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Long-Term Health Effect of Earned Income Tax Credit

Ze SONG

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Abstract

Using decades of variation in the federal and state Earned Income Tax Credit (EITC) and the Panel Study of Income Dynamics (PSID) dataset, I examine the impact of exposure to EITC expansions *in utero* and during childhood on health outcomes in adulthood. In order to overcome the confounding relationship between family income and health outcomes, this study uses the maximum EITC benefit as the key variable. Reduced-form estimates show that EITC expansions had a positive impact on self-reported health status. Specifically, a \$1000 increase in the maximum EITC exposure from ages 13 to 18 corresponds with a 0.01 point increase in the reported health status during adulthood. In addition, being exposed to EITC expansions *in utero* increases reported health status by 0.05 point. Relative to the range of reported health of 1 to 5 and the standard deviation of 0.94, these are very small effects. Nonetheless, these health effects are consequential, associating with increases in both family income and maternal labor supply.

1 Introduction

As one of the largest cash-transfer programs in the United States, the Earned Income Tax Credit (EITC) has been shown to have substantial benefits for low income families. However,

the analysis is limited to labor market outcomes, educational attainments and poverty status. Given its central place in the US safety net, EITC should have benefits on health. In addition, most previous studies focus on the contemporaneous effects. Since the early childhood years are formative, in addition to delivering short-term gains, the exposure to public programs may also lead to long-lasting consequences. Therefore, in my research, I examine the long-term health effect of the EITC, so as to improve the understanding of public safety net and the health formation problem as well.

The Synthesis of Literature

The importance of EITC has been studied for several decades. Overall, past studies indicate multidimensional benefits for low-income families, particularly single mothers, with respect to labor market outcomes (Eissa and Liebman 1996; Eissa and Hoynes 1998; Blundell and MaCurdy 1999; Ellwood 2000; Saez 2002, 2010) and family well-beings such as consumption, marriage, poverty and health (Dickert-Conlin and Houser 1998; Nichols 2006, 2013; Barrow and McGranahan 2000).

In addition to various impacts on adults, some recent literature examines the impact of the EITC on children’s educational attainment and achievement. Using an instrumental variable strategy, Dahl and Lochner (2012, 2017) estimate the effect of income induced by EITC expansion on children’s math and reading achievement and find a short-term increase in the test scores. Manoli and Turner (2014) use a regression kink design to study the effect of EITC refunds in high school on subsequent college enrollment. While these studies almost all find positive contemporaneous effects of the EITC, little is known about the long-term effects of the EITC exposure on children’s outcomes once they reach adulthood.

Two exceptions are Bastian and Micheltore (2018) and Thomas (2018). Using data from 1968 to 2013 in the PSID, Bastian and Micheltore investigate the effect of the expansions

in federal and state EITC structures on long-term educational and labor market outcomes. They find that increases in exposure from ages 13 to 18 are most influential and that a \$1000 increase in potential EITC received in this age range increases the likelihood of high school graduation and graduating from college. Thomas (2018) applies the identical methodology to the children with mothers in the National Longitudinal Survey of Youth 1979 dataset and finds similar results.

Among the measurements of family well-being, health is obvious and important. Several studies build the relation between EITC and health. Using difference-in-differences strategy, Evans and Garthwaite (2014) study the effect of EITC on women’s health. They find that the EITC expansion improved the mental health and self-reported health of women with multiple children relative to those with fewer. Among studies on infant beneficiaries, Hoynes, Miller and Simon (2015) use variation from the federal tax reform in 1993 to evaluate the effect of the EITC on infant health outcomes and find that the EITC reduces the incidence of low birth weight by 2 to 3 percent mainly through having more prenatal care and less negative health behaviors (smoking). However, it is debated whether these positive contemporaneous health effects from EITC would last and lead to long-term gains.

A line of health and labor research focuses on the long-term effect of early life experiences. Under the conceptual framework constructed by Grossman (1972), health is modeled as a stock variable that varies over time in response to the investments and natural depreciation. Given this formation process (sometimes the depreciation assumption is released), much research focuses on whether exogenous shocks on the investment in early life have sustained effects on adult health. Although there is growing empirical evidence on the “early influences”, little research looks at the policy remediation, partly because of power and dataset issues. Moreover, as noted by Currie and Almond (2011), it is usually hard to interpret results due to parental responsive investments in the later childhood which can either com-

pensate or reinforce the impact of early shocks.

The discussion of long-term health effect is usually divided into two critical windows corresponding to *in utero* influences and influences during childhood (Currie and Almond 2011). Barker (1992) popularized the importance of "fetal origins", then Currie and Hyson (1999) broke ground in economics by exploring whether disruptions to the prenatal environment lead to chronic health conditions in adulthood. A series of research has followed, examining the prenatal environment exposure, which could be categorized into three groups by differentiating factors: fetal health (e.g. nutrition, birth weight and infection), economic shocks and pollution (Currie and Almond 2011). Using a dataset from Norway with sibling fixed effects, Black, Devereux, and Salvanes (2007) find the longer-run effect of birth weight on outcomes such as adult height, IQ and earnings. By contrast, the evidence with respect to economic shocks such as the recession is less consistent. Baten, Crayen, and Voth (2007) use British Censuses and find nutritional shortages had a nonlinear effect on numeracy in industrializing England. However, Cutler, Miller and Norton (2007) find no long term morbidity effects for cohorts born during the Dirty Thirties era.

The second strand of the literature focuses on long-term effect of experiences during the early childhood. In addition to evaluating the impact of shocks, research also examines human capital formation. In particular, some literature investigates the effect of family income and income induced childhood health conditions on the later consequences. For example, Case, Lubotsky and Paxson (2002) identify the positive relationship between economic status and childhood health status, which strikingly becomes more pronounced as children age. The steeper income-health gradient can be partly explained by the accumulation of adverse health effects of lower income over children's lives. In addition to how much poor health in childhood, in turn, affects future outcomes, for health formation, now attention is being given to whether there are critical periods. Using Canadian administrative data, Currie et

al. (2009b) find early childhood health conditions by themselves are predictive of future outcomes, but only the later ones matter once they are added, suggesting physical health in early childhood affects future outcomes as it affects later childhood health.

Meanwhile, other literature focus on the relation between parental time and children's health as the growth in labor market participation among women with young children has raised concerns about its implications for child development. For example, Del Boca, Flinn and Wiswall (2013) find parents' time inputs are important for the cognitive development of their children, particularly when the child is young.

Given the evidence showing various early influences on later life health outcomes, if EITC exposure is a positive shock in childhood, it is highly likely that the policy and policy induced intermediate changes would result in some long-term health consequences. My research adds to previous literature by nesting those pieces of evidence together and novelly investigating the long-term health effect of the EITC exposure. In particular, taking advantage of the longitudinal feature of PSID, I would build the link between the EITC exposure from the prenatal period until the year children turn 18 and health outcomes in the adulthood. Section 2 provides the background information of EITC and a health investment model. Data and sample construction are laid out in section 3 and followed by a brief discussion of methods in section 4. The fifth section of the paper gives some discussions of the result and followed by a conclusion in section 6.

2 EITC and Health Investments

2.1 EITC

The United States federal EITC initially enacted in 1975, is a refundable tax credit for low-to moderate-income working individuals and couples, particularly those with children. The

amount of EITC benefit depends on a recipient's income, marital status, and the number of children. To qualify for the tax credit, people must have earned income from working or running a business and meet certain eligibility. In the 2017 tax year, working families with children and annual incomes below \$39,617 to \$53,930 (depending on the number of dependent children and marital status) are eligible for the federal EITC. Childless individuals (married couples) who have incomes below \$15,010 (\$20,600) can also receive a small amount of EITC benefit.

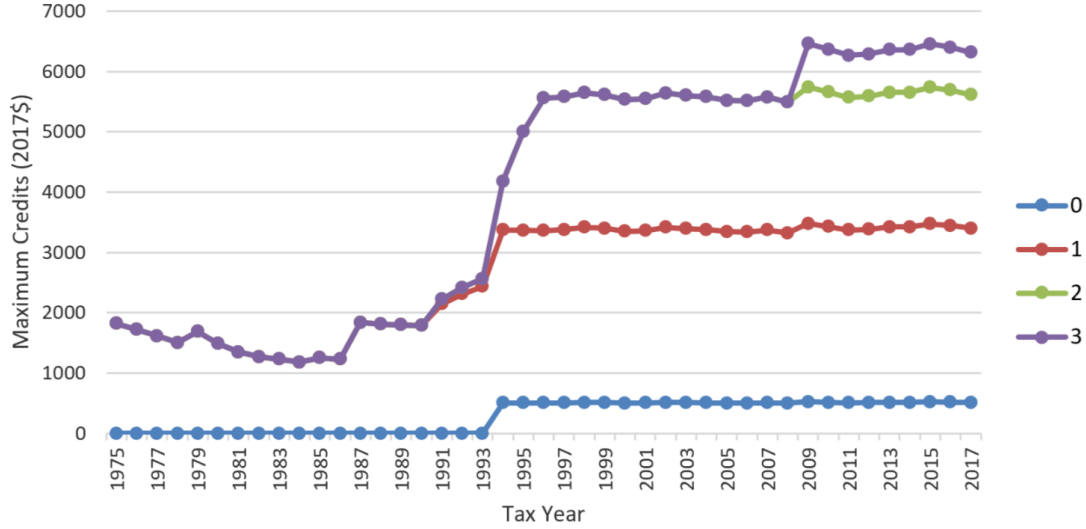
There are three regions in the credit schedule. In the initial phase-in region, workers receive a credit equal to a percentage of their earnings up to a maximum credit. In 2017, the subsidy rate was 34% for taxpayers with one child and 40% for taxpayers with two children. After the credit reaches its maximum, it remains flat until earnings reach the phaseout point. Thereafter, the amount of credit declines with each additional dollar of income until no credit is available. Based on the 2017 EITC schedule, when in the flat region, the family with one child receives the maximum credit \$3,400 (\$510 with no qualifying children, \$5,616 with two children, and \$6,318 with three or more qualifying children).

In addition to the federal EITC, 29 states plus the District of Columbia have established state EITCs by 2017, 4 of which however are not in effect for tax year 2017. In general, state-level policies build on the federal EITC benefits by a fixed rate, ranging from 3.5 to 85 percent of federal EITC benefits.

