TOTS AND TEENS: HOW DOES CHILD'S AGE INFLUENCE MATERNAL LABOR SUPPLY RESPONSE TO THE EARNED INCOME TAX CREDIT?

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Abstract:

Building on earlier work that shows that the Earned Income Tax Credit (EITC) has a substantial positive effect on maternal labor supply, we show that labor supply effects are concentrated among mothers with children under age three, with only moderate effects of the EITC on the labor supply of mothers with teenagers. These increases in labor supply are coupled with large increases in the use and cost of child care among mothers with children under age three. Decomposition analyses suggest that the EITC explains more than half of the increase in single mother's labor supply from 1990 to 2000 among mothers with infants. Results highlight the importance of considering heterogeneous treatment effects of policy and raise implications for child care policy and other family policy.

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Early childhood (birth through age five) is widely recognized as a critical developmental period when important brain, social, and other foundational capabilities are developed (Shonkoff and Phillips, 2000). It is also a time when poverty can have especially detrimental impacts on children through poorer brain development (Hair et al 2015; Noble 2015a, 2015b) and lower school readiness (e.g. Duncan et al. 2011). Interventions that increase income in early childhood have been shown to have long lasting positive effects on child wellbeing (e.g. Heckman and Carneiro, 2002; Duncan, Morris and Rodrigues, 2011; Chetty, Hendren and Katz, 2016). However, child poverty rates, and in particular, early childhood poverty rates, remain high in the U.S. Nearly one in four infants and toddlers are poor, compared to about one in six teenagers (authors' calculations, 2015 American Community Survey).

These high rates of poverty have prompted calls for efforts to reduce poverty in early childhood. As the U.S. has shifted away from direct cash assistance programs like Temporary Assistance for Needy Families (TANF) toward refundable work-contingent tax credits like the Earned Income Tax Credit (EITC), several proposals have called for expanding these tax credits for families with young children (West, Boteach and Vallas, 2015; Garfinkel et al., 2016; Maag and Isaacs, 2017; Shaefer et al. 2018;). In 2016, Oregon became the first state to implement a more generous EITC for families with children under age three.

Despite interest in expanding tax credits for families with young children, little research has considered how existing credits might affect young children differently than older children. Although many studies show that the expansions to the EITC in the 1990s had a positive impact on the labor supply of single mothers (Eissa and Liebman 1996; Ellwood 2000; Meyer and Rosenbaum 2001; Hoynes and Patel 2018, although for an exception, see Kleven 2019), increasing earnings (Dahl, DeLeire, and Schwabish, 2009), lifting families out of poverty

(Hoynes and Patel, 2015), and improving child outcomes (e.g. Dahl and Lochner, 2012; Hoynes, Miller and Simon, 2015; Bastian and Michelmore, 2018), the literature has largely overlooked how labor supply responses differ for mothers with very young children compared to mothers with older, school-aged children.[2]

This is surprising, given that the EITC (like other tax credits) is contingent on work, and maternal employment is patterned by the ages of her children. Mothers with very young children likely face more constraints or different preferences for work, and their labor supply rates have historically been lower than those of mothers with older children. These constraints are particularly pronounced for mothers with infants or toddlers, who face greater challenges finding affordable, quality child care (Jessen Howard et al. 2018), and for single mothers, who may not be able to rely on a second parent to aid with providing and paying for child care.

Even among children under the age of five, there is substantial variation in the availability and cost of quality child care for infants (ages 0-1) and toddlers (1-2) relative to three and four year olds (Jessen Howard et al. 2018; Henley and Adams, 2018). Three and four year olds may have access to Head Start or public preschool programs, and costs are substantially lower for these children relative to infants and toddlers: on average, infant care costs 60 percent more than care for a preschooler (Workman and Jessen Howard 2018). While tax credits may help pay for child care if it is available, they may not be enough to change personal preferences and lift financial constraints. This suggests that targeting tax credits for young children may not be effective at reducing poverty, especially among families with infants or toddlers.

[2] Some studies examine how labor supply responses differ for mothers with children under age five or six, compared to mothers over age five (Meyer and Rosenbaum 2001;, but none have fully modeled the differential labor supply effects according to child's age.

On the other hand, mothers with young children may be more responsive to tax credits because mothers with older children are likely closer to full employment levels than mothers with young children. Non-working mothers of older children may not work for a variety of difficult-to-change health or structural reasons, while non-working mothers of young children may be more likely to be marginal workers. Single mothers with young children may therefore be the most responsive to work incentives embedded in the EITC benefit schedule, raising further questions about the child care arrangements of these young children, and their subsequent outcomes. By studying labor supply effects of the EITC by child's age, our paper extends our understanding of the effectiveness of the EITC in increasing labor supply and reducing child poverty, informing future tax proposals to increase benefits for young children.

To test whether maternal labor supply responses to EITC expansions vary by child's age, we employ a parameterized difference-in-differences approach capturing both federal and state policy changes to the EITC over time. We use data from the Current Population Survey (CPS) covering 1990-2016, when most of the largest federal and state EITC expansions took place. We examine whether expansions to the EITC affected maternal labor supply by studying differences between infancy/toddlerhood (ages 0 to 2), preschool (3 to 5), middle childhood (6 to 12), and adolescence (13 to 17).[3] We focus on single mothers as they are a group of particular policy interest in efforts to reduce poverty and they are the primary recipients of the EITC (Tax Policy Center 2006), but in some analysis we also illustrate how results differ for married mothers. We also consider the implications of increased maternal labor supply on children's care arrangements and costs, using detailed information on child care arrangements from the Survey of Income and Program Participation from 1996 to 2008.

[3] We also estimate models using a less parametric approach to modeling child's age.

We find a significant age gradient in the maternal labor supply response to expansions in the EITC. In particular, we find much larger effects of the EITC on maternal labor supply among mothers whose youngest child is under age three, followed by mothers with a youngest child aged 3 to 5, and much smaller – or no response for mothers with a youngest child aged 6 to 17. A decomposition analysis reveals that about one-third of the increase in maternal labor supply between 1990 and 2000 is explained by EITC policy expansions, but that nearly half of the increase for mothers with very young children can be attributed to the EITC.

These large increases in labor supply among single mothers with very young children also lead to substantial increases in use of any child care (35%), the number of hours a child spends in formal child care (43%), and the cost of care ($750 per year). A back-of-the-envelope calculation suggests that increases in family income through the EITC and earnings outweigh the additional costs incurred through child care expenses, though there are likely substantial increases in other costs associated with work, such as transportation costs, that are unobserved.

Together, our findings suggest that tax credits that target families with young children may be effective at increasing labor supply and income, and reducing poverty. However, the results also raise questions about child wellbeing. Although evidence suggests that reducing early childhood poverty is good for children (e.g. Duncan et al. 2011), lack of high quality affordable child care (e.g. Henly and Adams, 2018), little availability of paid family leave (Addati, Cassirer and Glichrist, 2014), and some evidence that very early maternal employment is not necessarily good for children (e.g. Waldfogel, 2006) also raise questions about the overall effect of tax credits on child wellbeing. On the other hand, a long line of research suggests that, on net, expansions to the EITC over the last several decades have improved the outcomes of children, from reductions in incidence of low infant birth weight (Hoynes, Miller, and Simon

2015), increases in childhood test scores (Dahl and Lochner 2012; 2017), and increases in educational attainment (Bastian and Michelmore 2018; Manoli and Turner 2018). We consider these implications in the discussion section and highlight important areas for future research.

I. BACKGROUND

A. The Earned Income Tax Credit

The Earned Income Tax Credit (EITC) was implemented in 1975 as a temporary credit (made permanent in 1978) intended to offset payroll taxes paid by low-income families. The EITC has a trapezoidal structure, with benefits increasing to a plateau and then decreasing as earnings increase (shown in Figure 1). The federal EITC has been expanded several times since its inception. In 1991, a larger benefit for two or more children was introduced, and between 1993 and 1996, the phase in rate was increased– differentiating between families with one child and those with two or more children. In 2009, a larger tax credit was introduced for families with three or more children and the phase-in rate was further increased for those families.

[Figure 1 about here]

In addition to the federal EITC, twenty-nine states and the District of Columbia have implemented their own EITCs as of 2018.[4] State EITCs are typically set as a share of the federal credit, ranging from 3.5 percent to 40 percent of the federal benefit. States vary in terms of when they implemented EITCs, their overall generosity, whether the credits are refundable, and many states have changed their generosity over time (most becoming more generous but some becoming less generous or eliminating their credits altogether; see Appendix Table 1 for details). Rhode Island was the first state to implement an EITC in 1986; California implemented an EITC for the 2016 tax year. In 2017, Oregon became the first state to implement a more generous

[4] Our study goes through 2016 and includes 26 state EITCs and D.C. (WA, SC and MT are not yet implemented; Hawaii was implemented in 2017; NC was removed in 2016).

EITC for families with young children; California followed suit in 2019. States with EITCs vary in terms of size, region, and political orientation.

B. Why Might Differential Effects of the EITC by Child's Age Matter?

There are several reasons why heterogeneity in labor supply response by child's age is important to understand. Many studies support the notion that increased income, especially in early childhood, improves outcomes for children (Duncan, Magnuson and Votruba-Drzal, 2017), which would suggest that raising income for very young children should have long-term positive effects on wellbeing.[5] Children exposed to income interventions in early childhood may also benefit from longer treatment exposure (Chetty et al. 2016), especially if the intervention increases work experience (Cunha and Heckman, 2007; Dahl et al., 2009). Additionally, early childhood has been found to be a key time-period for intervention to reduce achievement gaps between poor and non-poor children (e.g. Heckman and Carneiro 2003) and related research finds that early exposure to policies that increase income (like Food Stamps) are linked with better health and economic wellbeing in adulthood (Hoynes, Schanzenbach and Almond, 2016).

On the other hand, since the EITC is contingent on work, it is not a pure income transfer. Children exposed to larger EITC benefits likely experience both an increase in family income, as well as an increase in the likelihood of having a mother in the workforce. Many studies have examined the effects of maternal employment on children (e.g. Bettinger et al. 2014), finding mixed evidence (for reviews see Lucas-Thompson, Goldberg, and Prause, 2010; Waldfogel, 2006, or Brand, 2015 for the literature on unemployment). Studies of maternal employment in the child's first year of life generally find it is linked with poorer child outcomes (Herbst, 2017),

[5] Many other studies (e.g. Duncan, Brooks-Gunn, Yeung & Smith, 1998; Duncan et al., 2010; Votruba-Drzal, 2006) explore the link between income and child outcomes and developmental timing generally finding larger associations between income and child outcomes in early childhood. Here we focus on experimental/quasi-experimental evidence.

although negative associations are more commonly concentrated among advantaged families and those mothers who work full-time (Brooks-Gunn, Han and Waldfogel, 2010; Hill et al., 2005; James-Burdumy, 2005; Ruhm, 2004; Waldfogel, Han and Brooks-Gunn, 2002). In comparison, studies of low-income families generally find few negative associations between maternal employment in the first year of life and child outcomes (Berger et al., 2008) and others find positive links with child wellbeing (Coley and Lombardi, 2013; Fuller et al., 2002; Lombardi and Coley, 2014; Pilkauskas, Brooks-Gunn and Waldfogel, 2018).

When mothers work, the amount of time they spend parenting is often reduced (Sayer, Bianchi and Robinson, 2004; Bianchi, Robinson and Milkie, 2006; Fox et al., 2013). Although children may fare better when cared for by a mother, evidence suggests mothers typically reduce unstructured time and not educational time with children when they work; thus, there is no observed detrimental effect on children (Bianchi, 2000; Hsin and Felfe, 2014). However, the stress of balancing work and parenting (especially among single mothers) may lead to role strain (Goode, 1960) and the challenge of taking on multiple roles has been linked with poorer parenting and in turn, worse child outcomes (Parcel and Menaghan, 1994; Raver, 2004).

II. DATA

Data come from the Current Population Survey Annual Social and Economic Supplement, a large, nationally-representative data source with representation at the state level, making it ideal for this analysis. The CPS data contain extensive income and demographic information on the non-institutionalized, civilian population and are collected annually. For this study we use data from 1990-2016. We restrict analyses to non-college-educated, single mothers (either never married, divorced, separated, or widowed) with at least one child under age 18.[6] We

[6] We focus on single mothers because they represent the majority of EITC claimants and expenditures. There is some concern that the EITC may affect the composition of single mothers, either through marriage (dis)incentives or

exclude college-educated single mothers, who tend to be quite different from less-educated single mothers, both in their labor supply, and their eligibility for the EITC.[7] After restrictions, the sample includes 150,691 single mothers.

A. Measures

Dependent variables. We examine five outcomes related to maternal labor supply. We first create an indicator equal to one if the single mother worked at all in the week prior to the interview. We also examine labor supply on the intensive margin by creating a variable representing the number of hours worked in the past week. From this intensive margin information, we also create an indicator for whether the single mother worked full-time, defined as more than 35 hours per week.

To understand how the EITC affects childhood poverty, we construct measures for family earnings and whether the family is above the federal poverty threshold. We analyze the impact of these tax credits on pre-tax family earnings, which includes only the earnings of the single mother before tax and transfer income. The March CPS conveniently contains information on annual income from the prior calendar year, reflecting taxable income from the previous year. Based on the number of children residing in the household, we also create indicators for whether the family has pre-tax earnings above the federal poverty line.

EITC measures. For our descriptive statistics, we document the share of mothers eligible for the EITC and their average EITC benefit using Census Bureau imputed EITC measures for the CPS. However, because of endogeneity concerns, whereby differences in tax credit eligibility

fertility incentives. Evidence on marriage incentives suggests relatively modest effects (Herbst, 2011; Michelmore, 2018). There is less research on the EITC and fertility, though the existing evidence does not find that the EITC encourages non-marital childbearing (Baughman and Dickert-Conlin, 2009).

[7] Results are robust to including college educated single mothers in the analysis (available upon request). We also run a placebo test on college educated mothers (see Appendix Table 2) and generally find few significant results.

are correlated with other household characteristics that are likely correlated with the outcomes of interest, we do not use household level measures of EITC benefits in our regression analysis. Instead, following a number of other studies (Currie and Gruber, 1996; Jones, Milligan, and Stabile, 2015; Jones and Michelmore, 2018), we create simulated measures of EITC benefits using the several federal and state policy changes over time. Changes in the size of the benefits arise from differences in policy parameters from year to year, by number of children and across and within states over time.

To construct the simulated EITC, we use a nationally-representative sample of single mothers (from the Survey of Income and Program Participation) in 1996[8] and inflate/deflate their income using the Consumer Price Index (CPI) for each year between 1989 and 2015, the tax years of interest. Relying on a single year of data on a nationally-representative sample holds constant the income distribution from year to year, accounting only for changes in the income distribution from inflation. Fixing the income distribution this way ensures that any changes in benefits are due to changes in the policy, and not changes in the income distribution. We then use NBER's TAXSIM to calculate federal income tax liability in each year, which includes measures for the EITC. We compute state EITC benefits by running this sample of single mothers through each state's EITC laws in each year between 1989 and 2015. Calculating state EITCs using the national sample of single mothers reduces concerns of endogeneity of state demographic characteristics with respect to state EITC benefits.

