Other non-white	1,614,107	0.0366	0.187
Years of education	1,614,107	13.424	2.684
Children	1,614,107	0.854	1.0315
Married	1,614,107	0.697	0.459
Actual marginal EITC rate	325,917	-0.00152	0.0352
State unemployment rate	1,614,107	0.0595	0.0168
Log real minimum wage	1,614,107	1.708	0.0660
Maximum AFDC benefit	1,614,107	6.111	0.426
Welfare reform	1,614,107	0.309	0.462
AFDC waiver	1,614,107	0.288	0.453
Top marginal state tax rate	1,614,107	0.0516	0.0327
Log real GSP per capita	1,529,154	10.386	0.169

Notes:
1. Sample is all aged 25-55, employed but not self-employed, with positive hours and earnings.
2. Hourly wages are deflated using the monthly CPI-U.
3. Families with more than three children are coded as having three children.
4. Sample size is smaller for actual marginal EITC rate, since this only includes individuals who were interviewed in March, and provided their family income. Sample size is also smaller for GSP data, since 2002 data has not yet been released.

To calculate the net effect of the EITC on labor supply and wages, I exploit variation in state EITC rates. Since state EITC rates simply act as a supplement to the federal program, they should magnify the overall impact of the EITC on wages. However, because state EITC supplements augment the federal EITC by a fixed fraction, their impact will be larger in years when the federal EITC was more generous. It is therefore

necessary to form a measure of the generosity of the federal EITC in a given year. In the primary specifications, I use the log real maximum credit amount available to a family with one child, but also test its robustness to using an alternative measure of generosity: the log of real per capita spending on the EITC.

To see the effect of EITC generosity on labor supply and wages, I estimate the following equations:

$$LS_{ist} = \alpha + \beta\rho_{st} + \delta X_{ist} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{ist} \quad (13)$$

where LS is a measure of labor supply (participation or log hours), ρ is the log of the maximum value of the EITC for a family with one child, taking into account any applicable state supplement, X is an exhaustive set of demographic characteristics for the individual and their spouse, Z is a set of state characteristics (the unemployment rate, the minimum wage, the top marginal state tax rate on wage income, welfare generosity, and dummies for whether the state had ever obtained an AFDC waiver or implemented welfare reform), ζ is a vector of state dummies, and λ is a vector of year fixed effects multiplied by a dummy denoting whether or not the individual had a dependent child. Note that this is a more stringent restriction than the usual approach of merely including time dummies, since it allows time effects to operate differently for families with and without children. I also include linear time trends for all demographic variables (including quadratic trends makes no substantive difference to the results). Although appropriate data on family structure are available in the CPS from 1984 onwards, few states provided EITC supplements during the 1980s. I therefore restrict the sample to the 14-year period 1989-2002.[10] Standard errors are clustered at the state level, to take account of serial correlation (Bertrand, Duflo and Mullainathan 2002).

Table 5 shows the relationship between the EITC and labor supply across different skill groups, with and without children. Panels A and B show the impact of the EITC on the extensive margin (employment), while panels C and D measure the impact on the intensive margin (hours). Since fixed effects probit models are known to be biased, the

[10] Determining the appropriate point to begin the sample is necessarily somewhat arbitrary. The numbers of states with EITCs during the 1980s were: 1984-86: 1, 1987: 2, 1988: 3, 1989: 4.

employment effect is estimated using a linear probability model. On the extensive margin, boosting the EITC has a significant positive effect on labor force participation of adults with children – with a 10 percent rise in EITC generosity boosting the probability of employment by 0.6 percent. Most of this effect is concentrated among high-school dropouts with children – for whom boosting the EITC by 10 percent increases participation by 1.8 percent. There is no significant relationship between EITC generosity and employment among higher skill groups with children, nor for childless adults.

Table 5: How do state EITC supplements affect labor supply across education groups?

	(1) All adults	(2) High school dropouts	(3) High school diploma only	(4) College graduates
Dependent variable: Whether employed				
Panel A: Adults with children				
Log maximum EITC for a family with 1 child	0.0623**	0.183***	0.0507	0.0269
	(0.0233)	(0.0500)	(0.0395)	(0.0336)
Observations	651,618	77,970	232,902	173,587
R-squared	0.15	0.20	0.12	0.14
Fraction EITC-eligible	*23.8%*	*50.5%*	*27.4%*	*12.1%*
Panel B: Adults without children				
Log maximum EITC for a family with 1 child	0.00273	-0.00668	0.0117	-0.0140
	(0.0173)	(0.0545)	(0.0249)	(0.0242)
Observations	725,195	90,747	257,309	198,954
R-squared	0.10	0.09	0.05	0.03
Fraction EITC-eligible	*5.6%*	*10.8%*	*5.8%*	*3.6%*
Dependent variable: Log hours per week				
Panel C: Workers with children				
Log maximum EITC for a family with 1 child	0.0798***	-0.0172	0.0714***	0.129***
	(0.0192)	(0.0425)	(0.0212)	(0.0231)
Observations	488,360	45,283	172,436	141,923
R-squared	0.16	0.11	0.16	0.16
Fraction EITC-eligible	*20.5%*	*43.5%*	*24.4%*	*11.5%*
Panel D: Workers without children				
Log maximum EITC for a family with 1 child	0.0189	-0.000436	-0.0319**	0.0858**
	(0.0192)	(0.0580)	(0.0141)	(0.0373)
Observations	555,402	49,611	191,730	171,736
R-squared	0.06	0.05	0.06	0.03
Fraction EITC-eligible	*3.9%*	*7.2%*	*4.0%*	*2.9%*

Notes:

1. Sample is 1989-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Standard errors are clustered at the state level.
2. Employment is estimated using a linear probability model.
3. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. The regressions also include the following state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform,

state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.

4. Fraction EITC-eligible is calculated only for those respondents who were interviewed in the March CPS, and whose annual income is known.

On the intensive margin (Panels C and D of Table 5), the effect of increasing the EITC is again positive and significant for workers with children, and insignificant for workers without children. Raising the generosity of the EITC by 10 percent leads to a 0.8 percent increase in log hours for those with children. Disaggregating the effect by skill groups, however, the effect appears to be concentrated in the higher-skill groups. The absence of an observed hours effect among high-skill dropouts with children is most likely due to compositional changes – since those who enter the labor market most likely work fewer hours than those already in the labor force, this will bring down the average number of hours for that group, making it difficult to discern the impact on the intensive margin.

