Money vs. Time: Family Income, Maternal Labor Supply, and Child Development*

Francesco Agostinelli† Giuseppe Sorrenti‡

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Abstract

This paper analyzes the relationship between work-promoting policies and child development. First, we provide new comprehensive evidence of the unintended consequences for child development of the Earned Income Tax Credit expansions during the 1990s in the United States. Second, our theory-driven empirical model reconciles this result by shedding light on the trade-off between the *income* effect (economic resources) and the *substitution* effect (time and quality of the parent-child interactions) on a child's cognitive and behavioral development. This money versus time trade-off is most pronounced for disadvantaged mothers. Overall, our results call for a policy debate on how to design targeted supplements for disadvantaged families to support working mothers and their children.

Keywords: Child development; Family income; Maternal labor supply.

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†School of Arts and Sciences, Economics Department, University of Pennsylvania (US). E-mail: fagostin@sas.upenn.edu

‡Amsterdam School of Economics, University of Amsterdam (NL). E-mail: g.sorrenti@uva.nl

1 Introduction

Families face a trade-off when allocating their time and resources to child development. Working more hours generates higher earnings, but it comes at the cost of time spent with the child. Conversely, time spent at home includes an opportunity cost in terms of forgone earnings and consequent reduction in consumption and expenditures on goods for the child. Although both time and money are important for child development, the net effect on children from a surge in earnings that accompany a parent's increased work hours is unclear.

Support programs such as the Earned Income Tax Credit (EITC), one of the largest federal income support programs in the United States, provide income transfers on the condition that the recipient works. Mothers, and especially single mothers, are usually the main target of similar welfare programs and are most responsive to incentives (Meyer, 2002; Blundell and Hoynes, 2004; Blundell et al., 2016; Løken et al., 2018).[1] Such responsiveness might shape child development by introducing a trade-off between the *income* effect, which arises from a surge in family income, and the *substitution* effect, which is due to maternal labor supply responses and a decrease in time parents spend with their child.

This paper provides an extensive analysis of the relationship between work-promoting economic policies—both family monetary and time resources—and child development. First, we evaluate the impact of the large expansion of the EITC during the 1990s on cognitive and behavioral development of children aged 4–16. Second, we use theory-driven exclusion restrictions to separately identify the policy-induced income and substitution effects on child development. Finally, we link the substitution effect to changes in parenting practices and parent-child interactions caused by the labor supply responses to EITC reforms.

Our analysis is based on the National Longitudinal Study of Youth 1979 (NLSY79) data set matched with its Children (NLSY79-C) section. This data set covers the mothers of the original NLSY sample, which is a representative sample of the US youth (between 14 and 22 years old) population in 1979, and it provides longitudinal information about child development, family income, and hours worked by the mother. The sample of mothers is particularly relevant for this project, given that the major reforms of the EITC program during the 1990s were targeted primarily to mothers. We proxy cognitive development through the child's achievement on the Peabody Individual Achievement Test (PIAT) in

[1] Hotz and Scholz (2003) and Nichols and Rothstein (2016) summarize theoretical and empirical findings about the effect of the EITC on maternal labor supply. Blundell et al. (2016) analyze a similar program in the United Kingdom and find substantial elasticities for women's labor supply.

mathematics and reading. To study behavioral development, we take advantage of the Behavior Problems Index (BPI).

We start by studying the reduced-form effects of EITC reforms on a child's short-term development through three different empirical approaches. First, we perform an event study analysis of the largest EITC reform, which was implemented in 1993. The setup compares, pre- and post-1993, the performance of children from families who—before the 1993 reform—were either targeted by the EITC program or who were not part of the program. Second, we follow the method in Dahl and Lochner (2012) and we construct a variable that captures the exogenous exposure to the policy-induced changes in EITC benefits at the family level during the 1990s. By exploiting the longitudinal dimension of the data, such variable is used in a model in first differences to identify the impact of a change in EITC benefits on the change in a child's development. Third, we exploit the policy-induced longitudinal changes in the EITC parameters, namely the changes in the maximum credit amount available given family characteristics. This alternative measure for the EITC expansion is then used again in a model in first differences to eliminate the child time-invariant unobserved heterogeneity.

Reduced-form estimates do not show any positive impact of the EITC expansion on short-term cognitive and behavioral development. Results are similar among the three empirical approaches and point to a differential effect of the EITC expansion on cognitive versus behavioral development. On the one hand, the EITC effect is negative for both dimensions of a child's development. On the other hand, the effect is larger (more negative) for behavioral development. To quantify effect sizes, our preferred empirical model suggests that a $1,000 increase in benefits causes a reduction by three percent of a standard deviation in the cognitive score and by five percent of a standard deviation in behavioral development.

Guided by theory-driven exclusion restrictions, we explore the existence of an EITC-induced income versus substitution effect on child development. This analysis is useful to rationalize the reduced-form evidence as well as to identify the sources of possible unintended effects of the policy. First, we provide preliminary evidence of the trade-off between the income and the substitution effect by showing that families who were exposed to the EITC program before the 1993 reform experienced, post-1993, a sizable boost in both income and maternal hours worked.

To directly link the income and the substitution effect with a child's development, we perform an instrumental variable (IV) analysis.[2] The IV strategy exploits two instrumental

[2]As for the reduced-form estimates, the IV specification is in first differences to take into account time-

variables to correct for the endogeneity of family income and maternal labor supply. The first instrument is based on the constructed variable for exogenous policy-induced changes in EITC benefits that we previously described. This variation provides us with exogenous changes in family monetary resources as well as changes in the work incentives for mothers. The second instrument we use is a measure of the local demand shocks for female labor. The local demand for labor can affect earnings and labor supply via local equilibrium effects on prices (wages).

The IV analysis confirms the existence of the trade-off between the income and the substitution effect on child development. The analysis of cognitive development shows that an additional $1,000 in family income improves cognitive development by about three percent of a standard deviation. The income effect is counterbalanced by a negative effect of hours worked by the mother. An increase in maternal labor supply of 100 hours per year decreases child cognitive development by three percent of a standard deviation. Finally, we find no evidence of a positive income effect on behavioral development, while the effect of maternal labor supply resembles the one for cognitive development. These findings suggest that money and time appear to be unequally important in the multidimensional process of a child's development.

We take a first step to further study the nature of the money versus time trade-off by analyzing the heterogeneity of such trade-off in the population. We find that the income effect is homogeneous among both outcomes. The same does not hold true for maternal labor supply. For cognitive development, the negative labor supply effect arises only from the most-disadvantaged families in the sample, who we hypothesize have difficulties in accessing high-quality childcare or after-school programs.[3] The labor supply effect is substantially homogeneous for the case of behavioral development, which is consistent with the hypothesis that parental investments in noncognitive skills are less substitutable; this lower degree of substitutability is unrelated to the socioeconomic status of the family. The latter evidence aligns with Løken et al. (2018). The authors show that a work-encouraging welfare reform targeted at single mothers in Norway caused a homogeneous reduction in children's GPA, an outcome that according to Borghans et al. (2016) is largely affected by students' socio-emotional skills.

invariant unobserved heterogeneity at the child (family) level.

[3] Bernal and Keane (2011) show that 75 percent of single mothers in the United States use informal care and that this source of care might have adverse effects on child test scores. Berlinski et al. (2020) develop a model of childcare markets with endogenous demand and supply. They show that high-quality childcare is essential as a supplemental input to avoid unintended consequences on children of the large increase of female labor supply over time.

In the last part of the paper, we directly look at the mechanisms behind the money versus time trade-off by analyzing changes in the *quantity* and *quality* of parental practices and parent-child interactions in response to the EITC expansion. We measure our outcomes of interest via the multiple measures of the Home Observation Measurement of the Environment (HOME) section of the NLSY data. The goal of this analysis is to provide insights to the policy debate on how to contemporaneously foster maternal employment and child development. Overall, the EITC expansion does not induce parents to compensate with extra parental investments (cognitive stimulation) for the increase in hours worked and the likely reduction in the total time spent with children. Moreover, we find some evidence that the EITC expansion has negative impacts on the qualitative aspect of parent-child interactions, with the largest (negative) reduction for both emotional support and parental involvement in children's education observed for the youngest children in our sample.

Overall, our findings reveal that work-promoting policies can manifest unintended consequences for child development via the money versus time trade-off. We provide two possible policy suggestions to offset these unintended consequences while still supporting working mothers. First, new programs should be introduced that grant access to alternative high-quality childcare or after-school programs for disadvantaged families. Second, new programs should be introduced that promote investments from companies in the human capital to foster the return of working. Our second proposal is supported by our findings that positive demand shocks for female labor in the 1990s—likely driven by technological progress and changes in labor productivity—do not generate any negative effect on short-term child development, despite predicting positive changes in maternal labor supply.[4]

Relationship to Literature. This article makes several contributions to the literature of child development and social policies.[5] First, we advise policymakers by highlighting that policies aimed at reducing poverty and promoting child development such as the EITC can generate unintended consequences if not paired with complementary initiatives aimed at providing good work conditions or high-quality childcare. Second, we bridge the gap between the literature on the effect of family income and that on the effect of maternal labor supply on child development. Among others, studies such as Duncan et al. (1998), Blau (1999), Løken et al. (2012) and Dahl and Lochner (2012) have found evidence of the positive income effect on child achievements. Studies on the effect of maternal labor supply during childhood

[4]See for example Ngai and Petrongolo (2017) for a discussion on how structural transformation and the rise of the service industries narrowed the gender gaps in hours and wages in recent decades.

[5]Our findings also provide insights on the identification and estimation of the technology of skill formation (Cunha and Heckman, 2007; Todd and Wolpin, 2007; Cunha et al., 2010; Agostinelli and Wiswall, 2016, 2020).

show, in general, that labor supply negatively affects child development (Baum, 2003; Ruhm, 2004; Bernal, 2008; Carneiro and Rodrigues, 2009; Bernal and Keane, 2011; Carneiro et al., 2015; Del Bono et al., 2016; Løken et al., 2018). There are two studies in the current literature that are most related to our work. Bernal and Keane (2011) study the effect of childcare and income on cognitive outcomes for children aged 3–6 in single-mother families. The authors find that the welfare reforms after 1993 had negative effects on a child cognitive development, with the effect occurring through childcare use. Dahl and Lochner (2012) take advantage of the quasi-experimental variation in the EITC during the 1990s to analyze the causal effect of family income on a child's cognitive achievement. In our framework, we have a model of multi-dimensional skills development where both income and hours worked are endogenously determined inputs in the production of a child's skills. Empirically, we consider various research designs to evaluate the impact of the extensions of work-incentives (EITC), and we connect our results to the theory-driven predictions of income and substitution effects on child development. Our substitution effects can be derived from many factors, including the change in quantity and quality of the parent-child interactions. We test these different channels in the final part of the paper.[6] Third, while many works exclusively focus on cognitive achievements (see Bernal and Keane, 2011; Dahl and Lochner, 2012; Del Boca et al., 2014), we extend the analysis to behavioral development to proxy a set of underinvestigated soft skills with large predictive power of future life outcomes (Heckman and Rubinstein, 2001). The difference in results when looking at different sets of skills highlights the importance of this choice.

The remainder of the paper is structured as follows. Section 2 provides a theoretical framework that drives the empirical analysis. Section 3 introduces the institutional setting and the data. Reduced-form results are discussed in Section 4, and Section 5 investigates the income versus the substitution effect. Section 6 sheds lights on the mechanism underlying the labor supply effect on child development. Section 7 concludes.

2 Theoretical Framework

We introduce a theoretical framework that will guide our empirical analysis. Our framework builds on previous work in Cunha and Heckman (2007), Cunha et al. (2010), and Del Boca et al. (2014). In particular, we model parents to have preferences over their consumption,

[6] Fan et al. (2015) study the connection between the trends in labor force participation for married women and the trends in the educational gender gap in the subsequent generations.

leisure, and time spent with the child as follows:

$$u^P(c_{i,t}, \ell_{i,t}, \tau_{i,t}, e_{i,t}) \equiv log(c_{i,t}) + \gamma_1 log(\ell_{i,t}) + \gamma_2 log(\tau_{i,t}) + \gamma_3 log(e_{i,t}) \quad , \tag{1}$$

where $c_{i,t}$ represents private consumption, and the $e_{i,t}$ represents the quantity of monetary investments to the child. Parents enjoy their leisure ($\ell_{i,t}$), as well as the time they actively spend with their children ($\tau_{i,t}$). The specified preferences will allow us to derive the parent labor supply and optimal time investments as well as the demand for consumption goods.

The maximization problem for parents is subject to time and budget constraints. We include the EITC benefits as a simple wage subsidy.[7] The program provides a cash transfer to families with earnings below a certain threshold conditional on recipients' employment. Parents maximize their utility subject to the following constraints:

$$\begin{aligned} \max_{c_{i,t},\ell_{i,t},\tau_{i,t},e_{i,t}} \quad & u^P(c_{i,t}, \ell_{i,t}, \tau_{i,t}, e_{i,t}) \\ \text{s.t. } c_{i,t} + e_{i,t} \cdot \kappa &= \underbrace{\omega_{i,t} \cdot L_{i,t} \cdot (1 + \xi^{EITC}) + \widetilde{I}_{i,t}}_{=I_{i,t} \text{ (Total Family Income)}} \\ L_{i,t} + \tau_{i,t} + \ell_{i,t} &= 1 \quad . \end{aligned} \tag{2}$$

κ is childcare price. Family income (I) is defined as the sum of earnings ($\omega \cdot L \cdot (1+\xi^{EITC})$) and family nonlabor income ($\widetilde{I}$). The parameter ξ^{EITC} captures the benefits associated with the current EITC regime. We just focus on the EITC program for the purpose of this illustrative example. The above problem is solved by the following set of first-order conditions:

$$\begin{aligned} (c): \ & \frac{1}{c} = \lambda \\ (L): \ & \frac{\gamma_1}{1-L-\tau} = \lambda\omega(1+\xi^{EITC}) \\ (\tau): \ & \frac{\gamma_2}{\tau} = \frac{\gamma_1}{1-L-\tau} \\ (e): \ & \frac{\gamma_3}{e} = \lambda\kappa \\ (\lambda): \ & c_{i,t} + e_{i,t} \cdot \kappa = \omega_{i,t} \cdot L_{i,t} \cdot (1 + \xi^{EITC}) + \widetilde{I}_{i,t} \quad , \end{aligned}$$

where λ represents the Lagrange multiplier. Solving the system of equations allows us to

[7] The EITC can be thought of as a wage subsidy for workers with low earnings. Although the EITC is a nonlinear function of earnings (see Figure 1), here we consider the simple case of a proportional wage subsidy to simplify results' derivation.

find the following optimal parental choices:

$$L^*(\xi^{EITC}) = \max\left\{0\,,\; \frac{1}{1+\gamma_1+\gamma_2}\left(1-(\gamma_1+\gamma_2)\frac{\widetilde{I}_{i,t}}{\omega_{i,t}\cdot(1+\xi^{EITC})}\right)\right\} \tag{3}$$

$$\tau^*(\xi^{EITC}) = \frac{\gamma_2}{\gamma_1+\gamma_2}\left(1-L^*(\xi^{EITC})\right) \tag{4}$$

$$\ell^*(\xi^{EITC}) = \frac{\gamma_1}{\gamma_1+\gamma_2}\left(1-L^*(\xi^{EITC})\right) \tag{5}$$

$$e^*(\xi^{EITC}) = \frac{\gamma_3}{\kappa}\left(\omega(1+\xi^{EITC})L^*(\xi^{EITC})+\widetilde{I}\right) \tag{6}$$

$$c^*(\xi^{EITC}) = (1-\gamma_3)\cdot\left(\omega(1+\xi^{EITC})L^*(\xi^{EITC})+\widetilde{I}\right) \quad , \tag{7}$$

The set of solutions in (3)–(7) shows that an expansion in the EITC regime (positive change in ξ^{EITC}) would predict a nonnegative change in hours worked in the model, as the labor supply function is a nondecreasing function of the wage rate and the EITC wage subsidy (strictly increasing when hours are positive). At the same time, the EITC regime expansion in the model predicts a nonpositive change in leisure (ℓ) and time investments with children (τ). The demand for private consumption and expenditure for child goods would also increase as both consumption and demand for a child's goods are proportional to total family income ($\omega(1+\xi^{EITC})L^*+\widetilde{I}$).

