The Long-Term Impact of the Earned Income Tax Credit on Children's Education and Employment Outcomes

Author(s): Jacob Bastian and Katherine Michelmore

Source: *Journal of Labor Economics*, October 2018, Vol. 36, No. 4 (October 2018), pp. 1127-1163

Published by: The University of Chicago Press on behalf of the Society of Labor Economists and the NORC at the University of Chicago

Stable URL: https://www.jstor.org/stable/10.2307/26553340

The Long-Term Impact of the Earned Income Tax Credit on Children's Education and Employment Outcomes

Jacob Bastian, *University of Michigan*

Katherine Michelmore, *Syracuse University*

Using 4 decades of variation in the federal and state Earned Income Tax Credit (EITC), we estimate the impact of exposure to EITC expansions in childhood on education and employment outcomes in adulthood. Reduced-form results suggest that an additional $1,000 in EITC exposure when a child is 13–18 years old increases the likelihood of completing high school (1.3%), completing college (4.2%), and being employed as a young adult (1.0%) and earnings by 2.2%. Our analysis reveals that the primary channel through which the EITC improves these outcomes is increases in pretax family earnings.

I. Introduction

The Earned Income Tax Credit (EITC) is one of the largest cash-transfer programs in the United States. In 2013, the EITC distributed over $66 bil-

This paper contains elements from an earlier version under a different title, "The Effect of Income on Educational Attainment: Evidence from State Earned Income Tax Credit Expansions." We thank Martha Bailey, Charles Brown, Susan Dynarski, Ron Ehrenberg, Jim Hines, Hilary Hoynes, Brian Jacob, Lance Lochner, Michael Lovenheim, Doug Miller, Ross Milton, Mike Mueller-Smith, Kelly Musick, Sharon Sassler, Jeff Smith, Mel Stephens, and seminar participants at Cornell University, the University of Michigan, and the University of Wisconsin's Institute for Research on Poverty for helpful advice and comments. Any remaining errors are our own. This research is supported by the Institute of Education Sciences, US Department of Ed-

[*Journal of Labor Economics*, 2018, vol. 36, no. 4]

Submitted January 21, 2016; Accepted July 12, 2017; Electronically published July 19, 2018

lion to 28 million low-income families and lifted more than 3 million children out of poverty (CBPP 2014). Research on the EITC over several decades indicates that it has had a substantial impact on low-income families, increasing labor force participation of single mothers (Eissa and Liebman 1996; Meyer and Rosenbaum 2001; Bastian 2017), raising pretax earnings (Dahl, DeLeire, and Schwabish 2009), lifting families out of poverty (Hoynes and Patel 2015), and improving health (Evans and Garthwaite 2014).[1]

Recent work has shown that children from low-income households benefit from the EITC as well. Hoynes, Miller, and Simon (2015) find that the EITC led to a reduction in the occurrence of low birth weight, Dahl and Lochner (2012, 2017) find that the program led to an increase in childhood test scores, and Maxfield (2014) and Manoli and Turner (2018) find positive effects of the EITC on college going. While these papers all find positive contemporaneous effects of the EITC on children, little is known about the long-term effects of the EITC on children's outcomes once they reach adulthood. This is an important question, as it has implications for the intergenerational transmission of poverty. This paper builds on prior research by analyzing how exposure to the EITC in childhood affects subsequent educational attainment and labor market outcomes in adulthood.

The EITC has the potential to affect the long-term outcomes of children through multiple pathways. First, the EITC benefit itself provides additional resources to low-income households. This "income effect" could lead to improvements in long-term outcomes. Second, mothers may increase their labor supply (often on the extensive margin) as a response to the EITC.[2] Although household earnings may rise substantially, this "substitution effect" may result in more time spent working and less time spent with children at home. The overall effect of the EITC on children's long-term outcomes is therefore theoretically ambiguous. As we demonstrate empirically, the EITC leads to large increases in pretax household earnings, with only minor declines in time that mothers spend with their children.

Since there are no limits on the number of years that households can claim the EITC, this program has the potential to affect children from birth until

ucation, through grant R305B110001 to the University of Michigan. The opinions expressed are those of the authors and do not represent views of the Institute or the US Department of Education. The collection of data used in this study was partly supported by the National Institutes of Health, under grant R01 HD069609, and the National Science Foundation, under award 1157698. Contact the corresponding author, Katherine Michelmore, at kmmichel@syr.edu. Information concerning access to the data used in this paper is available as supplementary material online.

[1] See Nichols and Rothstein (2016) for a recent summary of the EITC.

[2] The EITC has consistently been shown to increase the labor supply of single mothers, but it may reduce the average labor supply of married mothers (Eissa and Hoynes 2004), although married women with lower-earning spouses respond positively as well (Eissa and Hoynes 2006; Bastian 2017).

college.[3] Family resources have been shown to affect the human capital and long-run outcomes of young children (Cunha and Heckman 2007; Chetty, Friedman, and Rockoff 2011; Currie and Almond 2011) as well as the outcomes of older children (Dynarski and Scott-Clayton 2013; Manoli and Turner 2018; Carneiro et al. 2015; Cohodes et al. 2016). This is the first study to use the longitudinal nature of the EITC to causally estimate when in a child's life the EITC (and family income) matters most for later-life outcomes.

To conduct this analysis, we use data from the 1968–2013 waves of the Panel Study of Income Dynamics (PSID). For each individual of interest, we construct annual measures of "EITC exposure" in childhood, defined as the maximum federal and state EITC benefits that a child's family could receive, given the year, state of residence, and number of children residing in the household.[4] This measure of exposure, rather than actual EITC eligibility based on actual family income, is used because of concerns of endogeneity of own EITC eligibility with respect to education outcomes. We then analyze the impact of EITC exposure in childhood on educational attainment and employment when these children reach adulthood. Variation in EITC generosity over 4 decades, as well as panel data on individuals from several birth cohorts, allows for the estimation of heterogeneous treatment effects by age of exposure. EITC exposure is then used as an instrument for family income to investigate how exogenous shocks to family income in childhood affect education and employment outcomes in adulthood.[5]

This paper makes the following contributions. First, we extend the literature on the impact of the EITC on children of EITC recipients by estimating its effect on education, employment, and earnings when children reach adulthood. Second, this is the first analysis to exploit 4 decades of policy-induced changes to EITC generosity at both the federal and state levels. Third, we contribute to the broader literature on how household resources affect educational attainment. Finally, we examine when in a child's life the EITC (and family income) matters most for later-life outcomes.

Results indicate that a policy-induced increase in EITC generosity in childhood has a positive effect on educational attainment and employment in adulthood. These effects are driven by EITC exposure during the teenage years, which is consistent with a growing body of research that finds positive education outcomes for children exposed to additional resources in

[3] Children can be claimed on the EITC until they turn 19, or 24 if they remain full-time students.

[4] There is little evidence that the EITC affects fertility, reducing concerns of endogeneity of family size (Baughman and Dickert-Conlin 2009). Likewise, the EITC has at most a minor impact on marriage and divorce rates (Dickert-Conlin and Houser 2002; Herbst 2011; Michelmore 2018).

[5] Family income is defined as reported earnings plus the imputed EITC benefits a family is eligible for, given their state, year, family size, marital status, and earnings.

their teenage years (Manoli and Turner 2018; Carneiro et al. 2015; Cohodes et al. 2016). Reduced-form estimates of the impact of EITC exposure on education and employment outcomes suggest that a $1,000 (2013 dollars are used throughout this paper) increase in EITC exposure between ages 13 and 18 leads to a 1.3% increase in high school graduation, a 4.2% increase in college graduation, and a 1.0% increase in employment in adulthood.

Our instrumental-variables analysis reveals that EITC exposure in childhood leads to large increases in pretax family earnings, which leads to increases in educational attainment and employment in adulthood. A $1,000 increase in the maximum EITC when a child is 13–18 years old increases family income over that age range by approximately $12,000 (or $2,000 per year). A $1,000 increase in family income generated by EITC exposure between ages 13 and 18 leads to a 0.2% increase in the likelihood of completing high school and a slight increase in total years of schooling. These education gains also translate into labor market gains. A $1,000 increase in family income generated by EITC exposure between ages 13 and 18 leads to a 0.1% increase in the probability of being employed between ages 22 and 27 and a $57 (or 0.2%) increase in annual earnings. Conditional on exposure at older ages, we find no significant positive effects of EITC exposure before age 13 on education outcomes, although in many cases estimates are too noisy to draw firm conclusions regarding the relationship between exposure to the EITC in early childhood and subsequent education outcomes.

These results provide further evidence that, in addition to the positive economic impacts that it has on its adult recipients, the EITC also has positive effects on children growing up in low-income households and that these effects persist into adulthood. These findings have important implications for intergenerational mobility, suggesting that the EITC improves the financial well-being of children growing up in disadvantaged households. These results also have implications for intergenerational income inequality, as we find that effects are largest among individuals from the lowest-income households.

II. Federal and State EITC Policy Changes over Time

The EITC is a refundable tax credit that provides an annual earnings subsidy to low-income workers. Benefits are determined by the state of residence, marital status, and number of children of the taxpayer and were worth as much as $8,462 in 2013 for households earning between $13,430 and $22,870.[6] The EITC structure contains a phase-in region, where benefits increase as a function of earnings; a plateau region, where benefits do not change as a function of earnings; and a phase-out region, where benefits decrease as a function of earnings. The slopes of these regions vary by the

[6] For a married family with three or more children living in a state with an EITC worth 40% of the federal EITC.

number of children living in the household. The structure of the federal EITC for the 2013 tax year is presented in figure 1.

Since its inception, the EITC has undergone several changes at both the federal and state level. The federal EITC began in 1975 as a 10% earnings subsidy for low-income parents. By 1986, the phase-in rate had increased to 14%, and in 1991, a larger benefit was introduced for households with two or more children. The largest federal expansion occurred in the years leading up to welfare reform in the 1990s. By 1996, the phase-in rate for households with two or more children was 40%, while for households with one child it was 34%. This resulted in a difference of up to $2,000 (2013 dollars) in annual EITC benefits between families with one and families with at least two children. In 2003, the plateau region of the EITC was extended for married couples, and in 2009, a larger credit was introduced for households with three or more children that phased in at a rate of 45%. Over this period, maximum federal EITC benefits grew from $1,700 in 1975 to $6,000 in 2013 (2013 dollars).