Once we obtain measures of federal and state credits for the nationally-representative sample of single mothers, we then collapse the sample to the state-year-family size level. This

[8] We use 1996, but in extensions, have tested using different years and the results are not sensitive. We use data from the SIPP to use a nationally-representative sample of single mothers that are independent of our own samples. However, we have also tested using a sample from the CPS and again the results were unchanged.

produces a data set that contains a measure of the average federal and state EITC for a given family size (one, two, or three or more children), in a given state, in a given year. We match this information to our sample by year, state, and number of children residing in the household.

After controlling for state, year, and family size fixed effects, variation in the simulated EITC is driven by the interaction of these three sources of variation. One source of variation is driven by comparing single mothers with the same number of children, living in the same state, in different years. For example, a single mother with two children living in New York in 1993 (the year before the state introduced an EITC) faces an average EITC of $953 (in 2016 dollars), whereas a single mother with two children living in New York in 1997 could have received an average EITC of $2,541 (in 2016 dollars)—a difference of more than $1,500.[9] A second source of variation is driven by comparing single mothers living in the same state, in the same year, with different numbers of children. Finally, a third source of variation is driven by comparing single mothers with the same number of children in the same year, where one lives in a state that has an EITC, and another lives in a state that either does not have an EITC, or has an EITC with a different generosity level.

Figure 2 shows the federal and state variation over time for one, two, and three child households. Panel A depicts only variation in the average federal credit for one, two, and three or more child households over time, while panels B through D illustrate the variation in the federal and state EITCs combined, for one (B), two (C), and three or more (D) child households. From Panel A, it is clear that the average federal EITC increased substantially for households with two or more children beginning in the early 1990s, increasing the average benefit from just under $1,000 to $2,000 for those households (2016 dollars). In 2009, the federal credit was expanded

[9] In 1997, New York had an EITC worth 20% of the federal EITC. All numbers calculated using the simulated EITC measure described above.

for households with three or more children, increasing the average benefit by about $500 between 2009 and 2010.

Panels B through D illustrate the substantial variation in combined federal and state EITCs over time. The average difference between the most generous state in a given year and the federal EITC is about $500. Among two-child households (panel C), where the average EITC benefit is higher, the average difference between the least generous and most generous state was about $1,000. Last, among three-child households (panel D), the average benefit increase over time was the same as two-child households until 2009, when an expansion produced an average increase in EITC benefits of about $500 for families with three or more children. Over this time period, approximately 38% of our variation is captured by year-over-year (federal) changes in generosity, 44% is explained by variation across household size, and 6% is explained by variation across states.[10]

[Figure 2 about here]

At the same time as many of the federal expansions to the EITC occurred, there was also a dramatic rise in maternal employment, particularly among single mothers with young children. In Figure 3, using data from the March CPS, we observe that although employment rose for all mothers between 1990 and 2000 (vertical lines represent federal EITC expansions), the most dramatic rise was among mothers whose youngest child was under three. Employment increased by 59 percent for mothers with children under the age of three; from 34 percent in 1990 to 54 percent in 2000. Although employment among other groups also increased, the rate of change was much less steep: an increase of 33 percent for those with children ages 3 to 5, 19 percent for children 6 to 12, and 7 percent for mothers with children aged 13 to 17. This resulted in a

[10] Calculated by regressing the simulated benefit on state, year, and household size fixed effects and noting differences in the r-squared measure.

narrowing of the employment gap between mothers of school-aged children and mothers with young children. Although there have been some fluctuations in maternal employment rates by child's age (such as in the Great Recession), since 2000 levels of maternal employment across all age groups have remained steady. These descriptive findings suggest that maternal employment is closely linked with child's age, and that the secular increase in maternal employment over time has not occurred uniformly across the population.

[Figure 3 about here]

B.Sample Descriptives

Table 1 presents demographic characteristics of the single mothers overall, as well as separately according to the age of her youngest child. Mothers are on average about 34 years old and have about 1.8 children in the household. About half of women have just one child, a third have two children, and one in five have three or more children. Not surprisingly, we find significant differences in the characteristics of mothers according to the age of her youngest child: mothers whose youngest child is 0-2 years old are younger (27 years old, on average), have slightly larger families (1.97 children compared to 1.79 children in the sample overall), and are more likely to have not completed high school (26 percent compared to 21 percent of the sample overall). Mothers with teenagers, on the other hand, are older (43 years, on average), have fewer children (1.34), and are more likely to have just one child in the household (71 percent). They are also more likely to have completed some college (40 percent).

[Table 1 about here]

Mother's annual earnings are approximately $19,000 a year (2016$), and about 60 percent live below the poverty line based on mother's annual earnings. Despite high levels of

poverty, the majority of single mothers work (62 percent), but less than half work full-time (40 percent). Employment rates are higher among mothers of older children, as are earnings and number of hours worked per week. Despite these differences, we find similar rates of EITC eligibility among single mothers regardless of the age of her youngest child—just over half are eligible based on their earnings, with a sample average benefit of about $1500 (regardless of eligibility). The simulated EITC is similar, at approximately $1600 for mothers, though in both imputed household benefits and in the simulated EITC, benefits are slightly higher among mothers with younger children; mothers with teenagers have an average EITC that is about $150 less than the sample average. We attribute these small differences to the difference in the number of children residing in the household—mothers with teenagers are more likely to have one child residing in the household relative to mothers with younger children. This is intuitive since the sample is limited to households where the youngest child is a teenager—older children are likely to have already left the house.

III. Empirical Strategy

We begin our analysis by examining whether increases in EITC generosity increase the labor supply of single mothers, without differentiating patterns according to the ages of the children residing in the household. This exercise serves to replicate and update previous research on how the EITC affects maternal labor supply. We estimate models of the following form:

$$(1)\quad Y_{istc} = \beta_0 + \beta_1 EITC_{stc} + \beta_2 X_{istc} + \beta_3 \alpha_{st} + \beta_4 \theta_c * \alpha_{st} + \delta_s + \gamma_t + \theta_c + \varepsilon_{istc} ,$$

where Y_{istc} represents the labor supply outcome of interest, measured for single mother *i,* living in state *s,* in year *t,* with number of children residing in the household *c*. We model this as a

function of EITC generosity, $EITC_{stc}$, which represents the one year-lagged average benefit for a single mother residing in state *s,* at time *t,* with number of children c. The coefficient of interest, β_1, represents how maternal labor supply changes when the average household EITC benefits increase by $1,000.

X_{istc} represents a vector of demographic characteristics, including race (non-Hispanic black, non-Hispanic white, Hispanic, and other), mother's age, and mother's education (less than high school, high school, or some college). α_{st} represent state-year level controls, such as the state unemployment rate, whether the state had a welfare waiver in place prior to 1996, the maximum welfare benefit for a family of three, the maximum food stamp benefit for a family of three, the state minimum wage, and state GDP.[11] These state-year contextual variables control for other conditions at the state-year level that may be correlated with implementation and expansions of the federal and state EITCs. We also allow each of these state-year contextual variables to affect the outcomes of interest differently according to the number of children residing in the household through an interaction term ($\theta_c * \alpha_{st}$).

State fixed effects (δ_s) control for state-level characteristics that may produce different levels of maternal labor supply and also correlate with state policy generosity. Year fixed effects (γ_t) control for national events, such as recessions, that may be correlated with both benefit generosity and maternal labor supply. Number-of-child fixed effects (θ_c) control for differences in maternal labor supply by number of children in the household.

Since our identifying variation comes from state policy changes that were implemented over time, as well as federal policies that affected larger households more than smaller

[11] Data on state-year contextual variables come from the University of Kentucky's Center for Poverty Research's National Welfare Data: http://ukcpr.org/resources/national-welfare-data.

households, with all controls in the model, we assume that there were no other policies or events that occurred at the same time that states implemented or expanded their EITCs, or at the same time as the federal expansions that disproportionately affected larger households. Since we control for state, year, and household size fixed effects in our analysis, any threat to identification must occur at the intersection of these fixed effects (state-by-year, household-size-by-year, or household-size-by-state); we test the robustness of our findings to inclusion of two-way fixed effects to reduce concerns of omitted variable bias.

We additionally test the robustness of our findings to the inclusion of state-specific linear time trends and number-of-child-specific time trends. Controlling for state time trends allows us to control for state-level trends in maternal labor supply that may correlate with changes in EITC policy. Number-of-child-specific time trends control for any trends in maternal labor supply that differentially occur for mothers with multiple children. Since federal expansions to the EITC affect households with multiple children differently than those with one child, if there were secular trends in maternal labor supply patterns that also varied for mothers with one child compared to two children, failure to control for number-of-child specific time trends will generate omitted variable bias on the estimate of how the EITC affects maternal labor supply. However, if changes to the EITC affected not only point-in-time maternal labor supply, but also the trends in maternal labor supply over time, then these number-of-child-specific time trends may be "over fitting" the model. We present results from such models as a robustness check, but our preferred specification excludes state and number-of-child-specific time trends.

A. Testing for Differences in Labor Supply Responses by Age

We next estimate how the expansions of the EITC differentially affected maternal labor supply according to the age of her youngest child. To do this, we revise equation (1) above to include age interactions:

$$(2)\ Y_{istc} = \beta_0 + \beta_1 EITC_{stc} + \beta_2 f(age) + \beta_3 EITC_{stc} * f(age) + \beta_4 X_{istc} + \beta_5 \alpha_{st} + \beta_6 \theta_c * \alpha_{st} + \delta_s + \gamma_t + \theta_c + \varepsilon_i$$

Here, child's age at the time of the survey, $f(age)$, is modeled as a set of mutually exclusive indicators for age: 0 to 2, 3 to 5, 6 to 12, and 13 to 17 (reference). We interact these age indicators with the average EITC measure to estimate how a $1,000 policy-induced increase in tax credit generosity affects maternal labor supply differentially according to the age of her youngest child We chose the youngest child because this child is likely the binding constraint for mothers' labor market decisions (see, for example, Fitzpatrick 2012), and ensures that each mother is represented exactly once in the sample.[12] However, because other children in the household are likely to affect labor supply decisions, we also include indicators for the presence of other children in the household in each age range (0-2, 3-5, or 6-12), as well as controls for the total number of children in the household.

We test the sensitivity of results to the age specification shown here, by modeling age 1) as a cubic function interacted with EITC generosity, 2) as a full interaction of age indicators (0 to 17) with EITC generosity, and 3) by running models separately for each of the four age categories (0-2, 3-5, 6-12, and 13-17).

[12] We also conducted analyses using all children residing in the household and conduct the analysis at the child level; results are quite similar and presented in **appendix table 3.**

B. Decomposing the Rise in Maternal Labor Force Participation by Age: The Role of the EITC

We also conduct a decomposition analysis to examine the extent to which expansions in the EITC explain increases in maternal labor force participation and in particular, differences by the age of the youngest child, between 1990 and 2000. We use an extension of the Blinder-Oaxaca method for decomposing dichotomous variables. We conduct a pooled analysis since the choice of reference year can yield different estimates (Neumark, 1988; Oaxaca and Ransom, 1994). We estimate the decomposition using normalized effects (deviations from a grand mean; see Yun, 2005a, 2005b for more details) in order to properly estimate detailed composition effects as the choice of the excluded category can affect the estimate (Jann, 2008). In addition to the simulated EITC, our decomposition includes the following individual level measures: income to poverty ratio, food stamp receipt, Medicaid receipt, Social Security receipt, Supplemental Security Income receipt, whether a grandparent resides in the household, maternal education, maternal age, maternal race/ethnicity, and the total number of children residing in the household. We run the decomposition for the full sample of children as well as stratified by child's age (0-2, 3-5, 6-12 and 13-17).

IV. RESULTS

A. The EITC and Maternal Labor Supply

We first examine the link between the EITC and maternal labor force outcomes without accounting for child's age, in order to compare with previous estimates in the literature. Results, presented in Table 2 and based on estimating equation (1), are consistent with previous research illustrating that the EITC increases the employment of single mothers along several dimensions.

[Table 2 about here]

Following a $1,000 increase in the average EITC benefit, we estimate a 5.3 percentage point increase in employment among single mothers, a 2 hour increase in the number of hours worked per week, and a 3 percentage point increase in the likelihood of working at least 35 hours per week. Along with this increase in employment, we find significant increases in annual, pre-tax earnings: a $1,000 increase in the average EITC leads to a $1,081 increase in annual, pre-tax earnings.[13] This also leads to reductions in household poverty, by approximately 1.2 percentage points.

This employment effect of 5.3 percentage points has an implied elasticity of 0.14, which is slightly lower than estimates obtained by Hoynes and Patel (2017), who estimate elasticities ranging from 0.26 to 0.47 in their analyses of the federal EITC expansions in the 1980s and 1990s on maternal labor supply. Our analyses reflects a different time frame (1990 through 2016) and also include the many state EITCs that have been introduced over the last two decades, while their analysis focused on the federal EITC expansions in the 1980s and 1990s.[14] In percentage terms, however, our estimates are quite similar: we estimate a 9% increase in employment associated with a $1,000 increase in the average EITC, while Hoynes and Patel (2017) estimate an 11% increase in employment.

B. Does the EITC Affect Maternal Labor Supply Differently by Child's Age?

We next turn to analyses testing how maternal labor supply responses differ according to the age of the youngest child in the household (Table 3). Since we omit the age category for children aged 13 to 17, all of the interaction terms can be interpreted as the relative change in the outcome of interest following a $1,000 increase in the average EITC benefit at the state, year,

[13] Pre-tax earnings do not include the value of the household EITC benefit.

[14] Hoynes and Patel (2017) also limit their analyses to single women aged 24-48, while we include all single mothers with at least one child under the age of 18 residing in the household. Results are quite similar when making the same sample restrictions as Hoynes and Patel (2017).

family size level among mothers with children in the given age category, relative to mothers whose youngest child is 13 to 17 years old. The coefficient on the simulated EITC (main effect) reflects the average labor supply response among mothers whose youngest child is 13 to 17. The total labor supply effect for mothers with children in each age group can be obtained by summing the coefficient on the main effect with the coefficient on the interaction term, which we present at the bottom of Table 3, along with F-tests for each estimate.

[Table 3 about here]

Following a $1,000 increase in average EITC generosity, single mothers whose youngest child is 13 to 17 are approximately 3 percentage points more likely to work. Mothers with children younger than three are much more responsive to increases in the EITC relative to mothers with teenagers: they are nearly 4.6 percentage points more likely to work in the last week, relative to single mothers with children aged 13 to 17, for a total increase of nearly 8 percentage points following a $1,000 increase in the average EITC (0.032+0.046=0.078, F-statistic=19.19). Although there is also an effect of the EITC on labor supply for mothers with children ages 3 to 5, the size of the coefficient is roughly one-third that of mothers with 0 to 2 year olds (1.5 percentage points), resulting in a total increase in employment of 4.7 percentage points among mothers with 3 to 5 year olds. For mothers with children ages 6 to 12, we find no significantly different effect on work relative to mothers with children aged 13 to 17; they are approximately 3.6 percentage points more likely to work.