Parental choices and the quality of parent-child interactions affect child development (Heckman and Mosso, 2014). We model the formation of a child's skills as a function of monetary and time parental investments as well as the quality of parent-child interactions ($q_{i,t}$). In particular, a child's cognitive (θ^C) and behavioral (θ^B) skills are formed according to the following specification:

$$\theta^k_{i,t} = \psi_0 + \eta_i + \psi_1 e_{i,t} + \psi_2\tau_{i,t} + \psi_3\ell_{i,t} + \psi_4 q_{i,t}(L_{i,t}) + \nu_{i,t} \quad \forall k\in\{C,B\} \quad , \tag{8}$$

where η_i represents an individual-specific input in the formation of a child's skills, while $\nu_{i,t}$ represents the unobserved skill production shock. The four parameters ψ_1, ψ_2, ψ_3, and ψ_4 represent the productivity of monetary investment, educational time investments, noneducational time investments (or shared leisure time), and quality of parent-child interactions, respectively. Finally, the quality of parent-child interactions can affect a child's development for a given level of monetary and time investments. We allow the quality of parent-child interactions to be a function of hours worked by the parent. By substituting the optimal parental choices and assuming $q_{i,t} = -\gamma_4 L_{i,t}$ (where $\gamma_4 \geq 0$), we obtain:

$$\theta^k_{i,t} = \psi_0 + \eta_i + \psi_1\frac{\gamma_3}{\kappa}I(\xi^{EITC}, L^*(\xi^{EITC})) + \psi_2\frac{\gamma_2}{\gamma_1+\gamma_2}\left(1-L^*(\xi^{EITC})\right)$$

$$
\begin{aligned}
&+\psi_3\frac{\gamma_1}{\gamma_1+\gamma_2}\cdot(1-L^*(\xi^{EITC}))-\gamma_4\psi_4L^*(\xi^{EITC})+\nu_{i,t}\\
=&\psi_0+\psi_2\frac{\gamma_2}{\gamma_1+\gamma_2}+\psi_3\frac{\gamma_1}{\gamma_1+\gamma_2}+\psi_1\frac{\gamma_3}{\kappa}I(\xi^{EITC},L^*(\xi^{EITC}))\\
&-\left(\psi_2\frac{\gamma_2}{\gamma_1+\gamma_2}+\psi_3\frac{\gamma_1}{\gamma_1+\gamma_2}+\gamma_4\psi_4\right)L^*(\xi^{EITC})+\eta_i+\nu_{i,t}\\
=&\alpha_0+\alpha_1I(\xi^{EITC},L^*(\xi^{EITC}))+\alpha_2L^*(\xi^{EITC})+\eta_i+\nu_{i,t}\quad,
\end{aligned}
$$

where the total family income $I(\xi^{EITC},L^*(\xi^{EITC}))=\omega(1+\xi^{EITC})L^*(\xi^{EITC})+\widetilde{I}$, while the parameters are: $\alpha_0=\psi_0+\psi_2\frac{\gamma_2}{\gamma_1+\gamma_2}$, $\alpha_1=\psi_1\frac{\gamma_3}{\kappa}$, and $\alpha_2=-\psi_2\frac{\gamma_2}{\gamma_1+\gamma_2}-\psi_3\frac{\gamma_1}{\gamma_1+\gamma_2}-\gamma_4\psi_4$.

In this model, an expansion in the EITC program has ambiguous effects on child development.[8] By defining a program expansion as a change in ξ^{EITC}, it is possible to decompose the effect of the change in ξ^{EITC} on child development in two components: an income effect (α_1) that positively affects child development and a substitution effect (α_2) induced by a reduction in the quality and/or quantity of parental investments. Formally, the two effects can be expressed as:

$$
\frac{\partial\theta^k_{i,t}}{\partial\xi^{EITC}}\equiv\underbrace{\alpha_1\cdot\frac{\partial I(\xi^{EITC},L^*(\xi^{EITC}))}{\partial\xi^{EITC}}}_{\text{Income Effect}}+\underbrace{\alpha_2\cdot\frac{\partial L^*(\xi^{EITC})}{\partial\xi^{EITC}}}_{\text{Substitution Effect}}\quad. \tag{9}
$$

Equation (9) shows that the overall effect of the EITC expansion depends on three elements: (i) inputs productivity; (ii) the elasticity of labor supply, leisure, and expenditures to program expansions; and (iii) the change in the quality of parent-child interactions induced by the policy change. In particular, a positive EITC-induced income effect might be offset by the substitution effect created by the increase in hours worked. The effect of hours worked on a child's development depends on three main factors: the relative productivity of quality (ψ_4) versus quantity of parental investments (ψ_2 and ψ_3) and the endogenous substitution between hours worked and both educational time investments and leisure (γ_1 and γ_2), as well as the change in the quality of the parent-child interactions (γ_4).

If the quality of parent-child interactions is very important for child development (high ψ_4), the substitution effect is negative in case the quality is affected by the change in hours worked ($\gamma_4>0$). Finally, even if educational time investments do not respond to changes in hours worked (γ_2=0), the decrease in leisure associated with higher hours worked can generate a negative substitution effect if noneducational time investments are productive ($\psi_3>0$).

[8]See Figure 1 for a graphical representation of the EITC expansion in the United States in the 1990s.

In the following empirical analysis, we test the existence of the possible trade-off between the income and the substitution effect and compare their relative magnitude in shaping child development.

3 Institutional Setting, Data, and Definitions of Variables

This section accomplishes two tasks. First, we introduce the institutional framework. We start with a description of the EITC program, its expansion over time, and the construction of the variable capturing such expansion. Then, we describe the construction of a second important variable for the empirical analysis, namely, a measure capturing exogenous local demand for (female) labor. Second, we describe the main data used in this study.

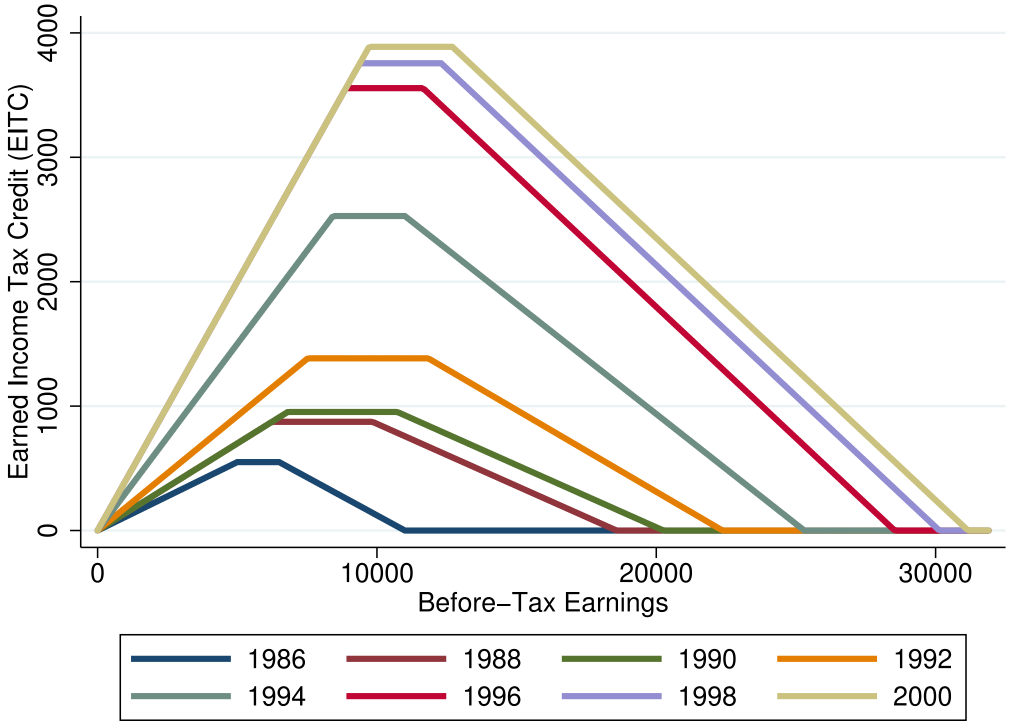
The EITC program. When the EITC was introduced in 1975, it was a modest program that aimed to improve economic and social conditions of low-income families with dependent children in the United States. Over the year, the EITC was progressively expanded. The largest expansion, in 1993, made the EITC the largest cash transfer program for low-income families with dependent children in the United States (Eissa and Liebman, 1996). In 2013, total federal EITC payments reached $63 billion given to 27 million individuals. In 2015, the program lifted about 6.5 million people out of poverty, including 3.3 million children (Center on Budget and Policy Priorities, 2016).

EITC eligibility depends on three criteria: (i) a positive earned income; (ii) adjusted gross income and earned income below a certain year-specific threshold; and (iii) at least one qualifying child.[9] As a consequence of these criteria, the EITC primarily affects the incentive of mothers to work (Nichols and Rothstein, 2016) and single mothers have been found to be the most responsive target to these incentives (Blundell et al., 2016).

The EITC income thresholds and benefits have changed over time. In Figure 1, we plot the different amounts of received transfers conditional on family labor income, keeping all the family characteristics (e.g. marital status, number of dependent children, etc.) fixed. Focusing on a single year, it is possible to observe the structure of the EITC program and, specifically, the three phases that characterize the program. In the phase-in, the credit is a pure wage subsidy. This is followed by a flat phase, after which the credit starts to gradually

[9] A few exceptions to the last criterion were introduced in 1994.

Figure 1: The EITC Expansion



This figure shows the changes in the federal EITC schedule for families with two children. Both before-tax earnings and eitc benefits are in nominal terms. We calculate the EITC benefits over time using the TAXSIM program.

phase out according to a set income schedule.

In terms of EITC federal schedule expansions over time, families with an income of around \$10,000 received a transfer of around \$1,000 in 1988 or 1990. The same families received an amount that was 400 percent higher (around \$4,000) in 2000.

Measuring the EITC Expansion. In our analysis, we aim to measure the longitudinal expansion of the EITC program by (i) relying on exogenous policy-induced changes in benefits each family is exposed to, (ii) *not* relying on endogenous responses by families induced by the policy change. In other words, we construct a variable capturing the EITC expansion that exclusively relies on policy changes, as the actual change in the transfer that families receive would be a function of both policy changes in the EITC schedules and the endogenous response in family income. Indeed, family income endogenously changes in response to several factors such as individual labor supply choices and changes in marital status or household structure.

To exploit only policy changes in the EITC schedules, we construct the variable as in Dahl and Lochner (2012). We calculate the change in EITC benefits due to changes in the EITC schedules over time based on the predicted family income change that would have happened in any case, keeping fixed the family structure and characteristics to avoid possible endogenous changes in family composition and characteristics. Specifically, our variable takes the form:

$$\Delta EITC_{i,t} = \widehat{\xi}_{i,t} - \xi_{i,t-1} \quad . \tag{10}$$

where the future EITC benefits ($\widehat{\xi}_{i,t} = EITC_{i,t}(\widehat{I}_{i,t}^{pre-tax})$) are based on the predicted family income ($\widehat{I}_{i,t}^{pre-tax}$). This way, our variable does not capture changes in the EITC benefits due to endogenous responses in the individual's labor supply and income. Predicted family income is obtained via regressing the current income on an indicator variable for positive lagged income and a fifth-order polynomial in lagged income.[10]

Measuring Local Demand for Labor. The conditions of the local economy potentially shape child development through multiple channels, for example, parental labor market conditions. We account for this by constructing a variable that works as a proxy for the performance of the local economy. As the demand for labor represents a good measure for the economic performance of a certain area, we rely on labor demand shocks as the spatial differential effects of long-term aggregate trends on local labor markets. Different local labor markets are characterized by different economic sectoral compositions, inducing different expositions to aggregate structural changes in the economy. Ideally, we would identify differences in exogenous labor demand changes, unrelated to the supply side, that shift the equilibrium of local labor market outcomes.

Following the approach first developed by Bartik (1991) and used in many other empirical works (see, for example, Blanchard and Katz, 1992; Autor and Duggan, 2003; Luttmer, 2005; Aizer, 2010; Notowidigdo, 2011; Bertrand et al., 2015; Diamond, 2016; Charles et al., 2018a,b), we construct an empirical analog of the above-mentioned thought experiment by considering the cross-state differences in industrial composition and aggregate growth in the employment level.