In addition to the federal EITC, 24 states and the District of Columbia had their own EITCs in 2013. In general, these policies supplemented fed-

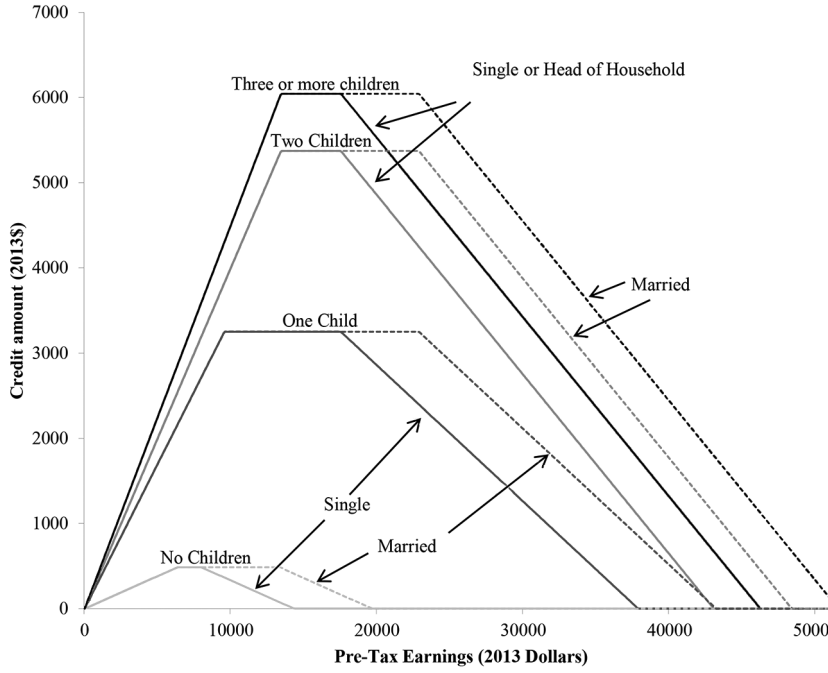

FIG. 1.—2013 Earned Income Tax Credit (EITC) schedule by number of children and marital status. Source: authors' calculations from EITC parameters in 2013. A color version of this figure is available online.

eral EITC benefits by a fixed rate, ranging from 3.5% to 40% of federal EITC benefits. States began implementing their own EITCs in the late 1980s, but many did so in the late 1990s. After welfare reform in 1996, states were given federal block grants to reduce welfare caseloads, with flexibility in determining how that money was spent. Many states used these block grants to establish EITCs. Table A1 (tables A1–A14 and B1 are available online) lists the states that have ever implemented EITCs as well as the generosity of state EITCs as of 2013. States with EITCs can be found in all regions of the country and across the political spectrum (e.g., Washington, Pennsylvania, and Alabama do not have an EITC, while Oregon, New York, and Louisiana do).[7] The year that a state enacted an EITC and the generosity of state EITC benefits are sources of between-state variation. There is also within-state variation in EITC benefits as states expanded (and occasionally reduced) their programs over time.

Numerous policy expansions in federal EITC benefits and dozens of state-level changes interact to provide substantial identifying variation. Figure 2 presents variation in the federal and state maximum potential EITC a household could receive for each of the states that have their own EITCs from 1975 to 2013. Figure 2 illustrates the three sources of plausibly exogenous variation in EITC generosity: variation in the generosity of the federal credit over time, variation based on the implementation and expansions of state EITCs over time, and variation based on the number of children residing in the household. All values are presented in 2013 dollars, adjusted by the Consumer Price Index. In 1986, just one state had its own EITC, and by 2013, there were 25 states with their own EITCs. In 1986, the difference between the most generous and least generous states in terms of the maximum potential EITC was quite small. By 2013, the difference was more than $2,000.

Using state EITCs yields more variation than federal EITC policy expansions alone and allows for more precise estimation of the impact of the EITC on the outcomes of interest. This variation also implicitly controls for national events that may have coincided with federal EITC expansions, such as recessions or welfare reform. Much of the early research on the EITC relies on a one-time expansion to the federal EITC during the mid-1990s, a time when the federal economy was booming and traditional welfare was undergoing a significant reform. It is not clear whether results based on this federal expansion are generalizable under different economic circumstances. Using state policy variation in EITC benefits helps address this concern and takes advantage of policy changes that occurred over several decades and across the business cycle.

[7] The federal EITC has been expanded by every president since it began under President Ford. State EITCs have also been created and expanded by Republican and Democrat governors alike.

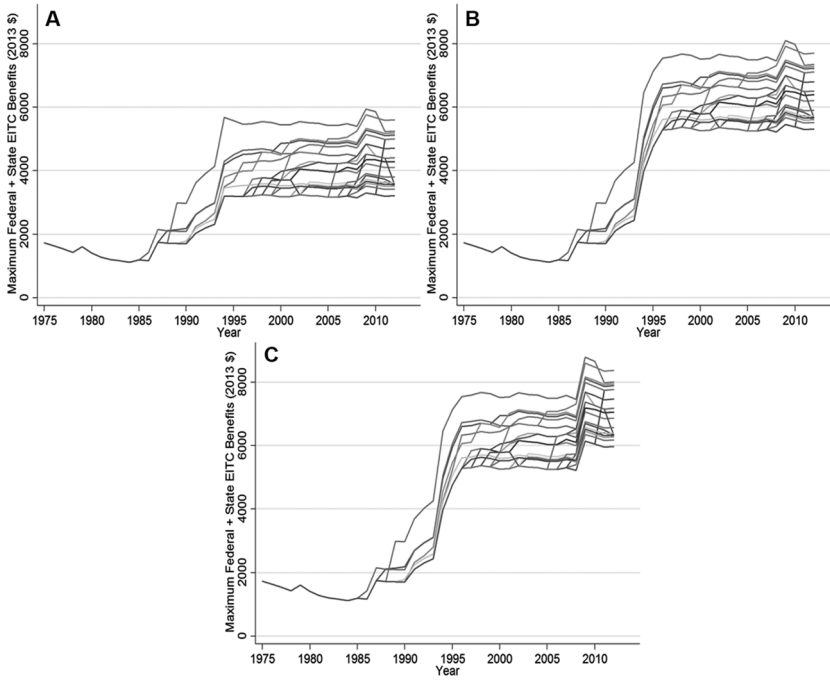

FIG. 2.—Federal and state Earned Income Tax Credit (EITC) exposure by year and state. EITC exposure is defined as the maximum potential federal and state EITC an individual could receive in a given year and state for a one- (*A*), two- (*B*), or three-plus-child (*C*) household. The lowest line denotes federal EITC for states with no state EITC; other lines are for individual states. Source: authors' calculations. A color version of this figure is available online.

In using state-level variation, we assume that changes in state EITC generosity are uncorrelated with other state-level policies or economic conditions that may also affect education and employment outcomes. For instance, if states are more likely to increase their EITC benefits when the unemployment rate is high and high unemployment induces more individuals to stay in school, then changes in educational attainment will reflect not only higher state EITC benefits but also the effect of high unemployment.

To test whether state EITC generosity is correlated with other state policies or macroeconomic events, we regress the maximum federal and state EITC on several state-by-year characteristics such as GDP, unemployment rate, the top marginal income tax rate, the minimum wage, welfare generosity, higher-education spending, and total state tax revenue. We also include lags of each of these controls. Results in table A2 indicate a negative relationship between state EITC generosity and spending on higher education (significant at the 10% level). States with more generous EITC benefits tend

to spend less on higher education, which would bias our results toward 0 if spending on higher education is positively correlated with educational attainment. Although we cannot reject that all 14 covariates are statistically 0 in a joint F-test (p-value = .32),[8] these state-year variables are included as controls throughout the analysis to help alleviate concerns that state-year policies and economic conditions might be correlated with both EITC generosity and long-run outcomes. We also control for state-specific time trends to account for additional policies or conditions that vary by state over time. We also explicitly test the sensitivity of results to the inclusion of state EITC variation; results are robust to excluding state EITC variation and relying on federal variation alone.

III. Previous Research

A few studies have investigated the relationship between the EITC and children's education outcomes. Using a federal expansion of the EITC for two-child households in the 1990s, Dahl and Lochner (2012, 2017) show that a $1,000 increase in family income generated by the EITC increased math and reading test scores on the Peabody Individual Achievement Test (PIAT) by 4% of a standard deviation. It is not clear whether these positive effects persist or whether these test score improvements lead to gains in long-run educational attainment or labor market outcomes. Many policy interventions that improve the short-run test scores of children have been shown to fade out after the intervention ends (Currie and Thomas 2000; Kane and Staiger 2008; Jacob, Lefgren, and Sims 2010). However, some policies have been shown to improve longer-term outcomes such as educational attainment or labor market outcomes (Krueger and Whitmore 2001; Ludwig and Miller 2007; Deming 2009; Heckman et al. 2010; Chetty et al. 2011). This paper assesses whether the test score gains found in Dahl and Lochner (2012, 2017) translate into improvements in longer-term outcomes.

Manoli and Turner (2018) examine the impact of the EITC on college going among high school seniors. The authors exploit variation in family income generated by kinks in the EITC benefit structure and the tax code more generally to analyze the impact of an increase in family income during tax time on college enrollment the following fall. The authors find a 0.4–0.7 percentage point (or about 1.9%–3.4% from a base of 20.5%) increase in college enrollment associated with a $1,000 increase in household income during one's senior year of high school. The authors exploit sources of variation that differ from those exploited here and utilize different populations for comparison groups. Manoli and Turner (2018) primarily focus on the sample of individuals located at different kink points along the EITC benefit schedule, comparing individuals on either side of the kink points. If there are heterogeneous treatment effects by family income, the Manoli and

[8] This is also true when the sample is restricted to states that have ever had an EITC (table A2, col. 2).

Turner (2018) results may not be generalizable to the full population or the full EITC-eligible population. In addition, Manoli and Turner (2018) examine college-going patterns for individuals who receive an exogenous shock to family income in their senior year of high school, while our analysis tests whether there are differential effects of family income received at different points in childhood. The extent to which the results presented here align with those of Manoli and Turner (2018) will shed light on potential mechanisms through which the EITC affects children's educational attainment.

Chetty, Friedman, and Rockoff (2011) also analyze the impact of the EITC on later-life outcomes of children. Chetty, Friedman, and Rockoff (2011) examine how the EITC affects long-run outcomes through its impact on childhood test scores. They find that a $1,000 increase in tax credits leads to a 6% of a standard deviation increase in childhood test scores. This increase in childhood test scores results in a 0.3 percentage point increase in college going by age 20. The authors also find significant increases in earnings in adulthood as a result of test score increases in childhood. Chetty, Friedman, and Rockoff (2011) express education and earnings gains in adulthood in terms of a single-year gain in test scores generated by the EITC. If exposure to the EITC has a cumulative effect on outcomes in adulthood, we would expect to find larger gains in education outcomes than earlier studies.

Our analysis builds on prior work by estimating the impact of exposure to the EITC throughout childhood on children's education and employment outcomes when they reach adulthood. Both federal and state EITC variation over 4 decades enables estimation that is not limited to a specific point in time or segment of the income distribution. Panel data on EITC exposure across time, birth cohorts, and age allow for the estimation of heterogeneous effects of the EITC by age of exposure. An analysis of how the timing of EITC exposure affects children's long-term outcomes is an area of particular interest, as prior work linking the EITC to children's education outcomes has not explored whether there are differential impacts of the EITC on education outcomes by age of exposure. Finally, while we estimate the reduced-form effect of EITC exposure on long-term outcomes, we also use an instrumental-variables approach to show that the EITC has a substantial impact on pretax family earnings, which also leads to improvements in education and employment outcomes.

IV. Data and Sample

Data come from the 1968–2013 waves of the PSID. The PSID is a nationally representative household survey that has followed households and their offspring since 1968. The original sample contained information on approximately 5,000 households, and over 70,000 individuals have participated in the PSID as of the 2013 wave (McGonagle et al. 2012). All individuals residing in the household are interviewed, and any individual born into the household is then followed for life even if they subsequently leave the

household.[9] Households were interviewed annually until 1997, after which they were interviewed biannually.[10] The PSID contains a rich set of information regarding household and individual characteristics, facilitating the calculation of annual EITC exposure during childhood.

