Who gets the Earned Income Tax Credit?
Impact and Incidence

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Abstract

How are hourly wages affected by the Earned Income Tax Credit (EITC)? To determine the incidence of the credit, I use two sources of variation – average EITC parameters in an employee's occupation, and an employee's predicted EITC parameters, based on their demographics. In both specifications, I find that the EITC affects wages through an income and a substitution effect. The income effect of the maximum credit amount raises hourly wages for all recipients, while the substitution effect of the marginal rate lowers wages in the phase-in region, and raises wages in the phase-out region. Using variation in state EITC supplements, I find that the net effect of the EITC is to reduce hourly wages for low-skill workers. This is consistent with other EITC studies, which have shown that the policy had a net positive effect on labor force participation rates.

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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 $1.4 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 the incidence of the EITC is also relevant for the study of income taxation incidence more generally.

Targeted at low-wage workers, the EITC has focused on achieving two major goals – distributing income towards low-paid workers (thus narrowing inequality), and increasing labor force participation rates. The extent to which these goals are achieved will depend crucially on the incidence of the credit. For example, if the net effect of the EITC is to cause pre-tax hourly wages to fall, the policy will have less impact on reducing inequality than if it has no impact on hourly wages. In addition, if the overall impact of an EITC increase is to lower the equilibrium wage for childless workers (whose EITC payments are negligible at best), these individuals may find themselves worse off than had the policy not been implemented.

As with the incidence of income taxation more generally, the incidence of the EITC is an under-explored area. Reviewing the body of research on the EITC, Hotz and Scholz (2003) conclude that, "We can think of no major EITC-related topic that has not had at

[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. Where state EITCs are non-refundable, I assume that their value is reduced by one-third. The Indiana state EITC is omitted, since this was not based on the federal EITC.

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 inequality in the U.S., but also for considering how it might be applied in other countries. 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 Australia has in recent years debated introducing an EITC. By comparison with the United States, social policy in these two nations tends to focus more upon reducing unemployment than ameliorating inequality. In the context of an EITC, boosting labor force participation is therefore regarded as more important than redistributing income to low-wage workers. Studying the incidence of the US EITC may therefore assist with policy formulation in these and other countries.

Using variation in federal and state EITC parameters, I find that the incidence of the EITC depends upon the marginal rate, rather than the average rate. For all recipients, there is an income effect, which reduces labor supply, and raises pre-tax hourly wages. Additionally, there is a substitution effect – consistent with findings in the literature that because the EITC increases labor supply in the phase-in range and decreases labor supply in the phase-out range, it correspondingly lowers wages in the phase-in range, and boosts wages in the phase-out range. Holding the income effect constant, the incidence of the EITC is split evenly between employer and employee.

The remainder of this paper is organized as follows. Section 1 reviews the development of federal and state EITCs. Section 2 discusses relevant literature on the EITC and

taxation incidence. Section 3 sets out a model of EITC incidence. Section 4 outlines the wage data and policy variables to be used. Section 5 presents results from two different sources of variation in EITC parameters. Section 6 considers the net effect of changes in the EITC on hourly wages, and the final section concludes.

1. EITC structure and history

Introduced in 1975, and significantly expanded in tax years 1987, 1991 and 1994, the EITC operates as an earnings top-up for low-wage workers. Based on family income, the credit has a phase-in range (during 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). The credit was unavailable to taxpayers without children prior to 1994, and remains substantially more generous for families 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.

Over the past two decades, sixteen states and the District of Columbia have implemented some form of state EITC. 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 rate).[2] For example, a single parent with one child who earned $7370 in 2002 would have received a federal EITC payment of $2506 (34 percent). If she lived in New York, which had an EITC rate of 27.5 percent, her effective rate would have been 43.4 percent (34*1.275), and she would have received an additional $689 ($2506*0.275) from the state government.

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). States with EITCs are primarily in the Midwest and Northeast.

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 GSP. Since GSP includes both government and personal income, it should not – to a first

[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 which met these criteria received a refundable credit of 0.034*(12000-total income). Because there is no straightforward way of including this credit in the model, I drop respondents from Indiana in the years 1999-2002. I also ignore local EITCs paid to residents of Montgomery County, MD (15% in 1999-2002) and Denver, CO (20% in 2002).

approximation – be affected by changes in tax rates. 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 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 about here

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 state EITC supplements and GSP. A 10 percent increase in GSP is associated with a 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 supplement. If this induces bias in the regressions, it will be towards a finding that more of the incidence of the credit is on the employee.