Given the focus on maternal labor supply of this work, we exploit heterogeneous labor demand shocks for women by state and educational attainment. We define a group (or cell) "se" as the aggregation index for people living in a state s with a level of education e. For each variation unit se, we create labor demand shocks as national changes in industry-specific

[10]All the results presented in this study are robust to the use of several different sample selection criteria or specifications for the income prediction model.

employment rates weighted by the industry female-employment share at the baseline year. For our empirical analysis, we fix the baseline year at 1980, as our empirical analysis focuses on the period from 1986 to 2000. We use the Current Population Survey (CPS) and the 1980 Census Integrated Public Use Microdata Series (IPUMS) to construct our measure.[11]

Any observation i that belongs to the specific cell se is matched with the following variable value:

$$LabDemShocks_{i,t} = \sum_{ind} (\ln E_{ind,-s,t} - \ln E_{ind,-s,1980}) \frac{E_{ind,se,1980}}{E_{se,1980}} \quad , \tag{11}$$

where $(\ln E_{ind,-s,t} - \ln E_{ind,-s,1980})$ is (approximately) the percentage change in the aggregate employment rate in industry ind relative to 1980. To calculate this statistic for each state s, we consider all states except state s to avoid possible concerns of endogeneity (Goldsmith-Pinkham et al., 2020). $\frac{E_{ind,se,1980}}{E_{se,1980}}$ represents the 1980 female-employment share of industry ind for a specific education group e in state s. We consider four types of educational levels, namely high school dropout, completed high school, some college, and completed college. The variable constructed in Equation (11) can be interpreted as the average long-term growth in employment rates by state and educational attainment.

Data. We use the National Longitudinal Study of Youth 1979 (NLSY79) for our analysis as this data set contains multiple measures for child development and family conditions. Moreover, the information in the data is collected longitudinally. Information about children and their families is obtained by matching the information of the mothers in the original NLSY79 to the additional children's survey (NLSY79-C). This matched data set (C-NLSY) results from a survey conducted every two years from 1986 to 2014. The sample selection rule adopted is simple: observational units include only children for whom there is information about cognitive or behavioral development.

Cognitive development is measured through achievements in math and reading activities. Specifically, we exploit the Peabody Individual Achievement Test (PIAT), a set of tests assessing proficiency in mathematics (math), oral reading and word recognition (reading recognition), and the ability to derive meaning from printed words (reading comprehension).

[11]The CPS is representative of the US civilian noninstitutional population. We use an integrated version of the CPS from Integrated Public Use Microdata Series (IPUMS). The 1980 Census Integrated Public Use Microdata Series (IPUMS) allow us to construct in the most precise way employment shares in the baseline year by industry, state, and education level. We choose 1980 as the baseline year instead of an earlier decade as the earlier versions of census data sets are only one percent samples instead of five percent samples. The following industries are considered: agriculture, mining, construction, manufacturing, transportation, wholesale trade, retail trade, finance, business service, personal service, entertainment service, professional service, and public administration.

For each test, we use the raw NLSY test score data and we account for the age profile of the tests, namely, the residualized test score with respect to the child's age. We standardize each test score to obtain a measure with a mean of zero and a standard deviation of one. Finally, we compute an aggregate measure of math-reading achievement as the average of the three standardized single test scores and standardize this mean to obtain a variable with a mean of zero and a standard deviation of one.

The second outcome of interest, which captures behavioral development, is the Behavior Problems Index (BPI). The BPI was created by Nicholas Zill and James Peterson to measure the frequency, range, and type of childhood behavior problems for children age four and older (Peterson and Zill, 1986). In the C-NLSY data set, five indicators for behavioral problems are collected: antisocial behavior (7-point scale), anxious behavior (6-point scale), headstrong behavior (6-point scale), hyperactive behavior (6-point scale), and peer conflicts behavior (4-point scale). Each index is transformed to obtain a positive scale so that higher values correspond to fewer behavioral problems. Hence, a higher index score corresponds to a higher-achieving (in terms of behavior) child. We standardize each single index to obtain a measure with a mean of zero and a standard deviation equal to one. We compute a comprehensive index, which is the average of the five single indexes. This average value is standardized to obtain a measure with a mean of zero and a standard deviation of one.

Information about child achievement and demographics is matched with family and mothers' information such as family income, marital status, and education level. We exclude from the analysis children whose mothers changed marital status in two consecutive periods as this might have several implications on a child's development, for example, through changes in family income due to changes in the presence of a husband in the family. We also restrict the analysis to the period until the year 2000 for four main reasons: (i) to focus on the main EITC reforms during the 1990s; (ii) to consider the period in which the vast majority of the NLSY children are in the age range of interest for this study; (iii) to avoid mixing EITC changes with the two tax cuts of 2001 and 2003; and (iv) to avoid confounding the aggregate effects of the 2001 recession and the Great Recession after 2007. Finally, we use the TAXSIM program by Daniel Feenberg and the National Bureau of Economic Research to compute the after-tax family income and the federal EITC for each family and period.[12]

Table 1 reports the descriptive statistics for the two main samples of the analysis, namely, the sample used for the analysis of cognitive development as measured by the math-reading

[12]TAXSIM allows one to calculate "federal and state income tax liabilities from survey data." See Feenberg and Coutts (1993) for further details.

standardized test score and the one for the analysis of behavioral development as measured by the BPI.

The two samples are remarkably similar; therefore, we mainly describe the one used for the analysis of cognitive development (columns 1 and 2). The average performance on the math test is about 44 (out of 84) points and the average BPI is 3.2 (out of 4.8). The average family in the sample reports a real (in year 2000 dollars) after-tax income of around $37,000 (median = $30,252), while mothers spend on average around 1,200 hours per year working.[13] Children are assessed biennially with PIAT tests and BPI tests starting at ages 5 and 4, respectively, until they reach the age of 16.[14] Children in our estimating sample are, on average, approximately ten years old. The sample is perfectly balanced in terms of gender, while it overrepresents ethnic minorities such as Blacks (more than 30 percent) and Hispanics (20 percent). Only nine percent of the sample consists of an only child, 37 percent have one sibling, and 54 percent have two or more siblings. About 63 percent of observations in our sample live with married mothers, and 70 percent live with a mother who have at most a high school diploma.

4 The EITC Expansion and Child Development

We start the empirical analysis by studying the reduced-form effect of the expansion of the EITC program on a child's development. We perform several analyses. First, in line with many EITC-related empirical works, for example, Dickert et al. (1995), we show the event study analysis of the impact of EITC reforms on child development. Second, we estimate the impact of the EITC expansion on child development by means of the constructed variable for longitudinal changes in policy-induced EITC benefits (see Section 3). Finally, we replicate the analysis by measuring the EITC expansion with longitudinal between-states changes in the maximum amount of available benefits.

4.1 The 1993 EITC Reform: Event Study Analysis

The largest expansion of the EITC program took place in 1993. This expansion is studied in several papers such as Dickert et al. (1995), Hoynes and Patel (2018), and Kleven (2020)

[13]All the monetary variables in the paper, including the EITC benefits, are in real year 2000 dollars.

[14]The fact that the collection of data on behavioral development starts one year earlier than the one for cognitive achievements is the main driver of the different sample sizes in the table.

through difference-in-differences (DiD) or event study empirical strategies. We replicate this design in our framework. We analyze the impact of the 1993 EITC reform on both cognitive and behavioral development of children in an event study design. Because Agostinelli et al. (2020) have shown that the DiD or event study results should be taken with caution when used to causally evaluate welfare reforms, we interpret it as first suggestive evidence of the EITC's impact on children. Our event study analysis takes the following form:

$$y_{i,t} = \beta_0 + \sum_k \beta_{1,k} Time_{k=t} \ + \beta_2 Treat_i \ + \sum_k \gamma_k (Time_{k=t} \times Treat_i) \ + X'_{i,t}\delta + \epsilon_{i,t} \quad , \quad (12)$$

where $y_{i,t}$ represents child i's development (math-reading test score or BPI) in period t.[15] The variable $Time_{k=t}$ is an indicator that takes the value of one if the current period t is k periods away from the policy reform. The variable $Treat_i$ indicates whether the child i belongs to a family likely targeted by the EITC. Targeted families are those families that received EITC benefits at least once pre-1993 or those with members that never worked before the reform.[16] Therefore, $Treat$ separates the sample in two groups: a treatment group of families likely exposed to the EITC reform and a control group likely unexposed to the EITC reform. $X_{i,t}$ contains variables for a child's gender, age, and race, and for the number of children in the household. All these variables are also interacted with the treatment indicator to allow for differential trends between the treatment and the control group. We are interested in the estimates of the set of parameters γ, which capture the differential policy reform effect for the treatment group compared to the control group.

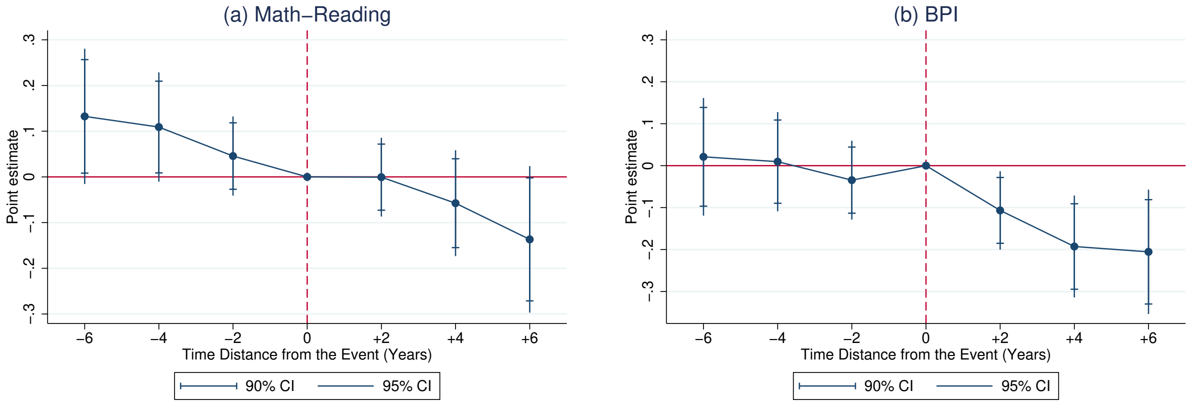
Figures 2(a) and 2(b) show the effect of the 1993 EITC reform on child cognitive and behavioral development, respectively. The x-axis reports the time difference in years from the 1993 EITC reform. The y-axis reports the point estimate, in percent of a standard deviation, for the effect of the reform on the treatment group compared to the control group. All models are estimated by clustering standard errors at the family level to allow for serial correlation of the error term over time and between siblings.

Figure 2(a) suggests that there is no positive effect of the 1993 EITC reform on a child's cognitive development. Despite the existence of some positive pre-reform trends for the treatment group, in the post-reform period the treatment and the control group perform similarly on the math-reading standardized test. If anything, four years after the reform, the treatment group seems to underperform with respect to the untreated control group. However, the point estimate is statistically nonsignificant. Two years later, the effect becomes

[15] We consider periods to be the child's age, and we use these two concepts interchangeably.

[16] We use the TAXSIM to compute the EITC benefits received by each family in the pre-1993 period.

Figure 2: The 1993 EITC Reform and Child Development



This figure shows the evolution over time of the effect of exposure to the EITC program on child development. Dependent variables: change in Math-Reading test score (left panel), change in the Behavior Problems Index (right panel). The y-axis shows the point estimates (percent of a standard deviation) for the interaction of the indicator variable for the treatment group with indicator variables for each year. The treatment group is defined as the group of families that received EITC benefits at least once pre-1993 or those with members that never worked before the reform. The x-axis reports the time distance (in years) from the 1993 EITC reform (Time = 0). The red, vertical, dashed line visually separates the pre-reform and the post-reform periods. The model includes control variables for a child's gender, age, and race, and number of children in the household. Each control variable is also interacted with the indicator variable for the treatment group. See text for further details. The figure reports 90 percent and 95 percent confidence intervals based on standard errors clustered at the family level.

larger and turns to be statistically significant at the ten percent level.

Figure 2(b) depicts a different picture for the effect of the EITC expansion on behavioral development. The treatment and the control groups appear on parallel trends in the pre-reform period. After the reform, the treatment group performs worse than the control group. Four years after the reform, treated children perform, on average, up to 20 percent of a standard deviation lower than the control group. The effect persists two years later.

4.2 EITC Family-Level Exogenous Policy Changes

We move beyond the event study setup—whose limits are highlighted in Agostinelli et al. (2020)—by studying the effect of multiple EITC expansions over time on child development by means of the variable for family-level exogenous policy changes. We are interested in the reduced-form effect of the EITC on a child's outcome:

$$y_{i,t} = \beta_0^{RF} + \alpha_0^{RF}\ t + \alpha_1^{RF}\ EITC_{i,t} + x_i'\ \beta_{1,t}^{RF} + x_{i,t}'\ \beta_2^{RF} + \eta_i + \epsilon_{i,t}\ , \tag{13}$$

where $y_{i,t}$ represents child i's development in period t. $EITC_{i,t}$ is the EITC transfer to child i's family. x_i and $x_{i,t}$ represent observed child fixed and time-varying characteristics as well as other contextual factors (e.g. labor market conditions) with the potential to affect a child's development. η_i reflects unobserved child- or family-specific heterogeneity that can capture any permanent unobserved family factor or child unobserved ability. The model also includes an age-trend effect in children's outcomes (α_0^{RF}). Finally, $\epsilon_{i,t}$ is the additional time-varying unobserved heterogeneity in the child's outcome, which may include unobserved child developmental shocks.

We take first differences to eliminate child (family) fixed effects:

$$\Delta y_{i,t} = \alpha_0^{RF} + \alpha_1^{RF} \Delta EITC_{i,t} + x_i' \beta_1^{RF} + \Delta x_{i,t}' \beta_2^{RF} + \Delta\epsilon_{i,t}\ \ , \tag{14}$$

where $\beta_1^{RF} = \beta_{1,t}^{RF} - \beta_{1,t-1}^{RF}$ allows us to control for differential growth in children's outcomes by observable characteristics (e.g., gender, age, race). We include in Equation (14) the variable for changes in the local demand for female labor ($LabDemShocks_{i,t}$) to take into account the direct effect on child development of changes in the local economic conditions faced by mothers in the sample.

The policy-induced longitudinal changes in the individual's EITC benefits is constructed as in Equation (10). The coefficient α_1^{RF} expresses the effect of exogenous policy changes in the EITC program on changes in child development over time. To take into account that the variable capturing the longitudinal EITC expansion varies not only due to the exogenous changes in the EITC schedule over time but also due to the exogenous trends in family income over the life cycle, all the analyses in the study include a set of controls for the exogenous family-specific change (trend) in the pre-tax family income. These control variables are constructed in the following way. First, we calculate the estimated exogenous trend in family income by looking at the difference between the predicted income at time t and the observed income at time $t-1$ ($\widehat{I}_{i,t}^{pre-tax} - I_{i,t-1}^{pre-tax}$). Second, we construct an indicator variable for families with positive (or negative) predicted changes in family income. Third, we interact this indicator variable for positive family income trends with the predicted change in family income and its squared terms. This set of variables aims to flexibly control for the counterfactual family income changes that would have happened in the absence of any EITC reforms.