We limit the sample to individuals observed in at least one year in each of the age intervals in which EITC exposure is measured: 0–5, 6–12, and 13–18.[11] We also restrict our sample to individuals whom we can observe until at least age 18. These restrictions produce a sample of 3,495 individuals born between 1967 and 1995 (see the appendix, available online, for a more detailed description of the sample and variable definitions).[12]

Summary statistics are presented in table 1, weighted with childhood PSID weights averaged across the years from birth to age 18. All dollar values are adjusted for inflation with the Consumer Price Index and reported in 2013 dollars. Most of the individuals in the sample lived with parents who had completed high school, and about half had at least one parent who completed some college. The maximum federal and state EITC in the year individuals turned 18 was approximately $4,600, while the cumulative maximum EITC benefits from a child's birth to age 18 were worth approximately $77,000.[13] On average, individuals in our sample were exposed to larger EITC benefits between the ages of 13 and 18 ($29,300) than between birth and age 5 ($16,600), which is partially explained by the fact that much of the expansions to the EITC occurred over the past 2 decades, when much of our sample was older than 5. Only the youngest individuals in our sample would have been 5 or younger during the large federal expansions of the early 1990s. Demographically speaking, children under the age of 6 are also less likely than older children to have other siblings in the household, which may also explain why EITC exposure is lower during that age range.[14]

V. Empirical Method

To analyze how the EITC affects education and employment outcomes, we create measures of EITC exposure during childhood, defined as the max-

[9] Any individual who marries into a PSID household is observed while residing in that household but is not followed after separating from the household. See the 2013 PSID Main Interview User Manual (PSID 2013) for more details.

[10] For noninterview years, we impute family income and EITC benefits by averaging income and EITC benefits from the interview years just before and after the noninterview year.

[11] Results are robust to restricting the sample to individuals present for at least three of the years in each age range.

[12] Results are similar if we exclude all individuals born before 1975 and focus only on the sample with 18 years of exposure to the EITC.

[13] Discounting EITC exposure by 3% a year from age 18 results in a cumulative amount of about $36,000.

[14] Approximately a quarter of 0–5-year-olds in our sample have no other siblings in the household, compared to just 11% of 6–12-year-olds. The 13–18-year-olds are equally likely to have no other siblings in the household as 0–5-year-olds but are more likely to have at least two siblings in the household.

Table 1
Descriptive Statistics of Sample

Variable	Mean	Standard Deviation
Female	.49	.50
Black	.18	.38
Hispanic	.01	.08
Siblings	2.06	1.35
Ever-married parents	.88	.32
Mother finished high school	.95	.21
Mother attended some college	.69	.46
Father finished high school	.86	.34
Father attended some college	.60	.49
EITC exposure between ages 0 and 5 ($000s)	16.62	7.96
EITC exposure between ages 6 and 12 ($000s)	31.12	8.87
EITC exposure between ages 13 and 18 ($000s)	29.28	6.41
EITC exposure between ages 0 and 18 ($000s)	77.01	18.09
EITC exposure at age 18 ($000s)	4.60	1.58
Family income at age 18 ($000s)	77.76	80.84
Observations	3,495	

SOURCE.—1968–2013 waves of the Panel Study of Income Dynamics (PSID).
NOTE.—Children born between 1967 and 1995 who meet the following criteria: observed between ages 0 and 5, ages 6 and 12, and ages 13 and 18, observed at or after age 18, and either finished or dropped out of high school. All means are weighted by average childhood PSID weight. All dollar measures are in 2013 dollars. Earned Income Tax Credit (EITC) exposure is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children in the household.

imum potential federal and state credit a child's family could receive, given their state of residence, family size, and tax year, independent of own family income or parental marital status. For each individual in the analysis, EITC exposure is summed from an individual's birth until the year she turns 18 or the last year she resides in her parents' household, whichever comes first.[15] The value of EITC exposure changes over time for an individual, based on federal and state policy changes to the EITC as well as changes to the individual's family size or movements across states, the latter of which is relatively rare.[16] For instance, an individual who is the firstborn child of a household will be assigned the maximum federal and state EITC available for a one-child household in the year they were born, in their state of birth. If a second child enters the household a year later, both siblings in the household will then be assigned the maximum federal and state EITC available for a two-child household in that state after the birth of the second child. Once the first-born child turns 19, the second-born child will be assigned the maximum federal and state EITC available for a one-child household for the remaining

[15] Parents cannot claim children for the EITC unless the children reside in the household for at least half the year. Only 38 observations in the sample were of children who did not live with a parent at age 18, and results are robust to excluding them.

[16] About 1.6% of individuals move across state lines in a given year, while 20% of individuals ever move across state lines between birth and age 18. All results are robust to excluding these individuals.

years until she turns 19 (assuming that no other children enter the household). Variation in annual EITC exposure stems from three primary sources: the year the individual was born (reflecting the generosity of the federal credit), the state the individual lives in (reflecting state EITC benefits), and the number of children in the household (reflecting larger EITC benefits available for larger households).[17]

We use this measure of EITC exposure, rather than own EITC benefits, because of concerns of endogeneity of family income and own EITC benefits with respect to education outcomes. Families eligible for the EITC must have income below a certain threshold, which was $51,567 in the 2013 tax year,[18] and thus EITC eligibility is negatively correlated with income. Individuals with higher levels of EITC benefits during childhood were also likely to be disadvantaged in other ways (e.g., poor neighborhoods and schools, single parenthood, poor nutrition) that may have affected their educational attainment. A direct analysis of the impact of own EITC benefits on education outcomes generates a negative correlation, as higher family EITC benefits are an indicator of economic hardship during childhood.[19] Using EITC exposure rather than actual EITC eligibility captures plausibly exogenous policy variation and excludes endogenous variation in own EITC eligibility.

Figure 3 simulates the variation in EITC exposure a child could have received from birth to age 18 by birth cohort, state, and number of children residing in the household—our treatment variable of interest. This figure is constructed by summing the maximum federal and state EITC benefits available in each year over 19 years (age 0–18) for each of the states that have ever implemented EITCs as well as the federal EITC alone (the bottom line in each panel) for one-, two-, and three-plus-child households. The figure simulates what EITC exposure would look like for individuals born between 1957 and 1995 if they lived in a one-, two-, or three-plus-child household over their entire childhoods. For simplicity, the simulations assume a fixed state of residence over the entire period of childhood as well as a fixed household size. The results of this simulation illustrate the substantial variation in exposure to the EITC, depending on the year of birth, household size, and state of residence. Individuals born in 1975 would have been ex-

[17] Bivariate regressions of EITC exposure on year fixed effects suggest that variation over time explains approximately 67% of the variation in EITC exposure. Similar regressions with state or number-of-children fixed effects suggest that state variation accounts for 7% of the variation in EITC exposure, while the number of children residing in the household accounts for 13% of the variation in EITC exposure.

[18] This threshold was lower for unmarried families or families with fewer than three children.

[19] In our sample, an additional $1,000 in own EITC eligibility at age 18 is correlated with a 1.6 percentage point decrease in the probability of finishing high school.

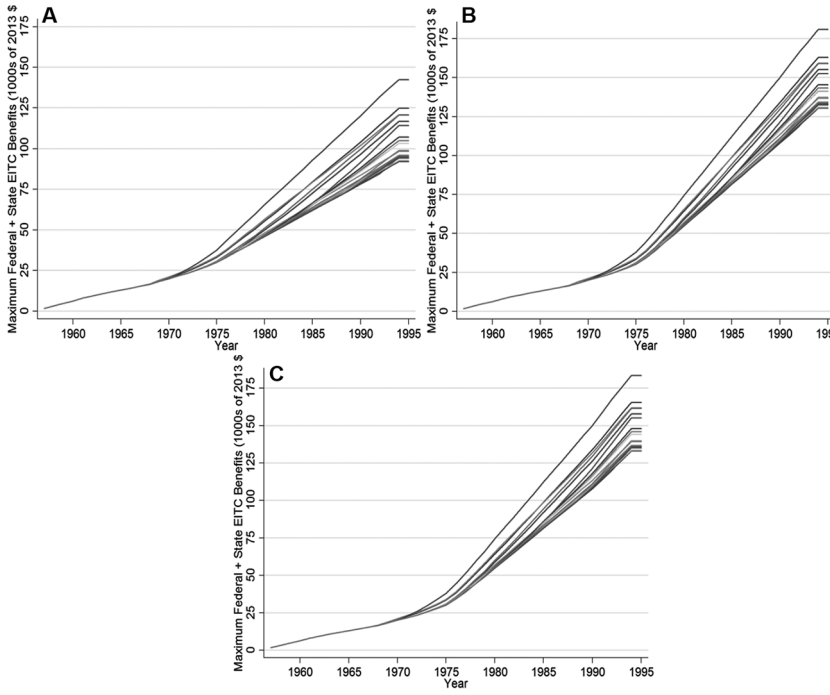

FIG. 3.—Federal and state Earned Income Tax Credit (EITC) exposure from birth to age 18 by cohort and state. EITC exposure is defined as the maximum potential federal and state EITC an individual could receive in a given year and state for a one- (*A*), two- (*B*), or three-plus-child (*C*) household. The lowest line denotes federal EITC benefits for states with no state EITC; other lines are for individual states. Source: authors' calculations. A color version of this figure is available online.

posed to roughly $30,000 (2013 dollars) in EITC benefits from birth to age 18, while individuals born 10 years later could have received up to $100,000 (2013 dollars) in EITC benefits during childhood.

Figure 4 illustrates how the potential variation in figure 3 translates to EITC exposure between birth and age 18 for our sample. Figure 4 reveals more than 1,400 unique values of EITC exposure for our sample of 3,495 individuals and reflects any changes in the number of children in the household as well as any cross-state moves an individual experiences between birth and age 18. Consistent with the variation presented in figure 3, figure 4 illustrates the substantial variation in EITC exposure among individuals in our sample, ranging from less than $15,000 for individuals born in 1967 to over $145,000 for individuals born in 1995. In addition to the refundable tax credits that these children could have received from the EITC, they also experienced an increase in household earnings as the EITC encouraged their parents to go to work over this time period as well. As a result, the EITC had a large impact

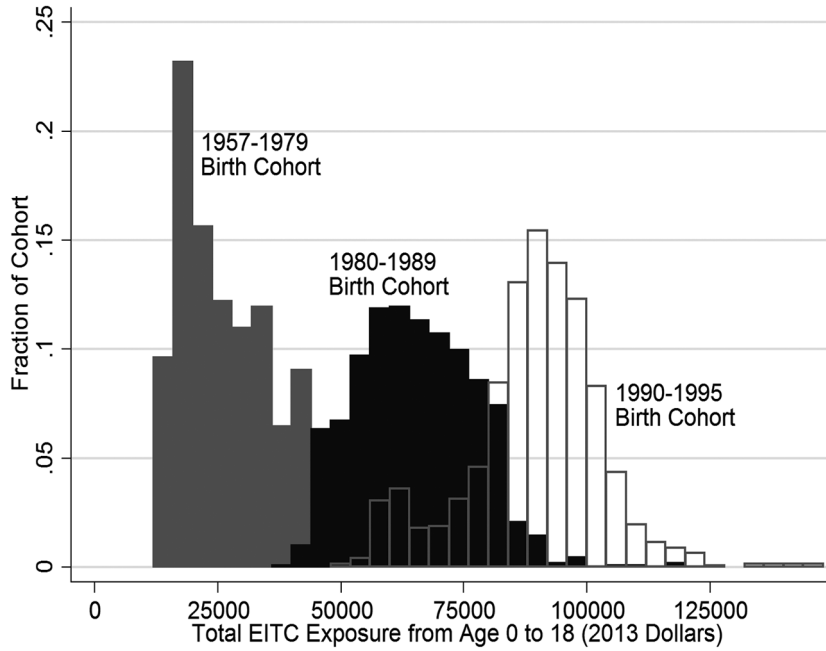

FIG. 4.—Distribution of total Earned Income Tax Credit (EITC) exposure from birth to age 18. EITC exposure is shown in thousands of 2013 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. The histogram reflects 1,454 unique values. The main sample of 3,495 observations was used. Panel Study of Income Dynamics (PSID) data cover only odd years after 1997; for even years between 1998 and 2012, EITC exposure is imputed as the average value of adjacent years. Source: 1968–2013 waves of the PSID.

on household resources for many children growing up in low-income families over this period.

