The Impact of the Earned Income Tax Credit Program on Children's Human Capital Formation

By

PARK, Yaesung

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

For the Degree of

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Committee in charge:

Professor Paik, Sung Joon, Supervisor

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Abstract

The present study quantifies the impact of the Earned Income Tax Credit (EITC) program on children's human capital formation and explores the channels that map the policy in question to the observed outcomes. Building on the existing studies, I hypothesize the existence of two channels at work. On the one hand, a rightward shift of the family's budget constraint is likely to map to, *ceteris paribus*, a higher level of children's human capital. On the other hand, the nature of the program in question positively affects parental working hours on both intensive and extensive margins. The implied reduction in hours spent with children at home speaks against the promise of observing a more sustainable human capital formation. Thus, the net reduced-form impact is an empirical question. My findings reveal a robust relationship between the EITC benefit and children's self-reported health. I also show suggestive evidence on improvements in educational performance of children generated by the program. These findings suggest that the program in question serves as a sustainable safety net well-attuned for the purpose of providing basic living standards for children from poor households.

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1. Introduction

The Earned Income Tax Credit program (EITC henceforth) was introduced in South Korea in 2009, to introduce a cost-efficient way to incentivize the labor force participation of the poor on the one hand and to provide the necessary income support on the other. The existing economic theories supply ambiguous predictions regarding the long-run impact of the program in question on children's later-life outcomes. On the one hand, a positive shock to the family's income speaks to the promise of observing higher human capital characteristics. On the other hand, employed mothers spend less time with their children, which constitutes a negative shock to the observed children's cognitive skills (e.g. Blau and Grossberg, 1992). Therefore, the net impact of the EITC program on children's human capital formation in later life is an empirical question.

Figure 1 exemplifies the logistics of the program for eligible households with one child in 2017. If the household earns less than 9 million KRW per year, then the amount payable is $\left(\frac{2}{9} \times earned\ income\right)$. If the household's earnings fall within 9 to 12 million KRW range, then the amount payable is flat 2 million KRW per annum. Finally, for those families, that earn above 12 million KRW per year, the amount payable is governed by: $(2\ million\ KRW - (earned\ income - 12\ million\ KRW\ ) \times \frac{2}{9}$.

As Figure 1 shows, the incentive to supply more working hours is the highest in the [0–9] interval along the *x*-axis. If mothers' working hours do respond positively to this economic incentive, then, holding household income constant, children may accumulate less human capital given less time spent with mothers. The relevant studies confirm that the EITC program does encourage labor force participation, with the largest impact observed among mothers (e.g. Elissa and Liebman, 1996; Liebman, 1998; Elissa and Hoynes, 2006).[1] All together, these studies seem to supply a safe ground to believe that mothers do work more (and hence spend less time with children) given the economic incentives implied by the EITC program.

[1] Qualitatively similar findings hold in Korean setting (e.g. Kim and Chang, 2008; Park and Lee, 2018).

A parallel strand of literature examines the relationship between maternal employment status and children's human capital formation. For example, Blau et al. (1996) and Baker and Milligan (2008) document the negative relationship between maternal employment and children's health, with less time spent on the interactions and breastfeeding being possible channels. Similarly, Baker, Gruber and Milligan (2008) document that more hours of work supplied by mothers negatively affect children's physical and mental health. This strand of literature points to the gains (losses) implied by more (less) hours spent by mothers with their kids. Finally, there exists a well-established link between the family income and children's human capital in the literature (e.g. Alaimo et al., 2001; Blanden and Gregg, 2004).

This study intends to add to the literature by examining the net reduced-form impact of the EITC program on children's human capital formation (in the form of health and education) in the long-run. Given the ambiguity of the theoretical examination, an empirical assessment is needed to fully understand the socio-economic implications of the EITC program.

