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Child Poverty as a Determinant of Life Outcomes: Evidence from Nationwide Surveys in Japan

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Abstract We attempt to examine the extent to which poverty in childhood adversely affects success in adulthood, using micro data from nationwide surveys in Japan and taking into account the recursive structure of life outcomes. We use retrospective assessments of income class at the age of 15, because longitudinal data on household income are not available. After controlling for its endogeneity, we confirm that children from poor families tend to have lower educational attainment, face higher poverty risks, and assess themselves as being less happy and as suffering from poorer health.

Keywords Child poverty · Educational attainment · Poverty risk · Happiness · Self-rated health

1 Introduction

Child poverty is now a central issue to be addressed in most advanced countries. One recent cross-country study by the OECD (2008) revealed that the risk of poverty for young adults and families with children has risen, while poverty among older people has fallen. The child poverty ratio, which is the share of children who live in households with income levels below the poverty line, was approximately 12% on average among the OECD member countries in the mid 2000s, which was 1% higher than the mid 1990s.

Many studies have examined the effects of family income and family background on developmental outcomes in adolescence and on adult poverty outcomes. Corcoran (1995)

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and Haveman and Wolfe (1995) provided comprehensive surveys on this issue, and Duncan and Brooks-Gunn (1997) thoroughly examined the ways in which economic deprivation damages children during their development. Numerous other empirical studies have accumulated since then, and it is now widely recognized that there are many possible ways for poverty to transition between parents and children (Seccombe 2000; Seccombe and Ferguson 2006).

The effect of family income on child development has been a key issue explored empirically by many studies. It has been observed that family income has a positive association with life outcomes for children, although more so for cognitive outcomes than for child behavior and health, and the effects of income differ across the childhood age span (Duncan et al. 1998; Bowles et al. 2005). It is difficult, however, to distinguish the effects of family income from preexisting differences between families. Indeed, Mayer (1997) and Blau (1999) found that the effect of income tends to be smaller when including other aspects of family background in empirical models. Shea (2000) also emphasized that the impact of family income is negligible when considering its variation induced by factors that may reflect luck.

Even so, it is reasonable to argue that those who have experienced poverty in childhood, regardless of its causes, are more likely to face circumstances unfavorable to their development. Indeed, Carneiro and Heckman (2003) stressed a limited rate of return from education in children from poor families. Their analysis strongly underscores the importance of family in creating a difference in both cognitive and non-cognitive abilities that shape success in life, pointing to the risk of a strong transmission of poverty from old generations to young generations.

In this paper, we examine the impact of child poverty on life outcomes using micro data from nationwide surveys in Japan. As in other advanced nations, child poverty has challenged the existing social policies in Japan (Abe 2008). Indeed, the OECD (2006) showed that more than half of single working parents in Japan lived in relative poverty, as compared with an OECD average of around 20%. Moreover, the OECD (2008) showed that the child poverty ratio was about 14% in the mid 2000s, which was 3% points higher than that in the mid 1980s, and exceeded the OECD average of 12%. At the same time, concerns about the potential transmission of poverty from parents to children have become increasingly heightened in Japan, against the backdrop of widening income inequality and increasing poverty risks (Tachibanaki 2005).

There have been, however, limited attempts to empirically examine the actual mechanism of transmission between child and adult poverty status in Japan. The main reason is that longitudinal information on socio-economic circumstances at the individual and household levels is not available, in contrast to the United Sates where comprehensive panel datasets such as the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey (NLS) can be used for empirical analysis.

To our knowledge, Oishi (2007) made the only attempt to explicitly explore the outcomes of child poverty in Japan. Her analysis was based on a small-sized survey (with 584 respondents) conducted in one anonymous municipality in the Tokyo metropolitan area. She reported that there is no clear correlation between the retrospective assessment of household income at the age of 15 and current poverty, while those from poor families tend to have lower educational attainment. It is premature, however, to conclude anything clear about the effect of child poverty in Japan, considering that Oishi's analysis relied on quite a small sample. More importantly, as she correctly mentioned, the risk is that the endogeneity of the retrospective assessment of household income in childhood may bias the estimation results.