A. EITC Exposure in Childhood Increases Educational Attainment

To analyze the impact of the EITC on educational attainment, we first estimate the reduced-form effect of increasing EITC exposure during childhood on subsequent education outcomes. To reflect our interest in measuring how the timing of income affects education outcomes, we parse cumulative EITC exposure throughout childhood into three age intervals: 0–5, 6–12, and 13–18.[20] Parsing EITC exposure this way allows us to test

[20] We also modeled the impact of EITC exposure at age 18 on subsequent education outcomes as a proxy for childhood EITC exposure. Results were consistent

two hypotheses regarding the timing of income and children's education outcomes. One hypothesis posits that the main mechanism through which the EITC increases educational attainment is by improving the home environment, noncognitive skills, or academic preparedness of young children. If this hypothesis prevails, we would expect to find relatively larger effects of EITC exposure on education when individuals are young. This would be consistent with evidence suggesting that early-childhood interventions are effective in improving the life outcomes of children growing up in poverty (Cunha and Heckman 2007; Ludwig and Miller 2007; Deming 2009; Chetty et al. 2011; Currie and Almond 2011; Caucutt and Lochner 2012). If, instead, the main mechanism by which the EITC improves educational attainment is alleviating credit constraints in paying for college, then we would expect to find larger effects of EITC exposure when individuals are adolescents. This would support the hypothesis that the household cash on hand in the years leading up to college decisions has a significant impact on college enrollment (Dynarski 2003; Belley and Lochner 2007; Kane 2007; Lovenheim 2011; Manoli and Turner 2018). These two hypotheses are not mutually exclusive. It is possible that each of these channels contributes to improvements in education outcomes. To test these hypotheses, we first model the reduced-form impact of EITC exposure on children's educational attainment as follows:

$$\begin{aligned} Y_i = {} & \beta_1 \text{EITC}_{i,(0\text{-}5)} + \beta_2 \text{EITC}_{i,(6\text{-}12)} + \beta_3 \text{EITC}_{i,(13\text{-}18)} \\ & + \eta \boldsymbol{X}_i + \psi \boldsymbol{V}_{s,t} + \lambda \boldsymbol{Z}_s + \pi \boldsymbol{W}_t + \varepsilon_i, \end{aligned} \tag{1}$$

where i indexes individuals, s indexes states, and t indexes years. Here, Y_i is the outcome variable of interest: high school completion, college attendance, college completion, years of schooling, employment, and earnings. Outcomes are evaluated as of age 20 for high school completion, age 24 for college attendance, and age 26 for college completion and years of schooling and between the ages of 22 and 27 for employment and earnings. For each outcome of interest, each individual is represented in the sample exactly one time. Coefficients of interest are β_1, β_2, and β_3, which represent the impact of an additional \$1,000 of EITC exposure when the focal child is 0–5, 6–12, and 13–18 years old, respectively, on subsequent education and employment outcomes.[21]

(table A6). We also examined the effects of the cumulative EITC exposure between birth and age 18 as well as the average annual EITC exposure. These results (not shown) proved to be largely redundant.

[21] We assume a linear functional form for the impact of EITC exposure on the outcomes of interest; results are robust to relaxing that assumption and using a semiparametric approach (see app. B).

The term $\boldsymbol{X}_i$ represents a vector of personal characteristics that includes cohort fixed effects, an age cubic, and indicators for black, Hispanic, female, ever-married parents, number of siblings at age 18 fixed effects, and whether the child's mother and father finished high school or at least some college, as well as interactions between black, Hispanic, and female indicators with state and birth year. These controls account for changes in educational attainment over time that vary by race, gender, and state as well as for family characteristics that correlate with educational attainment. Interactions allow for a more flexible model and control for differential trends by race and gender that vary by state and across years.

The term $\boldsymbol{V}_{s,t}$ includes state-by-year policy and economic indicators discussed in Section II: per capita GDP, the unemployment rate, the top marginal income tax rate, the minimum wage, maximum welfare benefits, spending on higher education, tax revenue, and a state-specific quadratic time trend. These controls are measured at age 18 and are included to address concerns that various state-by-year factors may confound the relationship between EITC generosity and education outcomes. State-specific time trends control for further unaccounted-for policies or conditions that vary by state across time. The terms $\boldsymbol{Z}_s$ and $\boldsymbol{W}_t$ are for state and year fixed effects, respectively, and ε_i is an idiosyncratic-error term. To account for unobserved correlation of the error terms within states, standard errors are clustered at the state level.[22]

Table 2 presents estimates of β_1, β_2, and β_3 for various education and employment outcomes for equation (1). Each column represents a separate regression. Results are weighted with the PSID childhood weights, averaging the weights across childhood years.[23]

Results suggest that the largest impact of the EITC on education outcomes occurs when a child is 13–18 years old. Columns 1–4 show that, conditional on EITC exposure at younger ages and the full set of controls, a $1,000 increase in EITC exposure when a child is between 13 and 18 years old leads to a 1.2 percentage point (or 1.3%) increase in the likelihood of completing high school, a 1.3 percentage point (or 4.2%) increase in the likelihood of completing college, and 0.08 (or 0.6%) more years of schooling. For employment outcomes, columns 5 and 6 show that a $1,000 increase in EITC exposure between ages 13 and 18 leads to a 0.8 percentage point (or 1.0%) increase in the likelihood of being employed in adulthood and a $564 (or 2.2%) increase in annual earnings.

[22] Models that progressively add these controls are presented in table A3; results are robust to the inclusion of additional fixed effects for family size and marital status (and their interactions with state and year fixed effects) as well as fixed effects that isolate the impact of federal and state EITC exposure (see table A4).

[23] Table A5 shows that results are robust to alternate weighting choices, including unweighted.

Table 2
Effect of Earned Income Tax Credit (EITC) Exposure on Education and Employment Outcomes (Reduced Form)

	Dependent Variable					
Variable	High School Graduate; Mean = .92 (1)	At Least Some College; Mean = .52 (2)	College Graduate; Mean = .31 (3)	Highest Grade Completed; Mean = 13.7 (4)	Employed; Mean = .817 (5)	Earnings (2013$); Mean = 25,391 (6)
EITC exposure between ages 0 and 5	−.005	−.000	−.007	−.024	.021	646.1
	(.005)	(.006)	(.019)	(.071)	(.022)	(818.3)
EITC exposure between ages 6 and 12	−.003	.002	.009	.008	−.002	42.4
	(.003)	(.005)	(.006)	(.022)	(.007)	(415.1)
EITC exposure between ages 13 and 18	.012***	.006	.013**	.081***	.008*	564.0**
	(.003)	(.007)	(.005)	(.025)	(.004)	(244.9)
P-value: *F*-test identical estimates	.006	.837	.513	.108	.562	.649
Observations	3,495	3,309	2,506	2,506	1,758	1,758
R^2	.331	.420	.380	.470	.310	.426

SOURCE.—1968–2013 waves of the Panel Study of Income Dynamics (PSID).

NOTE.—EITC exposure (in thousands of 2013 dollars) is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. High school graduation is evaluated by age 20, some college by age 24, college graduation and highest grade completed by age 26. Employment and earnings are measured between ages 22 and 27; the average value is used if observed more than once during these ages. Results reflect estimation of eq. (1) and include demographic controls; state-year controls at age 18; state, cohort, and year fixed effects; and state-specific quadratic time trends. Results in cols. 1 and 2 are similar if the sample is restricted to those in cols. 3 and 4. Standard errors (in parentheses) are corrected for heteroskedasticity and are clustered at the state level. Results are weighted by average childhood PSID weights.

* $p < .1$.
** $p < .05$.
*** $p < .01$.

We find little evidence that EITC exposure before age 13 has an impact on education outcomes, although estimates are noisy and, in most cases, not significantly different from the coefficients on EITC exposure between ages 13 and 18. Coefficients for each age range are significantly different, however, for the high school graduation outcome (p-value on an F-test of coefficient equality = .006). This implies that exposure to expansions in the EITC when a child is 13–18 years old yields a significantly larger effect on the likelihood of graduating from high school than exposure to expansions in the EITC at younger ages. These results could be interpreted as the EITC having little impact on the long-term outcomes of children under

12 when exposed to EITC expansions but may also be due to insufficient identifying variation for the youngest age range.

These results are largely consistent with the "cash-on-hand" hypothesis that household resources around the time of college going are important for college enrollment (Lovenheim 2011; Manoli and Turner 2018).[24] We find a point estimate for college going (proxied by having completed at least some college) that, although insignificant, is similar to that found in Manoli and Turner (2018) and Chetty, Friedman, and Rockoff (2011). Our estimate captures the effect of EITC exposure from ages 13 to 18, while Manoli and Turner (2018) focus on exposure in a student's senior year of high school. In table A6, we present results of regressing education outcomes on EITC exposure at age 18 (rather than parsing exposure into age intervals). This exercise reveals that a $1,000 increase in EITC exposure at age 18 increases the likelihood of completing at least some college by 3.5 percentage points (or 3.8%), which is much larger than the single-year estimates generated by Manoli and Turner (2018) and Chetty, Friedman, and Rockoff (2011). However, our measure of EITC exposure at age 18 can be interpreted as a proxy for EITC exposure throughout childhood: in results not shown, a bivariate regression of EITC exposure between ages 13 and 18 on EITC exposure at age 18 reveals that a $1,000 increase in exposure at age 18 is associated with a $5,000 increase in exposure between ages 13–18. Dividing the 3.5 percentage point effect by 5 suggests that a $1,000 increase in annual EITC exposure leads to a 0.7 percentage point increase in the likelihood of completing at least some college, which is consistent with both the Manoli and Turner (2018) and Chetty, Friedman, and Rockoff (2011) estimates.