2.2 Tax Reforms

Since the inception of EITC, it has experienced several changes at both the federal and state level. Several major expansions of EITC through tax reforms happened in 1986, 1990s and 2000s. Policy changes vary by the credit amount, the number of children and the marital status. Over the years, both the number of claimants and real EITC spending have grown.

Figure 1: Maximum Federal EITC by the Number of Children



Note: Author's calculation based on the parameters from Tax Policy center (2017). All values are presented in 2017 dollars, adjusted using the Consumer Price Index.

All of these changes will provide valuable identifying variation for the analysis.

Wisconsin first implemented State EITC in 1984, following by many other States in the late 1980s and 1990s. The state-level variation comes from different rates across states, changes of the rate within a given state over time as well as the different timing of states adopting their own EITCs. These will add to the variation caused by changes at the federal-level.

Figure 1 illustrates the maximum federal credit a household could receive from 1975 to 2017 by the number of dependent children. Table 1 shows the historical change of state EITC rates.

2.3 Health Investment Model

Based on Grossman (1972), Heckman (2007) and following the review of Currie and Almond (2011), I lay out a classic model underlying the long-term health formation process. The Grossman model considers health as a stock variable responsive to both material and time

Table 1: States EITC from 1975 to 2017

Year	CA	CO	CT	DE	DC	IL	IN	IA	KS	LA	ME	MD	MA	MI	NE	NI	NM	NY	NC	OH	OK	OR	RI	VT	VA	WI
1975	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1976	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1977	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1978	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1979	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1980	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1981	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1982	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1983	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1984	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1985	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	30%	
1986	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1987	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1988	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1989	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	
1990	0%	0%	0%	0%	0%	0%	0%	5%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	23%	0%	
1991	0%	0%	0%	0%	0%	0%	0%	6%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	28%	0%	5%	
1992	0%	0%	0%	0%	0%	0%	0%	6.5%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	28%	0%	5%	
1993	0%	0%	0%	0%	0%	0%	0%	6.5%	0%	0%	0%	50%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	28%	0%	5%	
1994	0%	0%	0%	0%	0%	0%	0%	6.5%	0%	0%	0%	50%	0%	0%	0%	0%	7.5%	0%	0%	0%	0%	0%	25%	0%	12%	
1995	0%	0%	0%	0%	0%	0%	0%	6.5%	0%	0%	0%	50%	0%	0%	0%	0%	10%	0%	0%	0%	0%	0%	25%	0%	4%	
1996	0%	0%	0%	0%	0%	0%	0%	6.5%	0%	0%	0%	50%	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	25%	0%	4%	
1997	0%	0%	0%	0%	0%	0%	0%	6.5%	0%	0%	0%	50%	10%	0%	0%	0%	20%	0%	0%	0%	5%	5%	25%	0%	4%	
1998	0%	0%	0%	0%	0%	0%	0%	6.5%	10%	0%	0%	50%	10%	0%	0%	0%	20%	0%	0%	0%	5%	5%	25%	0%	4%	
1999	8.5%	0%	0%	0%	0%	0%	3.4%	6.5%	10%	0%	0%	50%	10%	0%	0%	0%	20%	0%	0%	0%	5%	5%	25%	0%	4%	
2000	0%	0%	10%	0%	10%	5%	3.4%	6.5%	10%	0%	5%	50%	10%	0%	0%	10%	0%	22.5%	0%	0%	0%	5%	0%	32%	0%	
2001	0%	10%	0%	0%	25%	5%	3.4%	6.5%	10%	0%	5%	50%	15%	0%	0%	15%	0%	25%	0%	0%	5%	25.5%	32%	0%	4%	
2002	0%	0%	0%	0%	25%	5%	3.4%	6.5%	15%	0%	5%	50%	15%	0%	0%	17.5%	0%	27.5%	0%	0%	5%	25%	32%	0%	4%	
2003	0%	0%	0%	0%	25%	5%	6%	6.5%	15%	0%	4.92%	50%	15%	0%	0%	20%	0%	30%	0%	0%	5%	25%	5%	32%	0%	
2004	0%	0%	0%	0%	25%	5%	6%	6.5%	15%	0%	4.92%	50%	15%	0%	0%	20%	0%	30%	0%	0%	5%	25%	5%	32%	0%	
2005	0%	0%	0%	0%	35%	5%	6%	6.5%	15%	0%	4.92%	50%	15%	0%	0%	20%	0%	30%	0%	0%	5%	25%	10%	32%	0%	
2006	0%	0%	0%	20%	35%	5%	6%	6.5%	15%	0%	5%	50%	15%	0%	8%	20%	0%	30%	0%	0%	5%	25%	15%	32%	20%	
2007	0%	0%	0%	20%	35%	5%	6%	7%	17%	0%	5%	50%	15%	0%	10%	20%	8%	30%	0%	0%	5%	25%	15%	32%	20%	
2008	0%	0%	0%	20%	40%	5%	6%	7%	17%	3.5%	5%	50%	15%	10%	10%	22.5%	10%	30%	4%	0%	5%	6%	25%	32%	20%	
2009	0%	0%	0%	20%	40%	5%	9%	7%	17%	3.5%	4%	50%	15%	20%	10%	25%	10%	30%	5%	0%	5%	6%	25%	32%	20%	
2010	0%	0%	0%	20%	40%	5%	9%	7%	18%	3.5%	4%	50%	15%	20%	10%	20%	10%	30%	5%	0%	5%	6%	25%	32%	20%	
2011	0%	0%	30%	20%	40%	5%	9%	7%	18%	3.5%	5%	50%	15%	0%	10%	20%	10%	30%	5%	0%	5%	6%	25%	32%	20%	
2012	0%	0%	30%	20%	40%	5%	9%	7%	18%	3.5%	5%	50%	15%	6%	10%	20%	10%	30%	5%	0%	5%	6%	25%	32%	20%	
2013	0%	0%	25%	20%	40%	5%	9%	14%	17%	3.5%	5%	50%	15%	6%	10%	20%	10%	30%	5%	5%	5%	6%	25%	32%	20%	
2014	0%	0%	27.5%	20%	40%	5%	9%	15%	17%	3.5%	5%	50%	15%	6%	10%	20%	10%	30%	5%	10%	5%	8%	25%	32%	20%	
2015	85%	10%	27.5%	20%	40%	5%	9%	15%	17%	3.5%	5%	50%	15%	6%	10%	30%	10%	30%	0%	10%	5%	8%	10%	32%	20%	
2016	85%	10%	27.5%	20%	40%	5%	9%	15%	17%	3.5%	5%	50%	15%	6%	10%	35%	10%	30%	0%	10%	5%	8%	12.5%	32%	20%	
2017	85%	10%	27.5%	20%	40%	5%	9%	15%	17%	3.5%	5%	50%	15%	6%	10%	30%	10%	30%	0%	10%	5%	8%	15%	32%	20%	

Data Source: NBER TAXIM.

Note: 29 states plus the District of Columbia have established state EITCs by 2017. Hawaii, Montana, and South Carolina have EITCs but they are not in effect for tax year 2017. Minnesota's credit for families with children, unlike the other credits shown in this table, is not expressly structured as a percentage of the federal EITC. Red cell represents states with nonrefundable EITC, while green cell represents states with refundable EITC. Refundable EITCs give working households the full value of the credit they earn even if it exceeds their income tax liability. Federal EITC is refundable.

inputs. Define h as the health at the completion of childhood, and consider a constant elasticity of substitution (CES) health production function with a two-period parental health investment in childhood:

$$h = A[\gamma I_1^\phi + (1 - \gamma)I_2^\phi]^{1/\phi} \quad (1)$$

I_1 = Investment in the early childhood, an implicit function of time and material inputs

I_2 = Investment in the later childhood, an implicit function of time and material inputs

γ = Share parameter given the fixed total investment

ϕ = Substitution rate

Define μ as an exogenous shock (positive or negative) to health investment at the baseline, i.e. μ is independent of I_1 . Assume $I_1 + \mu > 0$. If the investment in the second period is fixed, the effect of shock on adulthood health stock is:

$$\frac{dh}{d\mu} = \gamma A[\gamma(\bar{I}_1 + \mu)^\phi + (1 - \gamma)\bar{I}_2^\phi]^{(1-\phi)/\phi} (\bar{I}_1 + \mu)^{\phi-1} \quad (2)$$

To further consider the case where investment behavior in the second period is responsive, I formulate parents' utility function. For simplicity, parents only trade off between consumption (C) and children's health (h) subject to a budget constraint and a time constraint, where H denotes the working time and B is non-labor income:

$$\begin{aligned}
& \max_{C, I_2} U(C, h) \\
& s.t. \quad C + f(I_2) = wH + B \\
& \quad 1 = H + g(I_2)
\end{aligned}$$

We are interested in the sign of $dI_2^*/d\mu$, which corresponds to the compensating investment if negative and the reinforcing investment if positive. This is fully determined by the shape of health production function h – the more substitutable the investments across periods ($\phi \rightarrow 1$), the more likely there is to be compensatory response ($dI_2^*/d\mu < 0$).

For simplicity, suppose EITC is a positive income shock only at the baseline. Being exposed to tax credits before age 5, conditional on the fixed investment after age 5, has a direct impact on children’s adulthood health stock as shown in equation (2). However, it would also have a cascade influence on parental investment in the second period. Given a substitutable production function, the increase in h from increasing I_1 will decrease the marginal utilities in h relative to C , thereby parents reduce I_2 and temper the effect on health. In addition to parental behavioral responses, the working requirements of the program blur the ultimate consequences as parents may reallocate their time. In an extreme case, the eligibility of tax credits could be equivalent to a higher wage. If the new wage is greater than the reservation wage, people now have the incentive to join the labor market. Given the time constraint, parents especially mothers need reduce $g(I_2)$, which will have negative impacts on h . However, The increase in H will release the budget constraint at the same time. This will raise $f(I_2)$ and lead to positive impacts on h . Therefore, from this model, the overall long-term health effect is ambiguous, which makes it necessary to study the health effect in the empirical work.

3 Data

3.1 Panel Study of Income Dynamics

The analysis takes advantage of the 1968 to 2015 waves of the Panel Study of Income Dynamics (PSID), which is the longest running longitudinal household survey in the world. The PSID began in 1968 with a nationally representative sample of over 18,000 individuals living in 5,000 families in the United States. Information on these individuals and their descendants has been collected continuously, including data covering employment, income, expenditures, health, child development, education, and numerous other topics (PSID Main Interview User Manual, 2017). Households were interviewed annually until 1997 and biennially thereafter.