This paper attempts to examine how and to what extent child poverty affects subsequent life outcomes in Japan, based on micro data from the Japanese General Social Surveys (JGSS). The JGSS is the Japanese version of the U.S. General Social Survey (GSS), which actually served as a model for the JGSS. We focus on the subjective assessment of poverty at age 15 by each respondent and its associations with educational attainment, current income/poverty, happiness, and self-rated health in adulthood. Our analysis, which is based on approximately 7,000 individuals, has three distinguishing features from previous studies.

First, we explicitly deal with the endogeneity of reported child poverty, a common issue to be addressed in countries with no quality longitudinal data about individual-level income. JGSS asks each respondent: "Thinking back to when you were around 15 years old, what would you say about your family income as compared to that of Japanese families in general at that time?" The respondent then chooses from 1 (=far below average), 2 (=below average), 3 (=average), 4 (=above average), and 5 (=far above average). We categorize the respondents who chose 1 or 2 as those from poor families; they accounted for 35.9% of the total sample. At age 15, children are at the final stages of nine-year compulsory education and mostly remain dependent on their parents.

The problem of such categorization is that the subjective assessment of income class in childhood may be affected by current and/or past socioeconomic conditions. To tackle this endogeneity problem, we estimate reported child poverty using information from the surveys about the parents' educational background and work status. We also consider residential locations at age 15 and current demographic and socioeconomic factors as instrumental variables when examining the impact of child poverty on outcomes in adulthood. We believe that this is a realistic and reliable method to grasp the impact of child poverty, if no longitudinal data on family income are available.

Second, we extend the analysis to include outcomes of subjective well-being—happiness and self-rated health—as well as educational attainment and poverty. Since the late 1990s, many economists have examined the factors determining happiness, as surveyed by Frey and Stutter (2002). For example, Blanchflower and Oswald (2004) and Easterlin (2001) showed that income raises happiness, while Clark and Oswald (1994), Winkelmann and Winkelmann (1998) and Di Tella et al. (2001) found that unemployment makes individuals unhappy. Various empirical studies have found that other socioeconomic factors including gender, age, marital status, and educational background also have a significant impact on happiness.

Meanwhile, many studies of social epidemiology have investigated the association between health and socioeconomic factors. It is now widely recognized that inequalities in health status associated with socioeconomic status are substantial. In particular, evidence that income and educational attainment significantly affect health has important implications for economic and educational policies (Smith 1999; Lleras-Muney 2005). It is, thus, of great interest to explore the extent to which child poverty affects both types of subjective well-being based on the common framework of analysis.

Third, we explicitly investigate the processes through which child poverty affects subsequent life outcomes. Children from poorer families typically quit studying earlier, and lower educational attainment probably reduces income. Lower income, together with lower educational attainment, is expected to make individuals more inclined to feel less happy and assess their health as being poorer. In addition, experiences in child poverty may directly affect these outcomes; likely affecting non-cognitive ability that is relevant for economic outcomes as well as psychological attributes that influence the subjective assessment of individual well-being. Our empirical analysis attempts to consistently grasp this structure, based on a recursive multiple-equation system. This approach is conceptually similar to the “life course approach” in chronic disease epidemiology (Ben-Shlomo and Kuh 2002; Kuh et al. 2003), which studies the long-term effects on health, or the disease risk of physical or social exposures during gestation, childhood, adolescence, young adulthood and later adult life.

Our results indicate that child poverty, even after controlling for the endogeneity of its retrospective assessment, adversely affects subsequent life outcomes in line with conventional views and results from previous studies. People raised in poor families are more likely to have lower educational attainment, fall below the poverty line, feel less happy, and to assess their health as being poorer.

We also find that the impact of child poverty is more or less direct. Its impact on poverty risks in adulthood cannot be entirely explained by its negative impact on educational attainment. Similarly, child poverty substantially reduces happiness and self-rated health on its own—not through current poverty and lower educational attainment. These results clearly underscore the importance of policy measures to directly reduce child poverty, which hinders success in later life.

The remainder of this paper is organized as follows. Sect. 2 explains the methods of our empirical analysis. Sect. 3 provides a brief description of the data on which our analysis is based. Sect. 4 presents our key estimation results. Sect. 5 concludes the paper.