To ensure that results are not driven by children from higher-earning families that were not eligible for the EITC, we use the full set of controls and estimate the relationship between EITC generosity and high school graduation as we restrict the sample to families with lower earnings (see fig. 5). We illustrate the results using EITC exposure at age 18 for simplicity in presenting coefficients.[25] As the sample is restricted to families earning below $60,000, $50,000, $40,000, and so on, the estimated effect of an additional $1,000 of EITC exposure on the likelihood of graduating from high school grows larger. In other words, there is an inverse relationship between the magnitude of the EITC's effect on education and the upper

[24] Using a structural model, Carneiro et al. (2015) also finds that parental income has a larger positive effect on the educational attainment of older children in Norway.

[25] As discussed above concerning results in table A6, for this analysis we use equation (1), except that we replace variables for EITC exposure at ages 0–5, 6–12, and 13–18 with EITC exposure at age 18 (which can be interpreted as a proxy for EITC exposure throughout childhood: empirically, a $1,000 increase in EITC exposure at age 18 is correlated with a roughly $5,000 increase in EITC exposure between ages 13 and 18).

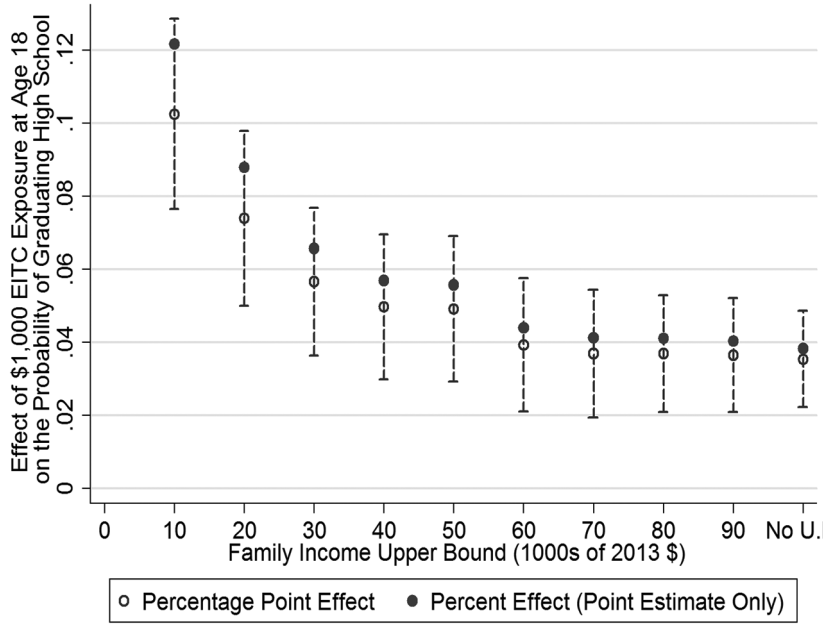

FIG. 5.—Earned Income Tax Credit (EITC) exposure has the largest benefits for lowest-income families. Each point represents the estimate of the effect of $1,000 of EITC exposure on the probability of high school graduation from a separate ordinary least squares regression. EITC exposure is shown in thousands of 2013 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. Regressions include demographic controls; state-year controls at age 18; state, cohort, and year fixed effects; and state-specific quadratic time trends. Estimates come from an estimating equation similar to equation (1), except that EITC exposure at age 18 is used instead of EITC exposure at ages 0–5, 6–12, and 13–18. Results are weighted by average childhood Panel Study of Income Dynamics (PSID) weights. Vertical bars represent 95% confidence intervals. Standard errors are corrected for heteroskedasticity and are clustered at the state level. Source: 1968–2013 waves of the PSID. A color version of this figure is available online.

bound on family income. Children from the lowest-income households benefit the most from expansions of the EITC.[26]

The effect of the EITC on educational attainment is also larger for subgroups of academically at-risk youth. Table 3 shows results for various subgroups: black youth, males and females separately, black males, and children

[26] As a placebo test, we conducted an analysis where we restricted the sample to children from families earning above $50,000 (or $60,000, $70,000, etc.) and found no significant effect of the EITC on educational attainment. Results are not shown but are available upon request. See table 3, col. 8, for a similar placebo test.

Table 3
Effect of Earned Income Tax Credit (EITC) Exposure on the High School Graduation of Subgroups (Reduced Form)

	Subgroup/Dependent Variable							
Variable	All; Mean = .92 (1)	Black; Mean = .91 (2)	Male; Mean = .92 (3)	Female; Mean = .93 (4)	Black Male; Mean = .90 (5)	Single-Parent Household; Mean = .85 (6)	Least Educated Parents; Mean = .85 (7)	Placebo Test: Most Educated Parents; Mean = .95 (8)
EITC exposure between ages 0 and 5	−.005	−.004	−.005	−.002	−.006	−.003	−.004	.006
	(.005)	(.007)	(.006)	(.008)	(.011)	(.008)	(.013)	(.007)
EITC exposure between ages 6 and 12	−.003	−.007	−.003	−.003	−.011*	−.009**	−.006	−.001
	(.003)	(.005)	(.005)	(.003)	(.006)	(.004)	(.008)	(.003)
EITC exposure between ages 13 and 18	.012***	.024***	.009**	.011***	.027**	.017***	.026*	.003
	(.003)	(.008)	(.005)	(.004)	(.011)	(.004)	(.014)	(.003)
P-value: *F*-test identical estimates	.006	.011	.050	.040	.007	.003	.091	.444
Mean EITC exposure, ages 0–18	34.9	34.9	36.9	33.2	38.0	34.6	33.2	35.6
Observations	3,495	1,503	1,681	1,814	706	1,468	632	1,291
R^2	.331	.359	.390	.417	.480	.537	.654	.503

SOURCE.—1968–2013 waves of the Panel Study of Income Dynamics (PSID).

NOTE.—EITC exposure is in thousands of 2013 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. High school graduation is evaluated by age 20. Results reflect estimation of eq. (1) and include demographic controls; state-year controls at age 18; state, cohort, and year fixed effects; and state-specific quadratic time trends. Least educated parents = both parents have at most 12 years of education; most educated parents = at least one parent has 16 years of education. Results are similar for other parental-education definitions. Standard errors (in parentheses) are corrected for heteroskedasticity and are clustered at the state level. Results are weighted by average childhood PSID weights.

* $p < .1$.
** $p < .05$.
*** $p < .01$.

with unmarried parents. Using the full set of controls, estimates show the effect of an additional $1,000 of EITC exposure at various points in childhood on the likelihood of graduating from high school. Results indicate that the effect of EITC exposure between ages 13 and 18 are larger for black children (2.4 percentage points) and children in single-parent households (1.7 percentage points), despite similar levels of EITC exposure across these groups (roughly $34,000 between birth and age 18). Effects are of similar magnitude for boys and girls (0.9 and 1.1 percentage points, respectively), and effects are largest among black boys (2.7 percentage points).[27]

Finally, the last two columns of table 3 illustrate differences by parental education. Children with the least educated parents (defined as neither parent having attended college) are 2.6 percentage points more likely to complete high school when maximum EITC benefits increase by $1,000 during the child's teenage years. In contrast, we find no significant relationship between the EITC and high school completion among children with the most educated parents (defined as at least one parent having completed college). This final column serves as a placebo test—we expect that children with highly educated parents would not be affected by policy expansions to the EITC in childhood.[28] In fact, we estimate that the relationship between EITC exposure in childhood and high school completion for this group is very close to zero for all three age coefficients.

B. Mechanisms

The results above indicate that the EITC has a positive impact on educational attainment and employment of individuals exposed to the EITC in childhood. We next explore several mechanisms through which the EITC could affect these outcomes. Table 4 tests whether the EITC affects imputed family EITC benefits,[29] pretax family earnings, maternal labor supply, standardized test scores, and daily time parents spend with their children. For these results, each outcome is measured in the same year as EITC exposure and can be interpreted as the contemporaneous effect of the EITC on the

[27] Subgroup analyses for other education and employment outcomes are reported in tables A7–A11. Results are somewhat similar, though quite noisy, because of smaller sample sizes for these other outcomes. One exception is that we never obtain statistically significant positive effects of the EITC on college attendance for any of the subgroups.

[28] In our sample only a fifth of children with the most educated parents are eligible for any (imputed) EITC benefits, compared to over half of children with the least educated parents.

[29] Actual family EITC benefits are not reported in the PSID, so we impute them on the basis of federal and state EITC rules for a given family based on the year, state, number of household children, family income, and marital status in the current year. This should be interpreted as EITC eligibility rather than EITC receipt, although take-up rates of the EITC tend to be higher than those of other social programs at around 80% (Scholz 1994; Currie 2004).

Table 4
Effect of Earned Income Tax Credit (EITC) Exposure on Intermediate Outcomes

	Dependent Variable							
Variable	EITC Benefits; Mean = .60 (1)	Family Earnings; Mean = 64.3 (2)	Mother Working; Mean = .48 (3)	Mother's Annual Hours Worked; Mean = 840.4 (4)	Standardized Test Scores; Mean = .00 (5)	Daily Minutes Spent with Mother; Mean = 151.6 (6)	Daily Minutes Spent with Father; Mean = 73.5 (7)	Daily Minutes Spent with Either Parent; Mean = 225.0 (8)
	A. Contemporaneous Effect of EITC Exposure (All Ages Pooled)							
Contemporaneous EITC exposure	.223***	2.825**	.046***	82.8***	.129**	−10.53	−.78	−11.31
	(.025)	(1.272)	(.009)	(17.6)	(.057)	(7.08)	(5.58)	(9.62)
Observations	48,623	48,623	48,623	48,623	4,533	4,975	4,975	4,975
Unique observations	3,495	3,495	3,495	3,495	2,489	2,539	2,539	2,539
R^2	.195	.300	.195	.178	.396	.276	.189	.285

	B. Contemporaneous Effect of EITC Exposure Varies by Age of Child							
EITC exposure × (age 0–5)	.224***	2.527*	.043***	80.2***	. . .	−10.14	1.85	−8.29
	(.030)	(1.414)	(.011)	(20.3)	. . .	(11.49)	(7.12)	(12.60)
EITC exposure × (age 6–12)	.225***	2.512**	.043***	74.4***	.125**	−11.05	−3.08	−14.13
	(.026)	(1.213)	(.010)	(18.4)	(.057)	(6.65)	(5.58)	(10.11)
EITC exposure × (age 13–18)	.223***	2.961**	.048***	85.8***	.278***	−2.06	−10.21	−12.27
	(.025)	(1.325)	(.009)	(17.4)	(.089)	(9.23)	(8.13)	(16.03)
P-value: *F*-test identical estimates	.970	.440	.256	.031	.038	.577	.410	.874
Observations	48,623	48,623	48,623	48,623	4,533	4,975	4,975	4,975
Unique observations	3,495	3,495	3,495	3,495	2,489	2,539	2,539	2,539
R^2	.195	.300	.195	.178	.396	.276	.190	.285

SOURCE.—1968–2013 waves of the Panel Study of Income Dynamics (PSID) and the PSID's 1997, 2002, and 2007 Child Development Survey (CDS).