The present manuscript is organized as follows. Section 2 presents the literature overview and derives a testable hypothesis. Section 3 presents data and empirical method attuned to test the hypothesis. Section 4 the findings. Section 5 concludes the manuscript.

2. Research Hypothesis and Related Literature

This section aims to develop the link between the EITC program and human capital of children based upon the existing findings in the related literature.

Labor Supply Effects—Ultimately, the progressive nature of the monetary gain from participation in the EITC implies that the program in question can be viewed as a mirror image of the progressive income tax. In other words, if an extra dollar of labor earning increases the net level of tax paid (and hence, for the given amount of hours worked, the net labor earning is strictly concave in pre-tax earnings), the EITC implies that every dollar earned *increases* the amount of the EITC benefit up to the certain threshold, as Figure 1 showed.

A standard model of labor-leisure choice suggests that the individual's labor supply increases in the net (in other words, after-tax) wage rate. An abundant amount of literature keeps consistently pointing at the positive sign of the empirically derived wage elasticity of labor

supply (e.g., Heckman, 1993). More notably, the empirical literature on labor economics recognizes that married women's hours of work are the most sensitive to the fluctuations in the net earning per hour (Mroz, 1987; Blau and Kahn, 2007). As a result, studies show that marginal tax discourages individuals from supplying more working hours via reducing the net earnings per hour (Burtless and Hausman, 1978; Hayo and Uhl, 2015).

Since the EITC program is the mirror image of the marginal tax, the positive response of the individuals' working hours to changes in the monetary benefit implied by the program in question is of little surprise. Studies repeatedly confirm the existence of the positive link between the individual's labor supply and the EITC in those countries where the program is existent, such as the United States (Eissa and Liebman, 1996), Britain (Leigh, 2007), and South Korea (임완섭, 2016).

The EITC and Children's Human Capital Formation—The link between the family's background income and children's human capital outcomes has been well-established in the empirical literature (Blanden and Gregg, 2004). For example, experimental studies suggest that direct cash transfers have a positive impact on children's cognitive abilities (Paxson and Schady, 2010), birthweights (Amarante et al., 2016), and test scores (Dahl and Lochner, 2012). Having these findings, it seems reasonable to immediately conclude that the impact of the EITC on children's long-run human capital outcomes is non-negative, as the program implies a higher income stream for eligible families.

However, it is important to bear in mind that the program incentivizes parents to work more. Studies show that all others being constant, a higher amount of working hours supplied by parents deteriorate the children's human capital in the long run. For example, Milligan and Stabile (2009) argue that decreased aggression, anxiety, and improved motor and social development among Canadian children are attributable to the policy intervention that incentivizes parents to interact more with their newborns. Baker, Gruber, and Milligan (2008) document that the maternal labor supply is a critical determinant of the duration of breastfeeding, which is the known determinant of the educational outcome of children in the long run (e.g., Nandi, Lutter and Laxminarayan, 2017). Taken together, this strand of studies supplies a plausible explanation to the empirically revealed negative impact of maternal labor supply on children's human capital (e.g., Blau et al., 1996; Milligan, 2008).

The aforementioned studies seem to supply the following causal pathway between the EITC and children's human capital. On the one hand, a positive income gain adds to the likelihood of observing higher years of schooling and better health of children in the long run. On the other hand, less time spent with children during their early childhood speaks to the promise of observing, *ceteris paribus*, lower stock of human capital. Thus, the net-reduced form impact of the program on children's human capital is an empirical question.

The next section introduces the data and empirical strategy designed to shed light on my research question.

3. Data and Empirical Strategy

3.1 Data

To the best of my knowledge, Korea Welfare Panel Study (KoWEPS henceforth) is the most natural candidate dataset that fits the goal of the proposed empirical investigation. As the name suggests, KoWEPS is a longitudinal survey that follows up approximately 7,000 families annually. Given that the EITC program was introduced in 2009, the resulting dataset employed in the present analysis covers the period between 2009 and 2018.