Across all of the outcomes we examined, we find the largest effects of the EITC on mothers with children under age three. On the intensive margin, single mothers with children under age three work 3.2 more hours per week following a $1,000 increase in the average EITC, while mothers with teenagers work 1.3 hours more per week (not statistically significant). We

find a similar pattern for full-time employment: mothers with children under age three are 5 percentage points more likely to work full-time, while mothers with teenagers are 2.5 percentage points more likely to work full-time (not statistically significant). For all of the employment effects, mothers with children under age three are statistically significantly more likely to work when the average EITC benefit increases, compared to mothers with teenagers.

In terms of earnings and poverty alleviation, we find that a $1,000 increase in average EITC generosity increases pre-tax earnings among mothers with children younger than three by nearly $1,900. This increase in pre-tax earnings also translates into reductions in the likelihood of young children residing in poverty, by approximately 4 percentage points. Again, we find a positive but smaller effect for children ages 3 to 5– increases of approximately $1,100 per year. For both earnings and poverty alleviation, we find no statistically significant effects of EITC expansions for mothers with children ages 6 to 17. Overall, these findings suggest diminishing effects of the EITC on maternal labor supply and earnings for mothers with older children.

Because mothers with very young children have lower baseline employment and earnings, these larger point estimates also imply larger effect sizes and larger elasticities among mothers with children under age three relative to mothers with older children. For employment, an increase in work by 8 percentage points translates to a 16 percent increase in employment among mothers with children under age three, or an elasticity of approximately 0.28. For mothers with older children, the effect sizes are 8 percent for mothers with 3 to 5 year olds, 5 percent for mothers with 6 to 12 year olds, and 4.5 percent for mothers with teenagers. Elasticities for mothers of older children are much smaller than those of mothers with children under three, and range from 0.07 to 0.13. In sum, these results suggest that the EITC had a

substantially larger effect on employment among mothers with infants relative to mothers with teenagers.[15]

Table 4 illustrates how results vary across a variety different subgroups—by race, educational attainment, and marital status. We find more pronounced age gradients in labor supply among white and black non-Hispanic single mothers, and no significant age gradient among Hispanic single mothers. Black mothers in particular illustrate a very steep age gradient—while mothers of children under age 3 were approximately 7 percentage points more likely to be employed following a $1,000 increase in the average EITC benefit, we find a negative labor supply effect on mothers with teenagers, although the estimate is not statistically significant.

[Table 4 about here]

We also find steeper age gradients among the more-educated single mothers in our sample—mothers of young children who had some college experience were 9 percentage points more likely to be employed following a $1,000 increase in the average EITC benefit, while mothers of young children with less than a high school diploma were 6.8 percentage points more likely to be employed. This could potentially be driven by differential ability to find and pay for child care among mothers with some college compared to mothers with less than a high school diploma—more highly-educated single mothers may have greater purchasing power compared to less-educated single mothers. On the other hand, labor supply responses among mothers with

[15] We also examine a number of other employment and earnings outcomes, in appendix table 4, such as likelihood of living above 50% of the federal poverty line, 200% of the federal poverty line, the likelihood of working part time, and hourly wages. We find a consistent pattern for lifting families above 50% of poverty, working part time, and hourly wages. We find little evidence that the EITC increases the likelihood of family income exceeding 200% of the federal poverty line, and we also find that only mothers with infants see a statistically significant increase in hourly wages, of about 5%. Mothers with older children, on average, experience a decline in hourly wages, which suggests evidence of negative selection into the labor force among mothers with children over the age of 2.

teenagers, who typically do not require child care, were similar regardless of educational attainment, at around 4 percentage points per $1,000 increase in average EITC benefits.

In examining effects by marital status, we find a larger labor supply response among divorced mothers with young children compared to never married mothers with young children—divorced mothers with children under age three were 11 percentage points more likely to work following a $1,000 increase in the EITC, compared to never-married mothers with children under age three, who were 6 percentage points more likely to work. Once again, this difference could be explained by differences in availability of child care—divorced mothers may have more access to child support or other types of financial and non-financial support from the father, relative to never-married mothers. Single mothers with teenagers had similar labor supply responses regardless of whether they were never-married (3.8 percentage points) or divorced (4.3 percentage points).

On the other hand, an analysis of the labor supply effects of the EITC on married mothers yields a completely different age pattern: we find no effect of increases in the EITC on the labor supply of married mothers with very young children (under age three), and negative, significant effects for married mothers with children aged 6 and older. These estimates are consistent with previous research (Eissa and Hoynes 2004), and imply that the EITC subsidizes leisure particularly among married mothers with school-aged children, rather than married mothers with very young children. The fact that we find a completely different employment response pattern for married mothers suggests that the age gradient we observe for single mothers is not driven by some spurious correlation between maternal labor supply and child's age.

C. Robustness Checks: Model specification

We illustrate the sensitivity of our estimates to the inclusion of different controls in Table 5. Panel A presents results for the sample of single mothers without differentiating according to the age of her youngest child (based on estimating equation (1)), while panel B presents results using regression model (2), which includes interactions of the age of the youngest child with the simulated EITC measure.

[Table 5 about here]

Column 1 presents results from a model with no other controls, and indicates that a $1,000 increase in the average EITC benefits leads to a 0.9 percentage point increase in the employment among single mothers. This increase in employment is largest among mothers with children under three (see panel B), and indicates a total increase in employment of roughly 3.5 percentage points. Mothers with youngest children aged 3 to 17 show similar responses in their labor supply—they are approximately 0.9 percentage points more likely to work following a $1,000 increase in the average EITC.

Adding demographic controls increases the magnitude of the point estimates, as does including number-of-child fixed effects, which are highly correlated with average EITC generosity. Adding state and year fixed effects, along with state contextual factors such as the unemployment rate, an indicator for having a state welfare waiver, and minimum wage increases point estimates slightly (column 5), and we continue to find substantially larger labor supply responses among mothers whose youngest child is younger than three. Column 5 presents results from our preferred model, and indicates that a $1,000 increase in the average EITC increases the likelihood of working by about 5 percentage points; and about 8 percentage points among mothers with infants and toddlers. The main point estimates fluctuate with the inclusion of other

controls such as state-specific time trends, number of child-specific time trends, interactions of the EITC with demographic characteristics and state contextual variables, and two-way fixed effects for number of children by year, and number of children by state. While the overall point estimates fluctuate, we continue to find the same pattern—that single mothers with very young children show the largest employment responses to the EITC than single mothers with children over the age of two. The robustness of this finding across a number of different model specification further suggests that the age patterns in maternal labor supply we obtain are not merely spurious correlations between EITC generosity and maternal labor supply.

D. Robustness Checks: Stratify by child's age

While we control for a host of demographic and state contextual variables in our main analysis, there may be some concern that unobserved differences in characteristics between mothers with young children and mothers with older children explain the differential employment responses to the EITC. We address this concern by stratifying our sample based on the age of the youngest child in the household, conducting separate regression analyses for mothers with children aged 0 to 2, 3 to 5, 6 to 12, and 13 to 17. In this analyses (results presented in Table 6), we compare mothers with similarly-aged children who are exposed to different average EITC benefits due to the year, state, or number of children in the household. This analysis compares, for instance, a mother with one two-year-old child living in New York in 1990, to a mother with one two-year-old child living in New York in 1996.

[Table 6 about here]

Results from this analysis produce somewhat similar patterns as those in Table 3, although we now find somewhat similar employment responses among mothers with children

aged 0 to 2, 3 to 5, and 6 to 12; mothers with teenagers continue to show very small employment responses to expansions to the EITC, and in this particular analyses, we find no significant increase in employment among mothers with teenagers. Following a $1,000 increase in the average EITC benefit, single mothers with children aged 0 to 2 are 6.4 percentage points more likely to work. Similarly, mothers with 3 to 5 year olds were 6.5 percentage points more likely to work, and mothers with 6 to 12 year olds were 5.1 percentage points more likely to work. Mothers with teenagers appear unresponsive to expansions to the EITC in their employment. In terms of effect size, we continue to find the largest employment response among mothers with children under age three, who are 13 percent more likely to work, compared to 11 and 7 percent among mothers with 3 to 5 and 6 to 12 year olds, respectively. We find very similar patterns across all of the other outcomes of interest—effects were largest among mothers with children younger than three, and small, and insignificant among mothers with teenagers.

E. Robustness Checks: Age and Model Specification

The analyses presented thus far model the age of the youngest child using four, mutually exclusive categories. In Figure 4, we test the sensitivity of our analyses to two different age specifications: a cubic function interacted with EITC generosity and a fully-interacted age specification with EITC generosity. Consistent with our main results, we find the largest effects for mothers with very young children regardless of how we specify age, with steep declines in the labor supply response for mothers for each one-year increase in child's age until about age 8. Although the fully interacted model is much noisier (with a possible bump up between ages 6 and 8, perhaps due to children entering full-day school), both the cubic and fully-interacted

models suggest little response in maternal labor supply to EITC expansions among mothers with children aged 8 or older.[16]

[Figure 4 about here]

Results were also robust to a variety of different model specifications, which we discuss in more detail in the appendix. In particular, we find a similar age gradient if we employ a traditional difference-in-differences analysis using the 1993 OBRA reform that expanded the EITC disproportionately for two-or-more child households compared to households with exactly one child. Similarly, when we use a difference-in-differences analysis comparing households with three or more children before and after the 2009 ARRA reform, we also find a similar age gradient as in the main results (see Appendix Table 6). Finally, we also tested the robustness of the findings to relying on only the federal or only the state variation in the EITC expansions; results were less precise when using only the state variation, though we found similar patterns using either the federal or state variation in the EITC (see Appendix Table 7). These results lend further validity to our main findings.

F. Child care arrangements

What happens to children when mothers go to work? The fact that the EITC has the largest labor supply effect among mothers with children under age three raises questions about who cares for these young children when mothers go to work. While children could potentially enter pre-K programs starting at age 3, there are far fewer, more expensive child care options for children prior to age 3.

[16] We also ran the models interacting EITC with each year of early childhood (0-5) with the EITC. These analyses, available upon request, are similar to those presented in Figure 5.

To examine this question, we use data from the Survey of Income and Program Participation (SIPP) from 1996 to 2008. The SIPP is a nationally-representative, short panel study, with panels starting in 1996, 2001, 2004, and 2008. Each panel is between 36 and 60 months in duration, and households are interviewed once every four months about their household composition, income sources, and a variety of other topics. In addition to the main questionnaire, each interview wave includes a different topical module, where respondents are additionally asked about things like wealth and assets, education, marital and birth histories, and child care arrangements. We use these child care arrangement topical modules to analyze how the EITC affects the child care arrangements of young children. Due to significant changes to the child care topical module in the 1996 survey, we are unable to use data prior to 1996, when many of the large federal expansions to the EITC occurred. Instead, this analysis relies more heavily on the state EITC expansions, as well as the 2009 ARRA expansion.

Employing the same empirical strategy, we examine how changes in the average EITC benefit affect child care arrangements, including the likelihood of being in any type of child care other than the mother, the total number of hours spent in child care per week, and the cost of those arrangements. We also examine the type of child care that children use on a regular basis, which include (not mutually exclusive): center-based care, Head Start (also included in center-based care), relative care, non-relative care, and parent care. Because child care arrangements differ substantially across age ranges, and the SIPP asks different questions for children under age six and children six and older, we estimate separate models for each age range, and limit our analysis to 0 to 2 year olds, 3 to 5 year olds, and 6 to 12 year olds (the SIPP does not ask questions about child care arrangements for children over age 14).

Results, presented in Table 7, indicate that increases in the average EITC benefit led to substantial increases in the likelihood of being in any type of regular child care arrangement among children aged 0 to 2. Following a $1,000 increase in the average EITC, children under age three are nearly 23 percentage points more likely to be in any type of child care arrangement (a 34% increase), and spent about 10 hours more per week in some type of child care arrangement (a 43% increase). While these are very large effects, we also find a much larger employment response using the SIPP data (25 ppt) relative to our estimates in the CPS (8 ppt). This is a much smaller sample size than that of the CPS, and we use a narrower time window due to data limitations of the SIPP. For these reasons, we interpret these coefficients with caution, and focus more on the sign of the effects rather than the magnitude. We do not find any significant effect of the EITC on employment or child care arrangements for mothers with children aged 3 to 5 or 6 to 12, which is substantively consistent with our estimates in the CPS.

[Table 7 about here]

Mothers with young children were also more likely to pay for child care, and their weekly payments increased by more than 100%. The baseline average weekly payment, however, is quite low, at around $50 per week; implying that the EITC increases these payments by $63 per month, or $750 per year. Given that the EITC increases average pre-tax earnings by approximately $1,900 per year, this implies that roughly 40% of that increase in earnings would go towards child care costs, though this does not include the increase in household income generated by the EITC benefit itself, and other tax credits associated with children such as the Child Tax Credit (CTC), and the Child and Dependent Care Credit (CDCC), all of which would offset some of the added costs of childcare.

The type of care has been shown to be very important for child outcomes (cite), with center-based care linked with the best outcomes for children (particularly low-income children). We find that the EITC leads to both increases in center-based care (11 percentage points) and relative care (18 percentage points) among children under age three. We also find marginally-significant increases in center-based care for 6 to 12 year olds, and declines in the likelihood of being care for by a relative. While center-based care is generally linked with better outcomes for children, relative care tends to be of lower quality, and could lead to worse outcomes for children relative to being cared for by a parent. Overall, these findings illustrate that the EITC is linked with increased use and costs of child care for very young children, some of which could be high-quality center-based care, which imply positive outcomes for children, but also more informal arrangements, which may lead to worse outcomes than if children were cared for by a parent. We find no effect of the EITC on use or costs of child care among children ages 3 to 12.

G. How Much of the Rise in Maternal Labor Supply is Explained by the EITC?

We end with a formal decomposition of the change in maternal labor supply between 1990 and 2000, estimating separate models according to the age of the youngest child residing in the household. Results, presented in Figure 5, suggest that the changes in the generosity of the EITC between 1990 and 2000 account for a large share of the increase in maternal labor supply over this time-period, particularly among mothers with very young children (the composition contribution/proportion explained for all the factors included in the decomposition are available in Appendix Table 8).

[Figure 5 about here]

For the sample of all single mothers, we find a 15 percentage point increase in the likelihood of working between 1990 and 2000. About one-third of this increase can be explained by increases in the generosity of the EITC – explaining about 5.6 percentage points of the increase. Although other factors, including changes in income-to-needs, Food Stamp/SNAP receipt, and increased maternal education all explain some of the increase in the employment of single mothers, all of the other factors included in the decomposition together explain less of the increase than the EITC alone.[17]

As shown in Figure 3, the increase in single mother's employment between 1990 and 2000 varied greatly by child's age. For mothers with very young children, expansions to the EITC account for more than half of the increase in labor supply over this time period, or about 11 percentage points. The EITC also explains some of the increase in labor supply for mothers with children ages 3-5 (4 percentage points or 24 percent of the increase). Interestingly, we find EITC expansions for mothers of 6-12 years olds would predict a reduction in employment. Lastly, changes in the EITC would predict an even higher rate of employment among mothers of adolescents.