NOTE.—EITC exposure is in thousands of 2013 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. All regressions include demographic controls; state-year controls; state, cohort, and year fixed effects; and state-specific quadratic time trends. EITC benefits are imputed by authors and are a function of year, state, marital status, number of household children, and household earnings. Family earnings are the pretax sum of parental earnings. Outcomes in cols. 1–4 were measured between 1975 and 2013, when individuals in the main sample were between 0 and 18 years old; outcomes in cols. 5–8 were measured in the 1997, 2002, and 2007 CDS. Column 2 also controls for a cubic in lagged family income, following Dahl and Lochner (2012, 2017). Standard errors (in parentheses) are corrected for heteroskedasticity and are clustered at the household level. Results are weighted by average childhood PSID weights.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

outcome of interest. The sample for each outcome is restricted to individuals in the main sample in table 1 who also have nonmissing data for each outcome.

The family earnings and maternal labor supply outcomes are measured at each interview wave between the focal child's birth and age 18. Test scores and time with parents is measured in the 1997, 2002, and 2007 PSID Child Development Supplement. Test scores are observed for individuals between ages 5 and 18; time with parents is observed for individuals between ages 2 and 18. All regressions include demographic controls and state, year, and cohort fixed effects as well as state-level controls and state-specific quadratic time trends. Panel A of table 4 shows regressions pooling all years and child ages and evaluating an overall effect of EITC exposure on the outcomes of interest, while panel B illustrates how EITC exposure varies by the child's age by interacting EITC exposure with the age of the child in the year the outcome was observed.

Results in table 4 indicate that the EITC had a substantial impact on financial resources, primarily through increasing maternal labor supply. Reflecting the fact that few individuals receive the maximum federal and state EITC, a $1,000 increase in the maximum EITC increases imputed family EITC benefits by an average of $223. We also find increases in pretax family earnings as a function of EITC generosity: a $1,000 increase in EITC exposure leads to a $2,800 increase in earnings (2013 dollars). This is similar to the estimates found by Dahl and Lochner (2017), who estimate that a $1,000 increase in EITC generosity increases family income by approximately $1,800 in 2000 dollars, or roughly $2,400 in 2013 dollars.

These results imply that much of the increase in family resources generated by the EITC comes from increases in labor supply and not the receipt of the benefit itself. This is consistent with prior research indicating that much of the antipoverty impact of the EITC is generated not by the benefit itself but through increases in pretax earnings generated by the labor supply incentives associated with the EITC (Hoynes and Patel 2015). Confirming a long line of research on the EITC's impacts on maternal labor supply, we find that a $1,000 increase in the maximum EITC benefit in a given state and year leads to a 4.6 percentage point increase in the likelihood of working among the mothers of the children in our sample. The annual number of hours worked also increases, by about 83 hours per year.[30] These results are in line with previous research showing significant increases in maternal labor supply as a function of EITC generosity (Eissa and Liebman 1996; Meyer and Rosenbaum 2001).

Consistent with prior work by Dahl and Lochner (2012, 2017), we also find evidence that the EITC increases test scores of young children. Results

[30] The annual number of weeks worked also increases by about 2 weeks; not shown.

indicate that a $1,000 increase in EITC exposure leads to a 12.9% of a standard deviation increase in contemporaneous child test scores. Since $1,000 of EITC exposure is correlated with an average increase in family earnings of about $2,700, this implies that $1,000 of family income is associated with about a 5% of a standard deviation increase in test scores. This aligns with previous estimates of the effect of $1,000 in family income on test scores: Dahl and Lochner (2012, 2017), Duncan, Morris, and Rodrigues (2011), and Chetty, Friedman, and Rockoff (2011) find estimates of 4%, 5%, and 6%–9% percent of a standard deviation, respectively.

While we have shown that the EITC increases maternal labor supply, it may also lead to less time invested in caring for children. We do not find much support for this theory: a $1,000 increase in EITC exposure leads to a statistically insignificant 10.5-minute reduction (or about 8%) in daily time that mothers spend with their children. We find virtually no effect of the EITC on time that fathers spend with their children; the overall decline in time spent with children is about 11 minutes per day. Previous research implies that this could have an adverse effect on children (Bettinger, Hægeland, and Rege 2014), although our estimates are small and imprecisely estimated. If we interpret the point estimates as the true reduction in daily time spent with children, they imply that mothers spend about 50 fewer minutes with their children over the course of a work week, while spending about 96 more minutes per week working.[31] Thus, our results imply that about half of the extra time mothers spend in the workforce as a function of EITC generosity comes from reductions in time spent with children.

To reflect our interest in understanding how exposure to the EITC at different points in childhood affects educational outcomes, we also examine each of these intermediate outcomes for each of our three age ranges of interest (panel B of table 4). To do this, we interact EITC exposure with an indicator for whether the individual is 0–5, 6–12, or 13–18 at the time the outcome was measured. Annual pretax family earnings and mothers' extensive-margin labor supply results are consistent across the three age ranges. We find some evidence that intensive-margin labor supply effects are larger for mothers with teenagers than for mothers of younger children, which may explain why our reduced-form estimates are also concentrated among those exposed to EITC expansions as teenagers. A $1,000 increase in EITC exposure when a child is 13–18 is correlated with mothers working 86 more hours annually. The coefficients on annual hours worked for the two younger age ranges are between 74 and 80 hours worked annually; these effects are statistically distinct (p-value = .031). Similarly, we find evidence that test score gains are larger among children aged 13–18 than among children aged 6–12 (p-value = .038).

[31] An increase of 83 in annual hours worked translates to almost 5,000 more minutes worked per year, or about 96 minutes per week.

If maternal time declines the most for children aged 0–5, this may partially explain why we find no significant effects of exposure to the EITC between ages 0 and 5 on later-life outcomes—the reductions in time spent with parents may partially offset the income gains to the family.[32] We find some evidence that maternal time spent with children declines the most for children under 6 at the time of EITC expansions, although it is not statistically different from the decline in maternal time spent with teenage children. We find the opposite age pattern for time spent with fathers: teenagers experience the largest reductions in time spent with fathers as a function of EITC generosity, while children under 6 experience small increases in time spent with fathers. These coefficients are not statistically different from one another, so we cannot rule out the scenario where time reductions are uniform across the three age ranges. If, in fact, there are significantly larger reductions in time mothers spend with their children when they are young, compared to late childhood, as a function of EITC generosity, this could explain why our positive education outcomes are concentrated among those exposed to EITC expansions in their teenage years. Still, reductions in time spent with either parent (table 4, col. 8) are substantively small and suggest that declines in time spent with either parent are comparable across each age range, alleviating some concern of differential effects of EITC exposure on time spent with parents across the three age ranges.

C. Instrumental-Variables Analysis

We next use an instrumental-variables (IV) strategy to directly analyze how a $1,000 increase in family income generated through policy-induced increases in the EITC affects education outcomes. Using EITC exposure as an instrument for family income, we model three first-stage equations, one for each of the age intervals:

$$I_{i,(a)} = \beta_{1,a}\text{EITC}_{i,(0\text{-}5)} + \beta_{2,a}\text{EITC}_{i,(6\text{-}12)} + \beta_{3,a}\text{EITC}_{i,(13\text{-}18)} + \gamma_a \boldsymbol{X}_i + \varphi_a \boldsymbol{V}_{s,t} + \theta_a \boldsymbol{Z}_s + \alpha_a \boldsymbol{W}_t + \varepsilon_{i,a}, \quad (2)$$

where $I_{i,(a)}$ represents family income (including imputed EITC benefits) for individual i at each age interval a (0–5, 6–12, and 13–18 years old) and is modeled as a function of EITC exposure at each of those age intervals with the full set of controls.

Using predicted family income $\hat{I}_{i,(a)}$ generated from equation (2), we then estimate the impact of increasing family income on education in the following second-stage equation:

[32] Prior research has shown that parental time is most important for young children (Del Boca, Flinn, and Wiswall 2014); reductions in parental time for young children might be particularly detrimental for child outcomes.

$$Y_i = \beta_0 + \beta_1 \hat{I}_{i,(0\text{-}5)} + \beta_2 \hat{I}_{i,(6\text{-}12)} + \beta_3 \hat{I}_{i,(13\text{-}18)} + \gamma \boldsymbol{X}_i + \varphi \boldsymbol{V}_{s,t} + \theta \boldsymbol{Z}_s + \alpha \boldsymbol{W}_t + \varepsilon_i. \quad (3)$$

Equation (3) parallels equation (1), except that $\text{EITC}_{i,(0\text{-}5)}$, $\text{EITC}_{i,(6\text{-}12)}$, and $\text{EITC}_{i,(13\text{-}18)}$ are replaced with predicted family income in each age interval, $\hat{I}_{i,(0\text{-}5)}$, $\hat{I}_{i,(6\text{-}12)}$, and $\hat{I}_{i,(13\text{-}18)}$, generated from equation (2). Results from this analysis indicate whether exogenous shocks to family income generated by expansions to the EITC affect subsequent educational attainment of children exposed to the EITC throughout childhood.

Using EITC exposure as an instrument for family income assumes that the EITC affects children's outcomes solely through its impact on family income. Table 4 shows that the EITC may also decrease the amount of time that mothers spend with their children, which could have a negative impact on children's subsequent outcomes. This would bias the IV estimates toward 0, in favor of finding a null result. However, it is also possible that the IV estimates could be biased upward if the benefits from the EITC are not fully captured by family income. This could happen if, in addition to the direct benefits of increased family income, children's long-run outcomes improve because of non-income-related benefits, such as having a working mother serve as a positive role model who inspires the child to achieve more. Although the overall bias is unknown and could be positive or negative, we provide evidence that the EITC is strongly correlated with family income and robust to a number of different specifications of the first stage. Further, estimates from the reduced-form models imply that the overall effect of expansions to the EITC on education and employment outcomes is positive.

Table 5 presents estimates from the first-stage regressions of family income on EITC exposure. Since we are interested in predicting family income in three age ranges, we have three endogenous regressors, with three instruments (EITC exposure in each age range) for each endogenous regressor. Table 5 therefore presents nine first-stage coefficients regressing family income in each age range on EITC exposure in each of the three age ranges. We present results in three panels: panel A presents results from regressing family income between ages 0 and 5 on the three measures of EITC exposure, panel B results for family income between ages 6 and 12, and panel C results for family income between ages 13 and 18. We present several different specifications to illustrate the robustness of our findings: the first specification includes state, year, and cohort fixed effects as well as demographic controls. The second specification adds state-by-year controls discussed in Section II, the third specification adds interactions of race and gender with state and year fixed effects, and the fourth specification adds state-specific quadratic time trends. Column 4 represents the main first-stage equation of our baseline IV specification, equation (2).