The present manuscript links a range of children's health indicators and their self-reported educational performance to the variation in the family income share of the EITC benefit observed in KoWEPS. When investigating the health outcomes, the focus is limited to children aged below 12 (i.e., primary school children or younger). The choice of the age window is motivated by the likely sensitivity of young children's health to fluctuations in health inputs. The empirical investigation of educational performance is very limited because (1) KoWEPS surveys on the educational performance of only children aged between 8 and 18, (2) non-response rates are high. For the purpose of preserving the statistical power, I follow the KoWEPS-determined age window and hence focus on children aged between 8 and 18 years.

Figure 2 shows the average family income's share of the EITC benefit plotted over time, conditional on the EITC benefit per se being non-zero. The overall trend is somewhat upward-sloping between 2009 and 2013, with a notable dip starting from 2014. Conditional

on the EITC benefit being non-zero, the median family's income share of EITC is somewhat around 2.2% of the annual household income.

Figure 3 shows the dynamics of children's health outcomes across two groups of families: those who receive the EITC benefit and those who do not. Four indicators of health shown in Figure 3 constitute the baseline set of the outcome variables of interest. The first is self-reported health, with possible answers ranging from 1 ("Very Poor") and 5 ("Very good"). The second indicator of health is the number of times a given child got hospitalized in a given survey year. The third health outcome is the number of days spent by a given child in the hospital (in a given survey year). The final outcome variable is a binary indicator of having at least one outpatient visit to the clinic in a given survey year. Table 1 reports the means and standard deviations of every outcome variable employed in the empirical analysis.

As shown in Figure 3, it is very hard to draw any meaningful conclusion regarding the link between the EITC program and children's health from the raw data. It seems that starting from the year 2015, children from families that receive the EITC benefit report better health while spending fewer days in the hospital and having a lower likelihood of having an outpatient visit to the clinic. It is important to recall that, according to Figure 2, this is the period when the family income share of the EITC benefit started to fall. Observing Figures 2 and 3 jointly, one might conclude that the EITC program harms rather than improves children's health. This ambiguity stemming from the observation of the raw data motivates the empirical analysis.

3.2 Empirical Strategy

The empirical strategy can be summarized by the following econometric specification:

$$y_{ipt} = \alpha_i + \beta \left(\frac{amount\ of\ EITC_{it}}{Family\ income_{it}} \times 100 \right) + X'_{it}\theta + \gamma_{pt} + u_{ipt}, \qquad (1)$$

where y_{ipt} is the outcome of child *i* observed in province *p* and year *t*. The key regressor is $\left(\frac{amount\ of\ EITC_{it}}{Family\ income_{it}} \times 100 \right)$, the share of EITC benefit in family income, expressed in percentage. The term X'_{it} is a set of controls. The set baseline of controls includes the child's age (quadratic), family income lagged by three years, and the employment status of the household head. I explicitly control for the child's unobserved stable characteristics (α_i),

which accounts for the child's genetic endowment, past family income, and other characteristics that do not change over time. The term γ_{pt} is the province-specific year fixed effect, which lifts the need to control for macroeconomic determinants of outcomes of interest that do not change within the province-year cell (e.g., provincial income per capita, unemployment, and inflation). Finally, u_{ipt} is the error term allowed to be arbitrarily correlated within a family.