2 The Empirical Model

To grasp the impact of child poverty on subsequent life outcomes, we consider a recursive multi-equation system, the structure of which is illustrated in Fig. 1. We focus on four life outcomes—educational attainment, current income/poverty, happiness, and self-rated health—all of which are expected to be affected, directly or indirectly, by child poverty. This life course causal model is analogous to a “pathways model” in life course epidemiology (Kuh et al. 2003).

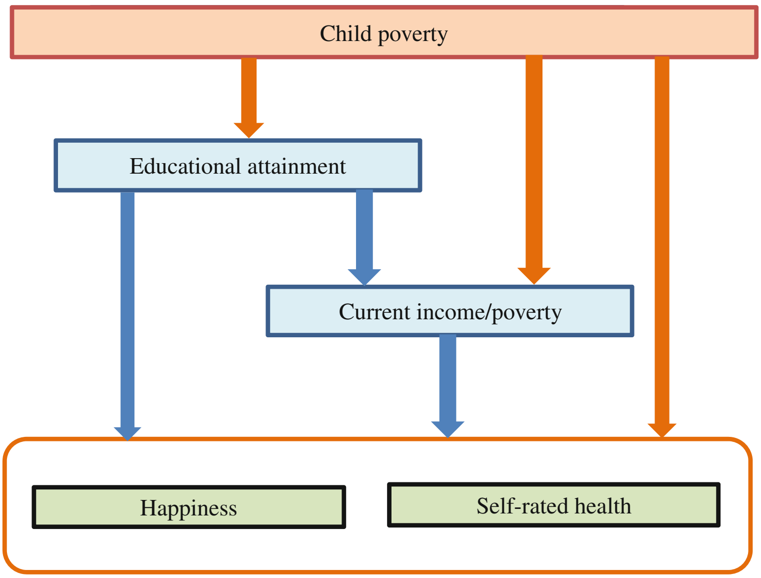

Fig. 1 Life course causal model

Child poverty first affects educational attainment, together with other family background such as parents' educational background and social status. As mentioned earlier, countless preceding studies have shown that children from poorer families tend to have lower educational attainment, although the income effect is difficult to identify. Then, educational attainment affects income or poverty. It is reasonable to assume that individuals with a lower educational background cannot easily obtain a high income. In addition, we consider the possibility that child poverty affects income directly—not through educational attainment. Child poverty may hinder a wider range of skills than those that are obtained or screened in school education.

In this analysis, we do not explicitly consider the impact of educational attainment on work status, because their relationship is not straightforward. For example, more highly-educated women tend to marry highly-educated, higher-income men, and their higher household income likely discourages these women from working as regular full-time employees. A combination of higher educational attainment and non-regular employment could make any association between educational attainment and work status less straightforward. Even if that is the case, however, educational attainment and household income are expected to be positively correlated. Education attainment probably plays a key role in raising income, regardless of its mechanism: for example, through enhancing labor productivity and skill levels, raising the pace of promotion, providing more chances to meet and marry a wealthy partner, and so on.

Finally, we examine the extent to which two key subjective outcomes—happiness and self-rated health—are affected by outcomes at earlier stages: educational attainment, income/poverty, and child poverty. Some preceding studies point to the positive impact of good health on happiness, while others find the reverse causal relationship. This may reflect their similar associations with common factors; for example, income may raise both happiness and self-rated assessments of health. Moreover, child poverty may affect views on life and society, attitudes towards others, and other psychological attributes that are relevant for the subjective assessment of individual well-being.

To make this recursive structure of life outcomes empirically tractable, we first dichotomize each outcome, as discussed later in more detail. We consider five binary variables: "poor at age 15," "graduated from college or above," "below the poverty line," "feel happy," and "good health." We then consider the recursive multivariate probit model, a full version of which is expressed as