Results indicate that EITC exposure in childhood has a substantial impact on family income during each of the three age ranges. Increasing EITC

Table 5
First-Stage Estimates (Effect of EITC Exposure on Family Income at Different Ages)

Variable	(1)	(2)	(3)	(4)
	A. Dependent Variable: Family Income between Ages 0 and 5			
EITC exposure between ages 0 and 5	9.39**	9.55***	10.42***	10.00**
	(3.59)	(3.46)	(3.67)	(4.00)
EITC exposure between ages 6 and 12	−.77	−1.12	−2.16	−3.22
	(2.25)	(2.21)	(2.45)	(2.70)
EITC exposure between ages 13 and 18	3.66	3.11	3.75	5.18*
	(2.69)	(2.67)	(2.74)	(2.87)
	B. Dependent Variable: Family Income between Ages 6 and 12			
EITC exposure between ages 0 and 5	−3.96	−3.96	−2.59	−3.76
	(5.55)	(5.58)	(5.52)	(5.97)
EITC exposure between ages 6 and 12	11.31**	11.60**	10.73**	11.56**
	(4.95)	(5.00)	(4.64)	(5.37)
EITC exposure between ages 13 and 18	2.42	1.83	1.54	3.52
	(4.77)	(4.51)	(4.60)	(4.33)
	C. Dependent Variable: Family Income between Ages 13 and 18			
EITC exposure between ages 0 and 5	−3.60	−3.75	−2.38	−1.96
	(4.31)	(4.27)	(3.66)	(3.43)
EITC exposure between ages 6 and 12	7.07**	7.11***	6.63**	5.78*
	(2.66)	(2.54)	(2.68)	(3.03)
EITC exposure between ages 13 and 18	11.24***	10.72***	10.46**	12.48***
	(4.04)	(3.89)	(3.95)	(3.61)
	Controls			
State, cohort, year fixed effects	X	X	X	X
Demographic controls	X	X	X	X
State-year controls		X	X	X
Interaction controls			X	X
State-specific quadratic time trends				X
Observations	3,495	3,495	3,495	3,495
Kleibergen-Paap rk LM statistic	8.1	9.5	7.5	7.0
Kleibergen-Paap rk Wald *F*-statistic	4.0	5.1	3.7	3.2

SOURCE.—1968–2013 waves of the Panel Study of Income Dynamics (PSID).

NOTE.—EITC exposure is in thousands of 2013 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. Each column in each panel represents a separate regression and reflects estimation of eq. (2). EITC exposure and family income are discounted at a 3% annual rate from age 18 (Chetty, Friedman, and Rockoff 2011). Stata's ivreg2 combines the three first-stage regressions for the three instruments into one Kleibergen-Paap rk Lagrange multiplier (LM) statistic (Kleibergen and Paap 2006) and one Kleibergen-Paap rk Wald *F*-statistic (Bound and Jaeger 1996; Stock and Yogo 2005). Standard errors (in parentheses) are corrected for heteroskedasticity and are clustered at the state level. Results are weighted by average childhood PSID weights.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

exposure by $1,000 when a child is 0–5 years old leads to a $10,000 increase in family income over that age range, which implies a roughly $2,000 annual increase in family income. We do not find much evidence that EITC exposure later in childhood (ages 6–18) has an impact on family income from age 0 to age 5, which is expected. However, in the specification that includes state-specific quadratic time trends, we do find some evidence that exposure to the EITC from age 13 to age 18 is correlated with family income from age 0 to age 5, but this is only marginally significant and may be due to unobserved family characteristics or a spurious correlation.

We find similar results for family income between ages 6 and 12 and between ages 13 and 18. A $1,000 increase in EITC exposure leads to an $11,500–$12,500 increase in family income, roughly $2,000 annually. We also find that EITC exposure from age 6 to age 12 has an impact on family income between ages 13 and 18. This correlation is robust to different specifications of the first-stage equation, suggesting that this cross-age correlation may not be spurious. This is plausible if we believe that the EITC increases permanent family income, such that exposure when a child is 6–12 increases maternal labor supply, which in turn increases future earnings. Previous research suggests that earnings growth does increase as a function of EITC generosity (Dahl, DeLeire, and Schwabish 2009); our findings are consistent with this previous research and suggests that exposure to the EITC not only increases contemporaneous earnings but also future-year earnings.

Results from the second-stage equations are presented in table 6. Consistent with results presented thus far, we find positive effects of family income on education and employment outcomes for children once they reach adulthood. In particular, a $1,000 increase in family income between ages 13 and 18 increases the likelihood of completing high school by 0.2 percentage points and increases the number of years of schooling by 0.01 years.[33] We also find positive associations between family income and college attendance and completion, although these results are not significant at conventional levels. Since our first-stage estimates imply that a $1,000 increase in the maximum EITC increases family income by approximately $12,000 over the 6-year period between ages 13 and 18 (roughly $2,000 per year), this implies a 2.5 percentage point increase in high school completion and a 0.12 increase in years of schooling.

Turning to the results for employment and earnings, the IV estimates suggest that a $1,000 increase in after-tax family income leads to a 0.1 percentage point increase in the likelihood of being employed and a $57 increase in annual earnings in adulthood. We also find a significant relationship between family income between birth and age 5 and annual earnings in adulthood—a $1,000 increase in family income generated by the EITC leads to a $118

[33] Second-stage results for different specifications are presented in table A12.

Table 6
Effect of Family Income on Education, Employment, and Earnings (Instrumental Variables)

	Dependent Variable					
Variable	High School Graduate; Mean = .92 (1)	At Least Some College; Mean = .52 (2)	College Graduate; Mean = .31 (3)	Highest Grade Completed; Mean = 13.7 (4)	Employed; Mean = .817 (5)	Earnings (2013 $); Mean = 25,391 (6)
Family income between ages 0 and 5	−.0001	.0002	.0004	.0024	.0017	117.5*
	(.0013)	(.0009)	(.0018)	(.0061)	(.0016)	(68.6)
Family income between ages 6 and 12	−.0017*	.0001	.0015	−.0009	−.0008	−26.6
	(.0010)	(.0014)	(.0015)	(.0059)	(.0007)	(32.4)
Family income between ages 13 and 18	.0021*	.0009	.0013	.0101**	.0011***	57.2*
	(.0011)	(.0014)	(.0012)	(.0045)	(.0004)	(32.4)
Implied total (sum of coefficients)	.0003	.0012	.0032	.0116	.002	148.1
P-value: *F*-test identical estimates	.123	.938	.864	.551	.146	.253
Observations	3,495	3,309	2,506	2,506	1,758	1,758

SOURCE.—1968–2013 waves of the Panel Study of Income Dynamics (PSID).

NOTE.—EITC exposure is in thousands of 2013 dollars and is defined as the maximum potential federal and state EITC a household could receive, given the year, state, and number of children. High school graduation is evaluated by age 20, some college by age 24, college graduation and highest grade completed by age 26. Employment and earnings are measured between ages 22 and 27, and the average value is used if observed more than once during these ages. All regressions reflect estimation of eq. (3) and include demographic controls; state-year controls at age 18; state, cohort, and year fixed effects; and state-specific quadratic time trends. EITC exposure and family income are discounted at a 3% annual rate from age 18 (Chetty, Friedman, and Rockoff 2011). Standard errors (in parentheses) are corrected for heteroskedasticity and are clustered at the state level. Results are weighted by average childhood PSID weights.

* $p < .1$.

** $p < .05$.

*** $p < .01$.

increase in annual earnings between ages 22 and 27. We find no clear impact of EITC generosity between birth and age 12 on any of the other education or employment outcomes in adulthood.[34]

Overall, our IV results imply that, conditional on income in early childhood, increases in family income (as a function of EITC generosity) during the teenage years have the largest impact on education and employment outcomes in adulthood. We do not find much evidence that family income between birth and age 12 leads to increases in educational attainment, although *F*-tests indicate that we cannot reject the null hypothesis that coefficients for the three age ranges are statistically identical. In one case, we find a marginally significant, negative association between family income from age 6 to age 12 and high school completion. This result is unexpected and may be partially explained by the cross-age correlations in EITC exposure we uncover in the first-stage estimates (table 5). An individual who experienced a $1,000 increase in EITC exposure between ages 6 and 12 is predicted to have an $11,500 increase in family income between ages 6 and 12 and a $5,780 increase in family income between ages 13 and 18, consistent with previous evidence showing that the EITC affects longer-term earnings growth (Dahl, DeLeire, and Schwabish 2009). In addition, since the EITC has been increasing since its inception, children who are exposed to EITC expansions when they are 6–12 are also likely exposed to expansions when they are 13–18.[35] Each of these cross-age correlations complicates the interpretation of the IV results in table 6.[36]

Taken at face value, our results imply that children's education outcomes are maximized when individuals are exposed to EITC expansions as teenagers, but not earlier in childhood. This is consistent with the cash-on-hand hypothesis that family income in the adolescent years is important for educational attainment (Lovenheim 2011; Manoli and Turner 2018) and consistent with recent findings linking Medicaid exposure with educational attainment (Cohodes et al. 2016). Finally, the coefficients on family income between ages 6 and 12 and family income between ages 13 and 18 are only

[34] We present IV results at age 18, rather than parsing exposure into age intervals, in tables A13 and A14. Table A13 shows first- and second-stage estimates across different sets of controls for high school graduation. Table A14 shows IV results for various education and employment outcomes. These results corroborate the evidence in table A6 and show that EITC-led increases in family income led to increases in education and labor market outcomes.

[35] In our sample, a bivariate regression shows that a $1,000 increase in EITC exposure at age 6–12 is associated with a $550 increase in EITC exposure at age 13–18.

[36] To estimate the total effect of increasing EITC exposure between ages 6 and 12 on high school graduation, one could sum the coefficients for each of the family income ranges with the appropriate first-stage coefficients as weights, revealing an estimate near 0 of -0.008 $((0.0021 \times 5.78) + (-0.0017 \times 11.56))$. This statistically insignificant negative estimate is consistent with the reduced-form estimate in table 2, col. 1.

marginally significant and are statistically indistinguishable, according to an *F*-test, perhaps indicating that the negative estimate in table 6 is the result of a spurious correlation.

VI. Conclusion

This paper analyzed the long-run effects of childhood EITC exposure on education and employment outcomes among individuals born between 1967 and 1995. Using variation in federal and state EITC benefits over time by family size, results indicate that the EITC significantly improves a number of outcomes for children and that these improvements persist into adulthood. After a policy-induced $1,000 increase in EITC exposure between ages 13 and 18, we find that individuals are subsequently 1.3% more likely to complete high school by age 20 and 4.2% more likely to complete a college degree by age 26. These education gains also translate into increases in employment and earnings in adulthood. Estimates suggest that a $1,000 increase in EITC exposure from age 13 to age 18 leads to a 1.0% increase in the likelihood of being employed between ages 22 and 27 and a $560 (or 2.2%) increase in average annual earnings.[37]

Conditional on EITC exposure between ages 13 and 18, we find little evidence that exposure before age 13 affects education and employment outcomes in adulthood. This suggests that the EITC increases the educational attainment of children growing up in low-income households by increasing the cash on hand that a family has when their child is approaching college age. However, results for younger ages are noisily estimated, and for many outcomes we are unable to rule out positive impacts of EITC exposure between birth and age 12 on subsequent educational attainment and employment outcomes. Given the large range of birth cohorts included in the sample, we have more variation in EITC exposure for the 13–18 age range than for earlier age ranges, which may also explain why we are able to estimate significant positive effects only for later ages. Since we include individuals born as early as 1967, we observe significant changes in EITC exposure for these earlier cohorts only when they were 13–18 years old. Results are robust to excluding earlier cohorts from our analysis, for instance, focusing on those born in 1975 or later. Further, since much of the federal and state policy variation in the EITC occurred over the past 2 decades, children born in the youngest cohorts of our analysis (1990–95) may not be old enough to have fully realized their educational attainment and employment outcomes. More time may be required before we are fully able to identify the impacts of exposure to the EITC between birth and age 5 on education and employment outcomes in adulthood.

[37] In results not shown, we also found that these individuals were more likely to report better health and to have earnings above 100%, 150%, and 200% of the federal poverty line as adults.