Among the policy variables, I find that being granted an AFDC waiver was associated with a 1½ percentage point lower state EITC supplement. I find no significant relationship between state EITC supplements and minimum wages, between state EITCs and top state 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 the EITC and other poverty, tax and welfare policies.

Unlike payroll taxation rates, which are directly visible to employers, whether an employee receives the EITC, and if so, what their marginal rate is, are essentially unobserved by employers. To determine eligibility, an employer would need to know the employee's number of children, and estimate his or her total family earnings (including spousal earnings). This situation contrasts with the U.K., where the default payment option for the Working Families Tax Credit is via the employee's pay packet, and employees know their EITC on a month-by-month basis. Although an advance payment option exists for the EITC, it is used by less than 1 percent of recipients (U.S. Treasury 2003; see also Hotz and Scholz 2003).

2. Previous research on the EITC and taxation incidence

2.1 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 show that the 1987 increase in the EITC led to an increase in the labor supply of single women. Eissa and Hoynes (1998) 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.

Like Eissa and Liebman, Meyer and Rosenbaum (2001) focus solely on single women. In addition, they model the impact of other tax and welfare changes, and include state EITCs (though these are not their primary source of variation). Meyer (2002) charts changes in labor force participation over the period 1986-2000, and concludes that its primary effect was on 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 the potential for endogeneity, they control for the state unemployment rate and welfare generosity. They analyze 1985-1994, a period during which only seven states had EITCs. Neumark and Wascher find that an increase in the state EITC 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 their earnings, an exogenous parameter must be found. Neumark and Wascher (2001) deal with this by restricting their sample to families with an income:needs ratio below three, and assigning all workers the EITC rate in the

phase-in range. By contrast, Meyer and Rosenbaum (2001) estimate the variable "Income Taxes if Work", which is based only upon the employee's state, year, and family composition.

2.2 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 to find that finds 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. Neither study takes 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. As Summers (1989) has pointed out, the benefit that workers' receive from these taxes must be taken into account, and as a consequence, the imposition of a payroll-type tax will entail both a downwards demand shift and a downwards supply shift.

Studies of the incidence of personal income taxes are more limited (Fullerton and Metcalf 2002). 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 the EITC 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.[3]

3. A model of EITC incidence with heterogeneity among recipients

Most models of tax incidence assume that taxation revenue is returned to households in a lump sum fashion, and therefore that income effects can be ignored. For payroll taxes and regular personal income taxes, this may not be an unreasonable assumption. However, in the case of the EITC, which provides a subsidy worth up to 30 percent of a worker's earnings, income effects are likely to be important. Moreover, while income and substitution effects operate in the same direction with positive income tax rates, the structure of the EITC is such that income and substitution effects may operate in opposite directions.

To see the effect of a change in the EITC on wages, I assume a single labor market, with one equilibrium wage, and no other taxes. Suppose that there are two types of employees

[3] 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)

– those who are eligible for the EITC, and those who are ineligible. For the time being, I assume that eligibles are homogeneous. Additionally, I assume that employees place the same valuation on the EITC as they do on post-tax earnings.[4] The following equation sets out the relationship between the amount of labor supplied (L_S), the uncompensated elasticity of labor supply (η_S), the equilibrium post-tax wage (W), the marginal EITC rate (τ), and the change in virtual income (V) as a result of the introduction of the EITC.

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

Virtual income is typically found by extending the budget set to the vertical axis. In practice, however, this produces large changes in EITC virtual income when the taxpayer moves across a kink point. In the empirical analysis that follows, I therefore assume instead that the virtual income for all EITC recipients is simply the log of the maximum EITC (the amount they would have received if they were in the flat area).

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

$$\frac{dL_S}{L_S} = \eta_S\left(\frac{dW}{W}\right) \quad (2)$$

[4] The issue of whether EITC payments are valued equally to post-tax earnings is discussed by Romich and Weisner (2000), who argue that although the net present value of the EITC is lower when paid in an annual lump sum, behavioral theory suggests that the utility of the lump sum payment may be just as large as if the cash were received monthly – since it acts as a form of enforced savings, allowing households to accumulate for durable goods purchases.