$$\begin{array}{ll} \text{Poor at age15:} & y_1^* = \boldsymbol{X}_1\boldsymbol{\beta}_1 + u_1, \\ \text{Graduated from college or above:} & y_2^* = \alpha_{21}\, y_1 + \boldsymbol{X}_2\boldsymbol{\beta}_2 + u_2, \\ \text{Below the poverty line:} & y_3^* = \alpha_{31}\, y_1 + \alpha_{32}\, y_2 + \boldsymbol{X}_3\boldsymbol{\beta}_3 + u_3, \\ \text{Feel happy:} & y_4^* = \alpha_{41}\, y_1 + \alpha_{42}\, y_2 + \alpha_{43}\, y_3 + \boldsymbol{X}_4\boldsymbol{\beta}_4 + u_4, \\ \text{Good health :} & y_5^* = \alpha_{51}\, y_1 + \alpha_{52}\, y_2 + \alpha_{53}\, y_3 + \boldsymbol{X}_5\boldsymbol{\beta}_5 + u_5 \end{array}$$

and

$$y_g = 1 \quad \text{if } y_g^* > 0; \quad = 0 \,\text{otherwise}, \quad \text{for } g = 1, 2, \ldots, 5.$$

Here, y_g* is a latent variable for the binary variable y_g. $\boldsymbol{X}_g$ is a vector of exogenous variables to explain y_g, and $(u_1, \ldots, u_5)$ is a vector of five-variate normally distributed disturbances with var $(u_g) = 1$ for $g = 1, 2, \ldots, 5$. Ten covariances between a pair of five disturbances, which are denoted as ρ_{gk} $(g, k = 1, 2, \ldots, 5; g > k)$, are also to be estimated. The estimation of the multivariate probit model is carried out using Stata software, which applies the simulated maximum likelihood estimation method (Cappellari and Jenkins

2003). If the disturbances are independent, this estimation is equivalent to the separate maximum likelihood probit estimation. The signs of the coefficients are expected such that: $\alpha_{21} < 0$; $\alpha_{31} > 0$, $\alpha_{32} < 0$; $\alpha_{41} < 0$, $\alpha_{42} > 0$, $\alpha_{43} < 0$; $\alpha_{51} < 0$, $\alpha_{52} > 0$, $\alpha_{53} < 0$.

Two things should be noted regarding this five-variate probit model. First, it completely reflects the life course structure illustrated in Fig. 1. Educational attainment and income/poverty are cumulatively added as explanatory variables for outcome at higher stages, while child poverty is included in each estimation equation. Happiness and poor health are two final and simultaneous outcomes to be explained by all other outcomes and child poverty.

Second, estimation of a recursive multivariate probit model requires some considerations for the identification of the model parameters. Maddala (1983) proposed that at least one of the reduced-form exogenous variables is not included in the structural equations as explanatory variables. Following Maddala's approach, we impose exclusion restrictions: (1) to make $\boldsymbol{X}_1$ include at least one exogenous variable that is not included in $\boldsymbol{X}_2$, (2) to make both $\boldsymbol{X}_1$ and $\boldsymbol{X}_2$ include at least one exogenous variable that is not included in $\boldsymbol{X}_3$, and (3) to make all $\boldsymbol{X}_1$, $\boldsymbol{X}_2$, and $\boldsymbol{X}_3$ include at least one exogenous variable that is not included in $\boldsymbol{X}_4$ and $\boldsymbol{X}_5$.[1]

To examine the robustness of this five-variate probit model—referred to as Model 1 hereafter—we additionally consider three alternative models. First, Model 2 is a combination of a probit equation for "poor at age 15" and a four-variate probit model which treats "poor at age 15" as exogenous. Comparing this model to Model 1 examines the biases of estimated coefficients caused by the endogeneity of reported child poverty.

Second, Model 3 consists of two bivariate probit models (for "graduated from college or above" with "poor at age 15" and "below the poverty line" with "poor at age 15") and one trivariate probit equation (for "feel happy," "good health," and "poor at age 15"). In each model, "poor at age 15" is treated as endogenous and the outcomes at earlier stages are treated as exogenous; for example, when estimating "below the poverty line" along with "poor at age 15," we treat "graduated from college or above" as exogenous. In contrast to Model 1, this model estimates outcomes separately, instead of considering the cumulatively recursive structure across the outcomes. If the disturbances in each model of Model 1 are correlated, Model 3 provides unbiased estimations.

Finally, Model 4 consists of three probit models (for "poor at age 15," "graduated from college or above," and "below the poverty line") and one bivariate probit model (for "feel happy" and "good health,"). In each model, we treat all other outcomes as exogenous. The difference between Models 3 and 4 reflects the endogeneity of reported child poverty.