One change remains something of a mystery. While there is no significant effect on hours for childless workers as a group, disaggregating this category by education suggests that a more generous EITC has a significant *negative* effect on hours for childless workers with a high-school diploma, and a significant *positive* effect on hours for childless college graduates. Since the two groups have a low exposure rate to the EITC (4.0 and 2.9 percent respectively), the observed employment effect is something of a mystery.

In sum, it seems that an increase in the generosity of the EITC has a much stronger positive effect on labor force participation of those with children than those without. I therefore proceed to estimate the impact of EITC generosity ρ on the real pre-tax hourly wage w, which is deflated by the monthly CPI:

$$\ln(w)_{ist} = \alpha + \beta\rho_{st} + \delta X_{ist} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{ist} \qquad (14)$$

Table 6 shows the result from estimating this equation. Across the entire adult workforce, a 10 percent increase in the generosity of the EITC is associated with a 1 percent fall in hourly wages – a substantial drop, given that in 2002 only 14 percent of adult workers were eligible for the EITC. Table 6, Panel A shows the effect of state EITC supplements on three population subgroups: high school dropouts, high school graduates, and college graduates. Across the population, supplementing the EITC is associated with a significant

wage reduction for the low-skilled, but has no effect on high-skill wages, suggesting that the wage effect is due to the policy itself, rather than extraneous factors. The effect is large and significant: when the generosity of the EITC is increased by 10 percent, wages for high school dropouts fall by 4 percent, and wages for those with only a high school diploma fall by 2 percent.

Table 6: How do state EITC supplements affect hourly wages across education groups?

Dependent variable: Log real hourly wage				
	(1) **All adults**	**(2)** **High school dropouts**	**(3)** **High school diploma only**	**(4)** **College graduates**
Panel A: With and without children				
Log maximum EITC for a family with 1 child	-0.134**	-0.386***	-0.193**	-0.000893
	(0.0637)	(0.102)	(0.0735)	(0.0564)
Observations	1,043,762	94,894	364,166	313,659
R-squared	0.33	0.20	0.20	0.15
Fraction EITC-eligible	*11.6%*	*24.6%*	*13.4%*	*6.8%*
Panel B: With children				
Log maximum EITC for a family with 1 child	-0.161**	-0.450***	-0.167*	-0.0427
	(0.0783)	(0.135)	(0.0949)	(0.0566)
Observations	488,360	45,283	172,436	141,923
R-squared	0.37	0.22	0.23	0.16
Fraction EITC-eligible	*20.5%*	*43.5%*	*24.4%*	*11.5%*
Panel C: Without children				
Log maximum EITC for a family with 1 child	-0.119*	-0.341***	-0.220***	0.0279
	(0.0604)	(0.0917)	(0.0732)	(0.0692)
Observations	555,402	49,611	191,730	171,736
R-squared	0.30	0.19	0.17	0.14
Fraction EITC-eligible	*3.9%*	*7.2%*	*4.0%*	*2.9%*

Notes:

1. Sample is 1989-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Standard errors are clustered at the state level.
2. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. The regressions also include the following state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.
3. Fraction EITC-eligible is calculated only for those respondents who were interviewed in the March CPS, and whose annual income is known.

Recall that because three-quarters of EITC recipients are in the flat or phase-out region, the marginal rate model predicts that an increase in the generosity of the credit should cause wages to rise. Since we observe a rise in labor force participation (and a fall in hourly wages) when the EITC becomes more generous, this suggests that employees are

not responding to the marginal rate, but are instead either responding to the average rate or treating the EITC as a lump sum benefit. In section 5, I adopt a different empirical strategy in order to better address this question.

Is the effect of the EITC to reduce wages more for workers with children than those without children? As we have seen, the EITC is substantially more generous for employees with children, and the effect on labor force participation is significantly higher for this group. If employees are affected primarily by their own EITC rate, the wage effect of a boost in all EITC rates should be much more pronounced for workers with children than for those without (indeed, for 5/14 of the years under analysis, the EITC was unavailable to childless employees). Alternatively, if most labor markets have similar proportions of employees with and without children, and employees' wages are primarily affected by the average EITC parameters in their specific labor markets, we might expect that an increase in the generosity of the EITC will have the same effect on the wages of workers with and without children.

Panels B and C of Table 6 show the effect of increasing the generosity of the EITC on the hourly wages of workers with and without children. As the bottom row of each panel shows, the fraction of workers eligible for the EITC is four to five times higher among those with children than those without. Yet for the two lowest skill groups, an increase in the generosity of the EITC has a similar effect on the wages of workers with and without children. For high school dropouts, the wage drop associated with a 10 percent increase in the EITC is slightly greater for those with children (-5 percent) than for those without children (-3 percent). For those with only a high school diploma, the reduction in wages is approximately the same for those with and without children (-2 percent). If what mattered was a worker's own EITC rate, we should expect to see quite much larger wage effects for employees with children. The fact that the wage effect is similar for those with and without children suggests that more emphasis should be placed upon the average EITC in a worker's labor market than on their own EITC rate.

In Table 7, I present three robustness checks. First, because state EITC supplements have been shown to be positively related to GSP, Panel A includes a control for log GSP per capita. Including GSP has no notable effect on the coefficients for high school dropouts and high school graduates, though it causes the coefficient on wages across the entire

labor force to increase modestly. Next, Panel B shows the effect of excluding those states whose EITC supplements were non-refundable (which could potentially have a different effect on wages). Again, the coefficients remain unchanged. Finally, Panel C shows the results using an alternative measure of EITC generosity: total EITC expenditure. For each year, I divide real spending on the federal EITC by the national population. Where a state provides an EITC supplement, I multiply the per capita spending by (1+state supplement for a family with one child). The coefficients reported from the regression in Panel C are virtually identical to those from the first measure of EITC generosity.