The other factor that explained a relatively large portion of the increase in employment across all groups was changes in the share of mothers receiving Food Stamps/SNAP, but this factor only explained 1-2 percentage points of the increase depending on the age of the child. For mothers with children ages 0 to 2, changes in Medicaid receipt also explained about 2 percentage points of the increase, whereas this was not the case for older children, and in fact, Medicaid receipt among mothers of older children reduced labor force participation. Increased maternal

[17] Because income to needs is endogenous to employment and the EITC, we ran a model (available upon request) excluding this factor and results were unchanged.

education also accounted for some of the increase in single mother's employment across all age groups.

Although this analysis includes many factors that likely explained the increase in single mother's labor supply, there are important drivers of this increase that are not included (for example, AFDC/TANF or availability of public pre-school). This exercise is not intended to capture all the factors that might explain the increase in single mother's employment but to examine the extent to which the EITC might have been a driver of this increase. Together these analyses suggest that the EITC is a large factor, likely one of the largest factors for single mothers with children, in explaining the increase in maternal employment among mothers with children under the age of three between 1990 and 2000.

V. Discussion

Using a parameterized difference-in-differences analysis exploiting the many federal and state policy changes to the EITC over the last 25 years, we showed that women with infants and toddlers were the most likely to respond to policy expansions in the EITC by increasing employment, hours worked, and earnings. Mothers of preschool aged children also increased their employment, work hours and earnings, but the magnitude of the effect was about half the size of that observed for mothers with children under age three. Likewise, for mothers with children ages 6 and older, we found some evidence of an effect on labor supply, but the effects were much smaller and were not consistent across all model specifications.

Our main findings—that mothers with very young children were most responsive to changes in the EITC—were robust to employing a traditional difference-in-differences model, running models separately for each child age group, parsing the variation into its federal and

state components, several federal and state-level controls and time trends, and to different specifications of child's age.

Along with this large increase in maternal labor supply, we found substantial increases in the use of formal child care for mothers with children under age three. Children under age three were substantially more likely to be cared for in a center-based environment, more likely to be cared for by a relative, and spent about 10 hours more per week in childcare compared to children exposed to smaller EITC benefits. Child care payments also increase when the EITC becomes more generous—mothers with children under three were substantially more likely to make payments for child care, and costs increased by about $750 per year.

Our findings also highlight a trend that is often overlooked in studies of maternal employment – that much of the increase in maternal labor force between 1990 and 2000 was concentrated among mothers with children under age three. Like prior research (e.g. Bainbridge, Meyers and Waldfogel, 2003), we found that the EITC explained a significant portion of the increase in maternal labor supply in the 1990s, about one-third of the total increase. For mothers with children under three the effect was more pronounced: the EITC explained about half of the increase in employment among such mothers.

Interpreting our findings in terms of adult and child wellbeing is not straight forward, as there are reasons to expect both positive and negative effects of moving mothers with very young children into the labor force. Increasing income of households with very young children is likely to have long-term positive impacts on children, as poverty in early childhood is thought to be particularly detrimental to development (e.g. Duncan et al. 2010, 2012). That we find increases in the likelihood of being in a center-based child care center implies potentially better outcomes for children, though outcomes are highly dependent on the type and quality of care (e.g. Chaudry

et al., 2017). Extant research on the effects of the EITC on child outcomes has also largely found positive effects on birth weight (Hoynes et al 2015) and on student test scores (Dahl and Lochner 2012). More research is needed to understand heterogeneity in effects by child's age, but one study found positive effects on education outcomes for adolescents but negative effects for children ages 6 to 12 (Bastian and Michelmore 2018).

There are also reasons to expect negative consequences of increased labor supply among mothers with very young children. Some research has found that early maternal employment is linked with poorer child outcomes (e.g. Ruhm 2004; Herbst, 2017), although there may be heterogeneity in outcomes across the income distribution (e.g. Lomardi and Coley, 2014). Research also shows that balancing parenting and work may be particularly stressful when children are young, which in turn can affect parenting quality (Raver, 2004) and time with children (e.g. Fox et al., 2013). That we find increases in the likelihood that children are cared for by a relative may also lead to worse outcomes for children compared to being cared for by a parent, depending on the quality of the care.

In sum, even if the weight of the evidence suggests positive overall impacts of the EITC on children and mothers, that the EITC is moving mothers with very young children into the labor force in particular, merits further consideration. Although this is beyond the scope of this paper, it may be the case that the steep labor supply response of mothers with very young children is in part due to an absence of other income support policies for mothers with young children. Unlike other Western countries, in the U.S., low-income mothers with very young children have few alternatives to working to make ends meet. Policies like family or maternity leave, little availability of subsidized or free child care, and a lack of a child benefit, may in part

explain why we see such large effects of the EITC in early childhood. More research is needed to understand the interaction between child's age, the EITC, and other policies.

This study is not without limitations. Our analyses assume that single mothers claim all of the children that are residing in the household; yet non-resident fathers or other family members may claim some of the children. Identifying tax-filing units is complex and difficult to determine with survey data. Additionally, families may not always correctly claim children as dependents on their tax returns.

Despite these limitations, our findings suggest much of the EITC's positive labor supply effects are driven by mothers with children under age three. Whether this is the desired outcome for mothers, society, or public policy, is open to debate. However, given prior research on the detrimental effects of early childhood poverty, our findings suggest that expansions to the EITC, and targeted expansions in particular, are likely to be effective at raising income among these families.

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Table 1. Descriptive statistics, single mothers with youngest child under age 18, tax years 1989-2015

	All	Aged 0-2	Aged 3-5	Aged 6-12	Aged 13-17
Mother's Characteristics					
Age	34.05	26.75	30.25	36.36	43.17
	(9.22)	(6.64)	(7.01)	(7.354)	(7.028)
Number of children in household	1.79	1.97	1.93	1.84	1.34
	(0.99)	(1.15)	(1.05)	(0.917)	(0.586)
One child	0.49	0.44	0.43	0.43	0.71
Two children	0.32	0.31	0.33	0.37	0.25
Three or more children	0.19	0.26	0.24	0.20	0.04
Education					
Less than high school	0.21	0.26	0.22	0.19	0.19
High school degree	0.41	0.41	0.41	0.40	0.41
Some college	0.38	0.33	0.38	0.41	0.40
Race/Ethnicity					
Non-Hispanic white	0.42	0.35	0.39	0.45	0.49
Non-Hispanic black	0.32	0.35	0.33	0.30	0.29
Hispanic	0.20	0.23	0.21	0.19	0.17
Other	0.06	0.07	0.06	0.06	0.05
Economic Wellbeing					
Mother's earnings (2016$)	18,684	11,360	16,919	21,699	24,681
	(26308)	(20276)	(28146)	(25761)	(29579)
Percent in poverty (earnings only)	0.59	0.76	0.63	0.52	0.44
Maternal Labor Supply					
Worked last week	0.62	0.48	0.61	0.68	0.70
Worked at least 35 hours/week	0.40	0.26	0.38	0.46	0.51
Number of hours worked/week	23.08	16.19	21.67	25.23	27.12
	(19.75)	(18.72)	(19.48)	(19.503)	(20.002)
EITC					
Eligible for the EITC	0.54	0.51	0.56	0.55	0.51
Household EITC benefit (2016$)	1493	1406	1604	1576	1358
	(1763)	(1743)	(1802)	(1798)	(1677)
Simulated EITC (2016$)	1622	1649	1672	1675	1452
	(621)	(633)	(634)	(638)	(527)
Number of Observations	150,689	35,730	30,055	53,186	31,718

Notes: March Current Population Survey 1990-2016. Sample is restricted to children under the age of 18 whose mothers are unmarried and have less than a college degree; youngest child in the household only. All dollars in 2016$. All values are weighted using sampling weights. Standard deviations in parentheses.

Table 2. The Effect of the EITC on Maternal Employment and Family Income

Worked last week	0.053
	(0.019)
Number of hours worked/week	2.14
	(0.838)
Worked at least 35 hours/week	0.032
	(0.016)
Pre-tax earnings ($1,000s of 2016$)	1.081
	(0.659)
Above 100% of poverty	0.012
	(0.01)
Above 50% of poverty	0.039
	(0.016)
Above 200% of poverty	-0.008
	(0.005)
Logged hourly wage	-0.028
	(0.02)
Number of observations	150,691

Notes: March Current Population Survey 1990-2016. Single mothers with less than a college degree and at least one child under the age of 18 residing in the household. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP, all interacted with number-of-child fixed effects), as well as state, year, number of child fixed effects. Each cell reports the coefficient for the simulated EITC (in thousands of $2016) from a separate regression. Standard errors clustered at the state level.

Table 3: Effect of the EITC on Maternal Employment and Family Income: Variation by age of the youngest child

	Working	Number of hours worked	Working >35 hours	Pre-tax earnings	Above poverty*
Simulated EITC	0.033	1.349	0.024	0.235	-0.007
	(0.019)	(0.871)	(0.018)	(0.836)	(0.014)
Simulated EITC*aged 0-2	0.046	1.832	0.026	1.627	0.045
	(0.008)	(0.304)	(0.007)	(0.41)	(0.008)
Simulated EITC*aged 3-5	0.015	0.674	0.010	0.923	0.011
	(0.009)	(0.378)	(0.01)	(0.451)	(0.01)
Simulated EITC*aged 6-12	0.004	0.149	-0.006	0.351	0.008
	(0.007)	(0.335)	(0.009)	(0.382)	(0.008)
Simulated EITC*aged 13-17 (reference)					
Total, aged 0-2	0.079	3.181	0.050	1.862	0.038
Total, aged 3-5	0.048	2.023	0.034	1.158	0.004
Total, aged 6-12	0.037	1.498	0.018	0.586	0.001
Total, aged 13-17	0.033	1.349	0.024	0.235	-0.007
F-statistic, aged 0-2	19.19	14.93	9.03	8.53	15.29
F-statistic, aged 3-5	5.87	5.25	3.59	2.99	0.21
F-statistic, aged 6-12	4.00	3.51	1.3	0.85	0.01
F-statistic, aged 13-17	1.73	1.55	1.29	0.28	0.5
Number of Observations			150,691		

Notes: March Current Population Survey (CPS) 1990-2016. Sample is restricted to the youngest child in the household (under the age of 18) whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP, all interactd with number of child fixed effects), as well as state, year, number of child fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

*Based on earnings

Table 4: Effect of the EITC on Maternal Employment by age of the youngest child; subgroup analyses

		Race/ethnicity			Educational attainment			Marital status		
	All	White	Black	Hispanic	<HS	HS Grad	Some college	Never married	Divorced	Married
Simulated EITC	0.033	0.047	-0.016	0.063	0.040	0.010	0.047	0.038	0.043	-0.022
	(0.019)	(0.015)	(0.026)	(0.04)	(0.022)	(0.021)	(0.024)	(0.026)	(0.025)	(0.007)
Simulated EITC*aged 0-2	0.046	0.036	0.083	0.023	0.028	0.058	0.043	0.024	0.060	0.021
	(0.008)	(0.013)	(0.014)	(0.026)	(0.015)	(0.015)	(0.012)	(0.014)	(0.009)	(0.006)
Simulated EITC*aged 3-5	0.015	0.013	0.043	0.000	0.009	0.034	0.001	0.003	0.021	0.009
	(0.009)	(0.013)	(0.016)	(0.02)	(0.017)	(0.014)	(0.01)	(0.014)	(0.008)	(0.007)
Simulated EITC*aged 6-12	0.004	-0.001	0.023	-0.006	0.003	0.016	-0.004	0.008	0.003	0.003
	(0.007)	(0.009)	(0.015)	(0.016)	(0.017)	(0.011)	(0.009)	(0.014)	(0.007)	(0.005)
Simulated EITC*aged 13-17 (reference)										
Total, aged 0-2	0.079	0.083	0.067	0.086	0.068	0.068	0.090	0.062	0.103	-0.001
Total, aged 3-5	0.048	0.060	0.027	0.063	0.049	0.044	0.048	0.041	0.064	-0.013
Total, aged 6-12	0.037	0.046	0.007	0.057	0.043	0.026	0.043	0.046	0.046	-0.019
Total, aged 13-17	0.033	0.047	-0.016	0.063	0.040	0.010	0.047	0.038	0.043	-0.022
F-statistic, aged 0-2	19.19	21.92	4.88	19.99	9.94	9.89	18.96	9.04	16.34	0.03
F-statistic, aged 3-5	5.87	13.79	0.99	5.51	5.07	5.79	3.75	3.29	6.29	3.85
F-statistic, aged 6-12	4.00	11.53	0.09	2.82	2.86	2.03	4.17	3.80	3.21	12.11
F-statistic, aged 13-17	1.73	3.18	0.61	1.55	1.78	0.49	2	1.46	1.68	3.12
Number of Observations	150,691	67,241	37,825	33,516	31,846	60,820	58,025	70,660	73,617	244,741

Sources: March Current Population Survey (CPS) 1990-2016. Sample is restricted to the youngest child in the household (under the age of 18) whose mothers have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP, all interacted with number of child fixed effects), as well as state, year, number of child fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

Table 5. The Effect of the EITC on Maternal Employment: Test different specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Panel A. No age interactions											
Simulated EITC	0.009	0.030	0.053	0.065	0.051	0.035	0.023	0.029	0.101	0.01	0.037
	(0.005)	(0.006)	(0.007)	(0.014)	(0.019)	(0.014)	(0.013)	(0.014)	(0.031)	(0.041)	(0.042)
Number of observations	150,691										
Panel B. Age interactions											
Simulated EITC	0.009	0.002	0.041	0.052	0.041	0.023	0.013	0.021	0.094	0.006	0.032
	(0.005)	(0.005)	(0.007)	(0.015)	(0.019)	(0.015)	(0.014)	(0.016)	(0.032)	(0.041)	(0.042)
Simulated EITC*aged 0-2	0.026	0.071	0.044	0.040	0.039	0.040	0.039	0.035	0.033	0.034	0.034
	(0.01)	(0.01)	(0.009)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)
Simulated EITC*aged 3-5	0.002	0.036	0.010	0.008	0.007	0.008	0.007	0.005	0.004	0.004	0.005
	(0.009)	(0.01)	(0.01)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Simulated EITC*aged 6-12	-0.003	0.009	-0.004	-0.006	-0.006	-0.005	-0.005	-0.006	-0.007	-0.006	-0.006
	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Simulated EITC*aged 13-17 (reference)											
Total, aged 0-2	0.035	0.073	0.085	0.092	0.080	0.063	0.052	0.056	0.127	0.040	0.066
Total, aged 3-5	0.011	0.038	0.051	0.060	0.048	0.031	0.020	0.026	0.098	0.010	0.037
Total, aged 6-12	0.006	0.011	0.037	0.046	0.035	0.018	0.008	0.015	0.087	0.000	0.026
Total, aged 13-17	0.009	0.002	0.041	0.052	0.041	0.023	0.013	0.021	0.094	0.006	0.032
F-statistic, aged 0-2	21.01	71.69	82.08	46.12	19.29	20.41	15.31	15.45	17.17	0.96	2.49
F-statistic, aged 3-5	3.14	19.01	32.99	15.26	5.85	4.23	1.92	2.69	9.84	0.06	0.73
F-statistic, aged 6-12	1.47	2.48	23.21	10.24	3.48	2.02	0.38	1.15	7.98	0	0.37
F-statistic, aged 13-17	1.46	0.32	5.99	4.76	2.18	1.54	0.94	1.28	2.96	0.15	0.76
Demographic controls		X	X	X	X	X	X	X	X	X	X
Number of child fixed effects			X	X	X	X	X	X	X	X	X
Year fixed effects				X	X	X	X	X	X	X	X
State fixed effects				X	X	X	X	X	X	X	X
State contextual variables*child fixed effects					X	X	X	X	X	X	X
State time trends						X	X	X	X	X	X
Number of child time trends							X	X	X	X	X
Demographics*EITC								X	X	X	X
State variables*EITC									X	X	X
Child*Year Fixed effects										X	X
Child*State Fixed effects											X
Number of observations	150,691										

Sources: March Current Population Survey 1990-2016. Single mothers with less than a college degree and at least one child under the age of 18 residing in the household. Demographic controls include parental age, educational attainment, race, indicators for presence of children aged 0-2, 3-5, 6-12, or 13-17 in the household. State-year contexual variables include: whether state had a welfare waiver pre-welfare reform (time-varying), welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP. Each of these variables is interacted with the number-of-child fixed effects. Each cell reports the coefficient for the simulated EITC (in thousands of $2016) from a separate regression. Standard errors clustered at the state level.