The choice of control variables is driven by several reasons. On the one hand, we want to isolate the variation of the EITC benefit from the variation of those confounding determinants of health that are related to the key variable of interest while being related to the key variable of interest. ($\frac{amount\ of\ EITC_{it}}{Family\ income_{it}}$). On the other hand, we want to preserve a reasonable amount of faith regarding the exogeneity of the right-hand side ingredients of Equation (1), to avoid the case of introducing the case bad controls. Thus, child's fixed effect is perhaps the most powerful regressor, as it absorbs the whole battery of unobserved stable characteristics that are relevant to the EITC benefit *and* outcomes of interest (e.g., past income of a family). Province-specific year fixed effect is exogenous to the child's health outcomes, whereas it explicitly partials out *all* the unobserved macroeconomic determinants of the child's health. Family income is lagged by three years, and therefore is likely to be pre-determined; similarly, age is another example of an exogenous determinant of the children's health. Finally, I control for the employment status of the household's age. Males are traditional breadwinners, which means that a substantial fraction of fathers in my sample are employed. Thus, conditional on children's fixed effects, the remaining variation of fathers' employment is unlikely to be affected by the amount of the EITC benefit.

The parameter of interest that summarizes the reduced-form impacts of the EITC program is β. Formally, caution is needed when interpreting the OLS estimate of β as the causal impact of the program in question on a given outcome of interest. The inclusion of the child's fixed effect, α_i, accounts for many characteristics that are not observable in the KoWEPS dataset. Besides, I explicitly control for the employment status of the household head and family income, which might imply that the remaining variation in the chief regressor of interest is as good as random. However, that might not be the case if there exists unobserved determinants of the outcome(s) of interest that are related to the amount of the observed

amount of the EITC benefit. A few examples include but are not limited to: parental wage offer, dynamic preferences for children's human capital, and family-level fertility planning. For this reason, I believe that the OLS estimate of β should be viewed as the association between the EITC benefit and the outcome of interest, conditional on age, family income, unobserved time-invariant characteristics of a child, and other controls included in Equation (1).

Finally, it is worth emphasizing the way to interpret the OLS estimate of the parameter of interest. As shown by Equation (1), I define the share of the EITC benefit in family income. The resulting variable is scaled up by 100, and hence it belongs to the closed interval between 0 and 100. As a result, $\hat{\beta}^{OLS}$ should be viewed as the estimated change in the y variable in response to a one percentage point increase in the share of EITC in family income.

4. Findings

4.1 Baseline findings

I depart from investigating the impact of the program's benefit on a range of health outcomes of children. Table 2 summarizes the results. At this stage, it is important to recall that the EITC variable is defined in percentage. According to column 1 of Table 2, a one percentage change point increase in the share of EITC (in family income) is associated with an increase in self-reported health by 0.014. In order to gain insight into the economic meaningfulness of this point estimate, it might be helpful to look at the summary statistics of the outcome variables reported in Table 1. The sample standard deviation of self-reported health is equal to 0.574; thus, a one percentage point increase in the family income share of EITC is associated with a 0.024 standard deviation increase in self–reported health. This estimated effect is numerically small yet statistically significant at the 10% level.

The rest of the columns of Table 2 show the estimated effect on a range of other health outcomes observed in the survey year, namely – the number of times a child got hospitalized, the number of days a child spent in the hospital, and a binary indicator of having at least one outpatient visit to the clinic. As shown in Table 2, none of the estimated coefficients is statistically significant; we cannot rule out the possibility that the true parameter in the population is zero.

4.2 Specification tests

The allocation of the EITC benefit is far from being random. Therefore, the proposed identification implicitly rests upon the very assumption stating that the control variables effectively isolate the variation in the EITC benefit from the variation of the other confounders relevant to the outcome variables of my interest. Perhaps, the inclusion of children's fixed effects greatly relieves the concern, as it explicitly partials out a number of important determinants of the true health and the amount of the EITC benefit, namely – genetic endowment, past parental labor market experience, and many others. Nevertheless, it is still worth checking whether the point estimates are sensitive to the alternative econometric specifications. To explore the sensitivity of my point estimates, I include the following control variables on the right-hand side of Equation (1), separately for mother and father: education, quadratic age, employment dummy, and unemployment dummy (omitted category – out of labor force).[2]

Table 3 reports the resulting estimates. The inclusion of the additional controls reduced the number of observations due to the missing information for some parental characteristics. Nevertheless, my baseline findings hold: a one percentage point increase in the income share of EITC benefit improves self-reported health by 0.018, which is roughly equal to 0.03 sample standard deviations. Besides, this effect is estimated more precisely – it is not significant at the 5% level. Finally, as Table 3 shows, the rest of the health outcomes – hospitalization and outpatient visits – does not show a statistically significant response to the variation in the income share of the EITC benefit.