Table 7: State EITC supplements and hourly wages – robustness checks

Dependent variable: Log real hourly wage				
	(1) **All adults**	**(2)** **High school dropouts**	**(3)** **High school diploma only**	**(4)** **College graduates**
Panel A: Controlling for GSP				
Log maximum EITC for a family with 1 child	-0.170***	-0.400***	-0.211***	-0.0579
	(0.0500)	(0.107778)	(0.0626)	(0.0428)
Log GSP per capita	0.308***	0.363**	0.283***	0.361***
	(0.0668)	(0.158)	(0.0783)	(0.0579)
Observations	923,102	85,859	328,406	272,569
R-squared	0.33	0.21	0.20	0.15
Panel B: Omitting states with non-refundable EITCs				
Log maximum EITC for a family with 1 child	-0.134**	-0.392***	-0.191**	-0.00420
	(0.0636)	(0.100)	(0.0731)	(0.0564)
Observations	995,683	91,321	348,412	298,112
R-squared	0.33	0.20	0.20	0.15
Panel C: Using per-capita EITC spending as the measure of EITC generosity				
Real per capita EITC spending	-0.134**	-0.386***	-0.193**	-0.000893
	(0.0637)	(0.102)	(0.0735)	(0.0564)
Observations	1,043,762	94,894	364,166	313,659
R-squared	0.33	0.20	0.20	0.15

Notes:

1. Sample is 1989-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Standard errors are clustered at the state level.
2. Sample with GSP control does not include 2002, since GSP statistics for that year have not yet been released.
3. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. The regressions also include the following state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.
4. Real per capita EITC spending is calculated annually using total EITC expenditure figures. Where a state has a state EITC, the figure is scaled up by the supplement rate for a family with one child.

5.2 Lagged EITC effects

Do past EITC rates affect wages? Given that the EITC is paid only at the end of the year, it is plausible that potential recipients only learn about an increase in EITC generosity at the time of filing tax returns. Another reason why lagged EITC rates might have an effect on wages is if wages are sticky in the short term. Table 8 shows the effect of lagged EITC rates for high school dropouts (the group whose wages are most affected by the EITC). In columns (1) to (3), lagged EITC generosity is included without a control for the current period rate. The generosity of the EITC one year ago, or three years ago, has a statistically significant negative effect on hourly wages, with a magnitude similar to the current period rate. The coefficient of the rate six years ago is negative but insignificant. Controlling for the current period EITC rate, the generosity of the EITC in earlier years has no significant effect on wages, suggesting that the primary effect of the EITC on wages occurs in the same year as the increase.

Table 8: Do lagged EITC rates affect hourly wages?

Dependent variable: Log real hourly wage *Sample is high school dropouts only*						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Maximum EITC (t)				-0.500**	-0.397***	-0.379***
				(0.198)	(0.122)	(0.113)
Maximum EITC (t-1)	-0.379***			0.135		
	(0.118)			(0.205)		
Maximum EITC (t-3)		-0.361***			0.0186	
		(0.132)			(0.150)	
Maximum EITC (t-6)			-0.194			0.0244
			(0.187)			(0.109)
Observations	94,894	94,894	94,894	94,894	94,894	94,894
R-squared	0.20	0.20	0.20	0.20	0.20	0.20

Notes:

1. Sample is 1989-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Standard errors are clustered at the state level.
2. "Maximum EITC" is the log of the real maximum EITC for a family with 1 child
3. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. The regressions also include the following state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.

5.3 EITC incidence and the minimum wage

Another issue is whether the net wage effect of the EITC differs if an EITC increase coincides with a rise in the minimum wage. Theory suggests that a higher minimum wage might constrain employers from reducing wages to the equilibrium wage – therefore placing more of the incidence on the worker. Table 9 shows the effect of interacting the real log minimum wage (standardized in each year to a mean of zero and a standard deviation of one) with the generosity of the EITC. While a higher minimum wage is associated with higher hourly wages (a one standard deviation increase in the minimum wage is associated with a 20 percent increase in the hourly wage of high school dropouts), the interaction term is negative and significant – suggesting that a higher minimum wage is associated with a *larger* drop in hourly wages. This is a surprising result, but it should also be noted that the magnitude of this coefficient is small. For states with an average minimum wage, a 10 percent increase in the EITC is associated with a 4 percent fall in the hourly wages of high school dropouts. For a state whose minimum wage is one standard deviation above the average in that year, a 10 percent increase in the EITC is associated with a 4.2 percent fall in hourly wages of dropouts.

Table 9: Does the minimum wage affect EITC incidence?

Dependent variable: Log real hourly wage *Sample is high school dropouts only*		
	(1) **No GSP control**	**(2)** **Controlling for log GSP per capita**
Log maximum EITC for a family with 1 child	-0.394***	-0.414***
	(0.108)	(0.110)
EITC supplement*minimum wage	-0.0289***	-0.0289***
	(0.00967)	(0.00883)
Log real minimum wage (normalized)	0.208***	0.209***
	(0.0700)	(0.0635)
Log GSP per capita		0.403**
		(0.158)
Observations	94,894	85,859
R-squared	0.20	0.21

Notes:

1. Sample is 1989-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Standard errors are clustered at the state level.
2. Minimum wage is normalized by year to a mean of zero and a standard deviation of unity.
3. Sample with GSP control does not include 2002, since GSP statistics for that year have not yet been released.
4. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. They also include the same state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum

AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.

5.4 How might interstate migration and compositional changes affect these estimates?

Two additional issues might affect the extent to which one can make out-of-sample predictions based upon these results. The first is interstate mobility. When a state increases its EITC, wages will be affected not only by changes in the participation of low-skilled workers, but also by migration of low skilled workers from states where the EITC is less generous. In the case of income taxation, Feldstein and Wrobel (1998) find that interstate migration causes gross wages to adjust in response to tax changes, until the net wage is equal across states. By contrast, a change in the federal EITC may increase the participation of low-skilled workers, but is unlikely to have any significant effect on immigration from other countries.

Since interstate migration is positively related to education (Rosenbloom and Sundstrom 2003) one might expect changes in state income taxes to induce less interstate migration than do changes in state EITC supplements. Nonetheless, interstate migration may still be driving some of the results in the previous sub-section. If this were the case, a 10 percent boost in EITC generosity from a state EITC supplement would have a more substantial effect on wages than a 10 percent increase in the generosity of the federal EITC.[11]

Another factor that might affect the foregoing results is the extent to which they are attributable to compositional changes. One possible explanation for the observed fall in low-skill wages is that it is mostly due to a compositional effect, as distinct from a supply effect. For example, if those induced to enter the workforce are less experienced than the average low-skill employee, they would most likely be paid less than the average for an employee of their education level. An increase in the EITC would therefore cause the mean wage to fall, but without affecting those who were already in the workforce.