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

$$\frac{dL_S}{L_S} = \theta\eta_S\left(\frac{dW}{W} + \frac{d\tau}{\tau} + \frac{dV}{V}\right) + (1-\theta)\eta_S\frac{dW}{W} \quad (3)$$

Assuming that eligible and ineligible workers are perfectly substitutable, the demand relationship will be:

$$\frac{dL_D}{L_D} = \eta_D\left(\frac{dW}{W}\right) \quad (4)$$

Combining equations (3) and (4) shows how the equilibrium wage will be affected by the introduction of a tax credit.

$$\frac{dW}{W} = \theta\left(\frac{d\tau}{\tau} + \frac{dV}{V}\right)\left(\frac{\eta_S}{\eta_D - \eta_S}\right) \quad (5)$$

Equation (5) suggests that the income effect (dV/V) will act to increase wages for all EITC recipients; while the substitution effect (dτ/τ) will reduce wages for those in the phase-in range, increase wages for those in the phase-out range, and have no impact on those in the flat region. This is consistent with the empirical findings on labor supply. Discussing evidence from the negative income tax experiments of the 1970s, Hausman (1985) concluded that the income effect was higher than had previously been thought,

and that the introduction of a negative income tax would lead to a significant drop in labor supply. Analyzing changes in the EITC over the 1980s and 1990s, Meyer (2002) concluded that the credit boosted labor supply on the participation margin (those likely to be on the phase-in region), but had no significant effect on the hours margins for low-wage workers (those more likely to be in the flat region). And in their study of the effect of the EITC on the labor supply of married women, Eissa and Hoynes (1998) found a negative effect on labor supply, which they attribute to these workers being primarily in the phase-out region.

Generalizing the model to a heterogeneous population, made up of N individuals, with differing marginal EITC rates (τ_i) and virtual incomes (V_i), equation (5) can be rewritten as:

$$\frac{dW}{W} = \left(\frac{\eta_S}{\eta_D - \eta_S} \right) \frac{1}{N} \sum_{i=1}^{N} \left(\frac{d\tau_i}{\tau_i} + \frac{dV_i}{V_i} \right) \qquad (6)$$

Note that in this model, employers do not need to be able to discern whether employees are eligible or ineligible. The EITC simply causes a downwards shift in labor supply, which boosts employment, lowers wages, or some combination of the two. 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 more for eligibles than ineligibles is if they believed in fairness (Bewley 2002), and sought to further this goal by promoting parity in post-tax

wages. 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 net wage of some ineligibles to fall below their reservation wage, and they would therefore quit.

An additional constraint is the minimum wage. In certain circumstances, employers may be unable to reduce the wages of workers who get the EITC because the minimum wage binds. With a higher minimum wage, employees in the flat region and phase-out region may still experience wage increases when the EITC rises; but those in the phase-in region are likely to see less of a fall in their wages.[5]

4. Wage data and state parameters

To obtain the largest possible cross-section of low-wage 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. In some of the following regressions, it will be necessary to know how many children the respondent has, since the generosity of the EITC varies with family income and the number of dependent children. 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, I match MORG respondents to

[5] Ensuring that the full incidence of the EITC is on the employee has led Bluestone and Ghilarducci (1996) to argue that the EITC and the minimum wage should be raised together. The opposite has been advocated in Australia, where the chief proponents of introducing an EITC have pitched it as a way of lowering real pre-tax wages (see for example Dawkins 2000).

responses from the March supplementary survey, which asked respondents for their number of children (no other supplementary surveys included this question).[6] Sample weights are adjusted so that the years 1994-99 are not under-weighted in the regressions.

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. From 1984 onwards, it is possible to identify the respondent's family status and number of children in the CPS. However, only three states had EITCs in the years 1984-88. Therefore, for specifications relying solely on variation in state EITCs, the sample is restricted to the fourteen-year period 1989-2002.[7]

To control for economic conditions and state policy changes, all specifications include the 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, and a dummy for whether the state had implemented welfare reform. Specifications relying only on variation in state EITC rates are also presented with log real GSP per capita included in the regression. Table 4 presents summary statistics.

[6] To be more precise, the MORG records for January 1994 to October 1999 were merged with the March CPS records for the same years, 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 – earnings are still taken from the MORG file.

[7] 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.

Table 4 about here

Additionally, specifications will include state fixed effects, and year*child fixed effects, to take into account the possibility of differential wage trends among individuals with families of different sizes.