4.3 Educational outcomes

KoWEPS surveys children aged between 8 and 18 regarding their self-reported overall academic performance and their self-assessed performance in three subjects: Korean language, Mathematics, and English language. However, there are two reasons why it is hard to put forth the educational outcomes as the principal object of empirical investigation. The

[2] I do not control for parental education in my baseline specification due to the likely fact that the majority of parents stop schooling after delivering a baby. If this is so, then the observed within-child variation in parental education is driven by a few outliers who continue their studies and the measurement error in respondents' responses.

first reason is the sample limitation: very few respondents self-reported their academic performance. The second reason is the likely responsiveness of educational performance to the past, but not the contemporary income, as studies show (Carneiro and Heckman, 2002; Lee and Kim, 2012).

Despite the limitations mentioned above, I view a supplementary analysis of educational outcomes as a useful empirical exercise. In Table 4, I report the estimated associations between the income share of the EITC benefit and a range of self-reported educational outcomes, namely – overall academic performance and performance in Korean language, mathematics, and English language. Possible answers range from 1 ("Very poor") to 5 ("Very good").

According to columns (1) and (2) of Table 4, there is a statistically significant association between the income share of the EITC benefit and self-reported overall performance, as well as performance in Korean language classes. For example, a one percentage point increase in the income share of the EITC is associated with a 0.05 sample standard deviations improvement in the self-reported overall academic performance, and this estimated effect is significant at the 10% level. Similarly, a one percentage point increase in the income share of the EITC is associated with a 0.1 sample standard deviation improvement in the self-reported academic performance in the Korean language, significant at the 5% level. It is worth noting that this latter effect is economically meaningful, as 0.1 sample standard deviations increase is a fairly large change. The rest of the columns of Table 4 shows no detectable effect of the EITC program on self-reported performance in Mathematics and the English language.

4.4 Synthesis

Overall, the findings in this section show evidence on the positive link between the EITC benefit and children's health and educational outcomes. The KoWEPS dataset reveals a statistically significant association between the income share of the EITC benefit and children's self-reported health, and this relationship holds after controlling a rich set of controls. However, given the sample limitation, it is hard to draw a meaningful conclusion regarding the educational outcomes. The analysis reveals suggestive evidence of some improvements in educational outcomes, namely – self-reported overall performance and

performance in Korean language classes. However, a small statistical power raises concern about the possibility of attributing this finding to Korean children's whole universe. Besides, as past studies show, the relationship between educational attainment and contemporary income is at best limited. Thus, caution is needed when interpreting my estimates as the ones that reflect the causal impact of the EITC benefit on children's educational outcomes.

5. Conclusion

In this study, I attempted to shed light on the impact of the Earned Income Tax Credit – The South Korean welfare program – on a range of children's health and educational outcomes. However, there is a list of limitations worth acknowledging before deriving the conclusions from my study. The primary difficulty of the analysis stems from the fact that the nature of the observed variation in the EITC benefits is never known ex-ante. Thus the empirical investigation is doomed to rely on a set of fairly strong assumptions regarding the econometric strategy employed. In response to this challenge, I attempted to isolate the observed impact of the program benefit from a rich range of characteristics of children and their families observed in the data.

Besides, most of the observed health and educational outcomes are self-reported. While social scientists pay increasingly more attention to information of this kind, future investigations might attempt to link the observed variation in the EITC benefit to the more objective information. For example, height-for-age and weight-for-age are commonly employed indicators of health in epidemiologic studies. In addition, standardized test scores serve as one of the most objective indicators of children's educational performance.