[11] One way of looking at the effect on equilibrium wages of an increase in the federal EITC is to exploit the fact that the credit is directed only at those in the bottom quintile. Therefore, when the federal credit rises, states with a higher fraction of poor workers should see equilibrium wages fall further than states with fewer poor workers. In a wage regression, the interaction term between the generosity of the federal credit and the fraction of workers in the bottom quintile in a state is indeed negative and significant (results not shown). However, it is difficult to compare magnitudes between this specification and the specifications in section 4.1.

One way of placing an upper limit on the composition effect is to carry out a bounds analysis (Manski 1995). To begin with, note that the composition effect is likely to be an issue only for single women. Estimating the effect of the EITC on labor force participation of other demographic groups, Meyer and Rosenbaum (2001) find no significant employment effects.

To calculate an upper bound for the composition effect, I assume that the rise in labor force participation by single women was due entirely to the EITC, and that all single women who entered the workforce earned the minimum wage. In states that had an EITC supplement at any point during the interval 1989-2002 ("EITC states"), single women constituted 16.5 percent of employed high school dropouts in 1989 and 18.0 percent of employed high school dropouts in 2002.[12] During this period, the minimum wage in EITC states was 53 percent of the mean wage for high school dropouts. So over the fourteen-year period, the 1.5 percentage point increase in the fraction of high school dropouts who were single women could have reduced the mean real wage for all high school dropouts in EITC states by as much as 0.7 percent (0.015*0.53).

This upper bound for the composition effect is relatively modest when compared with the overall effect of the EITC on wages. In Table 7, the coefficient on the generosity of the EITC was -0.4. From 1989 to 2002, the mean state EITC supplement applicable to a high school dropout in an EITC state rose from 1 percent to 14.7 percent. Holding other factors constant, this should have led to a 5 percent fall (-0.4*.137) in hourly wages for high school dropouts in these states. Even assuming that cross-state migration diluted some of this effect, changes in the composition of the low-skill workforce are clearly insufficient to account for the observed wage drop.

In this section, I used variation in state EITC supplements to analyze the net effect of the EITC on hourly wages. I found that hourly wages for lower-skilled workers fell when the generosity of the EITC was increased, and that the effect was similar for workers with and without children. This suggests that the appropriate model for analyzing the EITC is

[12] Although the economy was performing more poorly in 2002 than in 2001, I find no difference in participation rates among low-income single women in the two years.

to consider the impact of the mean credit parameters in an employee's labor market. In section 5, I adopt such an approach, using variation in the average EITC in a labor market to distinguish between the three possible models of EITC incidence.

6. How do the typical EITC parameters in an employee's labor market affect wages?

Evidence that an increase in EITC generosity reduces hourly wages on net suggests that employees are most likely not responding to the marginal EITC rate, but are instead responding to the average EITC rate or are treating the credit as a lump sum benefit. To test this more formally, I now analyze the effect on wages of the average federal EITC parameters in an employee's labor market. Note that this strategy differs from section 4, which used variation in state EITC supplements, and assigned the same level of "EITC generosity" to all employees in a given state and year. In using the average EITC parameters in an individual's labor market, this approach also differs from standard tax incidence models, which use the individual's own tax parameters. The results in section 4 support such an approach. Since increasing the generosity of the EITC has a similar impact on the wages of those with and without children, merely applying a standard tax incidence model would not capture the effect of the EITC on the equilibrium wage.

To define an individual's labor market, I adopt two characterizations. One assumes that employees' wages depend upon their three-digit occupation code (these are occupations at the level of elementary school teachers, janitors, and farm workers). An alternative assumes that employees' wages depend upon their gender, age and education. Dividing the adult population into two gender groups, six five-year age groups and four education groups, I construct a total of 48 gender-age-education groupings (eg. female college graduates aged 40-45). In each case, I assume that labor supply is inelastic across labor markets.

Within each labor market and year, it is then necessary to determine the average EITC parameters. Due to the way that the EITC operates, four factors determine the EITC parameters in a labor market: (i) the income distribution for employees with zero, one, two, and three children; (ii) the fraction of employees with zero, one, two, and three children; (iii) the parameters of the federal EITC; and (iv) the parameters of the state

EITC supplement. In this section, I ignore state EITC supplements (omitting states which had EITC supplements makes no substantive difference to the results).

One factor that could potentially bias estimates of the effect of changes in the EITC rate in a labor market is if the income distribution or average number of children in the labor market changed. This would affect the EITC parameters, but might also have an independent effect on wages. It is therefore necessary to construct a simulated instrument for the EITC rate (in the spirit of Currie and Gruber 1996). For ease of explication, I explain below how the instrument is constructed for the case in which an employee's labor market is taken to be their three-digit occupation. The process is analogous for the case in which an employee's labor market is taken to be determined by his or her gender-age-education cell.

To construct a simulated instrument for the EITC rate in an occupation, I use the 1 percent sample of the 1990 census to calculate precise measures of family structure and income distribution (by centile) within each occupation. For each of the years 1984-2002, I calculate the actual earnings of taxpayers at the 1st centile, 2nd centile, and so on, using the March CPS. Holding constant the family structure and income distribution within each occupation, I can then assign a dollar income to each type of family in each occupation. Using the National Bureau of Economic Research's Taxsim program, I then calculate for each occupation and year the fraction of EITC-eligible employees and the average EITC tax rate. I also calculate the marginal tax rate and the average amount of virtual income, which can then be split into EITC and non-EITC components (see Data Appendix for details). These tax rates are a simulated instrument for the actual tax parameters within a given occupation. In a similar manner, a simulated instrument is constructed for the EITC parameters in each gender-age-education cell.