Table 2 shows the OLS estimates of Equation (14) with standard errors clustered at the family level. We focus on cognitive development as measured by the math-reading standardized test score in columns (1) and (2) and on behavioral development in columns (3) and (4). In columns (5) and (6), we combine cognitive and behavioral development by averaging each of the two standardized indexes into a combined index. This combined index is then standardized to have a mean of zero and a standard deviation of one. For each outcome, we estimate two different specifications. The first specification is the baseline one and it includes control variables for a child's gender, age, and race, for the number of children in the household, and year as well as the set of controls for family income trend and the variable to capture local labor demand shocks. The second specification further controls for state fixed effects to capture state trends over time. In light of the data structure, the estimated coefficients for the EITC variable should be interpreted as the effects of biennial policy-induced changes in EITC benefits on biennial changes in children's cognitive and behavioral development.[17]

The analysis of the performance in the math-reading test corroborates the event study evidence and suggests that the EITC expansion over time does not positively shape short-term child cognitive development. On the contrary, a raise in family-level EITC benefits causes a statistically significant drop in child performance. In the baseline specification in column (1), a surge in EITC benefits by $1,000 causes a three percent of a standard deviation reduction in the math-reading test score. The effect is similar in the specification with state fixed effects (column 2).

As in the event study setup, the EITC effect is more sizable for behavioral development. Columns (3) and (4) display that an increase of $1,000 in benefits decreases BPI by about five percent of a standard deviation. The effect is statistically significant and remarkably similar across specifications.

In columns (5) and (6) of Table 2 we analyze the combined cognitive and behavioral score. The analysis confirms a negative effect on short-term child development implied by the EITC expansion over time. The effect amounts to about five percent of a standard deviation, and it is stable across specifications.

Threats to Identification. We discuss possible threats to our identification strategy by investigating the sensitivity of our baseline estimates to some changes in the estimated

[17] The same interpretation applies to all the analyses of child development in the remainder of the paper.

specifications. We focus on two possible threats: (i) endogenous eligibility to EITC benefits, and (ii) exogenous trends in child development.

First, we study whether endogenous eligibility to EITC benefits potentially affects the reliability of our baseline estimates. Our constructed changes in EITC benefits depend on the $t-1$ family income, which defines the amount of EITC benefits that each family is eligible for. However, we cannot directly control for this eligibility criteria in our regression model ($I_{i,t-1}^{pre-tax}$). Indeed, family income is likely correlated with changes in the unobserved heterogeneity $\Delta\epsilon_{i,t} \equiv \epsilon_{i,t} - \epsilon_{i,t-1}$ (Equation 14), because of the simultaneous correlation between family income and the error term ($Cov(I_{i,t-1}^{pre-tax}, \epsilon_{i,t-1}) \neq 0$). For this reason, in Table 3 we replicate our analysis by controlling for either the two-period (four years) lagged family income $I_{i,t-2}^{pre-tax}$ (Panel A) or the three-period (six years) lagged family income $I_{i,t-3}^{pre-tax}$ (Panel B). The idea behind this augmented specification is that, under restrictions of the serial correlation structure of the unobserved heterogeneity in the formation of a child's skills, past income realizations are predictive of current family income (EITC eligibility criteria), but they are uncorrelated with the changes in the error term $Cov(\epsilon_{i,t} - \epsilon_{i,t-1}, I_{i,t-q}^{pre-tax}) = 0$ for some $q \geq 2$.[18]

Table 3 reports the results for cognitive (column 1), behavioral (column 3), and combined cognitive-behavioral (column 5) development. As anticipated, Panel A includes two-period lagged family income, and Panel B considers the three-period lagged family income. The inclusion of lagged family income leaves all the results remarkably similar to baseline estimates. This similarity reassures that our main results do not depend upon endogenous eligibility to EITC benefits.

Second, we analyze the possible effect of exogenous trends in child development. Some of the families that are unaffected by changes in EITC benefits are families with income exceeding the EITC eligibility threshold. For this reason, a possible concern is that children from high-income families might experience steeper trends in math-reading test scores and behavioral measures than children from low-income families. This would generate a mechanical association between the measured changes in EITC benefits and measures for a child's development. We address this potential concern by replicating our baseline analysis on the subsample of children from families with income from the previous survey wave below \$35,000. This income threshold (roughly) identifies the sample of families likely exposed to the EITC program and filters the possible bias induced in the whole sample by families

[18] This idea resembles the intuition behind the validity of the internal instruments in Arellano and Bond (1991).

unexposed to the EITC program due to a high level of labor income.

Table 3 shows the analysis for the restricted sample of families with one-period lagged family income below $35,000. The analysis for cognitive development is in column (2), the analysis for behavioral development is in column (4), and combined cognitive-behavioral development is reported in column (6). In addition to the sample restriction, each specification includes as extra control variables the two-period (Panel A) or three-period (Panel B) lagged family income. Despite a natural reduction in sample size, all the results remain almost unchanged compared to the baseline analysis, therefore reassuring that exogenous trends in child development do not play an important role in shaping our baseline estimates.

4.3 Expansion of the Maximum EITC Benefits

In this section, we replicate our analysis with an alternative variable for exposure to the EITC program that is measured through the longitudinal changes in the maximum federal and state EITC benefits that a family could receive, given the year, state of residence, and number of children in the household. Such measure for exposure to the EITC, independent of family income, might represent a further interesting robustness test.[19]

We perform this test by replicating our analysis through the use of a variable for exposure to the EITC based on the maximum level of benefits a family (couple) residing in a specific state, in a given year, and with a certain number of dependent children is exposed to. To eliminate time-invariant unobserved heterogeneity, we estimate the following regression model in first differences:

$$\Delta y_{i,t} = \alpha_0^{MAX} + \alpha_1^{MAX} \Delta MaxEITC_{s,t,k} + x_i' \beta_1^{MAX} + \Delta x_{i,t}' \beta_2^{MAX} + \Delta \epsilon_{i,t} \quad , \qquad (15)$$

where the set of control variables is the same as in Equation (14). The variable $\Delta MaxEITC_{s,t,k}$ is the one-period (two years) change ($MaxEITC_{s,t,k} - MaxEITC_{s,t-1,k}$) in the maximum level of federal and state EITC benefits child i's family is exposed to, given state of residence s and number of dependent children k. To take into account how the EITC variable is constructed, the model is augmented with a full set of interaction terms between state (indicators) and year, number of children (indicators) and year, and child's age (indicators) and year. The coefficient α_1^{MAX} captures the effect of a change in exposure to the EITC

[19]A similar EITC variable has been previously used in Bastian and Michelmore (2018), who study the long-run effect of EITC exposure during childhood on education and employment outcomes.

program measured through the longitudinal change in its maximum available benefit, on longitudinal changes in child development.

Table 4 reports the OLS estimates of Equation (15) for cognitive (columns 1, 2, and 3) and behavioral (columns 4, 5, and 6) development, and the combined cognitive-behavioral measure (columns 7, 8, and 9). For each outcome, we propose a first specification estimated on the whole sample, a second specification with an extra control for four-year lagged family income, and a third specification based on the restricted sample of families with lagged (two years, namely from the previous survey wave) income below $35,000. Standard errors are clustered at the family level.[20]

Despite the use of a different measure for exposure to the EITC expansion, the analysis confirms the absence of a positive effect of the expansion on children's short-term cognitive development. The whole-sample specification suggests that an increase of $1,000 in the maximum level of EITC benefits significantly decreases the math-reading test score by two percent of a standard deviation. The effect does not change when lagged income is included as a control variable (column 2) and it remains negative, although it turns to be statistically nonsignificant in the restricted sample of families with income below the EITC eligibility threshold.

The expansion of the EITC program lowers children's short-term behavioral development. The analysis of BPI reveals that the EITC's effect is negative: a $1,000 increase in the maximum EITC benefits explains a three percent of standard deviation decrease in behavioral development. The effect is almost double in the restricted sample of families more likely to be exposed to the EITC program (column 6). The negative impact of the EITC expansion is confirmed by the analysis of the combined cognitive-behavioral measure in columns (7) to (9).

Table A.2 reconciles this analysis with the existing literature by estimating the specification with outcome and explanatory variables as in Equation (15) but expressed in levels.[21] The specification in levels (columns 1, 3, and 5) generates positive point estimates for the short-term effect of the EITC expansion on child development. These estimates resemble some of the estimated positive effects in the literature (see for example Bastian and Michelmore, 2018). However, once we move to specifications in differences (delta) allowing for within-

[20] Table A.1 replicates the reduced-form estimates in Table 4 for a restricted sample of mothers who did not change either their state of residence or the number of children in two consecutive NLSY surveys.

[21] For example, the test (behavioral) score instead of the change in the test (behavioral) score with respect to the previous survey wave constitutes the outcome variable of the empirical model. The same definition applies to the main explanatory variable of interest, namely the maximum level of EITC benefits.

child estimates (columns 2, 4, and 6), the analysis depicts a different scenario with results suggesting a negative short-term impact of the EITC expansion on child development. This evidence seems to support the use of longitudinal data to study the EITC effect on child development as the longitudinal dimension might allow issues related to time-invariant unobserved heterogeneity at the individual (or family) level to be overcome.

Summing Up. The three different analyses reported in this section depict a coherent picture pointing to possible unintended consequences related to the expansion over time of the EITC program. Specifically, we find evidence of negative effects for both short-term cognitive and behavioral development with the latter appearing more sizable. Our theoretical framework helps to contextualize these results. In light of the potential trade-off between the income and the substitution effect implied by the EITC expansion, the short-term impact of such expansion on child development is a priori unclear. The next section will empirically test and explore the actual existence and nature of such a trade-off.

5 The Income versus the Substitution Effect

This section investigates whether the expansion of the EITC program shaped the trade-off discussed in the theoretical framework between the income versus the substitution effect on child development. A progressively more generous program determines an income effect for families exposed to the program. Such income effect likely fosters child development. At the same time, the program structure and eligibility criteria might create work incentives for mothers. This labor supply response might affect parental time investment (quantity and quality) in child development. If this were true, the quality of alternative inputs and sources of childcare become crucial to foster child development.

We provide a dual analysis for the existence of the trade-off between the income and the substitution effect. First, we replicate the event study analysis by focusing on family income and maternal labor supply as outcomes of interest. Second, we perform an IV analysis to isolate the effect of family income and maternal labor supply on child development. The evidence obtained through this dual analysis will serve to rationalize the above-described reduced-form effects of the EITC expansion on child development.[22]

[22]See Del Boca et al. (2014), Francesconi et al. (2015) and Mullins (2016) as examples of structural models of household choices and child development that discuss the money versus time trade-off.

5.1 Event Study Evidence

We start with the event study analysis of the effect of the 1993 EITC expansion on family income and maternal labor supply. The event study specification mimics the one in Section 4.1 for child development and includes three pre- and post-reform years. The treatment group consists of those families that received EITC benefits at least once pre-1993 or those with members that never worked before the reform. With respect to the analysis of child outcomes that are measured every two years, we observe annual data for family income and maternal labor supply for the pre-1993 period.[23] We control for mother/family characteristics, namely number of children and race. The control variables are fully interacted with the treatment variable.

Figures 3(a) and 3(b) show the analysis of family income and maternal yearly hours worked, respectively. The x-axis reports the years in which the outcome is measured. The y-axis reports the effect on family income and maternal labor supply for the treatment group compared to the control group.

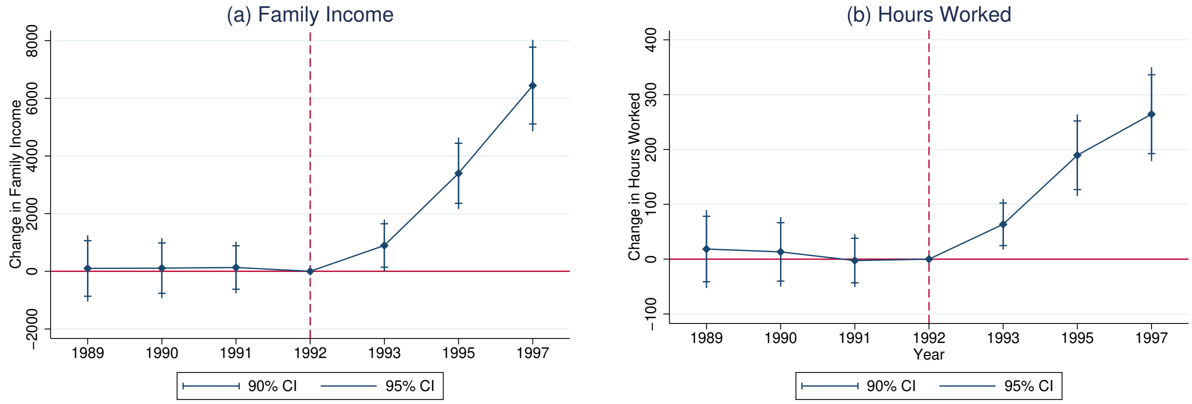
Figure 3(a) displays a sizable positive effect of the 1993 EITC expansion on family income. Pre-1993, the treatment and the control groups report identical trends in family income. Starting in 1993, the treatment effect of the reform becomes positive, statistically significant, and increasing over time. In 1993, the point estimate amounts to an extra \$864 for the treatment group with respect to the control group. The effect increases to about \$3,400 and \$6,400 in 1995 and 1997, respectively.

The post-reform increase in family income might be driven by the increase in EITC generosity as well as by responses in maternal labor supply. Indeed, the EITC work requirements might induce mothers to work or to work more to become eligible for the EITC or to qualify for higher benefits. Figure 3(b) highlights the positive labor supply effect of the EITC expansion. Pre-reform, the treatment and control groups are on parallel trends. Right after the reform, the treatment group starts a positive trend with respect to the control group. On average, the 1993 EITC expansion increases maternal (yearly) hours worked by 65, 187, and 264 compared to the control group in 1993, 1995, and 1997, respectively.[24]

[23]Family income and labor supply information are available in the NLSY annually until the 1994 survey wave.

[24]Figure A.1 replicates the analysis of maternal hours worked by augmenting the specification with the set of controls for state welfare waivers and unemployment level (and their interaction with the treatment condition) that Kleven (2020) finds lowers the estimates of the effect of the 1993 EITC reform on single mothers' labor supply at the extensive margin. Results remain similar.

Figure 3: The 1993 EITC Reform, Family Income, and Maternal Labor Supply



This figure shows the evolution over time of the effect of exposure to the EITC program on family income and maternal labor supply. Dependent variables: change in family income (in year 2000 dollars, left panel), change in maternal labor supply (in hours per year, right panel). The y-axis shows the point estimates for the interaction of the indicator variable for the treatment group with indicator variables for each year. The treatment group is defined as the group of families that received EITC benefits at least once pre-1993 or those with members that never worked before the reform. The x-axis reports years. The red, vertical, dashed line visually separates the pre-reform and the post-reform periods. The model includes control variables for a child's race and number of children in the household. Each control variable is also interacted with the indicator variable for the treatment group. See text for further details. The figure reports 90 percent and 95 percent confidence intervals based on standard errors clustered at the family level.