Table 6: Effect of the EITC on Maternal Employment and Family Income: Stratified by child's age

	Aged 0-2	Aged 3-5	Aged 6-12	Aged 13-17
Worked last week	0.064	0.065	0.051	0.004
	(0.014)	(0.018)	(0.019)	(0.014)
Effect size	13%	11%	7%	1%
Number of hours worked/week	2.498	2.618	2.056	0.465
	(0.54)	(0.722)	(0.784)	(0.638)
Effect size	15%	12%	8%	2%
Worked at least 35 hours/week	0.048	0.052	0.041	0.015
	(0.013)	(0.018)	(0.017)	(0.013)
Effect size	18%	14%	9%	3%
Pre-tax earnings	1.843	2.240	1.587	-0.214
	(0.491)	(0.82)	(0.499)	(0.861)
Effect size	16%	13%	7%	-1%
Above 100% of poverty (earnings only)	0.004	0.040	0.035	-0.017
	(0.01)	(0.013)	(0.011)	(0.015)
Effect size	2%	11%	7%	-3%
Number of Observations	35,730	30,056	53,186	31,719

Sources: March Current Population Survey (CPS) 1990-2016. Sample is restricted to the youngest child in the household (under the age of 18) whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state, year, number of child fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

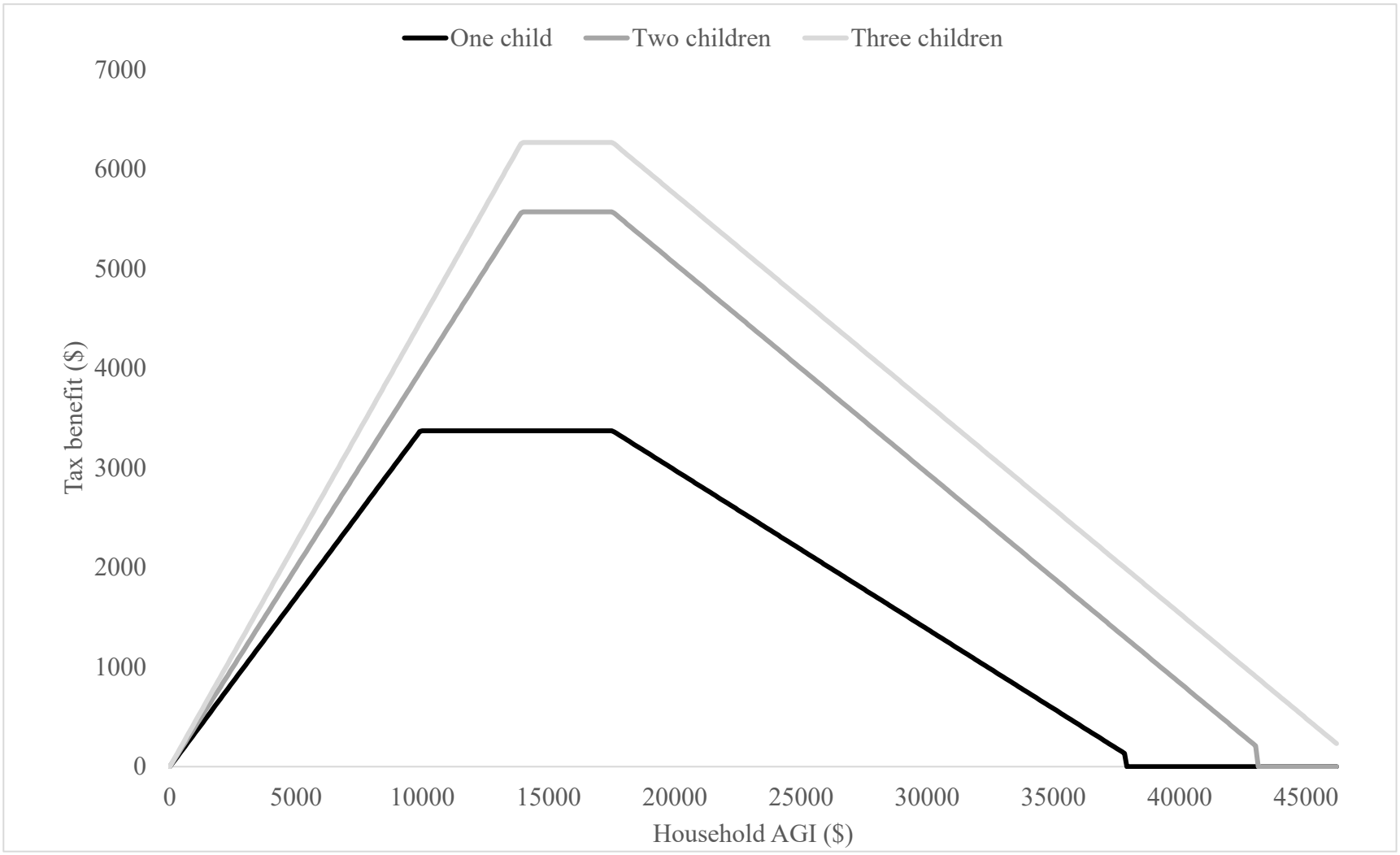
*Based on earnings

Table 7. Effect of the average federal and state EITC on child care arrangements of the youngest child; children under the age of 13 from the Survey of Income and Program Participation 1996-2008

	Age 0-2	Age 3-5	Age 6-12
Working mom	0.246	-0.019	-0.009
	(0.095)	(0.102)	(0.08)
	[0.44]	[0.57]	[0.66]
Any child care	0.228	-0.03	-0.116
	(0.06)	(0.072)	(0.082)
	[0.66]	[0.71]	[0.65]
Total hours	9.487	-3.624	0.214
	(2.644)	(4.393)	(3.148)
	[21.98]	[23.97]	[15.13]
Any payments	0.246	-0.014	0.034
	(0.064)	(0.087)	(0.069)
	[0.23]	[0.29]	[0.20]
Log monthly payment	1.20	-0.04	0.24
	0.36	0.49	0.34
	[1.23]	[1.60]	[1.01]
Type of arrangement			
Any center-based care	0.106	-0.049	0.057
	(0.048)	(0.075)	(0.033)
	[0.13]	[0.26]	[0.06]
Any Head Start	0.010	0.047	n/a
	(0.013)	(0.029)	
	[0.01]	[0.04]	
Any relative care	0.179	0.018	-0.162
	(0.075)	(0.095)	(0.086)
	[0.43]	[0.41]	[0.43]
Any non-relative care	0.084	0.025	-0.008
	(0.058)	(0.06)	(0.041)
	[0.13]	[0.14]	[0.11]
Any parent care	0.011	-0.123	-0.034
	(0.049)	(0.054)	(0.047)
	[0.14]	[0.12]	[0.12]
Number of Observations	4,840	4,012	5,765

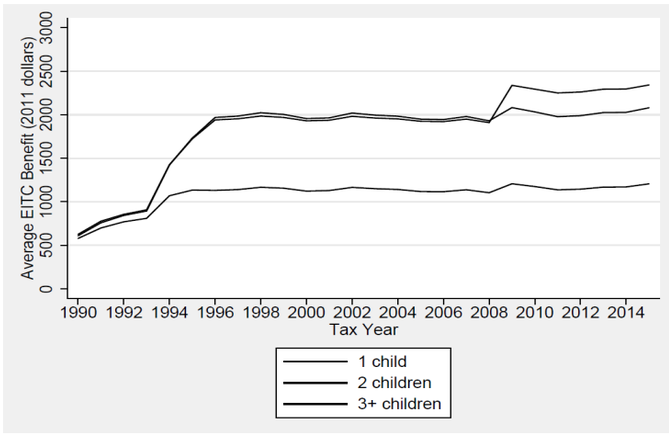
Source: Survey of Income and Program Participation panels 1996-2008. All children under the age of 15 living with an unmarried mother who has less than a college degree and is under the age of 45. Notes: Regressions run separately by each age group. Each regression includes demographic controls (mother's education, mother's age, race), state controls (unemployment rate, state GDP, maximum welfare benefits for a family of three, minimum wage, maximum food stamp benefits for a family of three), month, state, year, and number of child fixed effects, as well as state-specific linear time trends and number of child-specific linear time trends. + p<.10 ** p<.05 *** p<.01

Figure 1. EITC Benefit Schedule for Head of Household Filer, by Number of Children, 2015 Tax Year

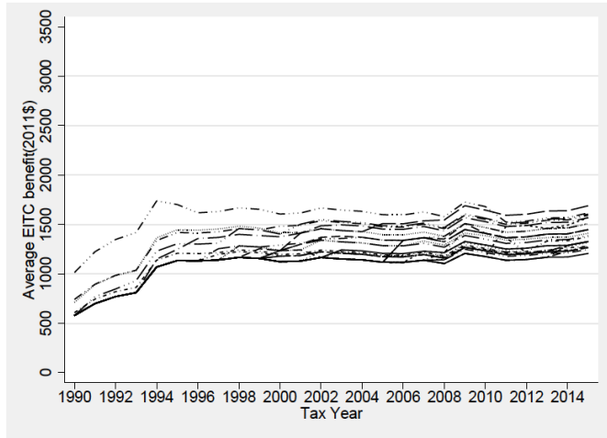


Source: Authors' calculations.

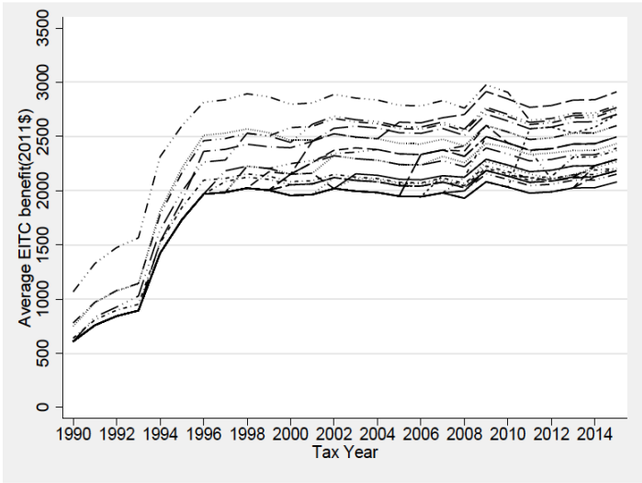
Figure 2. Variation in simulated EITC, by state and number of children



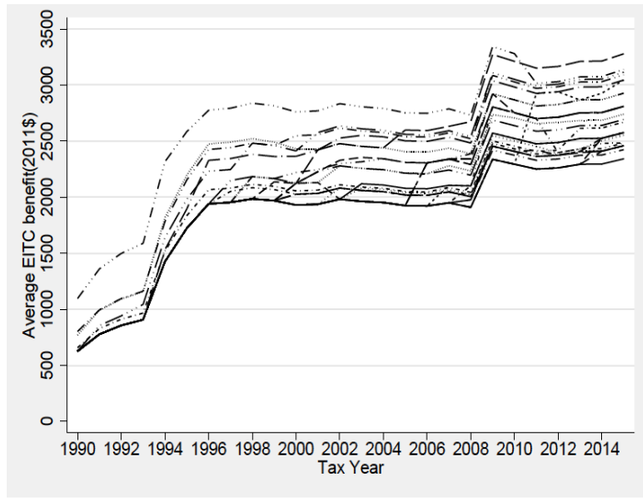
A. Variation in Federal EITC by number of children



B. Federal+State EITC: One child



C. Federal+State EITC: Two children



D. Federal+State EITC: Three or more children

Source: Survey of Income and Program Participation 1996 Survey and NBER's TAXSIM. Single women aged 19-45 with at least one child under the age of 19 residing in the household.

Note: Average household state and federal EITC benefits from 1990-2015 in 2011$. Each line represents a separate state, federal variation is bottom line in each graph. See description of simulated EITC in the text for more details.