3.2 Sample Construction

Few restrictions are applied to construct the sample. Specifically, children are observed at least one year in each of the age intervals: 0 to 5, 6 to 12, 13 to 18 and after 18. To build up the EITC exposure *in utero*, children also need to be observed during the first year of life (i.e. being observed at age 0). In addition, any observation with missing health outcomes ¹ and zero sample weight is excluded, producing a sample of 1,260 individuals (6,715 observations)². These individuals were born between 1968 to 1997 and entered adulthood between 1986 and 2015. Each individual could be observed in the sample multiple times but only for those years when the individual is greater than age 17. Table 2 presents the summary statistics.

The PSID dataset combines the Survey Research Center (SRC) and Survey of Economic Opportunity (SEO) samples³. Since both samples and their combination are probability

¹There is a potential sample selection issue due to the data generating process. I apply Heckman’s control model to adjust the results.

²This sample corresponds to self-reported health status. Samples with respect to other health outcomes are slightly different due to different number of missing observations

³A total of approximately 500 post-1968 immigrant families were added in 1997/1999 to update the PSID

samples with unequal selection probabilities, the individual childhood average sample weight is used for the descriptive statistics and all the regressions. All dollar values are inflation adjusted to 2015 dollars. Health outcomes and demographic characteristics are measured after age 17. From the summary statistics, most of the individuals in the sample are in good health condition. On average, individuals in the sample were exposed to larger EITC benefits during late childhood (\$25,570 between 13 to 18; \$22,090 between 6 to 12) and less benefits before age 5 (\$730 *in utero*; \$10,210 between 0 to 5). The sharp increase occurs at age 5 can be partly explained by the fact that much of the expansions to the EITC occurred over the last two decades, when much of the sample was older than five. In addition, younger children are less likely to have other siblings in the household, hence only qualifying for small benefit amounts.

4 Methodology

In the research design, I take advantage of the full set of EITC expansions since 1975 and individual-level data. The key variables and empirical model are described below.

4.1 Independent Variables

The variable of interest is the EITC exposure defined as the maximum potential federal and state credit a child's family could receive given their state of residence, family size, and tax year, which is independent of own family income and marriage status. Variation in annual EITC exposure stems from three primary sources: the year of birth, the state of living, and the number of children in the household.

For each individual in the analysis, EITC exposure is cumulated from the year before the birth until the year they turn 18. For those non-interview years, EITC exposure was imputed

by adding a representative sample of recent immigrants to the United States (PSID Main Interview User Manual, 2017)

Table 2: Summary Statistics

	Mean	S.D.	Min	Max	N
Age (Adulthood)	26.65	4.95	18	47	6,715
Number of Siblings	2.29	1.26	0	10	6,715
Female	0.58	0.49	0	1	6,715
Black(=1)	0.15	0.35	0	1	6,715
Max EITC Exposure					
~ <i>in utero</i> (\$1k)	0.73	0.79	0	7.26	6,715
~ 0-5 in total (\$1k)	10.21	5.08	0	45.88	6,715
~ 6-12 in total (\$1k)	22.09	10.81	7.10	54.06	6,715
~ 13-18 in total (\$1k)	25.57	9.14	5.40	50.15	6,715
Family Income					
~ <i>in utero</i> (\$1k)	52.49	41.71	0	323.40	6,715
~ 0-5 in total (\$1k)	305.22	229.79	0	1897.53	6,715
~ 6-12 in total (\$1k)	428.85	377.38	0	4323.03	6,715
~ 13-18 in total (\$1k)	418.87	485.63	0	8752.06	6,715
Health Outcomes					
Health Status (1-5: Poor-Excellent)	3.87	0.92	1	5	6,715
Weight(lbs)	173.68	44.14	50	400	6,225
Height(inches)	67.69	4.20	48	81	6,287
BMI	26.54	6.04	7.83	70.31	6,225
Smoke(=1)	0.25	0.44	0	1	4,708
Drink(=1)	0.72	0.45	0	1	6,287
Stroke(=1)	0.01	0.08	0	1	6,286
Diabetes(=1)	0.03	0.16	0	1	6,286
Cancer(=1)	0.02	0.15	0	1	6,286
Lung Disease(=1)	0.03	0.16	0	1	6,286
Heart Disease(=1)	0.01	0.08	0	1	6,285
Arthritis(=1)	0.04	0.19	0	1	6,286
Asthma(=1)	0.15	0.36	0	1	6,287
Mental Problem(=1)	0.01	0.10	0	1	6,238
Learning Problem(=1)	0.06	0.24	0	1	6,284
ADLs(=1)					
~ Bathing	0.008	0.08	0	1	5,394
~ Dressing	0.009	0.10	0	1	5,630
~ Eating	0.004	0.06	0	1	5,630
~ Getting Out of Bed	0.014	0.12	0	1	5,628
~ Walking	0.024	0.15	0	1	5,932
~ Getting Outside	0.006	0.08	0	1	5,630
~ Toilet	0.004	0.06	0	1	5,630

Source: 1968-2015 PSID. Sample construction follows the rule: children observed at least one year in each of the age intervals: 0-5, 6-12, 13-18 and 18+; observed at age zero; no missing health outcomes; no zero sample weight. Results are weighted using the childhood average PSID sample weight. All dollar values are inflation adjusted to 2015\$. All health outcomes and demographic characteristics are measured after age 17. Maximum values of weight, height and BMI are very extreme numbers, but those are only for few observations, which can be regarded as outliers and will not destroy the results.

by averaging the benefits in the year right before and after the non-interview year ⁴. Next, to further understand the critical window when the EITC exposure starts working and explore the heterogeneous effect across periods, I split the accumulative EITC exposure into 4 age intervals: *in utero*, 0-5, 6-12 and 13-18.

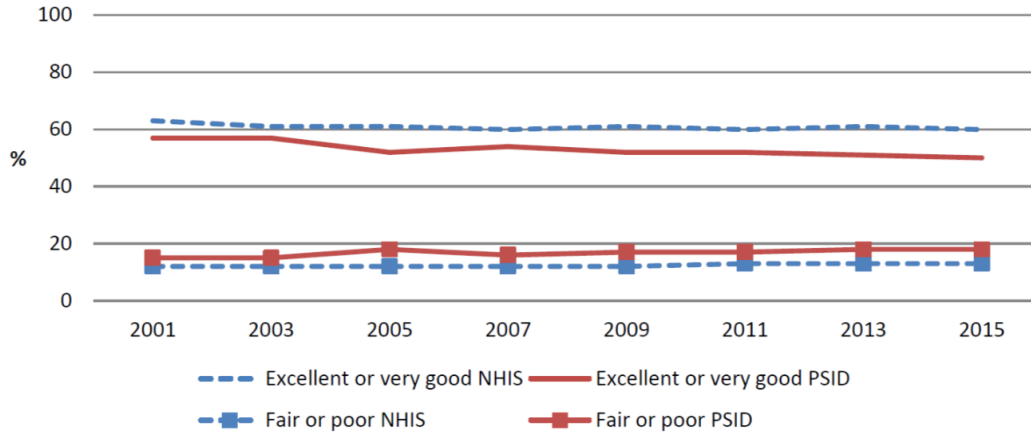
The reason for using the maximum EITC exposure instead of actual tax credit eligibility is to avoid the endogeneity issue caused by family social economics status and EITC eligibility with respect to health outcomes. As household must have taxable income below certain threshold to be eligible for EITC, low- to middle-income family is more likely to earn the tax credit. At the same time, children growing up in disadvantaged family may have worse health condition due to poor health endowment (e.g. low birth weight) or more negative health shocks (e.g. infection, malnutrition or insufficient medical care). By contrast, maximum EITC exposure independent of family income can help disentangle the health effect of EITC from the financial wellbeing during childhood and provide a causal inference. Although family size partially decides the amount of benefits and could be related to health, past research shows little evidence of EITC on fertility, reducing the concern of the endogeneity of family size to some degree.

4.2 Dependent Variables

The dependent variables are several health outcomes available in the dataset. All are measured at every single year during adulthood. In particular, I examine the impact on both objective and subjective indicators. Admittedly, health is hard to measure in current national surveys since most available measures have obvious flaws for being interpreted as objective health measures. Moreover, the multi-dimensional feature of health makes it difficult to be captured with a unique measure, yet using multiple different measures causes concerns about multiple hypothesis testing. I apply the most commonly-used measures with two checks to

⁴To deal with the concern of imputation, I alternatively use the benefit in the year before the non-interview year as a robustness check. Results are very similar.

Figure 2: Self-reported Health Status, 2001-2015 PSID and NHIS



Source: Reprinted from Insolera & Freedman (2017) PSID Technical Series Paper #17-01, page 13

add justifications. First, I check the quality of health data in PSID. Second, to deal with the potential sample selection issue, I use Heckman's control model to adjust the results.

To begin, I check the health data quality in PSID. Insolera and Freedman (2017) provide a comparison of health variables collected by PSID and National Health Interview Survey (NHIS), the most widely used national health survey. I reprint their outcome with respect to self-reported health status and illustrate in the Figure 2. They argue that the statistics of health measures in PSID are very close to NHIS, despite the difference in the designs of two surveys.

Before a discussion of sample selection issue, I would like to clarify the health indicators. The objective indicators include anthropometric measurements (height, weight and BMI), common diseases (stroke, diabetes, cancer, arthritis, asthma, lung disease, heart disease and mental problem), negative health behaviors (drinking and smoking) and activities of daily living (ADLs), a set of survey questions asking whether people can finish routine activities without assistance. In general, anthropometric measures especially the height would be interesting and regarded as objective when measured by trained observers with proper equipment. However the self-reporting feature of the PSID may lead to some measurement

errors and bias. Even though, I ignore this possibility for a while since it cannot be quantitatively confirmed and will not undermine the causal inference for now. ADLs ("Does health limit activities of daily living?") is also broadly used but could also be biased since whether health limits activities may depend on wealth and social support as well as personal view of appropriate activities. In addition, diseases and ADLs suffer from the provision of sufficient variation in my sample as the age of interest is young. Similarly, I will leave these potential issues aside for now as they are not key outcomes of interest and it is relatively hard to show these biases given current data availability. Negative health behaviors (smoking and drinking) as objective indicators are defined by the survey question "whether smoke or drink alcohol".