5. Calculating the incidence of the EITC

Relying on a single source of variation for determining EITC incidence is likely to be problematic. As discussed above, heterogeneity in EITC receipt may have the results that incidence depends upon the average rate in an occupation, or some combination of the individual and average rate. It is therefore necessary to analyze the impact on wages both of the average set of EITC parameters (maximum credit and marginal rate) that apply in an individual's occupation, and the EITC parameters applying to the employee herself. Another issue is the extent to which estimates from state EITCs are relevant for assessing changes in the federal credit. When a state increases its EITC, wages will be affected not only by changes in the participation of low-skilled workers, but also by in-migration of low skilled workers from neighboring states. In the case of income taxation, Feldstein and Wrobel (1998) find that cross-state migration causes gross wages to adjust in response to tax changes, until the net wage is equal across states. By contrast, since changes in the federal EITC are likely to have a much smaller impact on migration into the United States, changes in the supply of low-skilled workers will occur only due to

shifts in participation, and intra-firm substitution between low-skilled and high-skilled workers.

To determine the incidence of the EITC, I therefore present results based on two types of variance – the average EITC parameters in the individual's occupation, and the employee's own EITC parameters.

5.1 Using variation in the average EITC parameters for the occupation

As the above theoretical model suggests, if eligible and ineligible employees are perfectly substitutable, the primary impact on an employee's wages will occur when the average rate in their particular labor market changes. To test this, I assume that the relevant labor market for an employee is approximated by their three-digit occupation, and calculate the average marginal EITC rate and virtual EITC income in each occupation and year.

Because of the way in which the EITC operates, four factors determine an occupation's average marginal EITC rate and virtual EITC income: (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. Here, I am primarily interested in variation arising from the federal EITC rate, since state EITCs are relatively modest by comparison.

One factor that could potentially bias the regression is variation in the demographic structure and income distribution of an occupation, reflecting changes in the skill composition. This would have an effect on wages (independent of any EITC effect), but because compositional changes would also affect the average EITC parameters, this could bias the incidence estimates.

To avoid variation arising from compositional changes within an occupation, I therefore calculate for each occupation the income distribution (the fraction of employees in each centile) for employees with zero, one, two, and three children in 1989. A parallel exercise is performed to determine the breakdown within the occupation of zero, one, two and three-child employees. This income distribution and demographic structure is then applied to the federal EITC parameters for each year from 1989-2002, and multiplied by any applicable state EITC. The average marginal EITC rate in an occupation is defined as:

$$\tau_{cjt} = \phi_{j0}\tau_{cjt0} + \phi_{j1}\tau_{cjt1} + \phi_{j2}\tau_{cjt2} + \phi_{j3}\tau_{cjt3} \qquad (8)$$

where φ_{jo}, φ_{j1}, φ_{j2} and φ_{j3} are the share of employees with zero, one, two or three children in industry j; τ_{cjto}, τ_{cjt1}, τ_{cjt2}, and τ_{cjt3} are the average marginal EITC rate (state and federal combined) applying to employees in industry j, time t, and with a given number of children; and τ_{cjto} is the average marginal EITC rate applying to employees in industry j, time t, and with a given number of children. The average virtual EITC income is defined

to be zero for non-EITC recipients, and the log of the flat area amount for EITC recipients. It is calculated in an analogous manner to the average marginal EITC rate.

I then estimate the following model:

$$\ln(w)_{isjt} = \alpha + \beta\tau_{sjt} + \gamma V_{sjt} + \delta X_{ist} + \pi Z_{st} + \zeta_s + \theta_j + \psi_{jt} + \lambda_{kt} + \varepsilon_{isjt} \quad (9)$$

where w is the real hourly wage (deflated by the monthly CPI), τ is the average marginal EITC rate in the individual's occupation, V is the average virtual EITC income in the individual's occupation, X is a set of individual characteristics, Z is a set of state characteristics, ζ is a vector of state dummies, θ is a vector of occupation dummies, ψ is an occupational-specific linear time trend, and λ is a vector of child*year dummies. Because most of the variation arises from changes in federal EITC parameters rather than state EITC parameters, standard errors are not clustered by state. To test the robustness of this assumption, I exclude all states that provided an EITC supplement at any time during 1984-2002.

Table 5 about here

Table 5 presents the results from this regression. The coefficient on the marginal EITC rate is -0.48, while the coefficient on virtual income is 0.001 (both significant at the 5 percent level). This indicates that employees' hourly wages respond both to the level of the maximum credit, as well as to the slope of the phase-in and phase-out rates. Holding

constant the generosity of the EITC, the incidence of the credit is 52 percent on the employee, and 48 percent on the employer.

5.2 Using variation in the individual's own EITC parameters

A second approach is to consider the incidence of the credit based an individual's own rate. However, since the precise EITC that an individual receives is endogenous to their earnings, standard OLS estimates would bias the results towards a finding that most of the incidence of the credit was on the employer. It is therefore necessary to find a source of exogenous variation.