In examining the mechanisms that explain how increasing EITC generosity improves child education outcomes, we find that the EITC has a substantial impact on pretax family earnings. While a $1,000 increase in the maximum federal and state EITC increases imputed family EITC benefits by only about $200, it increases pretax family earnings by $2,700. This increase in family income is accompanied by significant increases in maternal labor supply (women are 4.6 percentage points more likely to be working) and minor reductions in time spent with children (11 minutes per day, although not statistically significant). This implies that one of the primary channels through which the EITC affects educational and employment outcomes is through increases in family income generated by increases in maternal labor supply. In using EITC exposure as an instrument for family income, we find that a $1,000 increase in family income between ages 13 and 18 leads to a 0.2% increase in the likelihood of completing high school by age 20 and a 0.1% increase in the probability of being employed between ages 22 and 27.

This analysis has shown that, in addition to lifting millions of households out of poverty each year, the EITC also improves a number of long-term outcomes for children from economically disadvantaged households. The EITC is a wide-reaching program that distributed an average of $2,400 per household to nearly 28 million families in the United States in 2013 (IRS 2013). Recent estimates suggest that fully half of all households with children will claim the EITC at some point over an 18-year period (Horowitz and Dowd 2011). This analysis has shown that the EITC also helps children finish high school and complete college, which supports previous research linking the EITC to higher test scores among low-income children (Dahl and Lochner 2012, 2017). These gains also translate into increases in employment and annual earnings once these individuals reach adulthood. Together, these results provide further evidence that the EITC not only works to lift families out of poverty for the current generation but also provides hope of upward mobility for future generations of children growing up in economically disadvantaged households.

References

Bastian, Jacob. 2017. The rise of working mothers and the 1975 Earned Income Tax Credit. Working paper, Department of Economics, University of Michigan.

Baughman, Reagan, and Stacy Dickert-Conlin. 2009. The Earned Income Tax Credit and fertility. *Journal of Population Economics* 22, no. 3:537–63.

Belley, Philippe, and Lance Lochner. 2007. The changing role of family income and ability in determining educational achievement. *Journal of Human Capital* 1, no. 1:37–89.

Bettinger, Eric, Torbjørn Hægeland, and Mari Rege. 2014. Home with Mom: The effects of stay-at-home parents on children's long-run educational outcomes. *Journal of Labor Economics* 32, no. 3:443–67.

Bound, John, and David A. Jaeger. 1996. On the validity of season of birth as an instrument in wage equations: A comment on Angrist & Krueger's "Does Compulsory School Attendance Affect Schooling and Earnings?" NBER Working Paper no. 5835 (November), National Bureau of Economic Research, Cambridge, MA.

Carneiro, Pedro, Italo Lopez Garcia, Kjell G. Salvanes, and Emma Tominey. 2015. Intergenerational mobility and the timing of parental income. Working paper.

Caucutt, Elizabeth, and Lance Lochner. 2012. Early and late human capital investments, borrowing constraints, and the family. NBER working paper no. 18493 (October), National Bureau of Economic Research, Cambridge, MA.

CBPP (Center on Budget and Policy Priorities). 2014. Analysis of the Census Bureau's March 2013 Current Population Survey. Washington, DC: Center on Budget and Policy Priorities.

Chetty, Raj, John Friedman, Nathaniel Hilger, Emmanuel Saez, Diane Schanzenbach, and Danny Yagan. 2011. How does your kindergarten classroom affect your earnings? Evidence from Project STAR. *Quarterly Journal of Economics* 126, no. 4:1593–660.

Chetty, Raj, John N. Friedman, and Jonah E. Rockoff. 2011. New evidence on the long-term impacts of tax credits. Statistics of Income White Paper, Internal Revenue Service, Washington, DC.

Cohodes, Sarah, Daniel Grossman, Samuel Kleiner, and Michael F. Lovenheim. 2016. The effect of child health insurance access on schooling: Evidence from public insurance expansions. *Journal of Human Resources* 51, no. 3:727–59.

Cunha, Flavio, and James Heckman. 2007. The technology of skill formation. NBER working paper no. 12840 (January), National Bureau of Economic Research, Cambridge, MA.

Currie, Janet. 2004. The take up of social benefits. NBER working paper no. 10488 (May), National Bureau of Economic Research, Cambridge, MA.

Currie, Janet, and Douglas Almond. 2011. Human capital development before age five. In *Handbook of Labor Economics*, vol. 4B, ed. David Card and Orley Ashenfelter, 1315–486. Amsterdam: Elsevier.

Currie, Janet, and Duncan Thomas. 2000. School quality and the longer-term effects of Head Start. *Journal of Human Resources* 35, no. 4:755–74.

Dahl, Gordon B., and Lance Lochner. 2012. The impact of family income on child achievement: Evidence from the Earned Income Tax Credit. *American Economic Review* 102, no. 5:1927–56.

———. 2017. The impact of family income on child achievement: Evidence from the Earned Income Tax Credit: Reply. *American Economic Review* 107, no. 2:629–31.
Dahl, Molly, Thomas DeLeire, and Jonathan Schwabish. 2009. Stepping stone or dead end? The effect of the EITC on earnings growth. IZA Discussion Paper no. 4146, Institute of Labor Economics, Bonn.
Del Boca, Daniela, Christopher Flinn, and Matthew Wiswall. 2014. Household choices and child development. *Review of Economic Studies* 81, no. 1:137–85.
Deming, David. 2009. Early childhood intervention and life-cycle skill development: Evidence from Head Start. *American Economic Journal: Applied Economics* 1, no. 3:111–34.
Dickert-Conlin, Stacy, and Scott Houser. 2002. EITC and marriage. *National Tax Journal* 55:25–40.
Duncan, Greg J., Pamela A. Morris, and Chris Rodrigues. 2011. Does money really matter? Estimating impacts of family income on young children's achievement with data from random-assignment experiments. *Developmental Psychology* 47, no. 5:1263–79.
Dynarski, Susan M. 2003. Does aid matter? Measuring the effect of financial aid on college attendance. *American Economic Review* 93:279–90.
Dynarski, Susan M., and Judith Scott-Clayton. 2013. Financial aid policy: Lessons from research. *Future of Children* 23, no. 1:67–91.
Eissa, Nada, and Hilary Hoynes. 2004. Taxes and the labor market participation of married couples: The Earned Income Tax Credit. *Journal of Public Economics* 88:1931–58.
———. 2006. The hours of work response of married couples: taxes and the Earned Income Tax Credit. In *Tax policy and labor market performance*, ed. Jonas Agell and Peter Birch Sørensen, 187–228. Cambridge, MA: MIT Press.
Eissa, Nada, and Jeffrey Liebman. 1996. Labor supply response to the Earned Income Tax Credit. *Quarterly Journal of Economics* 111, no. 2:605–37.
Evans, William N., and Craig L. Garthwaite. 2014. Giving Mom a break: The impact of higher EITC payments on maternal health. *American Economic Journal: Economic Policy* 6, no. 2:258–90.
Heckman, James J., Seong Hyeok Moon, Rodrigo Pinto, Peter A. Savelyev, and Adam Yavitz. 2010. The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics* 94, no. 1:114–28.
Herbst, Chris M. 2011. The impact of the Earned Income Tax Credit on marriage and divorce: Evidence from flow data. *Population Research Policy Review* 30, no. 1: 101–28.
Horowitz, John B., and Tim Dowd. 2011. Income mobility and the Earned Income Tax Credit: Short-term safety net or long-term income support. *Public Finance Review* 39, no. 5:619–52.

Hoynes, Hilary W., Douglas L. Miller, and David Simon. 2015. Income, the Earned Income Tax Credit, and infant health. *American Economic Journal: Economic Policy* 7, no. 1:172–211.

Hoynes, Hilary W., and Ankur J. Patel. 2015. Effective policy for reducing inequality? The Earned Income Tax Credit and the distribution of income. NBER Working Paper no. 21340 (July), National Bureau of Economic Research, Cambridge, MA.

IRS (Internal Revenue Service). 2013. Earned Income Credit. Internal Revenue Service Publication 596. Washington, DC: Government Printing Office.

Jacob, Brian A., Lars Lefgren, and David P. Sims. 2010. The persistence of teacher-induced learning. *Journal of Human Resources* 45, no. 4:915–43.

Kane, Thomas J. 2007. Evaluating the impact of the D.C. tuition assistance grant program. *Journal of Human Resources* 42, no. 3:555–82.

Kane, Thomas J., and Douglas O. Staiger. 2008. Estimating teacher impacts on student achievement: An experimental evaluation. NBER Working Paper no. 14607 (December), National Bureau of Economic Research, Cambridge, MA.

Kleibergen, Frank, and Richard Paap. 2006. Generalized reduced rank tests using the singular value decomposition. *Journal of Econometrics* 133, no. 1:97–126.

Krueger, Alan B., and Diane M. Whitmore. 2001. The effect of attending a small class in the early grades on college-test taking and middle school test results: Evidence from project STAR. *Economic Journal* 111:1–28.

Lovenheim, Michael F. 2011. The effect of liquid housing wealth on college enrollment. *Journal of Labor Economics* 29, no. 4:741–71.

Ludwig, Jens, and Douglas L. Miller. 2007. Does Head Start improve children's life chances? Evidence from a regression discontinuity design. *Quarterly Journal of Economics* 122, no. 1:159–208.

Manoli, Day, and Nicholas Turner. 2018. Cash-on-hand and college enrollment: Evidence from population tax data and the Earned Income Tax Credit. *American Economic Journal: Economic Policy* 10, no. 2:242–71.

Maxfield, Michelle. 2014. The effects of the Earned Income Tax Credit on child achievement and long-term educational attainment. Unpublished manuscript, Department of Economics, Michigan State University.

McGonagle, Katherine A., Robert F. Schoeni, Narayan Sastry, and Vicki A. Freedman. 2012. The Panel Study of Income Dynamics: overview, recent innovations, and potential for life course research. *Longitudinal and Life Course Studies* 3, no. 2:268–84.

Meyer, Bruce, and Dan T. Rosenbaum. 2001. Welfare, the Earned Income Tax Credit, and the labor supply of single mothers. *Quarterly Journal of Economics* 116, no. 3:1063–114.

Michelmore, Katherine. 2018. The Earned Income Tax Credit and union formation: The impact of expected spouse earnings. *Review of Economics of the Household* 16, no. 2:377–406.

Nichols, Austin, and Jesse Rothstein. 2016. The Earned Income Tax Credit. *Economics of means-tested transfer programs in the United States*, vol. 1, ed. Robert A. Moffitt, 137–218. Chicago: University of Chicago Press.

PSID (Panel Study of Income Dynamics). 2013. PSID main interview user manual: Release 2013. Ann Arbor: Institute for Social Research, University of Michigan.

Scholz, John Karl. 1994. The Earned Income Tax Credit: Participation, compliance, and antipoverty effectiveness. *National Tax Journal* 47, no. 1:63–87.

Stock, James, and Motohiro Yogo. 2005. Testing for weak instruments in linear IV regression. In *Identification and inference for econometric models: Essays in honor of Thomas Rothenberg*, ed. Donald W. K. Andrews and James H. Stock. Cambridge: Cambridge University Press.