Finally, studies show that, compared to the short-term hurdles, the long-term income constraints are far more meaningful for children's human capital formation. Therefore, further work might attempt linking the long-run indicators of socio-economic well-being – e.g., income and labor market performance – to the past exposure to the EITC benefit.

Nevertheless, to the best of my knowledge and belief, my findings can be viewed as a sensible indication of the program's benefit for children. First, being motivated by two theoretical effects with opposite signs, I found a statistically significant association between

the EITC benefit and children's self-reported health. Second, I found suggestive evidence on the improvements in educational attainment generated by the welfare program in question.

To the best of my knowledge, these estimated effects should be viewed as the lower bound of the true impact; that is – the true parameters in the population are likely to be larger than the point estimates proposed in the present manuscript. First, the EITC program benefit aims at the poor. If not captured by my set of control variables, children's poor economic background is likely to map to worse health and educational outcomes. These unobserved characteristics, if present, are likely to attenuate my point estimates. Second, as studies show, benefits of better schooling and nutrition, as likely implied by the EITC program, are more likely to be capitalized in stronger human capital in the long run (e.g., Gertler et al., 2014). Finally, there is the likely measurement error in the EITC variable, with it is a known feature of attenuating the point estimates if the error per se is random in its nature.

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Appendix

KoWEPS Data

Sample Design and Weight - In 2005, target population is households nationwide. Survey population is 90% enumeration districts in 2005 (except islands and special facility enumeration districts).

Frame - KoWEPS aims the frame at whole 230,000 enumeration districts (except islands and special facilities) from the 90% data of Population and Housing Census in 2005.

By region Composition of frame - From the first survey, 517 enumeration districts were extracted, and after identifying the household income, 446 enumeration districts were finalized as final sample (enumeration districts) survey. Out of 24,711 households from Survey of National Living Conditions in 2006, 7,072 households were selected as sample.

Sampling Process of KoWEPS

Step 1 Sampling: Out of the 237,000 preliminary survey districts surveyed by Population and Housing Census in 2005, 517 survey districts were stratified according to the size of the regional survey districts, and the major criteria for stratification were divided into 32 layers. Out of the total 517 sample survey districts, 487 survey districts were conducted except for those in areas where investigation is impossible due to natural disasters such as floods. The areas subject to investigation shall cover the whole country except for the island survey district and the special facility survey district of each city and province, including Jeju Island.

Step 2 Sampling: Total of 7,000 households were sampled on an income basis of 3,500 households with a median income of 60 percent or less and 350 households with a median income of more than 60 percent, respectively, based on the first-stage sample data, Survey of National Living Conditions in 2006. Sampling households by region and survey district were sampled for two layers by income size, and 3,500 households were selected for low-income households with relatively small scale for panel households.