The event study analysis sheds light on the potential drivers of the effect of the EITC expansion on child development. The analysis highlights a potential trade-off between the income and the substitution effect. On the one hand, we observe a surge in family income with the potential to improve resources available to foster child development. On the other hand, the substitution effect induced by the increase in maternal working time might also affect a child's development, making the quality and quantity of alternative inputs crucial in the child development process. The IV analysis below will further explore this trade-off, while Section 6 will focus on changes in parental inputs induced by the EITC expansion.

5.2 IV Analysis

Empirical Model and Identification. The IV analysis aims to unveil the mechanisms behind the reduced-form results. The theory in Section 2 provides useful exclusion restrictions to test the theory of the income versus the substitution effect on child development. In particular, the IV analysis allows us to isolate the single causal impact of family income and maternal hours worked on child development. The regression model takes the following form:

$$y_{i,t} = \beta_0 + \alpha_0\, t + \alpha_1\, I_{i,t} + \alpha_2\, L_{i,t} + x_i'\, \beta_{1,t} + x_{i,t}'\, \beta_2 + \eta_i + \epsilon_{i,t} \quad , \tag{16}$$

where $y_{i,t}$ represents the child's outcome (math-reading test score or BPI) in period t. $I_{i,t}$ and $L_{i,t}$ reflect the after-tax total family income and the maternal labor supply (yearly hours worked) at time t. All other variables in the equation are the same as in Equation (13).

First differences allow us to eliminate child (family) fixed effects and to obtain our baseline IV specification:

$$\Delta y_{i,t} = \alpha_0 + \alpha_1 \Delta I_{i,t} + \alpha_2 \Delta L_{i,t} + x_i' \beta_1 + \Delta x_{i,t}' \beta_2 + \Delta \epsilon_{i,t} \quad . \tag{17}$$

α_1 and α_2 are the parameters identifying the income and maternal labor supply effect on child development. The coefficient α_1 expresses the effect of changes in family income on changes in child development, and α_2 captures the effect of changes in yearly hours worked on changes in child development.

The identification of Equation (17) is challenging due to the endogeneity of both family income and maternal labor supply. Changes in family resources and *intra-family* labor market decisions can be correlated with family-specific unobserved permanent shocks, which threatens the validity of an OLS approach. We deal with this issue by implementing an IV estimation strategy based on exclusion restrictions of the two variables constructed in Section 3: longitudinal exogenous changes in the EITC schedule ($\Delta EITC_{i,t}$) and longitudinal variation in local demand for female labor ($LabDemShocks_{i,t}$).

The conditional independence of the instrumental variables is sufficient to interpret as causal the reduced-form effect on child development. However, the IV framework requires the exclusion restrictions for the two instruments to hold in order to interpret our estimates as the causal effect of family income and maternal labor supply. The EITC variable is constructed to isolate exogenous changes in the policy without relying on any endogenous response at the child or family level. The exclusion restriction of local demand for female labor requires labor demand shocks to affect children's outcomes through either changes in after-tax family income or changes in maternal labor supply and not directly in any other way. One concern potentially undermining the exclusion restriction relates to the fact that local labor demand shocks might affect employment and the allocated resources in the education industry. We will perform a specific test below to test the reliability of the exclusion restriction for the instrument based on local labor demand.

With these two instruments available, we estimate the following first stage for each of the endogenous variables $\Delta W \in \{\Delta I, \Delta L\}$:

$$\Delta W_{i,t} = \gamma_0 + \gamma_1 \Delta EITC_{i,t} + \gamma_2 LabDemShocks_{i,t} + x_i' \gamma_3 + \Delta x_{i,t}' \gamma_4 + \Delta u_{i,t} \quad , \tag{18}$$

with variables defined as usual. The second stage becomes:

$$\Delta y_{i,t} = \alpha_0 + \alpha_1 \widehat{\Delta I_{i,t}} + \alpha_2 \widehat{\Delta L_{i,t}} + x_i' \beta_1 + \Delta x_{i,t}' \beta_2 + \Delta \epsilon_{i,t} \quad , \tag{19}$$

where $\widehat{\Delta I_{i,t}}$ and $\widehat{\Delta L_{i,t}}$ are the predicted changes in family after-tax income and hours worked by the mother obtained through the first-stage estimates.

IV Estimates. We estimate two versions of Equation (19). The first specification, our baseline model, includes controls for a child's gender, age, and race, for number of children in the household, year, as well as the set of controls for family income trend. The second specification further controls for state time trends by adding state fixed effects. Indeed, the possible existence of state-specific trends in children's skill formation represents a potential threat to the validity of our IV analysis. The conditional independence of the instrument based on labor demand shocks requires that unobserved *changes* in children's skills in 1986–2000 are not correlated with the state-specific industrial compositions in the Unites States in 1980. All the models, at both the first and second stages, are estimated by clustering standard errors at the family level.

Table 5 reports the first-stage estimates.[25] We start by analyzing the first-stage results for the baseline specification without state fixed effects. Column (1) displays the first-stage estimates for family income. The expansion of the EITC has a positive effect on family income. A \$1,000 increase in EITC benefits induces a \$1,330 increase in after-tax family income. The size of the effect of the EITC expansion is in line with expectations. Indeed, a coefficient larger than one masks the two main effects implied by the EITC expansion. First, an increase in EITC generosity translates into higher family income. Furthermore, the EITC effect on maternal labor supply, anticipated in the event study analysis, also implies additional earnings at the family level. The second instrumental variable has the expected sign: positive shocks in the local demand for female labor boost family income. An upward shift in the labor demand directly affects worker compensation and family resources. In our framework, an increase by one percent in the employment rate relative to 1980 predicts an increase of about \$2,300 in after-tax family income.

[25] For the sake of brevity, we only report the first stage for the sample used for the analysis of cognitive development. The whole set of first stages is reported in Table A.3.

Column (2) of Table 5 presents the first-stage estimates for maternal hours worked. In our sample, increases in EITC benefits induce, on average, positive shifts in maternal labor supply. A $1,000 increase in EITC benefits causes an average increase of about 202 yearly hours worked. The EITC effect on labor supply is aligned with the findings in the literature summarized in Nichols and Rothstein (2016).[26] Shocks in local demand for female labor induce changes in hours worked. A one percent surge in the employment rate relative to 1980 induces an increase of around 44 yearly hours worked by mothers. This means that, for the average mother who works 1,242 hours per year (see Table 1), a one percent increase in the employment rate in her local labor market causes an increase of more than three percent of her labor supply.

Table 5 also shows that first-stage estimates remain similar in the specification with state fixed effects. Similarity holds both for family income (column 3) and maternal labor supply (column 4). If anything, the coefficient for the EITC effect on family income tends to become slightly larger (1.53 versus 1.33) while, controlling for state fixed effects, almost doubles the effect of labor demand shocks in both first stages.

Importantly, in addition to the evidence of strongly significant first-stage coefficients in both specifications, the bottom part of the table displays the diagnostic tests for each first stage. All the tests suggest that the instruments work particularly well in both specifications and that our estimates are not threatened by weak identification or underidentification.

Table 6 reports second-stage estimates. Columns (1) and (2) of the table report estimates for the effect of family income and maternal hours worked on children's cognitive development. In the baseline specification in column (1), family income positively affects a child's cognitive achievement. A $1,000 increase in after-tax family income, ceteris paribus, generates a three percent of a standard deviation increase in the math-reading test score. This result, although achieved through a different estimation framework, is aligned with Dahl and Lochner (2017).[27] Conversely, an increase in maternal hours worked induces a statistically significant negative effect on the math-reading test score. A 100-hour per year increase in maternal work, all else being equal, leads to a three percent of a standard deviation decrease in the score. Augmenting the specification with state fixed effects (column 2) leaves the results unaltered.

[26] This result also aligns with the sizable and positive EITC effect on single mothers' labor supply found in Agostinelli et al. (2020).

[27] Dahl and Lochner (2017) find that an additional $1,000 of family income causes an increase of 4.1 percent of a standard deviation in children's cognitive achievement.

Columns (3) and (4) of Table 6 show the IV analysis of behavioral development as measured by the BPI score. In column (3), the income effect on child behavioral development is negligible (about one percent of a standard deviation) and weakly significant, while it is a precisely estimated zero in the specification with state fixed effects (column 4). While changes in family income considerably affect cognitive development, behavioral development appears less sensitive (at least in the short term) to shocks in family income. The effect of labor supply on behavioral development fairly mimics the one for cognitive development. Maternal hours worked negatively affect child short-term behavioral development. A 100-hour per year increase in maternal work causes a three percent of a standard deviation decrease in short-term behavioral development regardless of the empirical specification analyzed.

Finally, in columns (7) and (8) we analyze the combined measure for child development consisting of both the cognitive and the behavioral dimensions. The analysis reveals the existence of a positive and significant income effect counterbalanced by a negative impact of maternal labor supply.

We run some robustness tests for our IV estimates. As for the reduced-form analysis, in Table 7 we test concerns of endogenous eligibility to EITC benefits and exogenous trends in child development. To this purpose, in Panel A of the table, we augment our specification with the two-period (four years) lagged family income. In Panel B, we use the three-period (six years) lagged family income. Moreover, in columns (2), (4), and (6), we further restrict the analysis to the sample of families with initial income (t-1) below $35,000.[28] Qualitatively, all the specifications display similar results with evidence of the trade-off between the income and the substitution effect on child development. From a quantitive viewpoint, point estimates are slightly larger than the baseline ones and, in some cases, display lower levels of statistical significance. However, two aspects are worth noting. First, the income effect is again always positive and larger for cognitive development than for behavioral development. The labor supply effect arises independently on the outcome variable. Second, the ratio between the income and the labor supply coefficient is remarkably similar to the one in the baseline analysis, therefore suggesting the same degree of income versus hours worked substitutability. Overall, this analysis reassures us of the stability of IV estimates to different strategies to test our concerns.[29]

As anticipated, local labor demand shocks might affect employment and the allocated re-

[28] Section 4.2 describes the intuition underlying these tests.

[29] As a further robustness check, we analyze the effect of a family's total hours worked. Table A.5 in the Appendix shows the results when we consider total hours worked at the family level (mother and spouse) instead of maternal hours. The results are unchanged.

sources in the education industry, therefore undermining the exclusion restriction of the instrument based on local demand for female labor. To take into account this potential concern, we have replicated our IV estimates after augmenting the model with variables for the change in per pupil total revenues and per pupil total current expenditures by state and over time. We use data about school resources from the CDD National Public Education Financial Survey, and we focus attention on two measures for revenues and expenditures per pupil.[30] Revenues per pupil are measured as the total revenues from all sources divided by the fall enrollment. Total current expenditures per pupil is defined as the total current expenditures for public elementary and secondary education divided by the fall enrollment. We augment the baseline model by adding both variables (in $1,000) expressed in difference with respect to the previous period. We show the results in Table A.4.[31] As usual, for each outcome, we estimate a baseline specification and a specification augmented with state fixed effects. The analysis shows that point estimates for both the effects of family income and hours worked by the mother are unchanged with respect to the specifications without controls for school financial and economic resources.

5.3 Heterogeneity in the Trade-Off

This section replicates the baseline analysis by focusing on various subpopulations of interest. We look for evidence of heterogeneous treatment effects induced by the EITC expansion. We aim to understand whether the effect of the EITC expansion is similar for different subgroups of mothers or children. For policy-making purposes, we are particularly interested in further exploring the negative effect of EITC-induced surges in maternal hours worked on child development before we discuss parenting practices and investments in Section 6.1.

The effect of maternal labor supply might be driven by (at least) two different factors. First, increases in maternal labor supply might decrease the quantity and quality of parental time investments in child development. Second, as explored in Section 6.1, surges in parental working time might affect the child-parent attachment as well as parental opportunities to monitor a child development and activities. Therefore, the quality and nature of alternative inputs and forms of childcare used to replace (or complement) parental time become crucial to avoid slowing down the child development process. However, high-quality alternative

[30] The CDD National Public Education Financial Survey's primary purpose is to make available to the public an annual state-level collection of revenues and expenditures for public education for students in prekindergarten through grade 12.

[31] Sample sizes are reduced with respect to the baseline exercise as data on school resources are only available starting in 1987.

inputs might be unavailable, unaffordable, or unknown to parents. Bernal and Keane (2011) show that informal care (grandparents, siblings, other relatives, parents' friends) has adverse effects on child development as measured through test scores. Moreover, they report that more than 75 percent of single mothers use informal care. Løken et al. (2018) show that in Norway, alternative forms of care (formal after-school care, informal care, unsupervised time at home) for children affected by a work-encouraging reform targeted at single mothers were not a perfect substitute for maternal care. We start with the analysis of the existence of possible heterogeneity in the treatment effect, and in Section 6.1, we home in on time investments with an emphasis on the distinction between quantity and quality time.

We investigate three different sources of heterogeneity: maternal educational level, maternal marital status, and child's age. We compare maternal educational levels by dividing the sample into mothers with at most a high school degree (*Low Education*) and mothers with some college education or more (*High Education*). We analyze marital status by comparing married mothers with unmarried mothers. Finally, we study heterogeneous effects by a child's age by dividing the sample into children under and over 12 years old.

We run two different analyses. The first analysis resembles the one in Section 4.2 and focuses on the subgroups' reduced-form effect on child development of the EITC expansion over time. Table 8 shows the reduced-form estimates (by subgroups) for a specification including only the standard control variables and an additional one augmented with state fixed effects. We analyze cognitive (columns 1 to 4) and behavioral (columns 5 to 8) development. The second analysis, reported in Table 9, performs the IV estimates as in Section 5.2 to isolate the income versus the labor supply effect on child cognitive (columns 1 and 2) and behavioral (columns 3 and 4) development. Overall, our results suggest that the unintended consequences for child development are most pronounced for disadvantaged families, although differences between subgroups are not statistically significant. However, we believe that the point estimates in Tables 8 and 9 display some interesting qualitative patterns.[32]

We start with the reduced-form analysis of cognitive development. The analysis by maternal education highlights an interesting result. Indeed, the negative effect induced by the EITC expansion only arises for low-educated mothers.[33] Conversely, for highly educated mothers,

[32]We decompose our predicted exogenous changes in our two endogenous variables in a two-stage least squares fashion, in which we allow the second-stage coefficients for income and hours worked to vary by mother's level of education, marital status, and child's age. We implement a family-level clustered bootstrap procedure (100 repetitions) to obtain the adjusted standard errors. For the sake of brevity, we do not report heterogeneous analysis for combined cognitive-behavioral development. Results for this analysis display similar patterns as the ones for the other outcomes.