There are a number of benefits to adopting such an approach. First, it accords with the theoretical model above and with the findings from variation in state EITC supplements. Second, using the census 1 percent sample to determine family structure and income distribution within a labor market provides much more precise measures than the CPS. Third, using a different dataset to construct the simulated instrument eliminates the possibility of correlation between the error in the wage equation and in the tax rate. And fourth, by using average EITC parameters rather than the individual's own parameters, I

need not assume – as most of the previous literature has done – that an employee's marital status and number of children is exogenous with respect to the generosity of the EITC.[13]

Before considering the impact of the EITC on wages, I first consider whether the marginal EITC rate, average EITC rate, and fraction of EITC-eligible employees have discernable impacts on labor supply. Since incidence is an echo of the labor supply effect, an absence of a clear labor supply effect means that there will not be a systematic relationship between the EITC and wages. To take into account both the participation and hours margin, I measure labor supply in two ways: as the fraction of employees who are in a given labor market and as the number of hours worked by employees in a given labor market. Formally, I estimate the following regression:

$$LS_{isjt} = \alpha + \beta(\textit{EITC parameters})_{jt} + \delta X_{ist} + \theta_j + \psi_{jt} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{isjt} \qquad (15)$$

where *EITC parameters* are either (a) virtual income and the log after-tax share based on the marginal rate, (b) the log after-tax share based on the average rate, or (c) the fraction eligible. LS is a measure of labor supply for person i in state s in labor market j at time t, X is a vector of individual characteristics, θ is a fixed effect for the employee's labor market group (ie. their occupation or gender-age-education cell), ψ is a linear time trend for the employee's labor market group, Z is a vector of economic characteristics and state policy variables, ζ is a state fixed effect, and λ is a vector of year fixed effects multiplied by a dummy denoting whether or not the individual had a dependent child. Excluding state dummies and characteristics makes no substantive difference to the results. For ease of computation, I use the simulated EITC parameters directly, instead of instrumenting for the true EITC parameters with the simulated parameters.

Table 10 shows the results of this regression, using employment share as a measure of labor supply. In each case, the marginal EITC rate is analyzed using two specifications:

[13] Ellwood (2000) finds only minimal effects of the EITC on marriage rates, but some impact on cohabitation patterns, suggesting that the impact of the EITC on family structure might become more apparent in the future. Baughman and Dickert-Conlin (2003) estimate that a 10 percentage point increase in the maximum EITC benefit increases the probability of non-white women having a first child or an additional child by 0.3 percent, while having no effect on the childbearing decisions of white women.

one that takes account only of the EITC, and ignores other taxes; and another which separates the marginal tax rate and virtual income into EITC and non-EITC components. In neither specification is there any consistent relationship between labor supply and the log after-tax share using the marginal EITC rate. This is consistent with the finding in section 4 that a more generous EITC reduces hourly wages.

Table 10: Labor supply under three different EITC models – participation margin

Dependent variable: Share of total employment in employee's labor market*100

All respondents are assigned the average EITC parameters for their labor market

	(1)	(2)	(3)	(4)
Panel A: 3-digit occupation as labor market				
Ln (1-$\tau_{\text{Marginal EITC rate}}$)	-0.0165	-0.0160		
	(0.0190)	(0.0202)		
Virtual Income (EITC component)	0.00111*	0.00112*		
	(0.000668)	(0.000668)		
Ln (1-$\tau_{\text{Marginal tax rate, excl EITC}}$)		0.000690		
		(0.00142)		
Virtual Income (Excl EITC comp.)		0.000009		
		(0.000033)		
Ln (1-$\tau_{\text{Average EITC rate}}$)			-0.0186**	
			(0.00840)	
% EITC-eligible				0.00247*
				(0.00137)
Observations	645,643	645,643	645,643	645,643
R-squared	0.83	0.83	0.83	0.83
Panel B: Gender-age-education cell as labor market				
Ln (1-$\tau_{\text{Marginal EITC rate}}$)	-0.0144	-0.0174		
	(0.0138)	(0.0140)		
Virtual Income (EITC component)	0.00111***	0.0011***		
	(0.000400)	(0.000395)		
Ln (1-$\tau_{\text{Marginal tax rate, excl EITC}}$)		0.000711		
		(0.00106)		
Virtual Income (Excl EITC comp.)		0.0000347		
		(0.0000216)		
Ln (1-$\tau_{\text{Average EITC rate}}$)			-0.0205***	
			(0.00712)	
% EITC-eligible				0.00277***
				(0.000876)
Observations	1,613,769	1,613,769	1,613,769	1,613,769
R-squared	0.84	0.84	0.84	0.84

Notes:

1. Sample is 1984-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Due to computing limitations, Panel A is a randomly selected 40% sub-sample of the available cases. Standard errors are clustered at the labor market level (occupation in Panel A, gender-age-education cell in Panel B).
2. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors in parentheses.
3. 2. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. They also include the same state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been

granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.

4. In addition, all specifications include a fixed effect for each labor market (occupation in Panel A, gender-age-education cell in Panel B), and a linear time trend for each labor market.

By contrast, both the average EITC rate and the fraction of EITC-eligible employees in a labor market appear to significantly affect labor supply in the expected direction. Recall that since the EITC is a negative income tax, an increase (decrease) in the after-tax share is equivalent to a fall (rise) in the EITC. The coefficient on the log after-tax share using the average rate is negative and significant, indicating that a rise in the average EITC is associated with an increase in employment in that labor market. Likewise, when the fraction of EITC-eligible employees in a labor market rises, the employment share in that labor market also increases.

Table 11 presents results using usual weekly hours as the dependent variable. In common with the existing literature on the EITC and labor supply, I find no systematic relationship between any of the measures of EITC generosity and the usual weekly hours worked in a labor market, with the exception of the fraction of EITC-eligible employees, which appears to be negatively correlated with usual hours.

Table 11: Labor supply under three different EITC models – hours margin

Dependent variable: Employee's usual weekly hours

All respondents are assigned the average EITC parameters for their labor market

	(1)	(2)	(3)	(4)
Panel A: 3-digit occupation as labor market				
Ln (1-$\tau_{\text{Marginal EITC rate}}$)	-33.206	-14.654		
	(42.500)	(44.412)		
Virtual Income (EITC component)	0.129	0.144		
	(1.091)	(1.092)		
Ln (1-$\tau_{\text{Marginal tax rate minus EITC rate}}$)		-16.064		
		(9.828)		
Virtual Income minus EITC comp.		-0.448**		
		(0.198)		
Ln (1-$\tau_{\text{Average EITC rate}}$)			-0.703	
			(9.326)	
% EITC-eligible				-4.149**
				(1.668)
Observations	645,643	645,643	645,643	645,643
R-squared	0.24	0.24	0.23	0.24
Panel B: Gender-age-education cell as labor market				
Ln (1-$\tau_{\text{Marginal EITC rate}}$)	-20.331	-14.520		
	(13.581)	(12.588)		
Virtual Income (EITC component)	-0.118	-0.0501		
	(0.542)	(0.538)		
Ln (1-$\tau_{\text{Marginal tax rate minus EITC rate}}$)		8.615*		
		(4.785)		
Virtual Income minus EITC comp.		0.106		
		(0.0953)		
Ln (1-$\tau_{\text{Average EITC rate}}$)			-2.953	
			(9.326)	
% EITC-eligible				-2.948**
				(1.306)
Observations	1,613,769	1,613,769	1,613,769	1,613,769
R-squared	0.14	0.14	0.14	0.14

Notes:

1. Sample is 1984-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Due to computing limitations, Panel A is a randomly selected 40% sub-sample of the available cases. Standard errors are clustered at the labor market level (occupation in Panel A, gender-age-education cell in Panel B).
2. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors in parentheses.
3. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. They also include the same state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.
4. In addition, all specifications include a fixed effect for each labor market (occupation in Panel A, gender-age-education cell in Panel B), and a linear time trend for each labor market.