Figure 3. Share of single mothers working 1990-2016, by age of youngest child

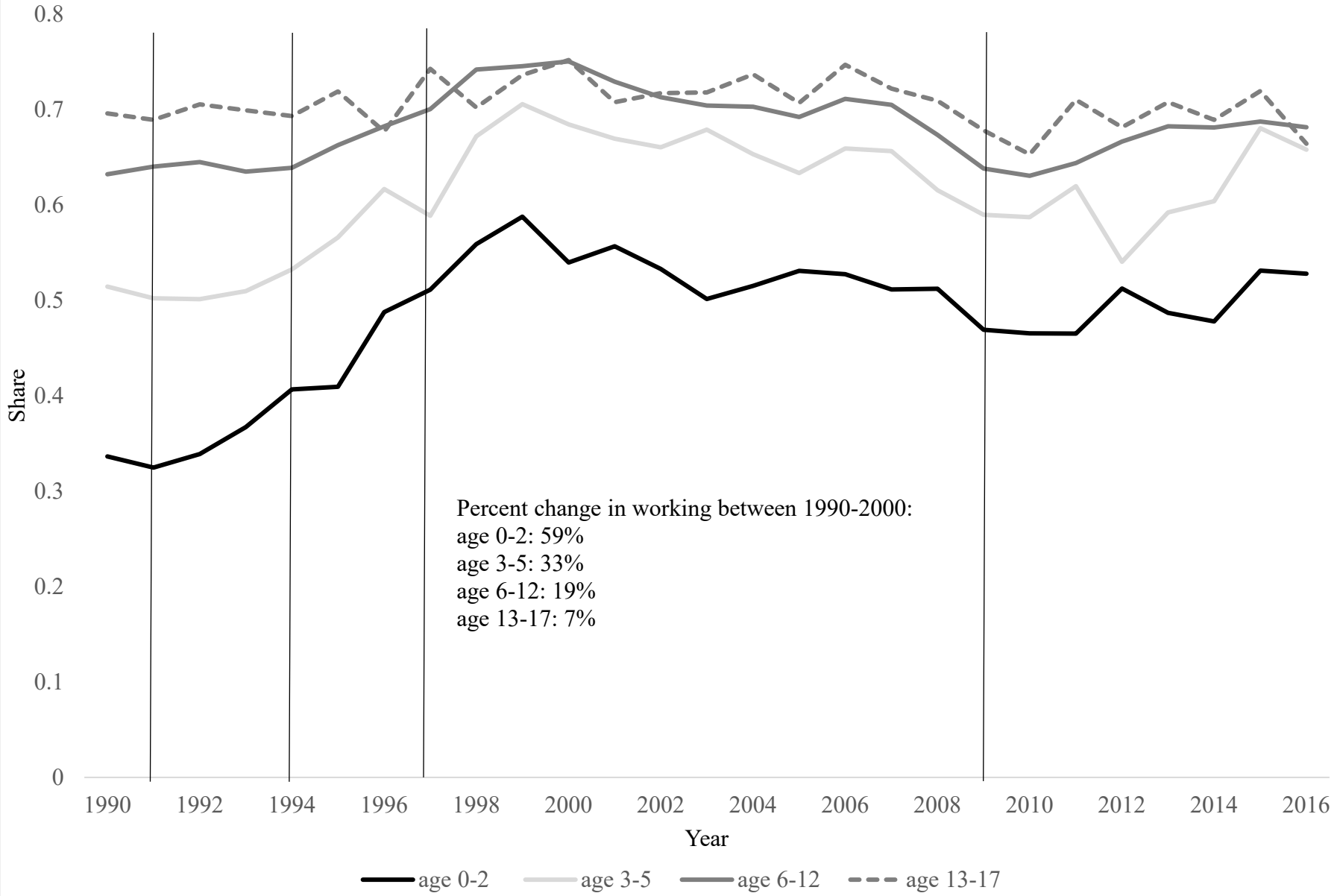
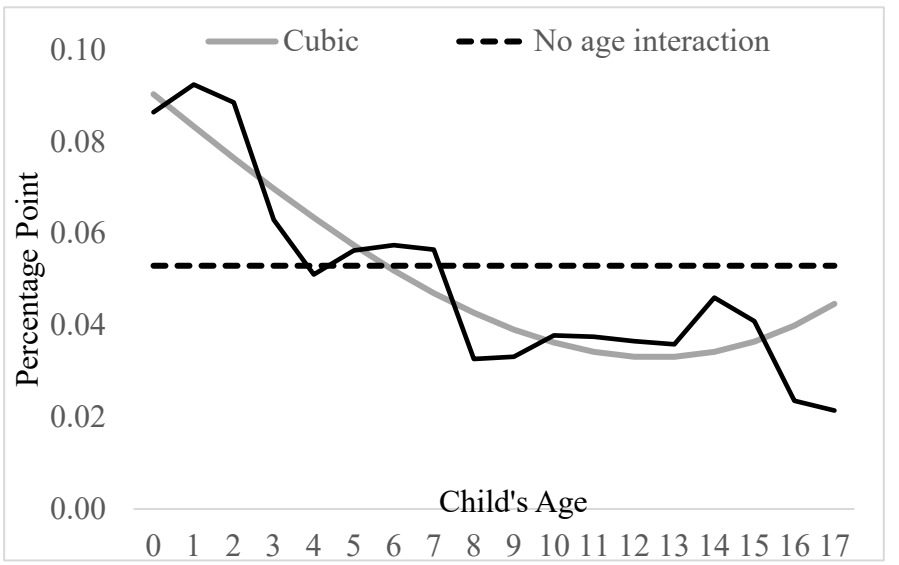
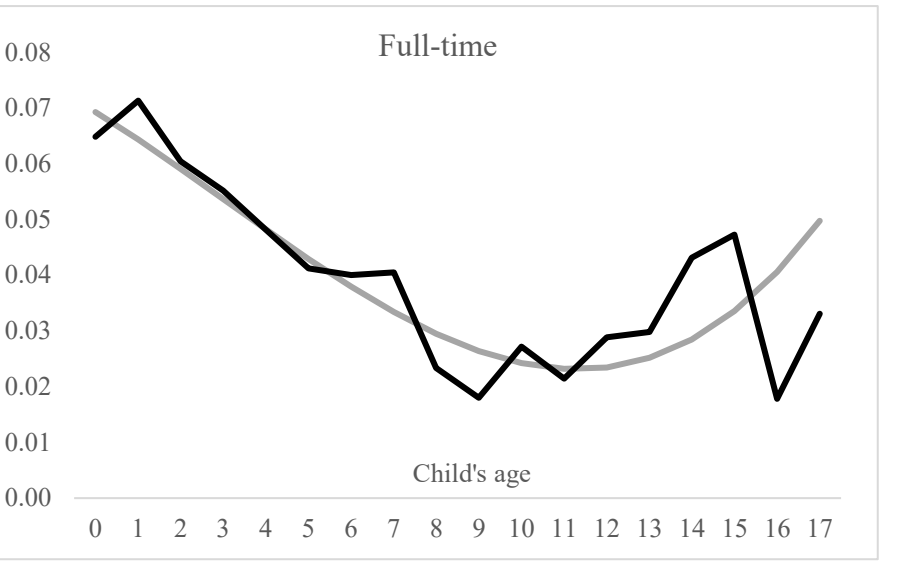
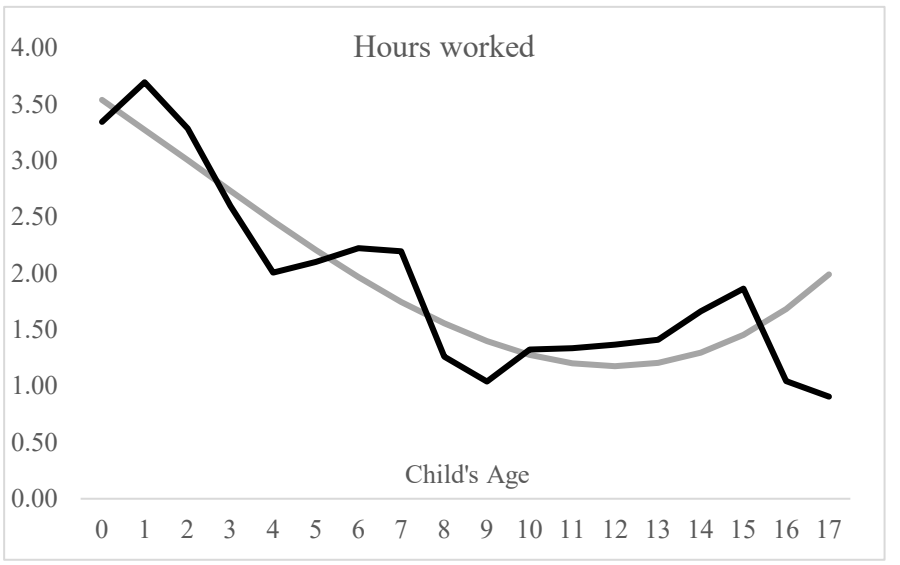
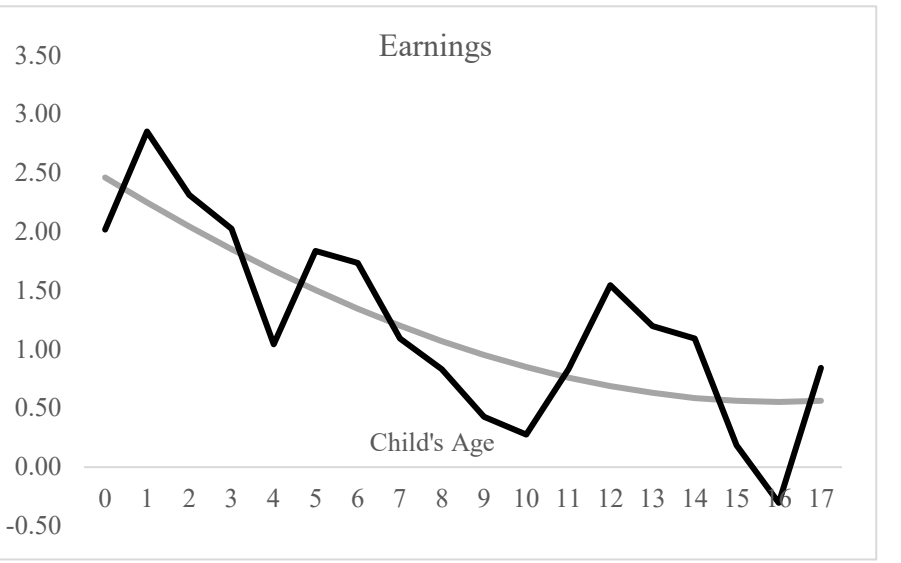


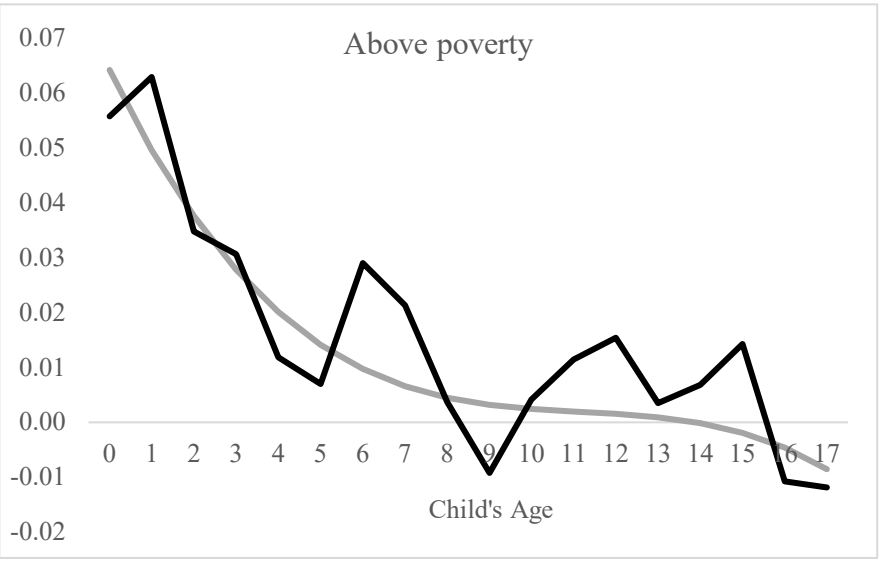
Figure 4. Testing Interaction Levels Using the EITC : Maternal Labor Supply (Working) by Child's Age





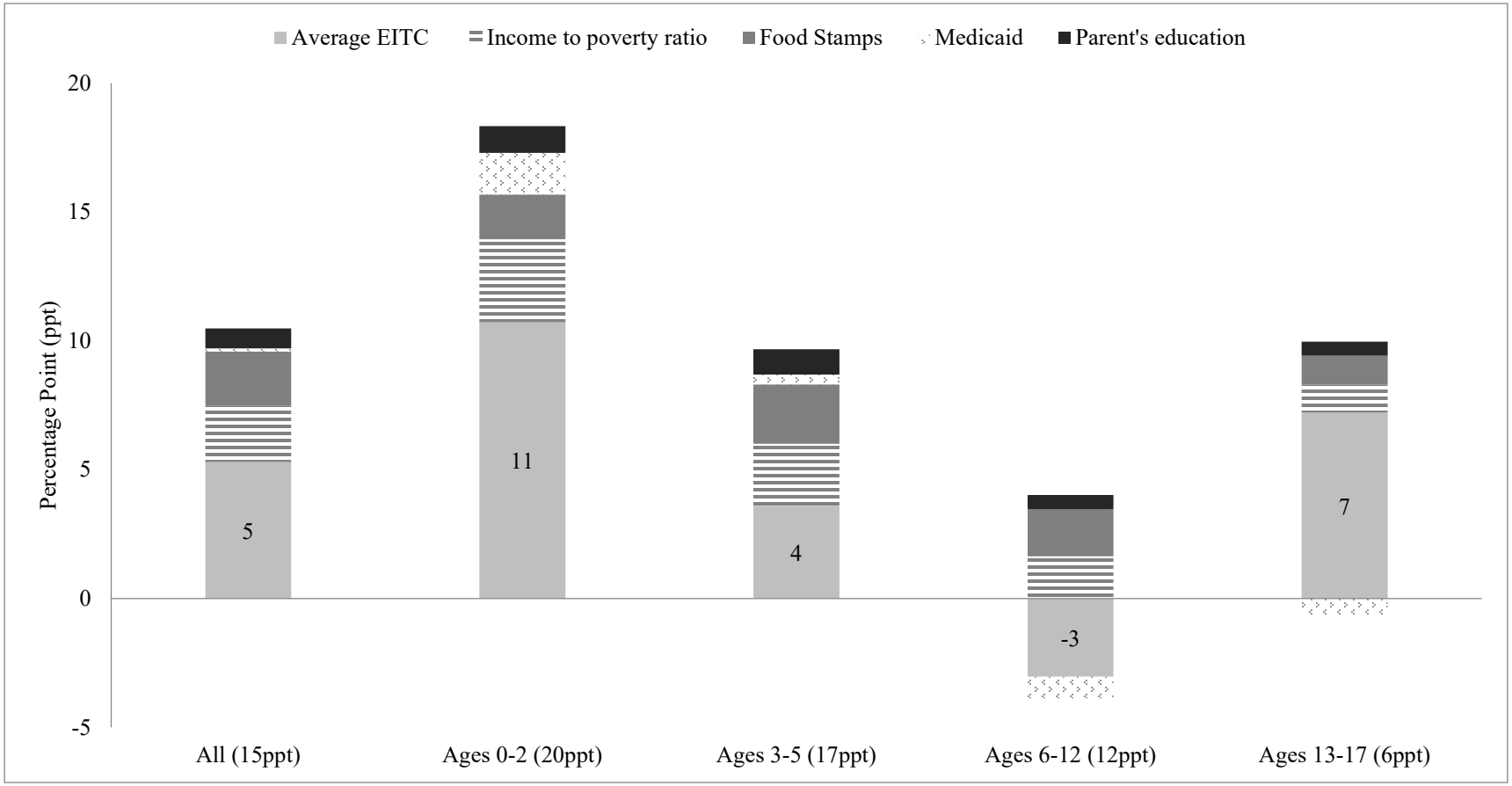






Sources: March CPS 1990-2016, representing tax years 1989-2015. Sample is restricted to children under the age of 18 whose mothers are unmarried and have less than a college degree. Regressions include demographic (parental age, educational attainment, race, indicators for presence of children aged 0-2,3-5,6-12) and state-year characteristics (welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state, year, number of child fixed effects, state-specific linear time trends and number of child-specific time trends. Standard errors clustered at state level.

Figure 5. Amount of Maternal Labor Supply Change Between 1990 and 2000 Explained by Each Factor (Total Change in Parentheses), Results from a Pooled Blinder-Oaxaca Decomposition, by Child's Age



Source: Current Population Survey 1990-2016. Note: Sample is restricted to children under the age of 18 who are the youngest child in the household and whose mothers are unmarried and have less than a college degree. Results from a Blinder-Oaxaca decomposition. Average EITC is simulated EITC used in regression models. Food stamps and Medicaid are indicators for whether the single mother reports receiving those benefits in the last month. Parental education is expressed in three categories: less than high school, high school diploma, and some college. See text for details.