[33]The specification with state fixed effects displays a negative coefficient that is statistically nonsignificant

the EITC expansion has a positive, statistically nonsignificant impact on cognitive development. The IV analysis displays a similar income effect by educational subgroups. However, the labor supply effect is only detected for low-educated mothers (-3 percent of a standard deviation). In other words, considering maternal education as a source of heterogeneity, the negative effect of hours worked shown in the IV analysis in Section 5.2 seems to be driven by the subgroup of mothers with low educational levels. Mothers with higher educational levels are likely to have access to better resources and to use higher quality alternative inputs for their children, therefore possibly mitigating the negative impact induced by their increase in individual labor supply.

The analysis of marital status displays a negative reduced-form effect of the EITC expansion only for the group of unmarried mothers. For unmarried mothers the effect turns to a positive value. Unsurprisingly, unmarried mothers constitute the only group of mothers with a significant negative labor supply effects in the IV analysis in Table 9 (columns 1 and 2 of the second panel). Results by marital status seem to suggest that married mothers have easier access to alternative forms of childcare to compensate for a surge in maternal labor supply.

Younger children seem more affected by the EITC expansion. The EITC reduced-form effect is statistically significant only for children below the age of 12. Moreover, despite a homogenous income effect by age subgroups, the negative effect of maternal hours worked seems slightly larger (at least in the baseline specification) for younger children. The effect induced by maternal labor supply might be larger when the child is younger and needs more supervision and parental care. Heterogeneity by age in the response to the EITC expansion is further discussed in Section 6.1.

The analysis of behavioral development depicts a different picture. The reduced-form estimates of the EITC expansion are negative and similar for all subgroups. By maternal education, the negative impact of EITC expansions seems only statistically significant for low-educated mothers. For marital status, the point estimates are slightly larger for married mothers. Again, the EITC expansion seems more detrimental for younger children. The IV analysis points to the absence of the income effect on behavioral development; the negative impact of maternal labor supply is quite homogeneous across population subsamples.

The heterogeneous analysis for cognitive and behavioral development further highlights the different accumulation process for cognitive versus behavioral skills. The negative impact

at the conventional levels.

of maternal labor supply on short-term cognitive development appears as mainly driven by the quality level of the alternative inputs in the child development process. For mothers from more-advantaged backgrounds and with more resources, as proxied by education and marital status, there is no evidence of a detrimental impact of maternal labor supply on short-term child development. These parents likely employ high-quality alternative inputs for the child when an increase in individual labor supply occurs. Alternatively, they are able to more productively substitute the quantity of time with the quality of time devoted to their children. The next section further explores these aspects to infer insights on how to design policies able to contemporaneously foster maternal labor supply and child development. Our findings are consistent with Berlinski et al. (2020), who estimate a novel structural model of endogenous demand and supply of childcare services. The authors find that access to high-quality childcare services is a key input for child development while supporting working mothers.[34]

6 Hours Worked and Child Development: To the Roots of the Result

This section digs into the mechanisms behind the impact of maternal hours worked on child development. This analysis is crucial to inform policymakers about the trade-off some policies might imply and on possible tools with the potential to contemporaneously foster maternal employment and child development. First, we analyze how parenting practices and investments respond to the expansion of the EITC program. Second, we analyze the effect on child development of local shocks on the labor market demand for female labor. This analysis unveils that maternal labor supply is not per se detrimental when it comes to children's short-term cognitive and behavioral development, but instead, that the unintended consequences on children's development are specific to some responses induced by the structure of the EITC program and its expansion over time.

[34]Our results are also in line with Rodríguez (2020), who analyzes the workfare experiment "New Hope" in Milwaukee. The author finds that when the EITC expansion and work requirements are bundled with generous childcare subsidies, the reform did not generate unintended consequences. On the contrary, it had positive effects on the academic performance of children.

6.1 Quantity and Quality Responses of Parental Investments

This section investigates parental responses to the EITC expansion. Did parents change their behavior and educational activities with their children in response to the EITC expansion? Did the quality of the parent-child interactions change? The answers to these questions are informative to understanding the mechanisms behind the substitution effect on child development induced by labor supply. An endogenous increase in investments (quantity) in the home environment and educational activities could offset the potential unintended consequences of the EITC expansion on child development. At the same time, a deterioration of the quality of the parent-child interactions, for a fixed quantity, could negatively affect a child's development.

We study parenting practices and quality of the parent-child interactions through the lens of cognitive support, emotional support, and involvement in a child's education. We measure cognitive support with the NLSY Cognitive Stimulation Score. The cognitive stimulation score proxies the level of cognitive stimulation in a child's home environment. The score is based on combined information as reported by the mother and the interviewer. For example, the mother reports the number of books available to the child, about parent-child reading activities, whether there is a musical instrument in the home, whether there are newspapers at home, etc. The interviewer reports her own impression on the overall quality of the home environment covering, among other things, aspects related to the rooms' luminosity and cleanliness. Mother's and interviewer's answers are then used to construct an overall score on a 160-point scale. Given the nature of the items, the cognitive stimulation score seems to better capture elements related to the "quantitative" aspect of the parental investment in child development.

We proxy the quality of the parent-child interaction with the NLSY Emotional Support Score. This score captures the level of emotional support each child is exposed to in the home environment. Also this score is based on combined information as reported by the mother and the interviewer. The mother reports about parental warmth (e.g., the quality of the interaction with parents, frequency of interactions with other people such as relatives and friends) or a child's involvement in home activities (e.g., making her own bed, cleaning her own room, bathing herself). The interviewer describes the mother-child interaction during the interview covering aspects related to the tone used by the mother to deal with the child or the attempt of the mother to actively involve the child in her interview. Mother's and interviewer's answers are then used to construct an overall score on a 140-point scale. The emotional support score appears to be more adept at proxying elements related to the "qualitative" aspect of the parental relationship (and investment) with the child.[35]

Finally, we measure maternal involvement in a child's education by considering the response to a child's poor scholastic performance. The NLSY data inspect several possible maternal reactions in response to hypothetical low school grades. In particular, each mother is asked to report on the seven following reactions to low grades: contact teacher or principal, lecture child, supervise child more closely, talk with child, see if child improves on own, tell child to study more, help more with schoolwork.[36] Each variable is expressed on a 5-point scale from "Very likely" (1) to "Not at all likely" (5). To simplify interpretation, we have reverted the scale so that larger values imply a more intense maternal response to low grades.

We estimate the reduced-form effect induced by exogenous EITC policy changes on changes in parenting practices and quality of the parent-child interactions by estimating the same specification as in Equation (14) with the cognitive stimulation score, the emotional support score, and maternal response to low grades as outcomes of interest. To ease the interpretation of the results, each outcome is standardized to obtain a measure with a mean of zero and a standard deviation of one and is expressed in first differences (difference between the current value and the value of the same variable from the previous survey wave).[37] Our analysis also takes into account that parenting practices might differ and produce differential effects depending on a child's age.[38]

Figure 4 graphically shows the results of the analysis.[39] Specifically, the figure shows the estimated coefficients for a specification that includes the variable for policy-induced changes in EITC benefits ($\Delta EITC_{i,t}$) interacted with three indicator variables for a child's age. The first indicator is for children below age 8, the second for those aged 9–11, and the third

[35]Refer to the NLSY website for more detailed information on the home environment scales and the full list of variables used for their construction. The cognitive stimulation and emotional support subscales are validated measures that are frequently used as outcomes of interest predicted by various family circumstances and as predictors of children's cognitive and behavioral performance.

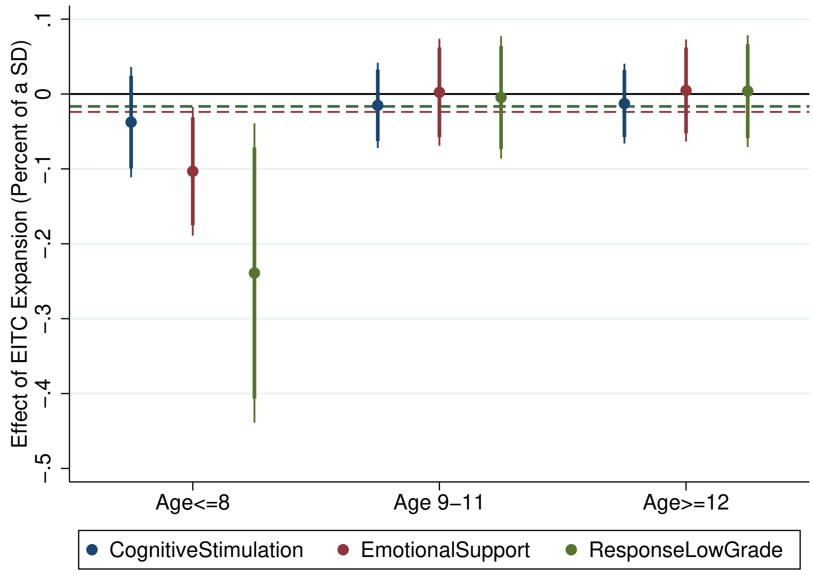
[36]The NLSY data also contain two additional maternal responses to low grades, namely "punish child" and "limit non-school activities." We have excluded from the analysis the variable for punishment as it is difficult to objectively characterize this behavior as a driver of child development due to its possible detrimental effect, for example, through the disruption of the parent-child relationship. The variable for limitation of activities is not included as it was not asked in the first waves of the NLSY. Results remain similar if these two variables are also included in the analysis.

[37]For maternal response to low grades, each item is standardized to have a mean of zero and a standard deviation of one. Then, the items are aggregated in a comprehensive measure by computing the average of the seven standardized single items. Finally, the average is rescaled to have a mean of zero and a unitary standard deviation.

[38]The importance of considering a child's age follows the analysis of heterogeneous treatment effects.

[39]The analysis in the figure is obtained through the baseline specification without state fixed effects. Refer to Figure A.2 for the replication of the analysis based on the specification with state fixed effects. Table A.6 provides the whole set of results.

Figure 4: The EITC Expansion and Parental Investment and Behavior



This figure shows the reduced-form estimates for the effect of EITC policy changes on changes in parental investment and behavior. Dependent variables: change in cognitive stimulation score (blue), change in emotional support (maroon), and change in maternal response to low grades (green). The y-axis shows the point estimates (percent of a standard deviation) for the effect of EITC policy changes (dashed lines) or for the interaction of the EITC policy changes with indicator variables for a child's age group (dots). The x-axis reports age groups. The model includes control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. The specification by child's age also includes indicator variables for each age group. See text for further details. The figure reports 90 percent and 95 percent confidence intervals based on standard errors clustered at the family level.

one is for children aged 12 or older. Each of these indicator variables for a child's age is also included in the regression. Each dot (with the respective spike) illustrates the point estimate for the EITC effect by age groups. The blue dots stay for the regression with cognitive stimulation as outcome of interest. Maroon is for the emotional support regression and green is for the maternal response to low grades.[40] For reference, the colored, dashed, horizontal lines represent the overall EITC effect (no heterogeneity by age) on cognitive stimulation, emotional support, and maternal response to low grades.

The figure conveys several insights. First, none of the point estimates are positive. Neither the analysis undifferentiated by age (dashed lines) nor the one considering heterogenous effects by age (dots) display evidence of positive effects induced by an increase in EITC

[40]Each color summarizes a regression. In other words, dots of the *same* color represent the coefficients of the interaction terms from the *same* regression.

benefits. By looking at the dashed lines, we observe a negative, statistically nonsignificant point estimate of about two percent of a standard deviation in the cognitive stimulation score, the emotional support score, and in maternal response to low grades. These effects hide vast heterogeneity by children's age. On the one hand, the cognitive stimulation score is quite similar across age groups. On the other hand, the emotional support score is strongly negative and statistically significant for the group of children below age 8: an increase of $1,000 in EITC benefits decreases the parental emotional support score by about ten percent of a standard deviation. The effect is zero for older children. The results for maternal response to low grades is similar as, despite lower precision, a large negative effect (more than 20 percent of a standard deviation) arises for the younger age groups, and a zero effect is found for older children.

Table A.7 aims to investigate the possible link between the IV results on the income versus the substitution effect and the responsiveness of parental investments to the EITC expansion. In particular, we test whether a lower level of parental involvement is a direct consequence of EITC-induced increases in labor supply. Our specification in first differences estimates the effect of changes in maternal hours worked on changes in the cognitive stimulation score (columns 1 and 2), the emotional support score (columns 3 and 4), and maternal response to low grades (columns 5 and 6). For each outcome, the first specification includes the usual set of control variables and the second one also includes state fixed effects. Maternal hours worked are treated as endogenous and instrumented with the variable for longitudinal changes in EITC benefits. Surges in maternal labor supply do not generate any increase in parental investments. Specifically, the table shows that an increase in hours worked leaves unaffected the cognitive stimulation score, while it causes a decrease in the emotional support score and in maternal response to low grades. This effect is sizable (6 to 11 percent of a standard deviation in response to a 100-hour increase) but, in line with previous results, only appears for younger children below age 8.

In sum, the results in this section show no evidence of positive compensating behavior for parents due to their increased labor supply. This evidence is consistent with the results in Bastian and Lochner (2020), where the authors show that the increase in maternal work time associated with the EITC expansion decreased time with children but had no effect on educational activities. Our findings shed light on the quality of the parent-child interactions, a potential driver of child development difficult to capture with time diary data. For younger children there is evidence of a negative impact of the EITC expansion on the quality of the parent-child interaction, as well as on the maternal response to low grades.[41]

[41] Even though the effects are mainly visible for younger children, the change in parenting practices can

6.2 Female Labor Demand and Child Development

Throughout the paper we have provided evidence of the unintended consequences of EITC reforms on child development via labor supply adjustments. Here, we investigate whether similar labor supply effects arise for the case of shocks in local demand for female labor. Table 10 shows the effect of local demand for female labor on a child cognitive (columns 1 and 2), behavioral (columns 3 and 4), and combined cognitive-behavioral development (columns 5 and 6). For each outcome, we estimate a specification that includes the usual set of control variables and a second set augmented with state fixed effects.

The analysis depicts an insightful picture: surges in local demand for female labor do not generate any negative effect on short-term child development. An expansion in the labor market demand for mothers causes a boost in child cognitive development and has no detrimental impact on a child's behavioral development. Quantitatively, the analysis of cognitive development in columns (1) and (2) suggests that a one percent surge in the employment rate relative to 1980 induces a significant boost in the math-reading cognitive score of 5 to 10 percent of a standard deviation. The effect on behavioral development is also positive (about 1 to 2 percent of a standard deviation) but statistically nonsignificant. The positive effect of the female labor demand also arises in the analysis of the combined cognitive-behavioral measure in the last two columns of the table. This evidence reassures of the fact that maternal hours worked do not necessarily harm a child's development.