One way of doing this is to instrument for the employee's EITC parameters, using a variable that is correlated with the true EITC parameters, but is uncorrelated with the error in the wage equation. Such an instrument can be constructed as follows. First, I estimate an equation for the individual's annual earnings (and those of their spouse, if applicable):

$$\ln(y)_{ist} = \alpha + \delta X_{ist} + \zeta_s + \varepsilon_{ist} \quad (10)$$

where X is a set of demographic characteristics (age, age^2, sex, dummies for race, sex-race interactions, and education) for the individual and their spouse, and a dummy denoting whether the individual is married. To improve accuracy, these demographics are interacted with year dummies. ζ is a state fixed effect.

I then use the fitted values from this regression to obtain the predicted income of the individual's tax unit ($\hat{y}$). Based on this predicted income, I use the relevant federal and state legislation to determine the employee's predicted marginal EITC rate ($\hat{\tau}$) and their predicted log virtual income ($\hat{V}$), given their number of children, state and year. These predicted values are simply nonlinear functions of the individual's demographic characteristics, where the function is the federal EITC schedule and the state supplement. Controlling for the regressors in equation (10), the predicted EITC rate and virtual income is exogenous to the respondent's earnings. I then estimate the following model:

$$\ln(w)_{ist} = \alpha + \beta\tau_{ist} + \gamma V_{ijt} + \delta X_{ist} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{ist} \qquad (11)$$

where w is the real hourly wage, τ is the individual's marginal EITC rate, V is the log of the individual's virtual EITC income, X is the full set of demographic characteristics (interacted with year dummies), Z is a set of state characteristics, ζ is a vector of state dummies, and λ is a vector of child*year fixed effects. Since τ and V are endogenous to the hourly wage, I instrument for them using $\hat{\tau}$ and $\hat{V}$.

Table 6 about here

As Table 6 illustrates, the coefficient on the marginal EITC rate is -0.78, while the coefficient on virtual income is 0.001. Excluding states with state EITCs does not significantly affect this result.

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

6.1 Using variation in state EITCs

The estimates in Section 5 indicate that the EITC has both an income and a substitution effect, which will cause wages to rise for those in the flat area and phase-out region, and have an ambiguous effect in the phase-in region. Because of the effect on wages differs across EITC recipients, knowing the incidence parameters does not allow us to determine the net effect of the EITC on wages.

In this section, I use a more reduced form model, exploiting 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. By comparing hourly wages in states before and after the introduction of a state EITC supplement, it is possible to see whether a higher overall EITC rate increases or decreases net wages.

$$\ln(w)_{ist} = \alpha + \beta\rho_{st} + \delta X_{ist} + \pi Z_{st} + \zeta_s + \lambda_{kt} + \varepsilon_{ist} \qquad (12)$$

where w is the real hourly wage, ρ is the state EITC supplement for a family with one child, X is the full set of demographic characteristics (interacted with year dummies), Z is a set of state characteristics, ζ is a vector of state dummies, and λ is a vector of child*year fixed effects. Table 7 shows the effect of state EITC supplements on three population

subgroups – high school dropouts, high school graduates, and college graduates. Because state EITCs have been shown to be positively related to GSP, I also repeat the specifications with GSP. Because few states had EITCs during the 1980s, the sample is restricted to the fourteen-year period 1989-2002. Standard errors are clustered at the state level, to take account of serial correlation (Bertrand, Duflo and Mullainathan 2002).

Table 7 about here

For low-skill subgroups, the net effect of the EITC is to reduce wages. When a state introduces a 10 percent supplement to the federal EITC, wages for high school dropouts fall by 4 percent, while wages for high school graduates fall by 2 percent. As might be expected, state EITCs have no impact on the wages of college graduates. Including GSP has no notable effect on the coefficients.

Is the net effect of the EITC reduced when the state increases its minimum wage at the same time? Table 8 shows the effect of interacting the real log minimum wage (standardized by year to a mean of 0 and a standard deviation of 1) with the EITC. If the minimum wage is a binding constraint on employers, we should this coefficient to be positive and significant (ie. given the same EITC rate, workers in areas with a higher minimum wage suffer a smaller wage reduction). In both cases, the effect of the interaction term is statistically indistinguishable from zero. This suggests that the minimum wage (at least at the level which prevailed during 1989-2002) did not affect the incidence of the EITC.