In contrast, self-reported health status ("Is your health excellent, very good, good, fair or poor?") is a subjective and good predictor of eventual mortality, though can be problematic as those in poor social economics status are more likely to misreport or fail to report health status.

Moreover, it is notable that the data generating process of all health outcomes create a suspicion of sample selection. Since PSID data is collected in family units, only the head and spouse/partner of each family are interviewed. Information for the rest of family members are reported by the family head/wife. In the main PSID dataset, only head and wife's health measurements are reported individually, producing a sample only consisting of individuals who have become the head or wife in the new generation. However, it is apparent that the masters of the house are not arbitrarily decided, which likely depends upon the age, education level and employment status. To solve this problem, I apply Heckman's control model and compare the results in the next section.

For the self-reported health status, the main PSID dataset contains the third variable named

as "health of other family members". This is based on the survey question "Now about the rest of your family living there—are any of them not in good health". If the answer is "no", it is natural to assign "good health" to all other family members. However, it is difficult to identify personal health status if the answer is "yes", creating a concern of misclassification. Since the number of the "yes" answer is quite small, I take advantage of this variable and construct a self-reported health status for all individuals above age 17. Then I compare the results using this full sample with those using the head/wife sample and show their similarities in the next section.

One potential way to fix the sample problem with respect to health outcomes is to merge PSID Child Development Supplement and PSID Transition into Adulthood Supplement which contain several health measurements for young adults. But using those datasets beginning in 2005 will largely reduce the length of sample and weaken the power of identifying long-term effects. If keeping using the third variable in the main dataset for other family members, in addition to applying new econometric models to deal with the misclassification, an alternative method would be calculating March CPS's probability of being identified as "other family member" such as children, matching it to the reported health status. These could be done in the future.

4.3 Control Variables

Control variables are chosen carefully so that they are either characteristics that cannot be affected by EITC exposure or they are characteristics determined before the tax year of EITC calculation. It includes cohort fixed effect (year of birth), age bins with the window of 2 years ⁵, the number of siblings and separate indicators for female, Black and Hispanic.

⁵Due to the multicollinearity, age-bin is omitted in some regressions

Bastian and Micheltmore (2018) as well as some other EITC-related work include state-by-year policy controls to account for the potential endogeneity at state level. For example, states would like to expand EITC when the economy falls and unemployment rate goes up. Meanwhile people’s general health condition has been shown related to the economic prosperity. Therefore using the state variation directly without controls may cause misleading results. However, given the size of my sample and the limited variation, I instead use state-specific time trends to capture such state-level factors over time. In addition, I also include state fixed effects and year fixed effects to control for unobserved time-invariant characteristics across states, state-invariant characteristics across years.

4.4 Reduced-Form Analysis

To begin with, I estimate the reduced-form model analyzing the effect of maximum EITC exposure during childhood on the health outcomes in the adulthood using a linear model with OLS estimator:

$$Y_{it} = \beta_0 + \beta_1 EITC_{it} + \alpha_1 X_{it} + \alpha_2 V_{st} + \sigma_s + \delta_t + \epsilon_{it} \quad (3)$$

Where i indexes individuals, s indexes states, and t indexes years. Y_{it} ’s are health outcomes valued at certain age after 17. Different from Bastian and Micheltmore (2018) who use only the last observation for each individual’s school attainment in the adulthood, I leave the panel structure of data because health status could change as people age⁶. $EITC_{it}$ is the accumulative maximum EITC exposure. X_{it} represents a vector of personal characteristics including age bins, gender, race and the number of siblings. V_{st} represents state-specific time

⁶I also run the identical regression using the mean health status after age 17 with only the last observation for each individual. Reduced-form results using cross-sectional data are very similar, which are shown in the Appendix 1.

trend. σ_s is state fixed effect, δ_t is year fixed effect and ϵ_{it} is the error term. Standard errors are clustered by id to account for the potential autocorrelation caused by panel structure.

To reflect the interest in measuring how the timing of EITC exposure affects health outcomes, I split cumulative EITC exposure throughout childhood and the prenatal period into four age intervals: *in utero*, 0-5, 6-12 and 13-18. Four exposure measurements are simultaneously included in the regression. All other variables are defined the same as above. Following Chetty, Hendren and Katz (2016), instead of using age intervals, it would be ideal in the future to apply non-parametric or semi-parametric model to evaluate how the effects of the EITC exposure vary with children's ages.

$$Y_{it} = \beta_0 + \beta_1 EITC_{it,(-1)} + \beta_2 EITC_{it,(0-5)} + \beta_3 EITC_{it,(6-12)} + \beta_4 EITC_{it,(13-18)} + \alpha_1 X_{it} + \alpha_2 V_{st} + \sigma_s + \delta_t + \epsilon_{it} \quad (4)$$

5 Results

5.1 EITC Exposure Improves Health Outcomes

I begin by presenting results from the reduced-form regressions shown in Table 3. Each column represents a separate regression. Dependent variables are a set of health consequences including anthropometric measures, negative health behaviors and self-reported categorical health status ⁷.

⁷Due to the lack of variation, results for the rest of health outcomes such as ADLs and diseases are presented in the Appendix 2. These models show little effect of EITC.

Column 6 indicates that the EITC exposure throughout the childhood and the prenatal period are positively related to self-reported health status. Particularly, a one thousand dollar increase in the EITC exposure during ages 13 to 18 significantly rises the likelihood of being healthy by 0.009 point, conditional on the EITC exposure in the early ages. Relative to the mean (3.9) and standard deviation (0.9) of reported health status, this is a very small effect. There is no evidence on health effect in other age intervals. Moreover, doing F-test for coefficient equality, I cannot reject the hypothesis that coefficients at each age interval are the same, suggesting the significance in the late childhood is not strong enough to be interpreted as a signal of critical window. Keeping the EITC exposure constant, coefficients on the set of controls indicate that Black, Hispanic, female and individuals with more siblings are disadvantaged in the reported health status. In addition to self-reported health status, column 2 shows that the EITC exposure during ages 12 to 16 significantly increases height in adulthood by 0.06 inches.

As noted in the section 4.2, the baseline reduced-form results are only for people who have already become the head or wife of the family, which can only be interpreted as the local treatment effect with the concern of sample selection. Particularly, people entering adulthood and becoming the master of house are more likely to be middle-aged, currently employed and well-educated, which may bias the reduced-form estimates. To solve this problem, I applied Heckman's control model to adjust the reduced-form results. Separate indicators for employment, high school graduation and college graduation are included in the selection equation as exogenous variables. Furthermore, age bins, the number of siblings and indicators for female, Black and Hispanic are also included in the selection equation. The outcome equations are identical to equation (4). It is notable that, from Heckman's classic method, the selection equation involves a nonlinear structure, no longer allowing me to use the panel data. Therefore, I transfer my panel dataset to a cross-section one by only taking the last observation per person with the use of mean health measurements after age 17. As past EITC

exposure is time-invariant for individuals entering adulthood, the transformation of dataset will not affect the independent variables. To make the reduced-form results comparable, I also report the health effect of EITC exposure using cross-sectional head/wife sample in the Appendix 1. Results are very similar to those using panel head/wife sample (Table 3).

Table 3b shows the effect of EITC exposure on some health outcomes using Heckman’s adjustment model. Compared to the baseline estimates, the magnitude and sign of coefficients do not vary a lot, whereas the significance changes. Particularly, a one thousand dollar increase in the EITC exposure during ages 13 to 18 significantly rises the likelihood of being healthy by 0.012 point. Being exposed to EITC expansions *in utero* increases reported health status by 0.064 point. In addition, column 3 shows that adulthood height increases by 0.272 inches as the result of *in utero* exposure and increases by 0.045 inches due to the exposure during ages 6 to 12.

Next, as noted in section 4.2, focusing on self-reported health status, I have the third variable reflecting the mixed health condition for all other family members. Combining this variable with the head and wife’s health status, I get a complete variable with respect to reported health status and thereby construct a full sample consisting of all the individuals above age 17. This may help recover the global treatment effect, though with the suspicion of misclassification. In Table 3c, I compare the health effect of EITC exposure using head/wife sample with the estimates using full sample. From column 3, using the full sample without additional controls, health effects of EITC exposure *in utero* and during late childhood (13-18) are consistent with results in column 1 and 2. Since past literature indicates nuclear family members are likely to benefit differently from other family members in the public program, I add an indicator for nuclear family as a control variable, suggesting very similar results. Meanwhile, using the head/wife indicator as an alternative control indicates slightly different health effects. This could be caused by the "bad control" problem (An-

grist and Pischke, 2008) as becoming head or wife is decided after the year of EITC exposure.

In general, using various models and samples, health effects of EITC exposure are robust, particularly in the prenatal period and during late childhood (13-18). Combining the results with respect to other health outcomes such as the adulthood height, it is reasonable to believe being exposed to EITC in the prenatal period and during late childhood leads to long-term health benefits.

One possible interpretation for these findings is the accumulation of beneficial effects, which is consistent with Case et al. (2002) and Currie et al. (2009b) stating that early childhood health conditions by themselves are predictive of future outcomes, but only the later ones matter once they are added. In the policy remediation scenario, this is parallel to the case where the EITC exposure during early childhood provides some health benefits, but is only revealed in the later childhood. Another interpretation involves the power issue pronounced in the "long-term impacts of early influences" literature. As tax benefits before age 5 for most people in my sample are small, it is very likely that current sample size is insufficient to yield any interesting finding during early childhood.

5.2 Income Enhancement and Maternal Labor Supply

In this section, I present two mechanisms through which the EITC exposure delivers health consequences. Two hypotheses working against each other may explain the observed health effect. One is the income channel suggesting the EITC exposure improves health in the long run through cash-in-hand. The other is that the increase in maternal labor supply, which reduces time taking care of children, leads to negative health consequences.