How do we rationalize the opposite effects on child development of EITC-induced labor adjustments versus the ones implied by surges in local demand for maternal labor? Our theory of the income versus the substitution effect on child development helps answering this question. Indeed, changes in the local labor market conditions can generate higher returns to working hours, with the local general equilibrium effects that can boost hourly wages for mothers. Conversely, the large increase in labor supply created by the EITC expansion can drive wages down (Rothstein, 2010). Under this hypothesis, the EITC expansion and shocks in female labor market demand can differentially affect child development because they differentially affect the change in disposable income per unit change of hours worked. The first-stage estimates in Table 5 confirm this intuition. Female labor demand shocks generate a change in disposable income per unit change of hours worked that is more than six times larger than the one generated by the EITC expansion.[42]

persist throughout childhood via dynamic complementarities in the skill-formation process (Heckman and Mosso, 2014).

[42]This value is calculated, in the most general specification with state fixed effects, through the ratio of the

7 Conclusion

Workfare programs like the EITC—which have been proven to successfully incentivize work and to improve the economic conditions of low-income families—can create a natural trade-off between working and parenting. This is especially relevant for the most disadvantaged families, who have limited access to high-quality alternative forms of childcare.

In this paper, we provide empirical evidence of this trade-off. Our results show that children from disadvantaged families experienced some losses in their short-term cognitive and even more losses in behavioral development induced by the EITC expansions in the 1990s. We reconcile these unintended consequences of the policy with a theory-driven empirical analysis of the trade-off between the *income* effect (economic resources) and the *substitution* effect (time and quality of the parent-child interactions) on the development of a child.

Putting all the evidence together, our results call for policymakers to consider this trade-off when designing policies that incentivize work. We show that maternal labor supply is not detrimental per se when it comes to short-term cognitive and behavioral child development. However, large-scale workfare policies can generate unintended consequences on already disadvantaged children if they are not paired with complementary policies that: (i) promote investments from companies on the human capital of their workers to foster the return to work; and (ii) grant access to high-quality childcare supplements for low-income families.

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Table 1: Summary Statistics

	Math-Reading Sample		Behavior Problems Index Sample	
	Mean (1)	St.Dev. (2)	Mean (3)	St.Dev. (4)
Math-Reading	44.09	13.34	44.25	13.34
Behavior Problems Index	3.20	1.13	3.20	1.13
Family income	36,730	30,132	37,118	29,649
Hours worked (yearly)	1,242	986	1,212	982
Age	10.62	2.29	10.01	2.54
Male	0.50	0.50	0.50	0.50
White	0.46	0.50	0.48	0.50
Black	0.34	0.47	0.32	0.47
Hispanic	0.20	0.40	0.20	0.40
No siblings	0.09	0.29	0.10	0.30
One sibling	0.37	0.48	0.38	0.49
Two or more siblings	0.54	0.50	0.52	0.50
Mother's marital status:				
Married	0.63	0.48	0.64	0.48
Mother's education:				
High school dropout	0.23	0.42	0.23	0.42
High school graduate	0.50	0.50	0.50	0.50
Some college	0.20	0.40	0.20	0.40
Graduated college	0.07	0.26	0.08	0.27
Observations	13,532		15,503	

This table shows the summary statistics of our estimating samples. Columns (1) and (2) refer to the estimating sample for the analysis of child cognitive development (combined Math-Reading test score). Columns (3) and (4) consider the estimating sample for the analysis of child behavioral development (Behavior Problems Index, BPI). Income is after-tax income and it is measured in year 2000 dollars.

Table 2: EITC Expansion and Child Development

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Δ EITC	-0.03**	-0.02*	-0.05**	-0.05**	-0.05***	-0.04**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	13,532	13,532	15,503	15,503	11,818	11,818
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

This table shows the reduced-form estimates for the effect of EITC policy changes on child development. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). Columns (1), (3), and (5) refer to the specification with control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 3: EITC Expansion and Child Development: Robustness Tests

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Panel A: Controlling for Lagged Income $t-2$						
Δ EITC	-0.02*	-0.02*	-0.05**	-0.05**	-0.05**	-0.05**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	12,212	6,855	13,662	7,495	10,656	5,876
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Income $t-2$	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Whole	I<35K	Whole	I<35K	Whole	I<35K
Panel B: Controlling for Lagged Income $t-3$						
Δ EITC	-0.03**	-0.03**	-0.05**	-0.06**	-0.05***	-0.06***
	(0.01)	(0.01)	(0.02)	(0.03)	(0.02)	(0.02)
Observations	10,471	5,660	11,527	6,039	9,138	4,844
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Income $t-3$	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Whole	I<35K	Whole	I<35K	Whole	I<35K

This table shows the reduced-form estimates for the effect of EITC policy changes on child development by augmenting the specification with additional controls for lagged family income. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). Columns (1), (3), and (5) refer to the specification with control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year, the set of controls for family income trend, and control variables for lagged family income. Columns (2), (4), and (6) refer to the same specification and to the restricted sample of families with initial income (t-1) below $35,000. Panel A includes control variables for 4-year lagged family income (2 periods, $t-2$). Panel B includes control variables for 6-year lagged family income (3 periods, $t-3$). EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 4: Maximum EITC and Child Development

	(1) Math-Reading	(2) Math-Reading	(3) Math-Reading	(4) BPI	(5) BPI	(6) BPI	(7) Combined	(8) Combined	(9) Combined
Δ MaxEITC	-0.02**	-0.03***	-0.02	-0.03**	-0.03**	-0.06***	-0.03***	-0.04***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.02)
Observations	13,532	12,212	6,855	15,503	13,662	7,495	11,818	10,656	5,876
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Age FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DepCh*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Age*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Income	No	Yes	No	No	Yes	No	No	Yes	No
Sample	Whole	Whole	I<35K	Whole	Whole	I<35K	Whole	Whole	I<35K

This table shows the reduced-form estimates for the effect of changes in the maximum federal and state EITC benefits on child development. Dependent variables: change in the Math-Reading test score (columns 1 to 3), change in the Behavior Problems Index (columns 4 to 6), and change in the combined cognitive-behavioral score (columns 7 to 9). All specifications include control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year. All specifications also include interaction terms between state (indicators) and year, number of dependent children (indicators) and year, and child's age (indicators) and year. Columns (1), (4), and (7) refer to the whole sample. Columns (2), (5), and (8) refer to the whole sample and are augmented with a control variable for 4-year lagged family income. Columns (3), (6), and (9) refer to the restricted sample of families with initial income (t-1) below $35,000. The maximum federal and state EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 5: Instrumental Variables: First-Stage Estimates

	(1) Δ Income	(2) Δ Hours	(3) Δ Income	(4) Δ Hours
Δ EITC	1.33***	2.02***	1.53***	2.08***
	(0.39)	(0.24)	(0.39)	(0.24)
Lab.Dem.Shocks	2.26***	0.44**	4.16***	0.83***
	(0.41)	(0.18)	(0.63)	(0.24)
Observations	13,532	13,532	13,532	13,532
Controls	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes
SW Chi-sq (Under id)	24.46	37.67	34.62	48.33
P-value	0.00	0.00	0.00	0.00
SW F (Weak id)	24.43	37.62	34.45	48.09
P-value	0.00	0.00	0.00	0.00
KP (Weak id)	12.26	12.26	17.74	17.74

This table shows the first-stage estimates for the IV analysis. Dependent variables: ΔIncome (columns 1 and 3) and ΔHours (columns 2 and 4). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1) and (2) refer to the specification with control variables for child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (3) and (4) refer to the same specification augmented with state fixed effects. Income and EITC benefits are measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. The analysis refers to the estimating sample for the analysis of child cognitive development (Math-Reading test score). See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 6: Instrumental Variables: Income, Hours Worked, and Child Development

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Δ Income	0.03***	0.03***	0.01*	0.00	0.02***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours	-0.03***	-0.03***	-0.03**	-0.03**	-0.04***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	13,532	13,532	15,503	15,503	11,818	11,818
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

This table shows the IV analysis for the effect of changes in family income and maternal labor supply on child development. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1), (3), and (5) refer to the specification with control variables for child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. Income is measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 7: Instrumental Variables: Robustness Tests

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Panel A: Controlling for Lagged Income $t-2$						
Δ Income	0.05**	0.05**	0.02	0.02	0.04**	0.03*
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Δ Hours	-0.06**	-0.06**	-0.04**	-0.05*	-0.06**	-0.06**
	(0.03)	(0.03)	(0.02)	(0.03)	(0.03)	(0.03)
Observations	12,212	6,855	13,662	7,495	10,656	5,876
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Income $t-2$	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Whole	I<35K	Whole	I<35K	Whole	I<35K
Panel B: Controlling for Lagged Income $t-3$						
Δ Income	0.05**	0.04*	0.02	0.01	0.04*	0.03
	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)	(0.02)
Δ Hours	-0.06**	-0.05**	-0.04**	-0.04	-0.06**	-0.05**
	(0.02)	(0.02)	(0.02)	(0.03)	(0.02)	(0.02)
Observations	10,471	5,660	11,527	6,039	9,138	4,844
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Income $t-3$	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Whole	I<35K	Whole	I<35K	Whole	I<35K

This table shows the IV analysis for the effect of changes in family income and maternal labor supply on child development by augmenting the specification with additional controls for lagged family income. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1), (3), and (5) refer to the specification with control variables for child's gender, age, and race, number of children in the household, year, the set of controls for family income trend, and control variables for lagged family income. Columns (2), (4), and (6) refer to the same specification and to the restricted sample of families with initial income (t-1) below $35,000. Panel A includes control variables for 4-year lagged family income (2 periods, $t-2$). Panel B includes control variables for 6-year lagged family income (3 periods, $t-3$). Income is measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 8: EITC Expansion and Child Development: Effect Heterogeneity

	(1) Math-Reading	(2) Math-Reading	(3) Math-Reading	(4) Math-Reading	(5) BPI	(6) BPI	(7) BPI	(8) BPI
				Mother's Education				
Δ EITC	-0.03**	-0.02	0.02	0.02	-0.04*	-0.05**	-0.05	-0.05
	(0.01)	(0.01)	(0.03)	(0.03)	(0.02)	(0.02)	(0.04)	(0.04)
Observations	9,870	9,870	3,662	3,662	11,187	11,187	4,316	4,316
Sample	Low Ed.	Low Ed.	High Ed.	High Ed.	Low Ed.	Low Ed.	High Ed.	High Ed.
				Mother's Marital Status				
Δ EITC	0.05	0.05*	-0.04***	-0.03*	-0.09*	-0.08	-0.04	-0.05*
	(0.03)	(0.03)	(0.02)	(0.02)	(0.05)	(0.05)	(0.02)	(0.02)
Observations	8,470	8,470	5,062	5,062	9,887	9,887	5,616	5,616
Sample	Married	Married	Unmarried	Unmarried	Married	Married	Unmarried	Unmarried
				Child's Age				
Δ EITC	-0.04**	-0.04*	-0.01	-0.01	-0.06**	-0.07***	-0.02	-0.01
	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Observations	8,575	8,575	4,957	4,957	10,776	10,776	4,727	4,727
Sample	Below 12	Below 12	Above 12	Above 12	Below 12	Below 12	Above 12	Above 12
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes	No	Yes

This table shows the heterogeneity in the reduced-form estimates for the effect of EITC policy changes on child development. Dependent variables: change in the Math-Reading test score (columns 1 to 4) and change in the Behavior Problems Index (columns 4 to 8). The following sources of endogeneity are investigated: (i) mother's educational attainment (Low Education: high school diploma or less; High Education: some college or more); (ii) mother's marital status (Married; Unmarried); and (iii) child's age (Below 12; Above 12). Columns (1), (3), (5), and (7) refer to the specification with control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), (6), and (8) refer to the same specification augmented with state fixed effects. EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 9: Instrumental Variable and Effect Heterogeneity

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI
	Mother's Education			
Δ Income*Low Ed.	0.02**	0.02***	0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Income*High Ed.	0.02*	0.03***	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours*Low Ed.	-0.03***	-0.03***	-0.03**	-0.02*
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours*High Ed.	0.01	-0.01	-0.03*	-0.03
	(0.02)	(0.02)	(0.02)	(0.02)
	Mother's Marital Status			
Δ Income*Married	0.02**	0.03***	0.02	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Income*Unmarried	0.03**	0.03***	0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours*Married	-0.00	-0.01	-0.05**	-0.04*
	(0.02)	(0.02)	(0.03)	(0.02)
Δ Hours*Unmarried	-0.04***	-0.04***	-0.03*	-0.02*
	(0.01)	(0.01)	(0.01)	(0.01)
	Child's Age			
Δ Income*Below 12	0.03***	0.03***	0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Income*Above 12	0.03***	0.03***	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours*Below 12	-0.05***	-0.04**	-0.03**	-0.02*
	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours*Above 12	-0.02	-0.03**	-0.03	-0.03*
	(0.01)	(0.01)	(0.02)	(0.02)
Observations	13,532	13,532	15,503	15,503
Controls	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes

This table shows the heterogeneity in the IV estimates for the effect of changes in family income and maternal labor supply on child development. Dependent variables: change in the Math-Reading test score (columns 1 and 2) and change in the Behavior Problems Index (columns 3 and 4). The following sources of endogeneity are investigated: (i) mother's educational attainment (Low Education: high school diploma or less; High Education: some college or more); (ii) mother's marital status (Married; Unmarried); and (iii) child's age (Below 12; Above 12). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1) and (3) refer to the specification with control variables for child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2) and (4) refer to the same specification augmented with state fixed effects. Income is measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. Standard errors are obtained through a family-level clustered bootstrap procedure based on 100 repetitions. See text for further details. Standard errors are reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table 10: Female Labor Demand Shocks and Child Development

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Lab.Dem.Shocks	0.05***	0.10***	0.02	0.01	0.04***	0.06***
	(0.01)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
Observations	13,532	13,532	15,503	15,503	11,818	11,818
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

This table shows the reduced-form estimates for the effect of changes in local demand for female labor on child development. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). Columns (1), (3), and (5) refer to the specification with control variables for EITC policy changes, child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Appendix A:
Additional Tables and Figures

Table A.1: Maximum EITC and Child Development: Restricted Sample

	(1) Math-Reading	(2) Math-Reading	(3) Math-Reading	(4) BPI	(5) BPI	(6) BPI	(7) Combined	(8) Combined	(9) Combined
Δ MaxEITC	-0.03***	-0.03**	-0.03*	-0.03**	-0.03*	-0.06**	-0.04***	-0.03***	-0.04**
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.03)	(0.01)	(0.01)	(0.02)
Observations	10,740	10,635	6,005	11,892	11,768	6,516	9,370	9,277	5,135
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Age FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DepCh*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Child Age*Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lagged Income	No	Yes	No	No	Yes	No	No	Yes	No
Sample	Whole	Whole	I<35K	Whole	Whole	I<35K	Whole	Whole	I<35K