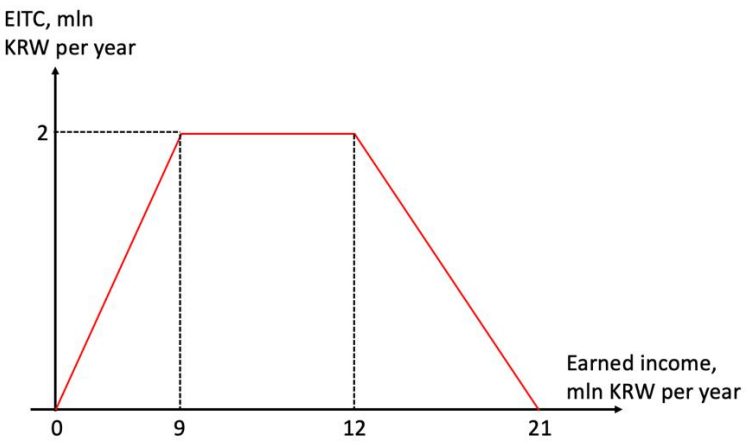

Figure 1. A graphical example of the EITC at work

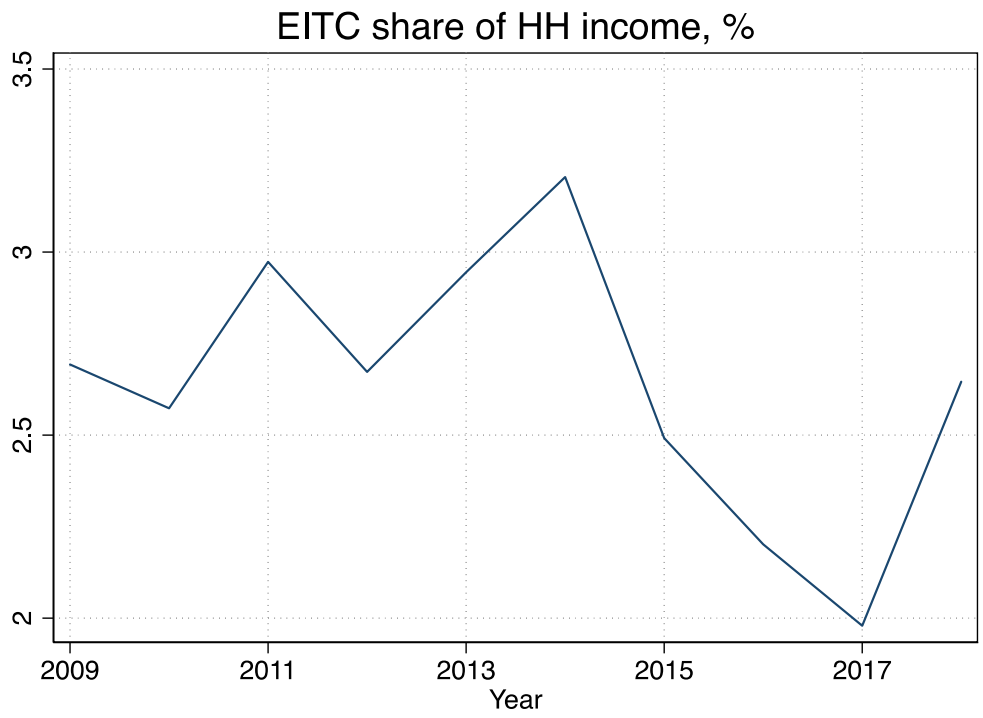

Figure 2. Dynamics of share of EITC in family income

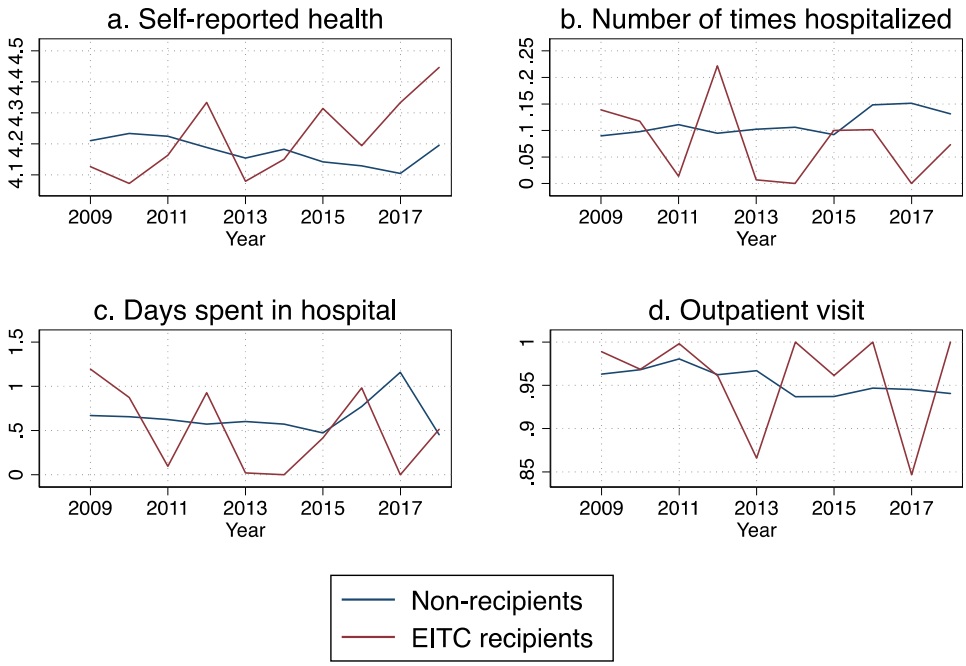

Figure 3. Children's health outcomes

Table 1 – Summary statistics

Variable	Obs	Mean	Std. Dev.
Panel A: Health outcomes (0–12 y.o.)			
Self-reported health (1 – Very bad, 5 – Very good)	16360	4.189	0.574
Hospitalization (number of times in a given year)	16375	0.113	0.465
Hospitalization (days in a given year)	16375	0.681	3.717
Outpatient Visit (1 = yes, 0 = no)	16375	0.944	0.23
Panel B: Educational outcomes (8–18 y.o.)			
Overall (1 – Very bad, 5 – Very good)	742	3.606	0.951
Korean (1 – Very bad, 5 – Very good)	742	3.871	0.925
Mathematics (1 – Very bad, 5 – Very good)	742	3.647	1.132
English (1 – Very bad, 5 – Very good)	742	3.679	1.164

Table 2 – Baseline findings

	(1)	(2)	(3)	(4)
	Self-reported health	Hospitalization (count)	Hospitalization (Days)	Outpatient Visit
(EITC/Family Income), %	0.014+	0.001	-0.011	-0.002
	(0.008)	(0.006)	(0.035)	(0.003)
Controls	Y	Y	Y	Y
Child FE	Y	Y	Y	Y
Province-year FE	Y	Y	Y	Y
Adj. R-sq	0.178	0.216	0.261	0.168
N	16360	16375	16375	16375