Appendix: Robustness checks using the OBRA and ARRA expansions to the EITC

In order to test the sensitivity of our results to the parameterized difference-in-differences approach, we also conducted analyses using the traditional difference-in-differences strategy employed in the early EITC literature, analyzing the effects of the 1990s federal expansion for two or more child households. Here, we limit our time period to 1991 to 1998, and interact an indicator for post-1993 with an indicator for whether the household had at least two children. We chose this time frame to maintain consistency with previous research analyzing the effects of the EITC on maternal labor supply (e.g. Hoynes and Patel 2018, Hoynes, Miller, and Simon 2015), and because there were other policy changes to the EITC that occurred in the late 1980s, and the earlier OBRA 1990 policy reform.

The main effect of the two-child indicator controls for level differences between one and two-or-more-child households in maternal labor supply, and the year indicator controls for other policy changes or events that may have occurred at the same time. The parameter of interest is the coefficient on the interaction of these two terms, which indicates how maternal labor supply changed differentially for mothers with two or more children compared to mothers with exactly one child over this time period.

It is difficult to isolate the effects of the EITC on maternal labor supply during this particular time-period, since there were other policy events happening around the same time that likely affected the same population. Welfare reform, which took place in 1996, was preceded by many states using welfare waivers to test the impact of work requirements on welfare recipients. Some argue that it was these welfare waivers that caused the increase in maternal labor supply over the course of the 1990s, rather than the EITC itself (Kleven 2019), despite research to the contrary (e.g. Meyer and Rosenbaum 2001; Hoynes and Patel 2017).

Before using the OBRA 1993 reform to test the effect of the EITC on maternal labor supply differentially by child's age, we test sensitivity of the point estimates to the inclusion of other state characteristics, such as welfare generosity, state unemployment rate, and an indicator for whether the state had a welfare waiver, that are correlated with changes in the EITC and may also affect maternal labor supply. Consistent with previous research, we interact each of these terms with number-of-child fixed effects to allow state conditions to operate differently for larger families, who are more likely to receive welfare benefits. Additionally, we also test the robustness of the results to excluding all states that had welfare waivers prior to 1996. We use both a difference-in-differences analysis, comparing the labor supply of single mothers with one child to that of mothers with two or more children before and after the reform in 1993, as well as using our simulated EITC benefit (over the same time frame) to incorporate the magnitude of changes to the EITC over this time period.

Results, depicted in appendix table 5, imply that single mothers with two or more children were about 5 percentage points more likely to work following the 1993 OBRA reform compared to mothers with only one child (column 1). Using the simulated EITC, we find that a $1,000 increase in average EITC benefits during this time period increased maternal employment by nearly 7 percentage points.

Including state controls interacted with number of child fixed effects (column 2), in the difference-in-differences model, the point estimate attenuates to 1.9 percentage points, and is no longer statistically significant. In the simulated EITC model, the estimate is also reduced somewhat, to about 5 percentage points, but remains statistically significant and economically meaningful. Excluding states that implemented welfare waivers (column 3), results in similar point estimates. This exercise illustrates the importance of incorporating the variation in the size

of the changes to the EITC for identifying maternal labor supply effects. The 1993 reform was phased in over a few years, and was not fully-implemented until 1996.

We adapt the traditional difference-in-differences model to also include interactions with age categories 0 to 2, 3 to 5, and 6 to 12, to test whether there are differential responses to the federal EITC expansion for households with young children relative to households with older children. The assumption is that, absent the EITC, maternal labor supply patterns by child's age would have been on parallel paths.[1] Results, presented in Appendix Table 6, are consistent with those in our main analyses: we find the largest effects among mothers with children aged 0 to 2. We also find a main effect of the EITC on employment and hours worked for all mothers, and the interactions for 3 to 5 and 6 to 12 year olds are not significant. This approach suggests that there are effects of the EITC on mothers of children of all ages, but the effect is largest for mothers of children younger than three.

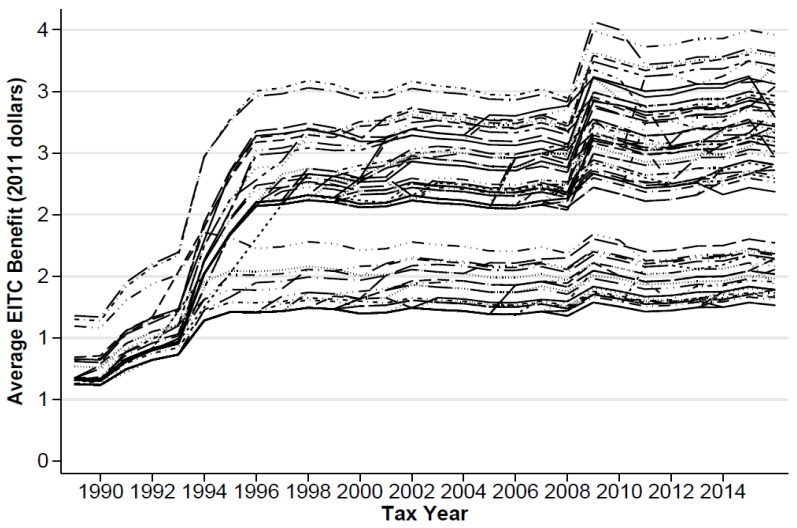
Akin to our approach for the OBRA 1993 expansion, we also show results from the traditional difference-in-differences model for the 2009 expansion, which increased the generosity of EITC benefits for households with three or more children, relative to households with two children. For that analysis, we include a triple interaction term of an indicator for post-2009 reform, an indicator for having at least three children, and the age of the youngest child in the household. Although there are some differences relative to the main results presented in Table 3, we continue to find that the largest effects are concentrated among mothers with children under three, with insignificant or negative effects for mothers with children aged 3 to 17.

[1] Evidence from the BLS suggest that patterns were parallel prior to 1991, when the federal EITC was expanded as part of OBRA. See estimates available at: https://www.dol.gov/wb/stats/NEWSTATS/facts/women_lf.htm#three.

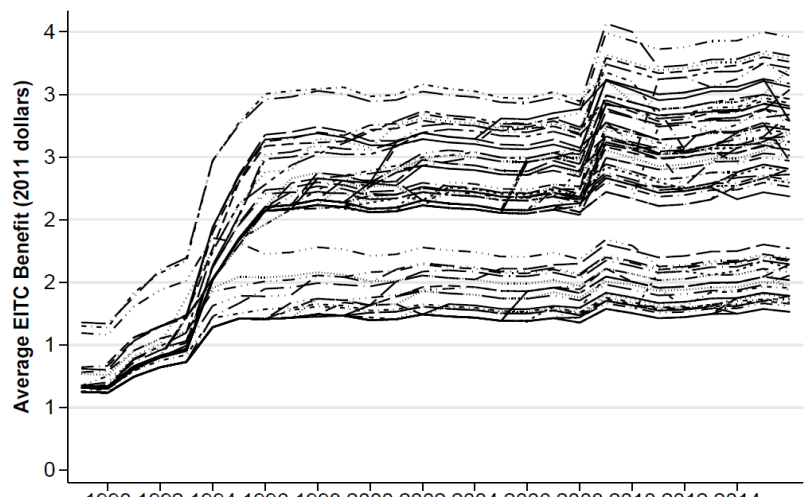
Finally, we partition the total variation in the EITC used in the main analysis into its federal and state components, to test whether patterns are similar when relying only on the federal variation in the EITC versus the state variation. Results, presented in appendix table 7, illustrate a similar age pattern regardless of whether we use federal or state variation in the EITC, though estimates using only the state variation are less precise, given that state EITCs are much smaller than the federal EITC. In sum, although the point estimates and precision differ across models (difference-in-differences approach using the OBRA and ARRA federal expansions, parsing federal and state variation in EITC benefits, combining the federal and state variation into a single simulated benefit) and specifications (four, mutually-exclusive age categories in the same model [our preferred specification], cubic age function, fully-interacted age function, separate models by child's age) the evidence suggests that labor supply effects of the EITC are largest for mothers with very young children as compared to those with older children.

Appendix Figure 1. Variation in simulated EITC, by state, year, number of children, and age of the youngest child

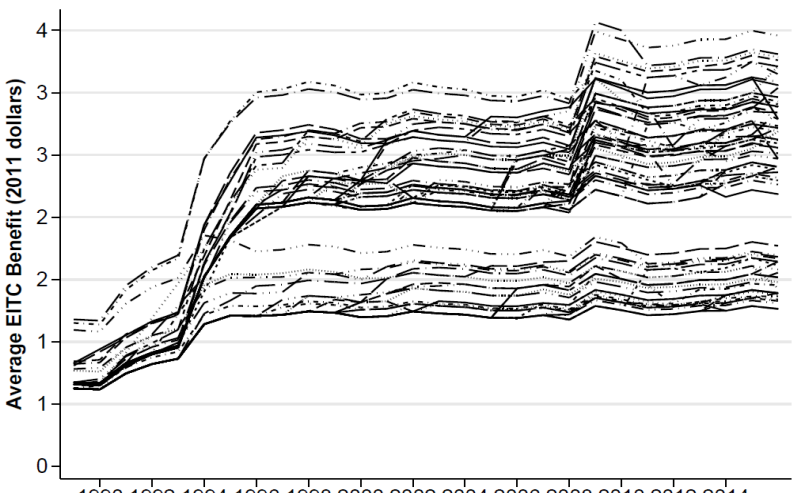
a. All



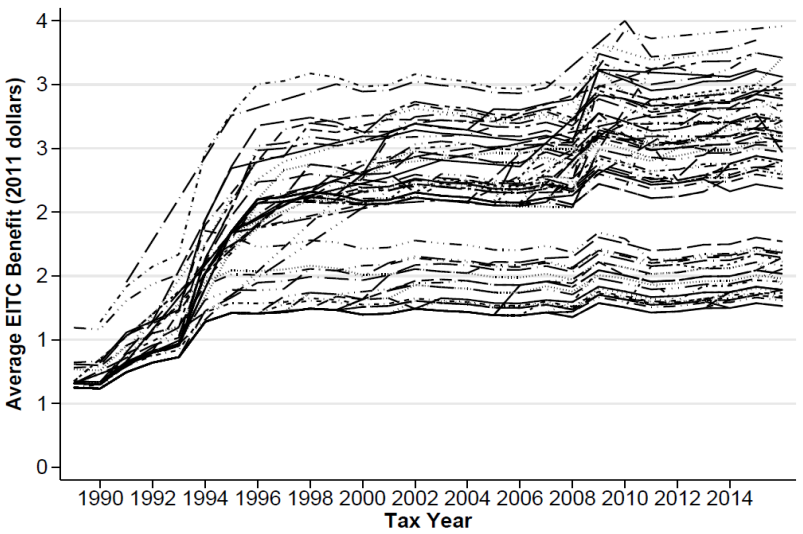
b. Aged 0-2



c. Aged 3-5



d. Aged 6-12



e. Aged 13-17

Appendix Table 1. State EITC Generosity by Year, Expressed as a Share of the Federal EITC

Tax Year	CA†	CO	CT	DC	DE**	HI**	IL	IN	IA	KS	LA	ME**	MD	MA	MI	MN*	MT	NE	NJ	NM	NY	NC	OH**	OK	OR	RI	SC**	VT	VA**	WA	WI (1)	WI (2)	WI (3)
1986																										0.22**							
1987																										0.23**							
1988																										0.23**		0.23					
1989																										0.23**		0.25		0.05	0.25	0.75
1990									0.05**																	0.23**		0.28		0.05	0.25	0.75
1991									0.065**							0.10										0.275**		0.28		0.05	0.25	0.75
1992									0.065**							0.10										0.275**		0.28		0.05	0.25	0.75
1993									0.065**							0.15										0.275**		0.28		0.05	0.25	0.75
1994									0.065**							0.15					0.08					0.275**		0.25		0.044	0.208	0.625
1995									0.065**							0.15					0.10					0.275**		0.25		0.04	0.16	0.50
1996									0.065**							0.15					0.20					0.275**		0.25		0.04	0.14	0.43
1997									0.065**					0.10		0.15					0.20				0.05**	0.275**		0.25		0.04	0.14	0.43
1998									0.065**	0.10			0.10	0.10		0.25					0.20				0.05**	0.27**		0.25		0.04	0.14	0.43
1999		0.085							0.065**	0.10			0.10	0.10		0.25					0.20				0.05**	0.265**		0.25		0.04	0.14	0.43
2000		0.10		0.10			0.05**		0.065**	0.10		0.05	0.15	0.10		0.25			0.10		0.23				0.05**	0.26**		0.32		0.04	0.14	0.43
2001		0.10		0.25			0.05**		0.065**	0.10		0.05	0.16	0.15		0.33			0.15		0.25				0.05**	0.255**		0.32		0.04	0.14	0.43
2002		0		0.25			0.05**		0.065**	0.15		0.05	0.16	0.15		0.33			0.18		0.28			0.05	0.05**	0.25**		0.32		0.04	0.14	0.43
2003		0		0.25			0.05	0.06	0.065**	0.15		0.05	0.18	0.15		0.33		0.08	0.20		0.30			0.05	0.05**	0.25		0.32		0.04	0.14	0.43
2004		0		0.25			0.05	0.06	0.065**	0.15		0.05	0.20	0.15		0.33		0.08	0.20		0.30			0.05	0.05**	0.25		0.32		0.04	0.14	0.43
2005		0		0.35			0.05	0.06	0.065**	0.15		0.05	0.20	0.15		0.33		0.08	0.20		0.30			0.05	0.05	0.25		0.32		0.04	0.14	0.43
2006		0		0.35	0.20		0.05	0.06	0.065**	0.15		0.05	0.20	0.15		0.33		0.08	0.20		0.30			0.05	0.05	0.25		0.32	0.20	0.04	0.14	0.43
2007		0		0.35	0.20		0.05	0.06	0.07	0.17		0.05	0.20	0.15		0.33		0.08	0.20	0.08	0.30			0.05	0.05	0.25		0.32	0.20	0.04	0.14	0.43
2008		0		0.40	0.20		0.05	0.06	0.07	0.17	0.035	0.05	0.25	0.15	0.10	0.33		0.10	0.23	0.10	0.30	0.035		0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.14	0.43
2009		0		0.40	0.20		0.05	0.09	0.07	0.17	0.035	0.05	0.25	0.15	0.20	0.33		0.10	0.25	0.10	0.30	0.05		0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.14	0.43
2010		0		0.40	0.20		0.05	0.09	0.07	0.18	0.035	0.05	0.25	0.15	0.20	0.33		0.10	0.20	0.10	0.30	0.05		0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.14	0.43
2011		0	0.30	0.40	0.20		0.05	0.09	0.07	0.18	0.035	0.05	0.25	0.15	0.20	0.33		0.10	0.20	0.10	0.30	0.05		0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.11	0.34
2012		0	0.30	0.40	0.20		0.05	0.09	0.07	0.18	0.035	0.05	0.25	0.15	0.06	0.33		0.10	0.20	0.10	0.30	0.05		0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.11	0.34
2013		0	0.30	0.40	0.20		0.05	0.06	0.07	0.18	0.035	0.05	0.25	0.15	0.06	0.33		0.10	0.20	0.10	0.30	0.05		0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.11	0.34
2014		0.10	0.28	0.40	0.20		0.10	0.09	0.14	0.17	0.035	0.05	0.25	0.15	0.06	0.33		0.10	0.20	0.10	0.30	0.05	0.05	0.05	0.08	0.25		0.32	0.20	0.1***	0.04	0.11	0.34
2015		0.10	0.30	0.40	0.20		0.10	0.09	0.14	0.17	0.035	0.05	0.25	0.15	0.06	0.33		0.10	0.20	0.10	0.30	0.05	0.05	0.05	0.06	0.25		0.32	0.20	0.1***	0.04	0.11	0.34
2016	0.85	0.10	0.28	0.40	0.20		0.10	0.09	0.15	0.17	0.035	0.05	0.26	0.23	0.06	0.33		0.10	0.30	0.10	0.30	0	0.10	0.05	0.08	0.13		0.32	0.20	0.1***	0.04	0.11	0.34
2017	0.85	0.10	0.28	0.40	0.20	0.20	0.14	0.09	0.15	0.17	0.035	0.05	0.27	0.23	0.06	0.33		0.10	0.35	0.10	0.30	0	0.10	0.05	0.08	0.15	1.25***	0.32	0.20	0.1***	0.04	0.11	0.34
2018							0.15						0.28																				
2019																.03***																	

Sources: Leigh(2010); Tax Policy Center (2015): http://www.taxpolicycenter.org/statistics/state-eitc-based-federal-eitc

*Minnesota has a different strucuture to its state EITC that is not a direct share of the federal EITC starting in 2001. The average benefit level is listed from 2001 onward for Minnesota

**Denotes non-refundable credit.

***Announced, but not implemented yet.

† California has a smaller range of eligible income than the federal EITC.