This table replicates the reduced-form estimates in Table 4 for a restricted sample of mothers who did not change either their state of residence or the number of children in two consecutive NLSY surveys. The table shows the reduced-form estimates for the effect of changes in the maximum federal and state EITC benefits on child development. Dependent variables: change in the Math-Reading test score (columns 1 to 3), change in the Behavior Problems Index (columns 4 to 6), and change in the combined cognitive-behavioral score (columns 7 to 9). All specifications include control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year. All specifications also include interaction terms between state (indicators) and year, number of dependent children (indicators) and year, and child's age (indicators) and year. Columns (1), (4), and (7) refer to the whole sample. Columns (2), (5), and (8) refer to the whole sample and are augmented with a control variable for 4-year lagged family income. Columns (3), (6), and (9) refer to the restricted sample of families with initial income (t-1) below $35,000. The maximum federal and state EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.2: Maximum EITC and Child Development: Cross-Section vs Longitudinal

	(1)	(2)	(3)	(4)	(5)	(6)
	Math-Reading (Level)	Math-Reading (Δ)	BPI (Level)	BPI (Δ)	Combined (Level)	Combined (Δ)
MaxEITC	0.04*		0.06***		0.06**	
	(0.02)		(0.02)		(0.02)	
Δ MaxEITC		-0.02**		-0.03**		-0.03***
		(0.01)		(0.01)		(0.01)
Observations	13,532	13,532	15,503	15,503	11,818	11,818
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Child Age FE	Yes	Yes	Yes	Yes	Yes	Yes
DepCh*Year	Yes	Yes	Yes	Yes	Yes	Yes
State*Year	Yes	Yes	Yes	Yes	Yes	Yes
Child Age*Year	Yes	Yes	Yes	Yes	Yes	Yes
Specification	Level	Delta	Level	Delta	Level	Delta

This table shows the reduced-form estimates (in level and in first differences) for the effect of (changes in) the maximum federal and state EITC benefits on child development. Dependent variables: Math-Reading test score (column 1), change in the Math-Reading test score (column 2), Behavior Problem Index (column 3), change in the Behavior Problems Index (column 4), combined cognitive-behavioral score (column 5), and change in the combined cognitive-behavioral score (column 6). All specifications include control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year. All specifications also include interaction terms between state (indicators) and year, number of dependent children (indicators) and year, and child's age (indicators) and year. The maximum federal and state EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.3: Instrumental Variables: First-Stage Estimates by Sample

	(1) Δ Income	(2) Δ Hours	(3) Δ Income	(4) Δ Hours	(5) Δ Income	(6) Δ Hours	(7) Δ Income	(8) Δ Hours	(9) Δ Income	(10) Δ Hours	(11) Δ Income	(12) Δ Hours
Δ EITC	1.33***	2.02***	1.53***	2.08***	1.17***	1.97***	1.41***	2.01***	1.43***	2.01***	1.66***	2.06***
	(0.39)	(0.24)	(0.39)	(0.24)	(0.39)	(0.24)	(0.40)	(0.24)	(0.42)	(0.26)	(0.43)	(0.26)
Lab.Dem.Shocks	2.26***	0.44**	4.16***	0.83***	2.53***	0.33*	4.54***	0.51**	2.25***	0.36*	4.34***	0.66***
	(0.41)	(0.18)	(0.63)	(0.24)	(0.40)	(0.17)	(0.59)	(0.23)	(0.42)	(0.19)	(0.65)	(0.25)
Observations	13,532	13,532	13,532	13,532	15,503	15,503	15,503	15,503	11,818	11,818	11,818	11,818
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	No	Yes	Yes	No	No	Yes	Yes	No	No	Yes	Yes
Sample	Math-Reading	Math-Reading	Math-Reading	Math-Reading	BPI	BPI	BPI	BPI	Combined	Combined	Combined	Combined
SW Chi-sq (Under id)	24.46	37.67	34.62	48.33	35.48	53.35	55.28	63.52	23.67	33.81	36.84	45.89
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SW F (Weak id)	24.43	37.62	34.45	48.09	35.43	53.28	55.04	63.24	23.63	33.76	36.63	45.63
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
KP (Weak id)	12.26	12.26	17.74	17.74	17.83	17.83	28.81	28.81	11.79	11.79	18.91	18.91

This table shows the first-stage estimates for the IV analysis. Dependent variables: ΔIncome (columns 1, 3, 5, 7, 9, and 11) and ΔHours (columns 2, 4, 6, 8, 10 and 12). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1)–(2), (5)–(6), and (9)–(10) refer to the specification with control variables for child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (3)–(4), (7)–(8), and (11)–(12) refer to the same specification augmented with state fixed effects. Income and EITC benefits are measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. The analysis in columns (1) to (4) refers to the estimating sample for the analysis of child cognitive development (Math-Reading test score). The analysis in columns (5) to (8) refers to the estimating sample for the analysis of child behavioral development (BPI). The analysis in columns (9) to (12) refers to the estimating sample for the analysis of child combined cognitive-behavioral development. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.4: Instrumental Variables: Controlling for Local School Expenditure

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Δ Income	0.03***	0.03***	0.01	0.01	0.03***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours	-0.04***	-0.03***	-0.03**	-0.03**	-0.04***	-0.04***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Total revenues	0.02	0.03	0.02	0.02	0.01	0.03
(per pupil)	(0.03)	(0.03)	(0.02)	(0.02)	(0.03)	(0.03)
Δ Total expenditure	-0.02	-0.04	-0.01	-0.02	-0.02	-0.03
(per pupil)	(0.04)	(0.04)	(0.03)	(0.03)	(0.04)	(0.04)
Observations	12,287	12,287	13,756	13,756	10,723	10,723
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

This table shows the IV analysis for the effect of changes in family income and maternal labor supply on child development when we control for per pupil school resources by state. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1), (3), and (5) refer to the specification with control variables for child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. Income is measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. The total revenues per pupil are the total revenues from all sources divided by the fall enrollment as reported in the state finance file. Total current expenditures per pupil is defined as the total current expenditures for public elementary and secondary education divided by the fall enrollment as reported in the state financial file. Expenditures and revenues are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.5: Instrumental Variables: Family's Hours Worked

	(1) Math-Reading	(2) Math-Reading	(3) BPI	(4) BPI	(5) Combined	(6) Combined
Δ Income	0.03***	0.03***	0.02**	0.01	0.03***	0.02***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Δ Hours (family)	-0.03***	-0.03***	-0.03**	-0.02**	-0.03***	-0.03***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Observations	13,532	13,532	15,503	15,503	11,818	11,818
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

This table shows the IV analysis for the effect of changes in family income and labor supply (family level) on child development. Dependent variables: change in the Math-Reading test score (columns 1 and 2), change in the Behavior Problems Index (columns 3 and 4), and change in the combined cognitive-behavioral score (columns 5 and 6). The two instrumental variables are: changes in EITC benefits (Δ EITC) and labor demand shocks (Lab.Dem.Shocks). Columns (1), (3), and (5) refer to the specification with control variables for child's gender, age, race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. Income is measured in $1,000 of year 2000 dollars. Hours worked are yearly hours and expressed in hundreds. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.6: EITC Expansion and Parental Inputs

	(1) Cognitive Stimulation	(2) Cognitive Stimulation	(3) Emotional Support	(4) Emotional Support	(5) Response Low Grades	(6) Response Low Grades
Δ EITC*Age≤8	-0.04	-0.03	-0.10**	-0.09**	-0.24**	-0.23**
	(0.04)	(0.04)	(0.04)	(0.04)	(0.10)	(0.10)
Δ EITC*Age9-11	-0.02	-0.01	0.00	0.01	-0.00	-0.00
	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)	(0.04)
Δ EITC*Age≥12	-0.01	-0.01	0.00	0.01	0.00	0.00
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Observations	12,170	12,170	11,158	11,158	10,218	10,218
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

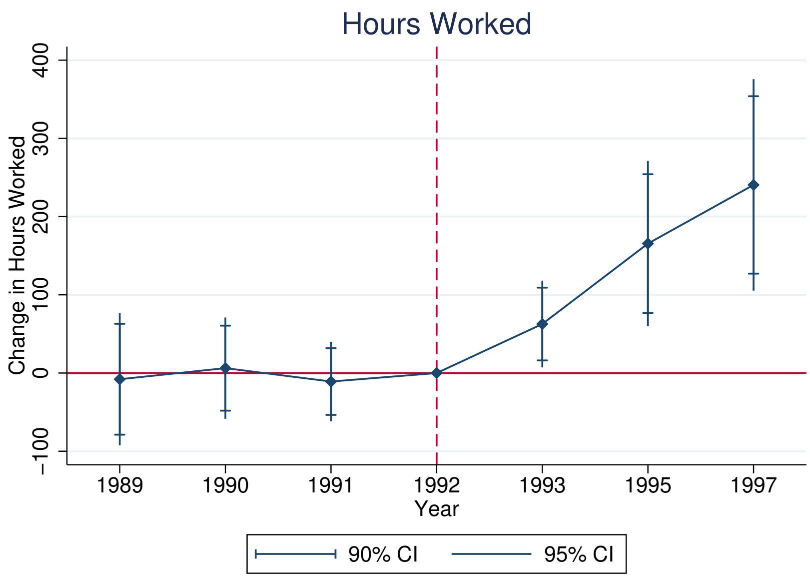
This table shows the reduced-form estimates by child's age for the effect of EITC policy changes on changes in parental investment and behavior. Dependent variables: change in the cognitive stimulation score (columns 1 and 2), change in the emotional support (columns 3 and 4), and change in maternal response to low grades (columns 5 and 6). Columns (1), (3), and (5) refer to the specification with control variables for changes in local demand for female labor, age groups (indicators), child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. EITC benefits are measured in $1,000 of year 2000 dollars. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Table A.7: Instrumental Variables: Parental Inputs and Hours Worked

	(1) Cognitive Stimulation	(2) Cognitive Stimulation	(3) Emotional Support	(4) Emotional Support	(5) Response Low Grades	(6) Response Low Grades
Δ Hours*Age≤8	-0.02	-0.02	-0.06**	-0.06**	-0.11**	-0.11**
	(0.02)	(0.02)	(0.03)	(0.03)	(0.05)	(0.05)
Δ Hours*Age9-11	-0.01	-0.01	0.00	0.01	-0.01	-0.00
	(0.02)	(0.02)	(0.03)	(0.03)	(0.02)	(0.02)
Δ Hours*Age≥12	-0.01	-0.00	0.01	0.01	0.00	0.00
	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
Observations	12,170	12,170	11,158	11,158	10,218	10,218
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes

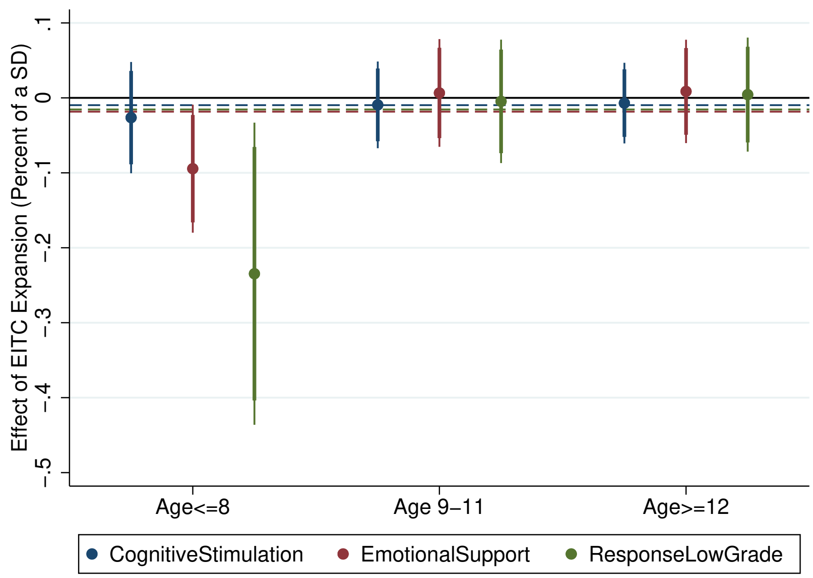
This table shows the IV analysis by child's age for the effect of changes maternal labor supply on changes in parental investment and behavior. Dependent variables: change in the cognitive stimulation score (columns 1 and 2), change in the emotional support (columns 3 and 4), and change in maternal response to low grades (columns 5 and 6). The instrumental variables are: changes in EITC benefits (Δ EITC) interacted with age groups (indicators). Columns (1), (3), and (5) refer to the specification with control variables for age groups (indicators), child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. Columns (2), (4), and (6) refer to the same specification augmented with state fixed effects. Hours worked are yearly hours and expressed in hundreds. See text for further details. Standard errors are clustered at the family level and reported in parentheses. *, **, *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

Figure A.1: The 1993 EITC Reform and Maternal Labor Supply: Additional Controls



This figure shows the evolution over time of the effect of exposure to the EITC program on maternal labor supply. Dependent variable: change in maternal labor supply (in hours per year). The y-axis shows the point estimates for the interaction of the indicator variable for the treatment group with indicator variables for each year. The treatment group is defined as the group of families that received EITC benefits at least once pre-1993 or those with members that never worked before the reform. The x-axis reports years. The red, vertical, dashed line visually separates the pre-reform and the post-reform periods. The model includes control variables for a child's race and number of children in the household. The model also includes control variables for state welfare waivers and unemployment level. Each control variable is also interacted with the indicator variable for the treatment group. See text for further details. The figure reports 90 percent and 95 percent confidence intervals based on standard errors clustered at the family level.

Figure A.2: The EITC Expansion and Parental Investment and Behavior (State FE)



This figure shows the reduced-form estimates for the effect of EITC policy changes on changes in parental investment and behavior. Dependent variables: change in cognitive stimulation score (blue), change in emotional support (maroon), and change in maternal response to low grades (green). The y-axis shows the point estimates (percent of a standard deviation) for the effect of EITC policy changes (dashed lines) or for the interaction of the EITC policy changes with indicator variables for a child's age group (dots). The x-axis reports age groups. The model includes control variables for changes in local demand for female labor, child's gender, age, and race, number of children in the household, year, and the set of controls for family income trend. The model also includes state fixed effects. The specification by child's age also includes indicator variables for each age group. See text for further details. The figure reports 90 percent and 95 percent confidence intervals based on standard errors clustered at the family level.