3 Data

Our empirical analysis is based on the six-year (2000–2003 and 2005–2006) pooled data from Japanese General Social Surveys (JGSS), which are conducted and compiled by the Institute of Regional Studies at the Osaka University of Commerce, in collaboration with the Institute of Social Science at the University of Tokyo.[2]

The JGSS divided Japan into six blocks, and subdivided those, according to population size, into three (in 2000–2005) or four (in 2006) groups. Next, the JGSS selected 300–526 locations (varying each survey year) from each stratum using the Population Census

[1] Wilde (2000) argues that one varying exogenous regressor in each equation is sufficient to avoid identification problems in multi-equation probit models with endogenous dummy regressors. As mentioned by Wilde, this argument depends on the assumption of a multivariate normal distribution of the disturbances.

[2] The 2004 Survey was not conducted.

divisions. Then, the JGSS randomly selected 12 to 16 individuals aged between 20 and 89 from each survey location. Data was collected through a combination of inter and self-administered questionnaires. The number of respondents for each survey year ranged between 1,957 (in 2003) and 2,953 (in 2002), with a response rate ranging between 50.5% (in 2005) and 64.9% (in 2000). The total sample size for the 6 years was 14,750. From these surveys, we obtain information about child poverty, educational attainment, income and poverty, happiness, self-rated health, and other socioeconomic factors.

In the empirical analysis, we excluded respondents aged 60 or above—who were born in 1940 or before—for two reasons. First, a substantial portion of them had retired by the survey year, because most private firms and public-sector institutions in Japan have a mandatory retirement age of 60, or slightly above. Their income conditions differ substantially from those of the younger respondents, and would distort estimation results if the two age groups are not separated.

Second, most of those aged 60 or above experienced a different education system from the one currently in place, which was established in 1947. This is crucial because we focus on age 15, when the current compulsory education system finishes. Excluding those aged 60 or above, ensures that all respondents experienced the same compulsory education system for the 6 years between the ages of 7 and 15.

We also removed students, as well as those with missing key variables. As a result, the total sample size was reduced to 7,002, about a half of the original sample. The summary statistics for all variables are presented in Table 1. We briefly explain the dependent and independent variables used in our empirical analysis below.

For the first equation for "poor at age 15" (y_1), we defined the lowest two income groups as being poor, as previously mentioned. The explanatory variables ($\boldsymbol{X}_1$) are divided into two groups. The first group provided information about situations at age 15. We first consider whether the family was a single-mother or single-father one. We also collected data on each parents' educational background—graduated from college or above or from junior high school (graduated from high school as a reference)—and work status—non-regular employee, self-employed, non-working, and others (regular employee as a reference). In addition, we collected data on the size of the area where the respondent lived at age 15, living in a large city or small town/village (living in a middle-sized city as a reference).[3]

The second group in the explanatory variables provided the key attributes of the respondent and his/her current situation, which may affect his/her retrospective assessment of family income. As key demographic factors, we included the dummy variables for gender (female = 1), age groups (aged 30–39, 40–49, and 50–59; aged 20–29 as a reference), marital status (never married, and divorced/widowed; married as a reference), the number of children (one, two, and three or more; zero as a reference). Next, we included the respondent's work status (retired, home, and unemployed; working as a reference). In addition, we collected data on the size of the area where the respondent lives; living in a large city or small town/village (living in a middle-sized city as a reference). We also included real prefecture income per capita in the year prior to each survey year, which we collected from the Cabinet Office and evaluated at 2005 prices, in order to grasp the standard level of living in the prefecture where the respondent resided.

[3] The number of siblings was not collected in the 2003 JGSS. We repeated the estimations by including it in "poor at age 15" and "graduated from college or above" equations and using data from the 2000–2002 and 2005–2006 surveys. We confirmed its significant impact (positive for "poor at age 15," and negative for graduated from college or above) but no substantial difference in the other estimated parameters.