Table 3: Effect of EITC Exposure on Health Outcomes (Reduced Form)

Dependent Variables	(1) Weight (lbs)	(2) Height (inches)	(3) BMI	(4) Smoke (=1)	(5) Drink (=1)	(6) Health (1-5)
Mean	173.683	67.692	26.538	0.254	0.724	3.871
Standard Deviation	44.141	4.201	6.038	0.435	0.447	0.92
Max EITC <i>in utero</i> (\$1k)	-1.984 (1.835)	0.135 (0.133)	-0.455 (0.281)	-0.009 (0.020)	0.021 (0.017)	0.047 (0.038)
Max EITC 0to5 (\$1k)	-0.581 (0.801)	-0.113 (0.069)	0.023 (0.114)	-0.006 (0.010)	-0.009 (0.009)	0.019 (0.019)
Max EITC 6to12 (\$1k)	0.088 (0.430)	0.060* (0.031)	-0.042 (0.064)	0.001 (0.005)	0.002 (0.004)	0.008 (0.009)
Max EITC 13to18 (\$1k)	-0.320 (0.280)	0.004 (0.021)	-0.059 (0.040)	-0.003 (0.003)	0.004 (0.003)	0.009* (0.005)
Black=1	17.891*** (5.089)	-0.362 (0.232)	3.040*** (0.754)	-0.083** (0.037)	-0.108*** (0.033)	-0.249*** (0.071)
Hispanic=1	13.349 (8.215)	1.631** (0.685)	0.810 (1.392)	-0.203** (0.086)	-0.014 (0.126)	-0.725** (0.350)
# of Siblings	0.976 (1.290)	-0.127 (0.082)	0.279 (0.187)	0.005 (0.013)	-0.067*** (0.012)	-0.022 (0.022)
Female=1	-35.755*** (2.713)	-6.102*** (0.173)	-0.584 (0.383)	-0.057** (0.027)	-0.106*** (0.022)	-0.169*** (0.047)
Observations	6,220	6,282	6,220	4,704	6,282	6,710
Individuals	1,615	1,618	1,615	1,398	1,619	1,620
R-squared	0.322	0.586	0.189	0.106	0.150	0.117

Source: 1968-2015 PSID

Note: Health represents self-reported health status ranging from 1 to 5 (5- Excellent, 4-very good, 3-good, 2-fair, 1-poor). Each column stands for a separate OLS regression using panel date with the year, state, cohort fixed effects, state-specific time trends and a vector of controls. Standard error is clustered by id and each regression is weighted by the average childhood PSID sample weights. All health outcomes are measured after age 17. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3b: Effect of EITC Exposure on Health Outcomes—Heckman Adjustment Model

Dependent Variables	(1) Weight	(2) Selection	(3) Height	(4) Selection	(5) BMI	(6) Selection	(7) Health	(8) Selection
Max EITC <i>in utero</i> (\$1k)	-0.507 (1.512)		0.272** (0.127)		-0.236 (0.223)		0.064** (0.028)	
Max EITC 0to5 (\$1k)	0.017 (0.649)		-0.107 (0.068)		0.088 (0.086)		0.005 (0.017)	
Max EITC 6to12 (\$1k)	0.105 (0.366)		0.045* (0.024)		-0.028 (0.050)		-0.003 (0.007)	
Max EITC 13to18 (\$1k)	-0.245 (0.276)		0.001 (0.016)		-0.02 (0.041)		0.012** (0.004)	
Black=1	8.742*** (2.628)	-0.030 (0.088)	-0.200 (0.298)	-0.193 (0.118)	1.603*** (0.435)	0.030 (0.087)	0.012 (0.053)	-0.111 (0.107)
Hispanic=1	23.517*** (10.861)	0.439 (0.387)	0.219 (1.089)	0.619 (0.435)	3.802*** (1.403)	0.275 (0.341)	-0.329 (0.215)	0.326 (0.301)
# of siblings	1.118 (0.947)	0.063** (0.032)	-0.133 (0.088)	0.067*** (0.026)	0.239 (0.159)	0.055* (0.031)	-0.041* (0.024)	0.080*** (0.026)
Female=1	-30.970*** (2.558)	0.062 (0.066)	-6.035*** (0.159)	0.226*** (0.075)	-0.200 (0.357)	0.174** (0.071)	-0.165*** (0.049)	0.236*** (0.064)
Age bin		0.136*** (0.010)		0.158*** (0.012)		0.133*** (0.010)		0.139*** (0.012)
Employment status		0.519*** (0.075)		0.799*** (0.062)		0.465*** (0.078)		0.703*** (0.087)
High school graduate		0.268*** (0.078)		0.576*** (0.112)		0.275*** (0.079)		0.457*** (0.105)
Finished college		0.271*** (0.082)		0.463*** (0.110)		0.191** (0.085)		0.500*** (0.115)
Observations	1,615	2,585	1,618	2,585	1,615	2,585	1,620	2,585
Individuals	1,615	2,585	1,618	2,585	1,615	2,585	1,620	2,585

Source: 1968-2015 PSID. Note: This table shows the results using Heckman adjustment model. Column (1), (3), (5) and (7) stand for separate outcome regressions using only the last observation per person with the year, state, cohort fixed effects, state-specific time trends and a vector of controls. Column (2), (4), (6) and (8) represent selection regressions using employment, high school graduation and college graduation as exogenous variables. Standard errors are clustered by states to account for potential within-state correlations and each regression is weighted by the average childhood PSID sample weights. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 3c: Effect of EITC Exposure on Self-reported Health–Comparison

Dependent Variable	(1)	(2)	(3)	(4)	(5)
	Self-reported Health Status				
Sample	Head/Wife (OLS)	Head/Wife (Heckman)	Full (OLS)	Full (OLS)	Full (OLS)
Max EITC <i>in utero</i> (\$1k)	0.047 (0.038)	0.064** (0.028)	0.052** (0.024)	0.051** (0.024)	0.032 (0.023)
Max EITC 0to5 (\$1k)	0.019 (0.019)	0.005 (0.017)	-0.001 (0.010)	0.001 (0.010)	-0.002 (0.008)
Max EITC 6to12 (\$1k)	0.008 (0.009)	-0.003 (0.007)	-0.001 (0.006)	0.001 (0.006)	0.003 (0.005)
Max EITC 13to18 (\$1k)	0.009* (0.005)	0.012** (0.004)	0.010** (0.004)	0.010** (0.004)	0.005 (0.003)
Black=1	-0.249*** (0.071)	0.012 (0.053)	-0.047 (0.049)	-0.082* (0.047)	-0.121*** (0.045)
Hispanic=1	-0.725** (0.350)	-0.329 (0.215)	-0.401* (0.240)	-0.386 (0.243)	-0.286 (0.202)
# of siblings	-0.022 (0.022)	-0.041* (0.024)	-0.034** (0.016)	-0.040** (0.016)	-0.016 (0.014)
Female=1	-0.169*** (0.047)	-0.165*** (0.049)	-0.174*** (0.033)	-0.170*** (0.033)	-0.108*** (0.032)
Age Bin	-0.131* (0.076)	omitted omitted	-0.032 (0.049)	-0.034 (0.048)	-0.052 (0.044)
Nuclear Family	- -	- -	- -	-0.521*** (0.033)	- -
Head/Wife	- -	- -	- -	- -	-0.948*** (0.046)
Observations	6,710	1,620	11,634	11,634	11,634
Individuals	1,620	1,620	2,461	2,461	2,461
R-squared	0.117	-	0.212	0.227	0.362

Source: 1968-2015 PSID. Note: This table shows comparison of reduced-form estimates with respect to self-reported health status using the head/wife sample and full sample. Column (1) stands for a regression using head/wife panel sample with the year, state, cohort fixed effects, state-specific time trends and a vector of controls. Column (2) uses Heckman's control model. Column (3) represents a regression using full panel data with same controls. Column (4) adds an indicator for the nuclear family. Column (5) adds an indicator for head/wife. The nuclear family is defined as being head, wife or children in each household. Head/wife is a dummy variable for being head or wife. Standard errors are clustered by id and each regression is weighted by the average childhood PSID sample weights. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Effect of EITC Exposure on Intermediate Outcomes

Panel A: Contemporaneous Effect				
VARIABLES	(1) EITC Eligibility	(2) Family Income	(3) Mothers' hours of work	(4) Maternal Employment
Max EITC	0.21*** (0.03)	5.39** (2.13)	5.20 (22.00)	0.04*** (0.01)
Controls	Y	Y	Y	Y
Observations	14,825	14,825	14,825	14,825
Individuals	1,620	1,620	1,620	1,620
Panel B: Contemporaneous Effect by Age Intervals				
VARIABLES	(1) EITC Eligibility	(2) Family Income	(3) Mothers' hours of work	(4) Maternal Employment
Max EITC				
× <i>in utero</i>	0.06 (0.05)	10.36*** (2.77)	11.18 (41.20)	0.05** (0.02)
× 0 to 5	0.21*** (0.04)	5.27** (2.14)	-33.93 (23.92)	0.04*** (0.01)
× 6 to 12	0.21*** (0.03)	5.21** (2.09)	-5.79 (22.15)	0.04*** (0.01)
× 13 to 18	0.22*** (0.03)	5.49** (2.21)	24.02 (22.25)	0.04*** (0.01)
Black=1	1.07*** (0.08)	-33.51*** (3.76)	-327.14*** (51.52)	-0.20*** (0.03)
Hispanic=1	-0.08 (0.24)	-9.94 (8.62)	30.62 (110.67)	0.04 (0.06)
# of siblings	0.13*** (0.03)	-9.04*** (1.51)	-93.65*** (16.83)	-0.06*** (0.01)
Female=1	0.10* (0.05)	-3.92 (3.44)	-59.31 (37.10)	-0.03* (0.02)
Age bin	-0.04* (0.02)	0.28 (0.58)	27.10*** (8.04)	0.02*** (0.00)
Observations	14,825	14,825	14,825	14,825
Individuals	1,620	1,620	1,620	1,620
R-squared	0.22	0.17	0.12	0.15

Source: 1968-2015 PSID. Note: EITC eligibility is imputed based on income data in the PSID and historical policy parameters. Family income is defined as the sum of taxable head&wife income plus EITC eligibility. Working Hour is mother's actual annual working time. Employment is the indicator for maternal labor force participation. All dollar values are in thousands of 2015 dollars. Each column represents separate regression with full set of controls, clustering standard error at id level and weighted by the average childhood PSID individual sample weight. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

In the simple health investment model sketched above, children from poor families could be disadvantaged in many ways. Particularly, poor families may invest less on children's health even if they have same preference as families with higher income. As a cash transfer program, EITC could expand family budget constraint through the tax refund. Furthermore, since household could claim benefit at any time of the year at a very low cost through the tax system, once the benefit becomes salient, they may regard it as permanent. This feature is attractive because in addition to solve the budgetary problems, poor families have incentives to change "health production function" (Currie and Almond, 2011). For example, households receiving tax credits are able to improve home environment, nutrition and provide better preventive medical care for children. These changes could happen throughout the childhood and have accumulative effect along the life time.