These findings indicate that employees do not respond systematically to the marginal EITC rate in their labor market. I therefore proceed to analyze the incidence of the credit with respect only to the average rate and the fraction of EITC-eligible employees. To

determine incidence, I run similar regressions to equation (15), but with real log hourly wages as the dependent variable.

For the effect of the average EITC rate on wages:

$$\ln(w)_{isjt} = \alpha + \beta \ln(1-\tau_{\text{Average EITC rate}})_{jt} + \delta X_{ist} + \theta_j + \psi_{jt} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{isjt} \quad (16)$$

For the effect of the fraction of EITC-eligible employees on wages:

$$\ln(w)_{isjt} = \alpha + \beta(\%\text{EITC-eligible})_{jt} + \delta X_{ist} + \theta_j + \psi_{jt} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{isjt} \quad (17)$$

Table 12 shows the results from this regression. Column (1) shows the results from regressing hourly wages on the log of the after-tax share, using the average EITC tax rate as in equation (16). A coefficient of -1 would mean that the net wage was unaffected by the credit (ie. the entire incidence of the credit was on the worker); while a coefficient of 0 would mean that net wages fell by the full amount of the credit (ie. that the entire incidence of the credit was on the employer).

Table 12: EITC incidence under two different EITC models

Dependent variable: Log real hourly wage *All respondents are assigned the average EITC parameters for their labor market*		
	(1)	**(2)**
Panel A: 3-digit occupation as labor market		
Ln (1-$\tau_{\text{Average EITC rate}}$)	-0.893	
	(0.597)	
% EITC-eligible		-0.545***
		(0.174)
Observations	645,643	645,643
R-squared	0.46	0.46
Panel B: Gender-age-education cell as labor market		
Ln (1-$\tau_{\text{Average EITC rate}}$)	-0.297	
	(0.504)	
% EITC-eligible		-0.354***
		(0.123)
Observations	1,613,769	1,613,769
R-squared	0.33	0.33

Notes:

1. Sample is 1984-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed. Due to computing limitations, Panel A is a randomly selected 40% sub-sample of the available cases. Standard errors are clustered at the labor market level (occupation in Panel A, gender-age-education cell in Panel B).
2. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors in parentheses.
3. All specifications include the following demographic controls: age, age^2, sex, race dummies, sex-race interactions, education dummies, sex-education interactions, a dummy for married, a full set of interactions with the married dummy, and the same characteristics for the spouse. All coefficients are then allowed to take a linear time trend. They also include the same state controls: annual state unemployment rate, the log real minimum wage (the greater of the state and federal minimum wage in the interview month), the top marginal state tax rate on wage income, the log real maximum AFDC/TANF benefit for a family with one adult and two children, a dummy if the state had ever been granted an AFDC waiver, a dummy for whether the state had implemented welfare reform, state fixed effects, and year fixed effects interacted with a dummy for whether the respondent had children.
4. In addition, all specifications include a fixed effect for each labor market (occupation in Panel A, gender-age-education cell in Panel B), and a linear time trend for each labor market.

Using three-digit occupations as labor markets, the coefficient on the after-tax share is -0.9, suggesting that most of the credit goes to the worker. By contrast, using gender-age-education groups, the coefficient on the after-tax share is -0.3, suggesting that a larger fraction goes to the employer than the worker. However, both of these estimates are imprecisely measured, and cannot be distinguished from zero or unity at conventional significance levels. However, they do provide some suggestive evidence that employees respond to the average EITC rate and that the increase in labor supply is associated with a fall in hourly wages.

A clearer effect arises when the fraction of EITC-eligible employees is used as the independent variable. A 10 percent increase in the fraction of EITC recipients in an employee's labor market is associated with a 6 percent fall in wages if three-digit

occupations are used as the employee's labor market, and with a 4 percent fall if the employee's gender-age-education cell is used as her labor market. Both estimates are statistically significant.

Lastly, it is worth noting the welfare implications of the above result. Conventional estimates of the EITC, in which employees respond to the marginal rate, suggest that while there will be a net welfare gain from the negative income tax rate in the phase-in region, this will be partially offset by the deadweight loss due to the positive tax rate in the phase-out range. However, if employees instead respond to the average rate, they will perceive a negative tax rate in all regions of the EITC, even the phase-out range. Therefore, the finding that EITC recipients respond more to the average than to the marginal rate indicates that the net welfare gain of the program is larger than conventional estimates would suggest.

7. Conclusion

Using variation in state EITC supplements, I find that the net effect of increasing the generosity of the EITC is to reduce hourly wages for low-skilled workers. A 10 percent rise in the generosity of the credit reduces hourly wages for high school dropouts by 4 percent, and reduces wages for those with only a high school diploma by 2 percent. The EITC has no effect on the wages of college graduates. Although the EITC has a much larger effect on the labor force participation of workers with children than those without, the wage effect appears to be similar for workers with and without children. This suggests that what matters is the average EITC rate in a labor market, not an employee's own EITC rate. This net downward adjustment in wages indicates that the EITC has less impact on reducing income inequality than if hourly wages were unaffected by the credit.

Variation in the prevailing EITC parameters across labor markets suggests that employees respond to the fraction of EITC-eligible employees in their labor markets, and to the average EITC rate, but not to the marginal rate. This is true whether labor markets are defined according to the employee's occupation or to her gender-age-education cell. A 10 percent increase in the fraction of EITC-eligible workers in an employee's labor market decreases hourly wages by 4-6 percent. The finding that employees respond to the average rate rather than to the marginal rate suggests that the net welfare gain associated

with the EITC is larger than a conventional marginal EITC rate model would have predicted.