Wisconsin has a different rate depending on the number of children in the household.

Hawaii implemented in 2017, non-refunable 20% of federal credit. South Carolina implemented in 2017, worth 125% of federal credit, but non-refundable. Montana passed 3% refundable EITC does not go into effect until 2020.

Appendix Table 2. Effect of the EITC on Maternal Labor Supply and Family Income: Variation by Child's Age; college-educated parents

	Working	Number of Hours worked	Working >35 hours	Pre-tax earnings	Above Poverty (Earnings Only)
			CPS		
Simulated EITC	-0.040	-0.244	0.019	0.294	0.010
	(0.017)	(0.89)	(0.02)	(3.)	(0.023)
Simulated EITC*aged 0 to 2	0.007	1.101	0.036	2.342	0.035
	(0.017)	(0.79)	(0.019)	(2.088)	(0.015)
Simulated EITC*aged 3 to 5	0.004	0.363	0.011	-1.445	0.003
	(0.011)	(0.434)	(0.015)	(1.232)	(0.013)
Simulated EITC*aged 6 to 12	0.008	0.308	0.003	1.694	0.011
	(0.009)	(0.399)	(0.01)	(1.369)	(0.01)
Simulated EITC*aged 13-17 (reference)					
Number of Observations			37,755		
			ACS		
Simulated EITC	-0.008	-0.480	-0.009	-0.196	-0.015
	(0.013)	(0.473)	(0.015)	(1.991)	(0.014)
Simulated EITC*aged 0 to 2	0.001	0.657	0.033	-1.261	0.029
	(0.006)	(0.219)	(0.006)	(0.774)	(0.008)
Simulated EITC*aged 3 to 5	-0.005	0.143	0.007	-1.093	0.004
	(0.004)	(0.193)	(0.006)	(0.605)	(0.005)
Simulated EITC*aged 6 to 12	-0.001	0.118	0.001	-0.682	0.004
	(0.003)	(0.096)	(0.003)	(0.446)	(0.004)
Simulated EITC*aged 13-17 (reference)					
Number of Observations			332,453		

Sources: March Current Population Survey (CPS) 1990-2016 and American Community Survey (ACS)/U.S. Census 1990, 2000-2016. Sample is restricted to children under the age of 18 whose mothers are unmarried, are coresident and who have a college degree. All regressions include demographic (parental age, educational attainment, race, indicators for presence of children aged 0-2,3-5,6-12) and state-year characteristics (welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state, year, number of child fixed effects, state-specific linear time trends and number of child-specific time trends. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

Appendix Table 3: Effect of the EITC on Maternal Employment and Family Income: Variation by age (all children)

	Working	Number of hours worked	Working >35 hours	Pre-tax earnings	Above poverty*
Simulated EITC	0.035	1.372	0.022	0.649	-0.001
	(0.022)	(0.973)	(0.02)	(0.778)	(0.012)
Simulated EITC*aged 0-2	0.037	1.780	0.034	1.635	0.052
	(0.005)	(0.189)	(0.005)	(0.22)	(0.005)
Simulated EITC*aged 3-5	0.015	0.857	0.018	0.713	0.012
	(0.005)	(0.208)	(0.005)	(0.244)	(0.005)
Simulated EITC*aged 6-12	0.007	0.316	0.001	0.222	0.005
	(0.003)	(0.158)	(0.004)	(0.193)	(0.003)
Simulated EITC*aged 13-17 (reference)					
Total, aged 0-2	0.072	3.152	0.056	2.284	0.051
Total, aged 3-5	0.050	2.229	0.040	1.362	0.011
Total, aged 6-12	0.042	1.688	0.023	0.871	0.004
Total, aged 13-17	0.035	1.372	0.022	0.649	-0.001
F-statistic, aged 0-2	11.52	11.27	8.97	11.10	25.02
F-statistic, aged 3-5	5.21	5.36	4.44	3.72	1.44
F-statistic, aged 6-12	3.83	3.28	1.62	1.49	0.19
F-statistic, aged 13-17	1.59	1.41	1.11	0.83	0.05
Number of Observations			263,898		

Notes: March Current Population Survey (CPS) 1990-2016. Sample is restricted to children (under the age of 18) whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP, all interactd with number of child fixed effects), as well as state, year, number of child fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.
*Based on earnings

Appendix Table 4: Effect of the EITC on Maternal Employment and Family Income: Variation by age of the youngest child

	Above 50% of poverty	Above 200% of poverty	Working part-time (<30 hours)	Log of hourly wage
Simulated EITC	0.019	-0.018	0.012	-0.039
	(0.019)	(0.007)	(0.005)	(0.024)
Simulated EITC*aged 0-2	0.047	0.028	0.009	0.087
	(0.008)	(0.005)	(0.005)	(0.015)
Simulated EITC*aged 3-5	0.012	0.012	0.004	-0.010
	(0.01)	(0.005)	(0.005)	(0.017)
Simulated EITC*aged 6-12	0.005	0.002	0.005	-0.011
	(0.008)	(0.005)	(0.005)	(0.013)
Simulated EITC*aged 13-17 (reference)				
Total, aged 0-2	0.066	0.010	0.021	0.048
Total, aged 3-5	0.031	-0.006	0.016	-0.049
Total, aged 6-12	0.024	-0.016	0.017	-0.050
Total, aged 13-17	0.019	-0.018	0.012	-0.039
F-statistic, aged 0-2	20.77	3.60	17.12	4.74
F-statistic, aged 3-5	4.01	1.4	9.99	5.56
F-statistic, aged 6-12	2.36	7.76	12.6	4.95
F-statistic, aged 13-17	1	2.65	2.42	1.65
Number of Observations		150,691		91,265

Sources: March Current Population Survey (CPS) 1990-2016. Sample is restricted to the youngest child in the household (under the age of 18) whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state, year, number of child fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

Appendix Table 5. Effect of the OBRA and ARRA expansions of the EITC on maternal labor supply; youngest child only, moms age 20-50, 1991-1998 tax years

	(1)	(2)	(3)
post1993*2 or more kids	0.048	0.019	0.016
	(0.011)	(0.016)	(0.017)
Simulated EITC	0.067	0.047	0.053
	(0.015)	(0.021)	(0.026)
Demographics	X	X	X
Number of child indicators	X	X	X
State variables*Number of Child Fixed Effects		X	X
Exclude states with AFDC waivers			X
Number of Observations	59,785	59,785	39,553

Sources: March Current Population Survey (CPS) 1990-2016. Sample is restricted to the youngest child in the household (under the age of 18) whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race) and state-year characteristics (whether state had welfare waiver, welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state, year, number of child fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

Appendix Table 6. Effect of the OBRA and ARRA expansions of the EITC on maternal labor supply outcomes; youngest child only

	Working	Number of hours worked	Working >35 hours	Pre-tax earnings	Above Poverty (earnings only)
		CPS: OBRA (1989-1998)			
post1993*2kids	0.047	1.538	0.04	0.726	0.029
	(0.021)	(0.82)	(0.018)	(0.957)	(0.016)
post1993*2kids*aged 0-2	0.033	1.235	0.015	1.456	0.032
	(0.021)	(0.832)	(0.017)	(0.94)	(0.017)
post1993*2kids*aged 3-5	-0.015	-0.272	-0.009	0.415	-0.019
	(0.02)	(0.859)	(0.023)	(0.941)	(0.018)
post1993*2kids*aged 6-12	-0.028	-0.952	-0.027	-0.314	-0.037
	(0.025)	(0.965)	(0.021)	(0.863)	(0.017)
post1993*2kids*aged 13-17 (reference)					
Number of Observations			43,665		
		CPS: ARRA (2000-2015)			
post2009*3kids	-0.018	-1.146	-0.019	0.542	0.015
	(0.03)	(1.167)	(0.027)	(1.359)	(0.026)
post2009*3kids*aged 0-2	0.037	2.423	0.068	2.526	0.074
	(0.035)	(1.336)	(0.03)	(1.482)	(0.027)
post2009*3kids*aged 3-5	-0.014	0.505	0.023	-0.339	-0.026
	(0.033)	(1.261)	(0.029)	(1.52)	(0.027)
post2009*3kids*aged 6-12	0.008	0.69	0.015	-0.741	-0.019
	(0.031)	(1.222)	(0.028)	(1.227)	(0.024)
post2009*3kids*aged 13-17 (reference)					
Number of Observations			103,148		

Sources: March Current Population Survey (CPS) 1990-2016 and American Community Survey (ACS)/U.S. Census 1990, 2000-2016. Sample is restricted to children under the age of 18 whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race, indicators for presence of children aged 0-2,3-5,6-12, indicator for having two or more children in the household) and state-year characteristics (welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state fixed effects. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

Appendix Table 7. Effect of the EITC on maternal labor supply outcomes, variation by child's age, test of federal versus state variation

	Working		Number of Hours worked		Working >35 hours		Pre-tax earnings		Above poverty (earnings only)	
	Federal	State	Federal	State	Federal	State	Federal	State	Federal	State
Simulated EITC	0.055	0.02	2.254	0.47	0.052	0.017	1.405	-0.446	0.024	-0.058
	(0.012)	(0.037)	(0.465)	(1.374)	(0.012)	(0.028)	(0.522)	(1.673)	(0.011)	(0.023)
Simulated EITC*aged 0-2	0.056	0.048	2.099	2.111	0.033	0.03	2.092	0.916	0.047	0.084
	(0.01)	(0.027)	(0.34)	(0.993)	(0.008)	(0.024)	(0.364)	(2.001)	(0.008)	(0.024)
Simulated EITC*aged 3-5	0.017	0.028	0.699	1.118	0.013	0.016	1.124	1.063	0.004	0.078
	(0.01)	(0.018)	(0.407)	(1.051)	(0.01)	(0.034)	(0.439)	(1.679)	(0.01)	(0.023)
Simulated EITC*aged 6-12	0.003	0.021	0.008	0.809	-0.007	-0.003	0.393	0.545	0.002	0.057
	(0.009)	(0.013)	(0.36)	(0.663)	(0.009)	(0.018)	(0.342)	(1.51)	(0.008)	(0.018)
Simulated EITC*aged 13-17 (reference)										
Total, aged 0-2	0.111	0.068	4.353	2.581	0.085	0.047	3.497	0.470	0.071	0.026
Total, aged 3-5	0.072	0.048	2.953	1.588	0.065	0.033	2.529	0.617	0.028	0.020
Total, aged 6-12	0.058	0.041	2.262	1.279	0.045	0.014	1.798	0.099	0.026	-0.001
Total, aged 13-17	0.055	0.020	2.254	0.470	0.052	0.017	1.405	-0.446	0.024	-0.058
F-statistic, aged 0-2	101.33	6.21	95.40	5.52	58.20	3.66	78.82	0.30	64.38	2.45
F-statistic, aged 3-5	35.84	2.06	41.64	0.97	36.94	0.74	29.75	0.37	9.2	1.14
F-statistic, aged 6-12	38.01	1.46	40.32	1.11	29.3	0.4	21.98	0.01	12.54	0.01
F-statistic, aged 13-17	4.49	0.53	4.84	0.34	4.22	0.6	2.69	-0.27	2.2	-2.56
Number of Observations	150,691									

Sources: March Current Population Survey (CPS) 1990-2016 and American Community Survey (ACS)/U.S. Census 1990, 2000-2016. Sample is restricted to children under the age of 18 whose mothers are unmarried, have less than a college degree and are coresident. All regressions include demographic (parental age, educational attainment, race, indicators for presence of children aged 0-2,3-5,6-12) and state-year characteristics (welfare generosity, food stamp generosity, minimum wage, unemployment rate, GDP), as well as state, year, number of child fixed effects, state-specific linear time trends and number of child-specific time trends. Each column represents a separate regression. Standard errors clustered at the state level. Simulated credits in thousands of 2016$.

Appendix Table 8: Pooled Non-Linear Decomposition of Change in Maternal Employment between 1990 and 2000 by Youngest Child's Age

	All	Ages 0-2	Ages 3-5	Ages 6-12	Ages 13-17
Worked last week					
Year 2000 mean	0.68	0.54	0.68	0.75	0.75
Year 1990 mean	0.54	0.34	0.51	0.63	0.70
Difference (2000-1990)	0.15	0.20	0.17	0.12	0.06
Explanatory Factors					
Average EITC	0.05	0.11	0.04	-0.03	0.07
Other Public Assistance					
Food Stamps	0.021	0.017	0.023	0.018	0.011
Medicaid	0.001	0.016	0.004	-0.008	-0.006
Social Security	0.001	0.002	0.001	-0.001	-0.001
SSI	-0.003	-0.002	-0.005	-0.003	-0.001
Maternal/Household Characteristics					
Education	0.008	0.010	0.010	0.006	0.006
Age	0.001	-0.002	0.000	0.000	-0.004
Race/Ethnicity	-0.002	-0.002	-0.008	0.002	-0.001
Number of children	0.000	0.001	0.003	0.002	-0.002
Income to poverty ratio	0.022	0.032	0.024	0.016	0.011
Living with grandparent	-0.001	0.000	-0.002	-0.001	0.002

Source: Current Population Survey 1990-2016. Note: Sample is restricted to children under the age of 18 whose mothers are unmarried and have less than a college degree. Results from a Blinder-Oaxaca decomposition. Average EITC is simulated EITC used in regression models. Food stamps, Medicaid, Social Security, and SSI are indicators for whether the single mother reports currently receiving those benefits. Parental education is expressed in three categories: less than high school, high school diploma, and some college. Race/Ethnicity is expressed in four categories: White non-Hispanic, black non-Hispanic, Hispanic, and all others. See text for details.