The alternative hypothesis emphasizes the time constraint faced by parents especially mothers who usually take more responsibility for childcare. To meet the working requirement of EITC or as a response to the EITC expansion, mothers tend to increase labor supply on either the extensive margin or intensive margin. Given time constraints, mothers would have to spend less time on childcare, which may have negative effects on children's cognitive or non-cognitive skills development. Intuitively, this substitution effect would be more pronounced during early childhood.

However, the unconditioned time substitution effects may not be negative. The rise in labor market participation, if any, could add family income at the same time, which may alleviate the negative health impact of time substitution.

Both channels could contribute to the health outcomes simultaneously, with different relative impact at different age intervals. Therefore the overall health effect is theoretically ambiguous. To test these hypotheses, I model the impact of EITC exposure on some in-

intermediate outcomes including EITC eligibility, family income, maternal employment and mothers' hour of work, results of which are shown in Table 4.

Different from previous regressions, estimates in Table 4 are calculated using a longer-term panel sample. Instead of adulthood observations, I take advantage of the sample consisting of all years before age 18. The sample is restricted to individuals in the baseline reduced-form analysis with respect to the reported-health-status⁸. In addition, as PSID households were interviewed annually until 1997 and biennially thereafter, to keep the time frequency of panel data fixed, I drop observations in the even years before 1997. Each column stands for a separate regression with the outcome variable measured at the same year as the EITC exposure. Pooling all ages and years together, panel A shows mixed contemporaneous effects and panel B illustrates contemporaneous effects by age intervals through interacting maximum EITC exposure with the age interval dummies.

Since many people in the dataset are actually not eligible for the EITC, it is useful to see the relation between the EITC eligibility and maximum EITC exposure. As actual family EITC benefits are not recorded in the PSID, eligibility is calculated based on the survey income and historical EITC parameters. Imputed EITC eligibility is not equal to either maximum EITC exposure or actual tax credit receipt because of the compliance issue⁹. Column 1 in Table 4 suggests that a one thousand dollar increase in the maximum EITC exposure is correlated with overall 210 dollar increase in the imputed EITC eligibility at 0.01 level of significance. For each age interval, the relation is robust except the prenatal period partly because the *in utero* eligibilities are so small, even bunching at zero. In addition, African Americans and individuals with more siblings are eligible for more tax credits.

⁸Results are similar using samples of other health outcomes and full sample. Estimates using the full sample are shown in the Appendix 3.

⁹There is huge tax literature showing the take-up rate of EITC is around 80% with all kinds of compliance issues, causing the difference between imputed treatment and actual receipt.

Column 2 shows the contemporaneous effect of EITC exposure on family income¹⁰, suggesting a significant positive relation in every age interval. The income effect in the prenatal period is larger than the income effects during childhood. This may be caused by the small mean value and standard deviation of the *in utero* EITC exposure. Given a smooth family income across periods, the smaller variance of the independent variable could lead to a steeper slope. Moreover, turning to the magnitude of coefficients, it is too large to be considered as solely a cash-in-hand effect, as a one thousand dollar increase in the EITC exposure corresponds to a roughly \$5000 increase in the family income. This may partially be explained by an increasing labor supply.

Consistent with most previous work, I do not find evidence of an effect on mother's working hours, but maternal labor force participation significantly goes up. Column 4 in panel A indicates a one thousand dollar increase in the EITC exposure significantly rises overall maternal labor force participation by 4 percentage points. The magnitude is robust when looking at the effect by age intervals. One flaw here is that mother's hours of work and maternal force participation does not necessarily reflect maternal time on children. To solve this problem, the next step in the future could be merging the PSID Child Development Supplement dataset which contains children's daily time spent with parents.

To sum up, the results support the fact that both channels work together. Being exposed to additional tax credits increases the family income and maternal labor supply simultaneously. Both effects have been shown for the prenatal period and childhood overall. Apparently, there is no time substitution effect *in utero*. If we believe that the time substitution effect is more pronounced during early childhood then vanishes gradually, whereas the income effect is uniformly showing up or even more pronounced in the late childhood, combining the effects, it is plausible to see a "U shape" health effect. In other word, it explains the reduced-form

¹⁰Family income is defined as the sum of taxable head and wife annual income plus imputed EITC eligibility.

findings suggesting a small but significant health effect in the prenatal period and during ages 13 to 18.

5.3 IV-type Analysis

As shown above, EITC exposure could affect children’s health through multiple channels. And the increase in family income could be one of the most effective ways. Combining results on financial wellbeing with results on health outcomes help the interpretation in light of both economic impact and health impact of the expansions. This is in the spirit of ”IV-type” analysis, but it is challenging in this context to isolate channels and give causal interpretations. It is tempting to interpret an EITC health effect as the result of pure income enhancement. In fact, EITC expansions have effects on other outcomes as well, most notably maternal labor supply. Thus, the reduced-form estimate for long-term health combines the pure policy-induced income effect and the impact on maternal labor supply. Following the previous literature, I model the income channel through a 2SLS estimate. In doing so, I am able to establish a link between EITC-induced income enhancement and long-term health consequences. This is referred to as an ”IV-type” analysis in my paper. To be specific, the first-stage equation is shown below:

$$\begin{aligned} faminc_i^{(age)} = & \beta_0 + \beta_1 EITC_{i,(-1)} + \beta_2 EITC_{i,(0-5)} + \beta_3 EITC_{i,(6-12)} + \beta_4 EITC_{i,(13-18)} \\ & + \alpha_1 X_i + \alpha_2 V_{st} + \sigma_s + \delta_t + \epsilon_i \end{aligned}$$

where $faminc_i^{(age)}$ is defined as the sum of taxable head and wife annual income plus imputed EITC eligibility for each individual at each of four age intervals. Imputed EITC eligibility is calculated according to the historical policy parameters and reported family income in the PSID. For each age interval, family income is modeled as the identical function of EITC exposure in all periods with same controls, so that I get four separate ”first stage” equa-

tions. Notably, the sample here is the adulthood cross-section with the same individual as "reduced-form" equations but only taking the last observation per person, because both childhood family income and EITC exposure are time-invariant for those adults. Standard errors clustered by state to account for within state autocorrelations.

Using the predicted family income generated from equations above, I am able to get the "second stage" estimates – how the income enhancement generated by EITC exposures influences adulthood health consequences, given other intermediate outcomes fixed. The second-stage equation is shown below:

$$Y_i = \beta_0 + \beta_1 f\hat{aminc}_{i,(-1)} + \beta_2 f\hat{aminc}_{i,(0-5)} + \beta_3 f\hat{aminc}_{i,(6-12)} + \beta_4 f\hat{aminc}_{i,(13-18)} \\ + \alpha_1 X_i + \alpha_2 V_{st} + \sigma_s + \delta_t + \epsilon_i$$

Table 5 reports estimates from first-stage regressions ¹¹. Column 1 to 4 show the effect of EITC exposure on the corresponding family income at each age interval, suggesting EITC exposure during childhood have substantial impacts on family income, though it is not significant during ages 0 to 5. However, it indicates little *in utero* income effect. This could be partially explained by the size of benefits in the prenatal period, equal to zero for one third individuals in my sample. It makes the *in utero* effect not perfectly comparable with other age periods. Next, to get the predicted value, I formulate family income in each age interval as a function of benefits in four periods. Estimates are shown in column 5 to 8. Specifically, a one thousand dollar increase in the maximum EITC exposure during ages 6 to 12 rises family income in the corresponding age interval by 14,820 dollars, around 2,000 dollar per year. However, family income during ages 6 to 12 is also affected by the exposure in the next period. This relation should be spurious. Results for the late childhood (13-18)

¹¹Table 5 reports estimates using the head/wife sample with respect to reported health status (N=1,620). Results with the use of full sample are shown in the Appendix 4.

are a bit noisy as family income during that period is not only affected by the corresponding EITC exposure (13-18), but pre-period exposure (6-12). This cross-interval effect may be spurious, but could also result from the increase in maternal labor supply. To be specific, mothers may increase the labor supply when children are 6 to 12, which in turn increase family income in the future. Turning to controls, African American children and children with more siblings are disadvantaged in family income.

Table 6 shows estimates from second-stage regressions. Beneficial health effects vanish in this case. As mentioned above, this IV-type analysis is easily undermined by the changes in other channels. Moreover, the F-statistics in the first-stage are all below 10, rising the concern of weak instruments. All these issues may drive the estimates to zero. In the future, I would like to extend this IV-type analysis to several subgroups, testing if there is heterogeneous health effect across groups.

6 Conclusions

Data and power are long-standing obstacles to the research on long-term effect of EITC exposure. Given decades of variation of the EITC and longitudinal PSID dataset which is now in its 50th year, I can examine some long-term benefits of the policy. Specifically, this paper examines the long-term health effect of EITC exposure, suggesting a one thousand dollar increase in maximum EITC exposure during late childhood (prenatal period) corresponds with 0.01 (0.05) point increase in the reported health status in adulthood, which is a significant but small beneficial effect relative to the standard deviation of reported health status. This may stem from the power issue of the policy in the early childhood as most expansions occurred in the last two decades. It may also be interpreted as the accumulation of health benefits stating that EITC exposure during early childhood provides some health benefits, but would not be revealed until the late childhood.