Table 8 about here

6.2 Considering compositional variation

One possible explanation for the findings in section 6.1 is that the observed fall in the equilibrium wage is primarily due not to the increased supply of low-skill workers when a state boosts its EITC supplement, but to changes in the composition of the low-skill workforce. If those induced to enter the workforce are of lower ability than the average low-wage worker, this would engender a downward bias in the coefficient on the EITC rate.

One simplifying factor is that this participation effect is likely to only be an issue 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 participation 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 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.[8] 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 (.015/.53). This upper bound for the participation effect is relatively modest, when compared with the effect of the EITC. In Table 7, the coefficient on the EITC supplement was –0.45. 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 6.1 percent fall in hourly wages for high school dropouts in these states. Even assuming that some of this effect was diluted by cross-state migration, changes in the composition of the low-skill workforce are clearly insufficient to account for the observed wage drop.

7. Conclusion

As economic theory predicts, the EITC has both an income and a substitution effect on hourly wages. This finding is robust to using two different sources of variation – the average EITC parameters in an employee's occupation, and an employee's predicted EITC parameters, based on their demographic characteristics. Holding the income effect constant, the incidence of the credit is falls approximately equally between employer and employee.

[8] 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.

Holding the income effect constant, the incidence of the EITC on the employee appears to be similar to that of Danish personal income tax (Bingley and Lanot 2002 find that 44 percent of the incidence of payroll tax is on the employee). EITC incidence on the employee is substantially lower than the incidence of payroll tax (Gruber and Krueger 1991 find that 86 percent of the incidence of payroll tax is on the employee, while Gruber 1997 finds that 100 percent of the incidence of payroll tax is on the employee), and below the incidence of the median marginal tax rate in an occupation (which Kubik 2002 finds to be 75 percent on the employee).

On net, evidence from changes in state EITCs indicates that increases in the credit lead to lower hourly wages for high school dropouts and those with only a high school degree, and have no effect on the wages of college graduates. This wage affect appears not to differ according to the level of the state's minimum wage.

This net downward adjustment in wages means that the EITC had less impact on ameliorating inequality than a model of 100 percent incidence on the employee would predict. But given that most studies of the EITC and labor supply find that the EITC has a positive effect on participation, the finding that the equilibrium wage falls should not be particularly surprising. Unless labor demand is perfectly inelastic, any rise in participation will be associated with a fall in the equilibrium wage.

These findings also raise the question of why employers do not do more to encourage employees to receive the EITC in their pay packet, so that they can precisely quantify

their credit. Since most of the EITC impact is 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 employee a wage slightly above the new equilibrium, rather than risk losing the employee in order to lower the wage to the new equilibrium. One explanation of why employers do not seek to pay the EITC through pay packets is that the administrative cost of doing so exceeds the benefit. Another is that social norms discourage employers from discriminating between eligible and ineligible employees. And a third is that the real deterrent comes from employees themselves – who would prefer that their employers not know the value of their EITC benefit.

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 if a rise in the EITC causes the equilibrium wage to fall. Indeed, it is possible that the introduction of the EITC has contributed to the increase in earnings inequality among some sub-groups in the low-income population. The indirect burden that the EITC imposes on low-income childless adults deserves greater consideration by policymakers.

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Figure 1: Federal EITC Schedule (2002)