These findings also raise the question of why employers do not do more to encourage workers to receive the EITC in their pay packets, so that they can precisely quantify their credits. Since the EITC tends to reduce equilibrium wages, and assuming job turnover imposes a cost on the employer, there may be instances in which the employer would find it more profitable to pay an ineligible worker a wage slightly above the new equilibrium, rather than risk losing the worker in order to lower her wage to the new equilibrium. One answer to this puzzle is that the cost to employers of administering the EITC may simply exceed the efficiency gain. Alternatively, it might be the case that EITC-eligible workers prefer that their employers not know the value of their EITC benefits.

A final implication of this paper applies to poor workers who compete in the labor market with EITC recipients who receive a much larger credit than themselves – for example, childless high school dropouts who work alongside high school dropouts with children. Because those with and without children will generally be paid the same equilibrium wage, childless workers may experience a reduction in their after-tax earnings when the EITC increases. The indirect burden that the EITC imposes on low-income childless adults deserves greater consideration by policymakers.

References

Baughman, R. and S. Dickert-Conlin. 2003. "Did Expanding the EITC Promote Motherhood?", *American Economic Review*, 93(2): 247-251.

Bertrand, M., E. Duflo and S. Mullainathan. 2002. "How Much Should We Trust Differences-in-Differences Estimates?" NBER Working Paper 8841. Cambridge, MA: NBER

Berube, A., A. Kim, B. Forman and M. Burns. 2002. "The Price of Paying Taxes: How Tax Preparation and Refund Loan Fees Erode the Benefits of the EITC". Washington, DC: Brookings Institution and Progressive Policy Institute

Bewley, T. 2002. "Fairness, Reciprocity, and Wage Rigidity", *mimeo*

Bingley, P. and G. Lanot. 2002. "The Incidence of Income Tax on Wages and Labour Supply", *Journal of Public Economics*, 83(2): 173-194

Bluestone, B. and T. Ghilarducci. 1996. "Rewarding Work: Feasible Antipoverty Policy", *American Prospect*, 26: 40-46

Borjas, G. 2003. "The Labor Demand Curve is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market". NBER Working Paper 9755. Cambridge, MA: NBER

Card, D and A. Krueger. 1995. *Myth and Measurement: The New Economics of the Minimum Wage*. Princeton, NJ: Princeton University Press

Currie, J. and J. Gruber. 1996. "Health insurance eligibility, utilization of medical care, and child health", *Quarterly Journal of Economics*, 111(2): 431-466

Dawkins, P. 2001. "The 'Five Economists' Plan: The Original Ideas and Further Developments". Paper delivered at Conference on Creating Jobs: The Role of Government. Australian National University, Canberra. 6-7 September

Dilnot, A. and J. McCrae. 1999. "Family Credit and the Working Families' Tax Credit". Institute for Fiscal Studies. Briefing Note Number 3. London: IFS

Eissa, N. and H. Hoynes. 2004. "Taxes and the Labor Market Participation of Married Couples: The Earned Income Tax Credit", *Journal of Public Economics*, 88(9-10): 1931-1958

Eissa, N. and J. Liebman. 1996. "Labor Supply Response to the Earned Income Tax Credit", *Quarterly Journal of Economics*, 111(2): 605-637

Ellwood, D. 2000. "The Impact of the Earned Income Tax Credit and Social Policy Reforms on Work, Marriage, and Living Arrangements", *National Tax Journal*, 53: 1063-1106

Feldstein, M. and M. Wrobel. 1998. "Can state taxes redistribute income?", *Journal of Public Economics*, 68: 369-396

Fullerton, D. and G. Metcalf. 2002. "Tax Incidence". In A.J. Auerbach and M. Feldstein (eds), *Handbook of Public Economics*. Oxford: Elsevier.

Fuchs, V., A. Krueger and J. Poterba. 1998. "Economists Views About Parameters, Values, and Policy: Survey Results in Labor and Public Finance", *Journal of Economic Literature*, 36(3): 1387-1425

Gradus, R. 2001. "Comparing Different European Income Tax Policies Making Work Pay", *IFO Studien*, 47(3): 311-326

Gruber, J. 1994. "The Incidence of Mandated Maternity Benefits," *American Economic Review*, 84: 622-641

Gruber, J. 1997. "The Incidence of Payroll Taxation: Evidence from Chile", *Journal of Labor Economics*, 15(3, Pt 2): S72-S101.

Gruber, J. and A. Krueger. 1991. "The Incidence of Mandated Employer-Provided Insurance: Lessons from Workers' Compensation Insurance". In D. Bradford (ed.) *Tax Policy and the Economy 5*. Cambridge, MA: MIT Press. 111-143

Gruber, J. and E. Saez. 2002. "The Elasticity of Taxable Income: Evidence and Implications", *Journal of Public Economics*, 84(1): 1-32

Harberger, A. 1962. "The incidence of the corporation income tax", *Journal of Political Economy*, 70: 215-240

Hausman, J. 1985. "Taxes and Labor Supply" In A. Auerbach and M. Feldstein (eds), *Handbook of Public Economics*. Vol 1. Oxford: Elsevier. 213-263

Hotz, V. and J. Scholz. 2003. "The Earned Income Tax Credit. In R. Moffitt (ed), *Means-Tested Transfer Programs in the United States*. Chicago: University of Chicago Press, chapter 3

Internal Revenue Service. 2003. *Data Book 2002*. Publication 55B. Washington, DC: IRS

Johnson, N. 2001. "A Hand Up: How State Earned Income Tax Credits Help Working Families Escape Poverty in 2001". Washington, DC: Center on Budget and Policy Priorities

Katz, L. 1998. "Wage Subsidies for the Disadvantaged". In R. Freeman and P. Gottschalk (eds), *Generating Jobs: How to Increase Demand for Less-Skilled Workers*, New York: Russell Sage. 21-53.