Table 5: Effect of EITC Exposure on Family Income (First Stage)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>in utero</i>	0to5	6to12	13to18	<i>in utero</i>	0to5	6to12	13to18
	Family Income by Age Intervals							
Max EITC <i>in utero</i>	1.15 (2.51)				1.13 (2.37)	7.45 (12.56)	4.64 (17.89)	10.62 (24.58)
Max EITC 0to5		9.09 (6.24)			-0.63 (1.21)	4.20 (6.84)	-6.55 (10.81)	-10.97 (12.35)
Max EITC 6to12			16.92*** (4.04)		0.85 (0.55)	2.52 (2.68)	14.82*** (4.44)	15.63** (6.16)
Max EITC 13to18				13.72*** (5.03)	0.15 (0.28)	2.55 (2.27)	5.50** (2.40)	9.31** (4.37)
Black=1	-34.47*** (4.53)	-201.27*** (22.26)	-276.20*** (32.28)	-263.14*** (28.85)	-33.53*** (4.62)	-198.32*** (22.81)	-276.18*** (31.19)	-253.63*** (29.28)
Hispanic=1	-25.74 (18.80)	-29.36 (82.66)	-111.91 (109.61)	-29.35 (137.86)	-24.41 (18.33)	-15.98 (77.73)	-96.75 (102.79)	-23.51 (146.02)
# of Siblings	-8.13*** (1.35)	-39.51*** (7.74)	-69.70*** (15.24)	-77.79*** (18.38)	-8.89*** (1.51)	-45.02*** (8.31)	-73.69*** (16.53)	-85.30*** (21.01)
Female=1	-0.63 (2.60)	-15.69 (16.27)	-31.00 (24.90)	-46.72 (39.07)	-0.28 (2.63)	-14.88 (16.67)	-31.52 (24.99)	-42.33 (39.45)
Observations	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620
Individuals	1,620	1,620	1,620	1,620	1,620	1,620	1,620	1,620
F-Statistics					2.29	2.05	5.74	3.2
R-squared	0.303	0.271	0.239	0.182	0.308	0.276	0.243	0.190

Source: 1968-2015 PSID

Note: Max EITC exposure is defined as the maximum EITC a household can receive given the year, state and family size. Family income is the sum of taxable head&wife income and EITC eligibility. For non-interview year, family income and EITC exposure are imputed as the average of what before and after that year. And all dollar values are in thousands of 2015 dollar. Each column represents separate regression using the head/wife cross-sectional sample for reported health status. Standard errors are clustered by states and regressions are weighted by the average childhood PSID sample weight. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Effect of EITC-Induced Family Income on Health Outcomes (Second Stage)

Dependent Variables	(1) Weight (lbs)	(2) Height (inches)	(3) BMI	(4) Smoke (=1)	(5) Drink (=1)	(6) Health (1-5)
Income <i>in utero</i>	0.3723 (1.1202)	0.1446 (0.1580)	-0.0790 (0.1982)	-0.0102 (0.0314)	0.0053 (0.0167)	-0.0019 (0.0557)
Income 0to5	-0.1051 (0.0983)	-0.0057 (0.0176)	-0.0100 (0.0177)	-0.0012 (0.0032)	0.0006 (0.0013)	0.0036 (0.0041)
Income 6to12	0.0992 (0.0954)	-0.0037 (0.0131)	0.0231 (0.0165)	0.0036 (0.0060)	-0.0020 (0.0014)	0.0032 (0.0059)
Income 13to18	-0.0875 (0.0812)	0.0002 (0.0118)	-0.0175 (0.0136)	-0.0026 (0.0041)	0.0014 (0.0010)	-0.0025 (0.0040)
Black=1	12.4243 (24.3493)	2.4544 (3.2198)	-0.0076 (4.4673)	-0.3148 (0.3490)	-0.0371 (0.4211)	0.7543 (1.1355)
Hispanic=1	28.8270 (28.7194)	3.3799 (3.4574)	1.5500 (5.3627)	-0.1188 (0.4368)	0.0513 (0.4304)	-0.3233 (1.0004)
# of Siblings	-0.0905 (5.7043)	0.6857 (0.7560)	-0.6331 (0.9881)	-0.0866 (0.1411)	-0.0063 (0.0904)	0.1443 (0.2848)
Female=1	-37.6614*** (3.5011)	-6.1535*** (0.3942)	-0.9584 (0.6451)	-0.0328 (0.0864)	-0.0922** (0.0438)	-0.0114 (0.0806)
Observations	1,615	1,618	1,615	1,398	1,619	1,620
Individuals	1,615	1,618	1,615	1,398	1,619	1,620

Source: 1968-2015 PSID

Note: EITC exposure is defined as the maximum EITC a household can receive given the year, state and family size. Family income is the sum of taxable head&wife income and EITC eligibility. Each column represents a separate second-stage of 2SLS regression using the head/wife cross-sectional sample, with full set of controls, year fixed effects, state fixed effects and state-specific time trends. Each regression is weighted by the average childhood PSID individual sample weight. Standard errors are clustered by states and shown in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Two mechanisms are examined to explain the long-term health benefits. I find, in line with the previous research, EITC exposure during childhood is positively related to both family income and maternal labor supply. Two channels are counterbalanced while providing long-term health effects. On the one hand, income enhancement leads to more parental health investment which directly increases children's health stock. On the other hand, the increase in maternal labor force participation is likely to reduce maternal time on childcare, leading to some negative health consequences.

7 Appendix

7.1 Baseline Reduced-Form Results Using Cross-Sectional Sample

Appendix 1 shows the effect of EITC exposure on mean health outcomes using a head/wife cross-sectional sample. For each individual, health measurements are averaged after age 17, and only the last observation per person is taken. Compared to the Table 3 using the head/wife panel sample, estimates are similar in terms of the sign and magnitude.

7.2 Reduced-Form Results for Other Health Outcomes

Appendix 2 shows the effect of EITC exposure on several common diseases using the head/wife cross-sectional sample. In general it shows little effect of the EITC exposure but with several exceptions. EITC exposure during late childhood decreases the likelihood of stroke by 0.0003 point, heart-attack by 0.0002 point, arthritis by 0.001 point and learning problem by 0.0017 point. In addition, being exposed to EITC expansions *in utero* reduces the likelihood of arthritis by 0.0047 point. Relative to the mean and standard deviation of these common diseases, these health benefits are still quite small. Appendix 2b shows the effect of EITC exposure on ADLs using the head/wife cross-sectional sample, suggesting no effect of the tax credits.

7.3 Intermediate Outcomes with Full sample

Appendix 3 shows the contemporaneous effect of EITC on intermediate outcomes using the full panel sample. Results are consistent with Table 4, suggesting positive relation between EITC exposure and the EITC eligibility, family income as well as maternal labor participation.

Appendix 1: Effect of EITC Exposure on Mean Health Outcomes (Reduced Form)

Dependent Variables	(1) Weight (lbs)	(2) Height (inches)	(3) BMI	(4) Smoke (=1)	(5) Drink (=1)	(6) Health (1-5)
Max EITC <i>in utero</i>	-1.701 (1.672)	0.251* (0.125)	-0.495* (0.259)	-0.003 (0.018)	0.032** (0.015)	0.034 (0.032)
Max EITC 0to5	-0.455 (0.780)	-0.103 (0.071)	0.041 (0.113)	-0.007 (0.013)	-0.006 (0.011)	0.020 (0.022)
Max EITC 6to12	0.206 (0.419)	0.044* (0.024)	-0.010 (0.070)	-0.003 (0.004)	-0.003 (0.004)	0.016 (0.010)
Max EITC 13to18	-0.530* (0.275)	0.003 (0.016)	-0.092** (0.044)	-0.004 (0.004)	0.006*** (0.002)	0.009 (0.006)
Black=1	15.513*** (3.967)	-0.328 (0.290)	2.664*** (0.570)	-0.087** (0.038)	-0.144*** (0.045)	-0.174** (0.073)
Hispanic=1	13.809 (9.863)	0.396 (1.177)	1.722 (1.438)	-0.327* (0.164)	0.081 (0.157)	-0.581** (0.233)
# of siblings	1.623 (1.016)	-0.122 (0.092)	0.364** (0.179)	0.013 (0.016)	-0.057*** (0.013)	-0.034 (0.025)
Female=1	-35.790*** (2.566)	-6.003*** (0.140)	-0.733** (0.361)	-0.037 (0.033)	-0.101*** (0.024)	-0.064 (0.057)
Observations	1,615	1,618	1,615	1,398	1,619	1,620
Individuals	1,615	1,618	1,615	1,398	1,619	1,620
R-squared	0.355	0.613	0.191	0.199	0.256	0.147

Source: 1968-2015 PSID

Note: Health represents self-reported health status ranging from 1 to 5 (5- Excellent, 4-very good, 3-good, 2-fair, 1-poor). Each column stands for a separate OLS regression using cross-sectional data with the year, state, cohort fixed effects, state specific time trend and a vector of controls. Standard error is clustered by state to account for the within-state correlations and each regression is weighted by the average childhood PSID sample weights. All health outcomes are averaged after age 17 by individual. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 2: Effect of EITC Exposure on Common Diseases (Reduced Form)

VARIABLES	(1) Stroke	(2) Diabetes	(3) Cancer	(4) Lung	(5) Heartattack	(6) Heartdisease	(7) Arthritis	(8) Asthma	(9) Mental	(10) Learning
EITC <i>in utero</i>	-0.0022 (0.0015)	0.0010 (0.0028)	-0.0025 (0.0016)	-0.0010 (0.0017)	0.0007 (0.0009)	-0.0007 (0.0006)	-0.0047** (0.0023)	-0.0027 (0.0067)	0.0000 (0.0015)	0.0010 (0.0032)
EITC 0to5	0.0004 (0.0003)	-0.0005 (0.0005)	-0.0005 (0.0009)	-0.0009 (0.0010)	-0.0007 (0.0006)	0.0000 (0.0002)	-0.0001 (0.0011)	-0.0018 (0.0027)	-0.0007 (0.0005)	-0.0024* (0.0012)
EITC 6to12	0.0000 (0.0001)	0.0003 (0.0003)	0.0001 (0.0003)	-0.0002 (0.0005)	0.0002 (0.0002)	0.0001 (0.0001)	-0.0000 (0.0008)	-0.0000 (0.0014)	0.0001 (0.0004)	0.0012 (0.0010)
EITC 13to18	-0.0003** (0.0001)	-0.0001 (0.0004)	-0.0005 (0.0003)	-0.0007 (0.0005)	-0.0002* (0.0001)	-0.0002* (0.0001)	-0.0010* (0.0005)	-0.0009 (0.0013)	-0.0004 (0.0004)	-0.0017* (0.0010)
Black=1	-0.0025 (0.0033)	-0.0035 (0.0059)	-0.0101*** (0.0028)	-0.0013 (0.0075)	-0.0011 (0.0009)	0.0018 (0.0025)	-0.0147*** (0.0053)	-0.0130 (0.0133)	-0.0027 (0.0033)	0.0016 (0.0130)
Hispanic=1	-0.0047 (0.0034)	-0.0107 (0.0070)	-0.0220** (0.0098)	0.0070 (0.0393)	-0.0019 (0.0021)	-0.0112 (0.0099)	-0.0194 (0.0130)	-0.1118* (0.0573)	-0.0034 (0.0042)	-0.0431** (0.0200)
# of Siblings	0.0017 (0.0013)	0.0010 (0.0024)	0.0035** (0.0017)	0.0026 (0.0022)	0.0011 (0.0007)	0.0020* (0.0012)	0.0034 (0.0022)	0.0101 (0.0068)	0.0014 (0.0012)	0.0028 (0.0040)
Female=1	0.0017 (0.0020)	0.0087** (0.0034)	0.0048* (0.0026)	0.0096*** (0.0035)	0.0000 (0.0011)	0.0031* (0.0016)	0.0122*** (0.0043)	0.0322*** (0.0080)	0.0019 (0.0021)	0.0068 (0.0079)
Observations	1,624	1,624	1,624	1,624	1,624	1,624	1,624	1,624	1,624	1,624
Individuals	1,624	1,624	1,624	1,624	1,624	1,624	1,624	1,624	1,624	1,624
R-squared	0.0480	0.1185	0.1157	0.0912	0.1139	0.0548	0.0866	0.1261	0.0592	0.0903