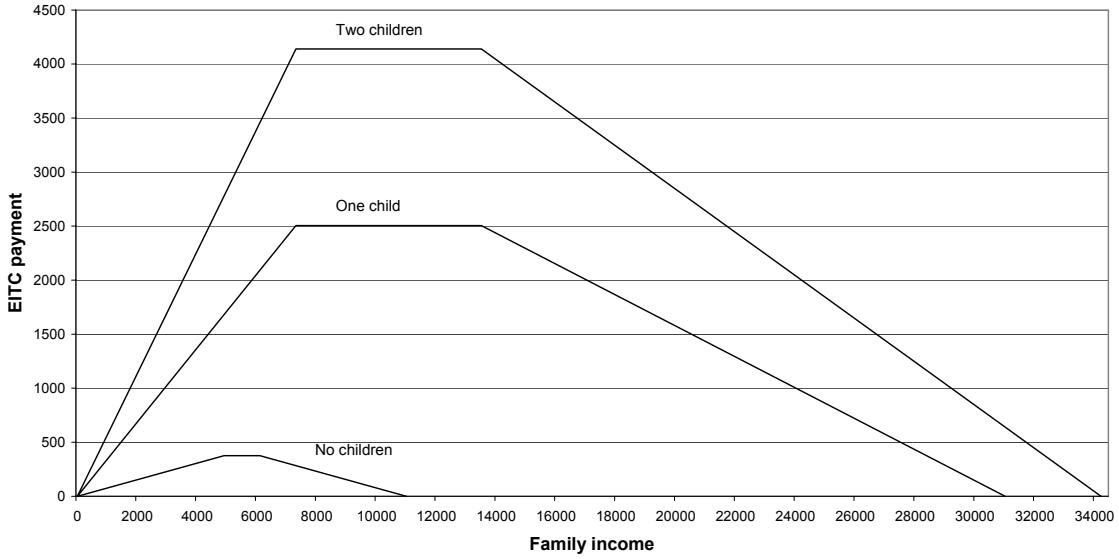

Table 1: Federal EITC parameters 1984-2002

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

Source: Internal Revenue Service, Individual Income Tax Return (form 1040), various years

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			27.5	25	4	14	43
1998				6.5	10		10	10	15	25		20			27	25	4	14	43
1999	8.5			6.5	10		10	10	25	25		20			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

Sources: Rates for recent years provided by Nicholas Johnson, of the Center for Budget and Policy Priorities. Earlier years from Neumark and Wascher (2001).

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.

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	.102***	.141***
	(.0260)	(.0349)
Unemployment rate	.667***	-.0863
	(.177)	(.158)
Log real minimum wage	-.0254	-.0746
	(.0503)	(.0592)
Maximum AFDC/TANF benefit for a family of 3	.00767	-.0231
	(.0201)	(.0167)
Implemented welfare reform?	-.00790	-.00924
	(.00765)	(.00601)
Obtained an AFDC waiver?	-.0142***	-.0167***
	(.00540)	(.00506)
Top state income tax rate	-.345	-.0832
	(.263)	(.258)
State fixed effects?	Yes	Yes
Year fixed effects?	Yes	Yes
Observations	918	663
Adjusted R^2	.69	.83

Sources: GSP per capita and unemployment rate from Bureau of Labor Statistics; minimum wage data supplied by Raj Chetty and Jesse Shapiro; welfare variables supplied by Adam Looney; state income tax rates from Daniel Feenberg.

Notes:

1. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors in parentheses.
2. Minimum wage is the greater of the state and federal minimum wage then prevailing.
3. State tax rate is the top marginal rate of taxation on income earned from wages.
4. Maximum benefit is the maximum AFDC/TANF benefit available for a family of three (one adult and two children) with no income, as at the end of the year. 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.
5. Welfare reform is 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.
6. AFDC waiver is 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.

Table 4: Summary Statistics

	Obs	Mean	Std. Dev.
Log real hourly wage	411080	2.699275	0.533901
Male	411080	0.540584	0.498351
Age	411080	38.30438	8.487707
Black	411080	0.109082	0.311743
Hispanic	411080	0.075939	0.2649
Other non-white	411080	0.036626	0.187842
Years of education	411080	13.42416	2.684938
Children	411080	0.854649	1.031598
Married	411080	0.697851	0.45919
Marginal EITC rate	81938	0.001521	0.035264
State unemployment rate	411080	0.059509	0.016883
Log real minimum wage	411080	1.70818	0.066026
Maximum AFDC benefit	411080	6.111022	0.426852
Welfare reform	411080	0.309482	0.462281
AFDC waiver	411080	0.28855	0.453089
Top marginal state tax rate	411080	0.051646	0.032794
Log real GSP per capita	380161	10.38675	0.169322

Source: CPS Merged Outgoing Rotation Group 1984-2002. From January 1994 to October 1999, number of children is from the March CPS supplementary survey. State income taxation rates from the National Bureau of Economic Research's Taxsim project.

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.

Table 5: Effect of the average EITC parameters in the respondent's occupation
Dependent variable: Log real hourly wage
All respondents are assigned the average EITC parameters for their occupation, based on national-level occupation demographics, and state and federal EITC rates