Kubik, J. 2002. "The Incidence of Personal Income Taxation: Evidence from the Tax Reform Act of 1986", *mimeo*

Liebman, J. 1998. "The Impact of the Earned Income Tax Credit on Incentives and Income Distribution". In J Poterba (ed.) *Tax Policy and the Economy*, Vol 12. Cambridge, MA: MIT Press

Liebman, J. and Zeckhauser, R. 2003. "Schmeduling", *mimeo*

Manski, C. 1995. *Identification Problems in the Social Sciences*. Cambridge, MA: Harvard University Press

Meyer, B. 2002. "Labor Supply at the Extensive and Intensive Margins: The EITC, Welfare, and Hours Worked", *American Economic Review*, 92(2): 373-379

Meyer, B. and D. Rosenbaum. 2001. "Welfare, the Earned Income Tax Credit, and the Labor Supply of Single Mothers", *Quarterly Journal of Economics*, 116: 1063-1114

Neumark, D. and W. Wascher. 2001. "Using the EITC to Help Poor Families: New Evidence and a Comparison with the Minimum Wage", *National Tax Journal*, 54: 281-318

Romich, J. and T. Weisner. 2000. "How Families View and Use the EITC: Advance Payment versus Lump Sum Delivery", *National Tax Journal*, 53: 1245-1264

Rosenbloom, J. and W. Sundstrom. 2003. "The Decline and Rise of Interstate Migration in the United States: Evidence from the IPUMS, 1850-1990" NBER Working Paper 9857. Cambridge, MA: NBER

Summers, L. 1989. "Some Simple Economics of Mandated Benefits", *American Economic Review*, 79(2): 177-183

United States Treasury. 2003. "Taxpayers Were Assessed Additional Tax for Advance Earned Income Credit Payments Not Received". Publicly released memorandum. Ref No. 2003-40-126.

Data Appendix

Real hourly wages: To obtain the largest possible cross-section of workers, I use the Current Population Survey Merged Outgoing Rotation Group (CPS MORG), which contains precise data on hourly earnings, and comprises around 30,000 individuals per month. For employees paid on an hourly basis, the wage is directly reported. For other workers, hourly earnings are calculated by dividing weekly earnings by usual weekly hours. The sample is restricted to those in the labor force aged 25-55 (workers nearing retirement age sometimes report anomalous earnings). Self-employed workers are excluded, since their hourly earnings are unreliable. Extreme wage observations – those in which employees reported earning less than half the federal minimum wage, or more than 100 times the federal minimum wage – are excluded. Wages are converted into 2002 dollars using the monthly CPI.

Children: From 1984 onwards, it is possible to determine the respondent's family type and number of children from the CPS. From 1984-1993, and from November 1999-2002, number of children is drawn from the MORG sample. Unfortunately, from January 1994 until October 1999, the basic monthly CPS (from which the MORG sample is drawn) did not ask respondents for their number of children. For this period, therefore, the MORG records for January 1994 to October 1999 were merged with the March CPS records for the same years (no other supplementary surveys included this question), resulting in a successful merge rate of around 80 percent. Note that the March survey is used only for the purpose of determining the respondent's number of children – hourly earnings are still derived from the MORG file. Sample weights are adjusted so that the years 1994-1999 are not under-weighted in the regressions.

EITC parameters: Federal EITC parameters from Internal Revenue Service, Individual Income Tax Return (form 1040), various years. State EITC supplements for early years from Neumark and Wascher (2001), and for recent years from Nicholas Johnson of the Center for Budget and Policy Priorities.

Real Gross State Product per capita: From Bureau of Economic Analysis, Regional Economic Accounts (www.bea.doc.gov/bea/regional/gsp/). Converted to 2002 dollars using the annual national CPI.

State unemployment rate: From Bureau of Labor Statistics, Local Area Unemployment Statistics (www.bls.gov/data/).

Real minimum wage: The greater of the state and federal minimum wage then prevailing, converted into 2002 dollars using the annual national CPI. Data for 1987-2002 supplied by Raj Chetty and Jesse Shapiro. Minimum wages for 1984-1987 coded from Council of State Governments, *The Book of the States 1988-89*, CSG: Lexington, KY, Table 8.27, 381-382.

State tax rate: The top marginal state tax rate on income earned from wages, from the NBER's Taxsim related files page (www.nber.org/~taxsim).

Real maximum welfare benefit: The maximum AFDC/TANF benefit available for a family of three (one adult and two children) with no income, as at December of that year, converted into 2002 dollars using the annual CPI. In states where benefits vary by region,

the figure is for the region with the largest caseload. Figures for Hawaii are for families on welfare for more than two months (a more generous benefit is initially available). Figures for New Mexico do not include housing subsidy. Figures for Wisconsin are for families not headed by a disabled adult. Figures for Nevada are for families without foster children. Data for 1984-1998 supplied by Adam Looney, and figures for 1999-2002 from annual TANF reports, produced by the Department of Health and Human Services, Office of Family Assistance (www.acf.hhs.gov/programs/ofa/indexar.htm).

Welfare reform: A dummy indicating whether the state had implemented TANF by the end of that year. It equals 0 for all states in 1989-95, and 1 for all states from 1998-2002. Data for all years from Adam Looney.

Aid for Dependent Children program waiver: A dummy indicating whether the state had ever received an AFDC waiver (as at the end of that year). No states received waivers prior to 1992. Since AFDC has now been abolished, states are coded with the same value in 1998-2002 as they had in 1997. Data for all years from Adam Looney.

Labor market EITC parameters: I calculate EITC parameters for two labor market cases: one in which the employee's labor market is approximated by her three-digit occupation, and another in which it is approximated by his or her gender-age-education cell. In what follows, I explain the procedure for the occupation-level estimates. An analogous procedure is followed when using gender-age-education cells.

First, I take all employed adults (aged 25-55) from the 1990 census 1 percent sample. Pooling all adults in the sample, I calculate an overall income distribution, and assign each person to an income centile (1 to 100), based on their family income. Next, for each three-digit occupation, I calculate the fraction of people in six family types – married with 0, 1 or 2+ children, and single with 0, 1 or 2+ children. For each family type within each occupation, I then calculate the fraction of employees at each income centile. For each occupation, I now have 606 parameters – the full centile income distribution for each of the six family types, and a single number denoting the share of each family type in that occupation.

To apply the EITC parameters to the prevailing tax rules, it is necessary to know the national income distribution in a given year. To determine this, I use the family income distribution among adults aged 25-55, as reported in the following year's March CPS (since the March CPS asks about earnings in the previous year). Combining this data with the occupation-level family and income distribution from the 1990 census, I assign earnings to each centile. This information is then entered into the NBER Taxsim program, which calculates the relevant tax parameters. I assume that all family income is wage earnings, that there are no other government transfers, and that married couples file jointly. The resulting tax parameters are then averaged up by occupation, weighting by the share of each centile and family type.