Source: 1968-2015 PSID

Note: This table shows the effect of EITC exposure on several common diseases. Each column stands for a separate OLS regression using cross-sectional data with the year, state, cohort fixed effects, state-specific time trend and a vector of controls. Standard error is clustered by state to account for the within-state correlations and each regression is weighted by the average childhood PSID sample weights. All health outcomes are averaged after age 17 by individual. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 2b: Effect of EITC Exposure on ADLs (Reduced Form)

VARIABLES	(1) Bathing	(2) Dressing	(3) Eating	(4) Getting out of Bed	(5) Walking	(6) Getting Outside	(7) Toileting
EITC <i>in utero</i>	0.0022 (0.0024)	0.0018 (0.0025)	0.0005 (0.0010)	-0.0006 (0.0022)	-0.0016 (0.0055)	0.0022 (0.0017)	0.0011 (0.0008)
EITC 0to5	0.0006 (0.0009)	0.0004 (0.0013)	0.0000 (0.0002)	0.0015 (0.0020)	-0.0002 (0.0025)	-0.0010 (0.0006)	-0.0002 (0.0002)
EITC 6to12	0.0001 (0.0002)	0.0001 (0.0005)	-0.0004 (0.0003)	0.0006 (0.0006)	0.0011 (0.0009)	0.0002 (0.0002)	0.0000 (0.0001)
EITC 13to18	-0.0000 (0.0002)	-0.0000 (0.0003)	0.0002 (0.0003)	-0.0004 (0.0005)	-0.0006 (0.0007)	-0.0002 (0.0002)	-0.0002 (0.0001)
Black=1	0.0075 (0.0062)	0.0112*** (0.0042)	-0.0001 (0.0022)	0.0047 (0.0064)	0.0044 (0.0079)	0.0067** (0.0033)	0.0040 (0.0027)
Hispanic=1	-0.0003 (0.0058)	-0.0046 (0.0059)	0.0064 (0.0067)	-0.0132 (0.0089)	-0.0118 (0.0097)	-0.0267* (0.0153)	0.0005 (0.0014)
# of siblings	-0.0004 (0.0016)	-0.0019 (0.0018)	0.0004 (0.0007)	0.0001 (0.0024)	-0.0003 (0.0030)	0.0008 (0.0012)	0.0005 (0.0008)
Female=1	0.0002 (0.0037)	0.0019 (0.0044)	-0.0027 (0.0024)	0.0119 (0.0084)	0.0079 (0.0086)	0.0015 (0.0021)	-0.0012 (0.0020)
Observations	1,605	1,605	1,605	1,605	1,605	1,605	1,605
Individuals	1,605	1,605	1,605	1,605	1,605	1,605	1,605
R-squared	0.0803	0.1547	0.0992	0.1046	0.1079	0.1118	0.1095

Source: 1968-2015 PSID

Note: This table shows the effect of EITC exposure on ADLs. Each column stands for a separate OLS regression using cross-sectional data with the year, state, cohort fixed effects, state specific time trend and a vector of controls. Standard error is clustered by states to account for the within-state correlations and each regression is weighted by the average childhood PSID sample weights. All health outcomes are averaged after age 17 by individual. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Appendix 3: Effect of EITC Exposure on Intermediate Outcomes (Full Sample)

Panel A: Contemporaneous Effect				
VARIABLES	(1) EITC Eligibility	(2) Family Income	(3) Mothers' hours of work	(4) Maternal Employment
Max EITC	0.19*** (0.02)	7.53*** (1.96)	-8.89 (16.19)	0.03*** (0.01)
Controls	Y	Y	Y	Y
Observations	22,612	22,612	22,612	22,612
Individuals	2,461	2,461	2,461	2,461
R-squared	0.21	0.12	0.10	0.14
Panel B: Contemporaneous Effect by Age Intervals				
VARIABLES	(1) EITC Eligibility	(2) Family Income	(3) Mothers' hours of work	(4) Maternal Employment
Max EITC				
× <i>in utero</i>	0.02 (0.03)	12.50*** (2.86)	23.37 (30.02)	0.03* (0.02)
× 0 to 5	0.17*** (0.02)	7.39*** (2.05)	-25.65 (17.21)	0.03*** (0.01)
× 6 to 12	0.19*** (0.02)	7.43*** (1.96)	-15.57 (16.10)	0.03*** (0.01)
× 13 to 18	0.20*** (0.02)	7.79*** (1.98)	13.93 (16.78)	0.03*** (0.01)
Black=1	1.07*** (0.08)	-35.97*** (3.26)	-323.24*** (45.62)	-0.22*** (0.02)
Hispanic=1	0.08 (0.21)	26.02 (43.91)	155.94 (124.74)	0.04 (0.05)
Female=1	0.05 (0.05)	-1.84 (3.75)	-26.19 (32.14)	-0.02 (0.02)
# of Siblings	0.15*** (0.02)	-9.16*** (1.50)	-88.14*** (14.82)	-0.06*** (0.01)
Observations	22,612	22,612	22,612	22,612
Individuals	2,461	2,461	2,461	2,461
R-squared	0.21	0.12	0.10	0.14

Source: 1968-2015 PSID. Note: EITC eligibility is imputed based on income data in the PSID and historical policy parameters. Family income is defined as the sum of taxable head&wife income plus EITC eligibility. Working Hour is mother's actual annual working time. Employment is the indicator for maternal labor force participation. All dollar values are in thousands of 2015 dollars. Each column represents separate regression with full panel sample before age 18, clustering standard error at id level and weighted by the average childhood PSID individual sample weight. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

7.4 First-Stage with Full Sample

Appendix 4 shows estimates from first stage regressions using full cross-sectional sample. Results are similar with Table 5. It suggests the EITC exposure during childhood overall is related to the family income in the corresponding age interval and the income effect is stronger in the middle to late childhood.

Appendix 4: Effect of EITC Exposure on Family Income (Full Sample)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	<i>in utero</i>	0to5	6to12	13to18	<i>in utero</i>	0to5	6to12	13to18
Family Income by Age Intervals								
Max EITC <i>in utero</i>	0.52 (1.20)				-1.47 (1.24)	-14.54* (7.83)	-7.41 (14.17)	-22.13 (21.67)
Max EITC 0to5		11.85*** (4.21)			1.22 (0.81)	11.07** (4.62)	6.09 (5.51)	6.43 (9.89)
Max EITC 6to12			15.93*** (4.13)		0.86 (0.55)	4.02 (2.41)	12.58*** (3.91)	16.53*** (5.73)
Max EITC 13to18				14.61*** (4.59)	-0.14 (0.22)	0.45 (1.23)	3.23 (2.73)	7.44* (3.95)
Black=1	-39.56*** (3.89)	-217.12*** (20.49)	-294.98*** (27.04)	-301.37*** (29.08)	-37.99*** (3.75)	-210.15*** (20.68)	-292.33*** (26.47)	-284.33*** (29.27)
Hispanic=1	-24.31 (15.90)	40.13 (93.16)	-3.87 (118.36)	2,597.12 (2,462.23)	-25.42 (15.88)	29.65 (87.09)	0.27 (114.20)	2,570.25 (2,461.03)
# of siblings	-7.15*** (1.37)	-42.97*** (5.09)	-63.31*** (10.75)	-84.74*** (17.18)	-7.88*** (1.41)	-43.50*** (5.44)	-66.09*** (11.66)	-87.62*** (18.19)
Female=1	-0.50 (1.96)	3.91 (16.40)	-11.83 (29.92)	-31.15 (50.14)	-0.30 (1.97)	4.68 (16.54)	-11.94 (29.44)	-28.01 (50.96)
Age Bin	-11.69 (15.91)	-65.74 (60.68)	-4.83 (84.17)	-60.18 (125.99)	-10.29 (15.53)	-76.58 (61.90)	-6.82 (82.44)	-44.31 (118.74)
Head/Wife=1	-5.65 (3.22)	-36.01 (20.88)	-22.08 (32.49)	-64.13 (42.86)	-5.31 (3.29)	-35.18 (21.29)	-21.57 (31.89)	-60.53 (43.61)
Observations	2,461	2,461	2,461	2,461	2,461	2,461	2,461	2,461
Individuals	2,461	2,461	2,461	2,461	2,461	2,461	2,461	2,461
F-Statistics					4.48	2.50	3.70	3.48
R-squared	0.281	0.264	0.208	0.175	0.290	0.269	0.209	0.182

Source: 1968-2015 PSID

Note: Max EITC exposure is defined as the maximum EITC a household can receive given the year, state and family size. Family income is the sum of taxable head&wife income and EITC eligibility. For non-interview year, family income and EITC exposure are imputed as the average of what before and after that year. And all dollar values are in thousands of 2015 dollar. Each column represents separate regression using full cross-sectional sample for reported health status. Standard error is clustered by state and each regression is weighted by the average childhood PSID sample weight. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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