	(1) All states	(2) Non-EITC states only
Marginal EITC rate	-0.486608**	To be added
	(0.219623)	
Log maximum credit amount	0.001113**	
	(0.000238)	
State unemployment rate	0.724775***	
	(0.136560)	
Log real minimum wage	0.011924	
	(0.030150)	
Maximum AFDC/TANF benefit for a family of 3	0.096027***	
	(0.025826)	
State implemented welfare reform?	-0.018867	
	(0.026987)	
State obtained an AFDC waiver?	0.012805**	
	(0.006483)	
Top state income tax rate	-0.137997	
	(0.165143)	
Male	0.206641***	
	(0.003747)	
Age	0.039004***	
	(0.001583)	
Age squared	-0.000394***	
	(0.000020)	
One child	0.046411	
	(0.031269)	
Two children	0.052695*	
	(0.031319)	
Three children	0.041395	
	(0.031508)	
Black	0.015018**	
	(0.006781)	
Hispanic	-0.036192***	
	(0.009404)	
Other non-white	-0.031973***	
	(0.011566)	
Black male	-0.120144***	
	(0.009658)	
Hispanic male	-0.065688***	
	(0.012362)	
Other NW male	-0.091229***	
	(0.015753)	
HS dropout	0.000000	
	(0.000000)	
High school only	0.120665***	
	(0.005031)	
Some college	0.176317***	
	(0.005607)	
BA or above	0.332262***	
	(0.006243)	

Table 5: Effect of the average EITC parameters in the respondent's occupation
Dependent variable: Log real hourly wage
All respondents are assigned the average EITC parameters for their occupation, based on national-level occupation demographics, and state and federal EITC rates

Married	-0.111709	
	(0.080986)	
Spouse age	0.000201	
	(0.000966)	
Spouse age squared	-0.000006	
	(0.000007)	
Spouse HS dropout	-0.037089***	
	(0.006124)	
Spouse High school only	-0.016606	
	(0.010583)	
Spouse some college	0.016334**	
	(0.007500)	
Spouse BA or above	0.060884***	
	(0.005299)	
Spouse male	0.146966*	
	(0.077022)	
Spouse black	-0.014428	
	(0.009040)	
Spouse Hispanic	0.008378	
	(0.006859)	
Spouse other non-white	-0.000723	
	(0.006797)	
Spouse black male	0.004425	
	(0.009577)	
Spouse Hispanic male	-0.003474	
	(0.007594)	
Spouse other NW male	0.026418***	
	(0.007513)	
State FE?	Yes	Yes
Year*Children FE?	Yes	Yes
Occupation FE?	Yes	Yes
Occupation time trend?	Yes	Yes
Observations	116354	116354
R-squared	0.45	0.45

Notes:
1. Sample is 1984-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed.
2. ***, ** and * denote significance at the 1%, 5% and 10% levels respectively. Robust standard errors in parentheses.

Table 6: Individual EITC rate (IV)
Dependent variable: Log real hourly wage

	(1) All states	(2) States without state EITCs
Marginal EITC rate	-0.782775**	To be added
	(0.194015)	
Log maximum credit amount	0.0013359**	
	(0.00014484)	
Observations	54918	
R-squared	0.32	

Notes:
1. Sample is 1984-2002, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed.
2. Instruments are the predicted marginal EITC rate and predicted maximum credit amount, based on fitted values from a regression of family income on demographic characteristics.
3. States without state EITCs are those states which did not have a state EITC supplement at any time in the period 1984-2002
4. All specifications include the same individual and spouse demographic controls as in Table 5: age, age^2, sex, race dummies, sex-race interactions, education dummies, and a dummy for married. 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.

Table 7: How do state EITC supplements affect hourly wages?
Dependent variable: Log real hourly wage

Sample:	(1) High school dropouts	(2) High school diploma only	(3) College graduates
Panel A: No GSP control			
State EITC supplement for families with 1 child	-0.445154***	-0.181054**	0.024643
	(0.105642)	(0.079169)	(0.049434)
Observations	47898	185687	158195
R-squared	0.20	0.19	0.14
Panel B: Controlling for log GSP per capita			
State EITC supplement for families with 1 child	-0.454648***	-0.204186**	-0.001294
	(0.127209)	(0.077987)	(0.038055)
Observations	43319	167425	137489
R-squared	0.20	0.19	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.
2. All specifications include the same demographic and state controls listed in Table 5.
3. Panel B does not include 2002, due to the delayed release of GSP statistics.

Table 8: 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
State EITC supplement for families with 1 child	-0.437616***	-0.458154***
	(0.098969)	(0.123266)
Log real minimum wage (normalized)	-0.007209	-0.007182
	(0.005671)	(0.005983)
EITC supplement*minimum wage	0.019982	-0.022242
	(0.048300)	(0.048416)
Observations	47898	43319
R-squared	0.20	0.20

Notes:
1. Sample is 1989-2001, restricted to those respondents aged 25-55, who are in the labor force, and not self-employed.
2. All specifications include the same demographic and state controls listed in Table 5.
3. Minimum wage is normalized by year to mean 0 and S.D 1.