Sample of children aged below 12. Controls include: quadratic term of child's age, natural log of family income (t-3), and employment status of the household head. Standard errors clustered by family in parentheses. + p<10 *p<0.05 **p<0.01

Table 3 – Robustness check

	(1)	(2)	(3)	(4)
	Self-reported health	Hospitalization (count)	Hospitalization (Days)	Outpatient Visit
(EITC/Family Income), %	0.018*	-0.004	-0.046	-0.002
	(0.008)	(0.007)	(0.042)	(0.003)
Controls	Y	Y	Y	Y
Parental controls	Y	Y	Y	Y
Child FE	Y	Y	Y	Y
Province-year FE	Y	Y	Y	Y
Adj. R-sq	0.156	0.183	0.257	0.163
N	15334	15351	15351	15351

Sample of children aged below 12. Controls include: quadratic term of child's age and natural log of family income (t-3). Parental controls (for mothers and fathers) include college dummies, quadratic age, and state of economic activity. Standard errors clustered by family in parentheses. + p<10 *p<0.05 **p<0.01

Table 4 – Educational outcomes

	(1)	(2)	(3)	(4)
	Overall	Korean	Mathematics	English
(EITC/Family Income), %	0.047+	0.097*	0.074	0.065
	(0.027)	(0.040)	(0.046)	(0.059)
Controls	Y	Y	Y	Y
Child FE	Y	Y	Y	Y
Province-year FE	Y	Y	Y	Y
Adj. R-sq	0.505	0.321	0.497	0.392
N	742	742	742	742

Sample of children aged between 8 and 18. Controls include: quadratic term of child's age, natural log of family income (t-3), and employment status of the household head. Standard errors clustered by family in parentheses. + p<10 *p<0.05 **p<0.01.