Table 1 Summary statistics for selected variables

Variables	Share	Variables	Share
Demographic factors and current situation		*Situations at age 15*	
Female	0.522	Poor at age 15	0.359
Aged 20–29 (reference)	0.131	Single-mother family	0.068
Aged 30–39	0.244	Single-father family	0.018
Aged 40–49	0.272	Father: Graduated from junior high school	0.378
Aged 50–59	0.352	Graduated from high school	0.469
Graduated from junior high school	0.144	Graduated from college or above	0.154
Graduated from high school	0.490	Mother: Graduated from junior high school	0.392
Graduated from college or above	0.402	Graduated from high school	0.527
Regular employee (incl. management)	0.516	Graduated from college or above	0.081
Non-regular employee	0.200	Father: Regular employee	0.545
Self-employed	0.077	Non-regular employee	0.006
Others	0.032	Self-employed	0.358
Retired	0.003	Other jobs	0.080
Home	0.153	Non-working	0.011
Unemployed	0.020	Mother: Regular employee	0.150
Below the poverty line	0.090	Non-regular employee	0.212
Never married	0.151	Self-employed	0.317
Divorced/widowed	0.060	Other jobs	0.024
No child	0.235	Non-working	0.297
One child	0.157	Living in a large city at age 15	0.150
Two children	0.416	Living in a small town/village at age 15	0.365
Three children or more	0.192		
Living in a large city	0.201		
Living in a small town/village	0.174		

Real prefecture income per capita (2005 prices, million, yen)	Mean	S.D.	Min	Max
	2.664	0.394	1.940	4.656

Sample size = 7,002 (total): 1,324 (in 2000), 1,183 (in 2001), 1,244 (in 2002), 759 (in 2003), 707 (in 2005), and 1,785 (in 2006)

For the second equation relating to educational attainment (y_2), we divided the respondents into those who graduated from college or above (40.2% of the total, including two-year college graduates) and those who did not. As for explanatory variables, $\boldsymbol{X}_2$, in addition to "poor at age 15," we used dummy variables for gender (female = 1), ages groups 30–39, 40–49 and 50–59 (age of 20–29 as a reference) for each respondent. The age dummies were used to capture the cohort effect on educational attainment, because educational attainment was completed by the survey years, after students were excluded from the sample. We also utilized information about the educational background of each parent; graduated from college or above, high school or junior high school (high school as a reference). In addition, we considered the size of the area where the respondent lived at age 15, living in a large city or small town/village (living in a middle-sized city as a reference).

The third equation relates to income/poverty in adulthood. The JGSS asked respondents to choose their pre-tax annual household income for the previous year from nineteen possible categories. We took the median value for each category and equivalized it by dividing it by the root of the number of household members, and evaluated it at 2005 prices. Then, we set the poverty line as 1.478 million yen at 2005 prices, which is equal to 50% of the median of equivalized household income for all respondents in all survey years. We define those whose income was below this poverty line (9% in the sample) as "below the poverty line." The set of explanatory variables, $\boldsymbol{X}_3$, includes the dummy variables for gender, age, residential area, and real prefectural income per capita, all of which have been explained above.

The last two equations relate to happiness and self-rated health. With respect to happiness, the JGSS asked the respondents to choose from among 1 (=happy), 2, 3, 4 and 5 (=unhappy) in response to the question "How happy are you?" With respect to self-rated health, the survey asked them to choose from among 1 (=good), 2, 3, 4 and 5 (=poor) in response to the question "How would you rate your health condition?" We categorize the top two categories in each question as "feel happy" and "good health," respectively. The percentages of those in the total sample who feel happy or who assess their health as being good were 65.0 and 52.2%, respectively. These two subjective outcomes have common explanatory variables—dummies for gender, age, and marital status (never married and divorced/widowed)—for $\boldsymbol{X}_4$ and $\boldsymbol{X}_5$, while $\boldsymbol{X}_4$ additionally included dummy variables for the number of children, which are supposed to be at least partly determined by health.

In addition, we included dummy variables for prefectures where the respondents live and those for survey years when estimating "poor at age 15," "below the poverty line," "feel happy," and "good health" to control for possible idiosyncratic effects. We also added dummy variables for prefectures where the respondent was living at age 15 when estimating "poor at age 15" and "graduated from college or above." Finally, we used JGSS-provided sampling weights and computed robust standard errors to correct for potential heteroscedasticity in all estimations.

4 Results and Discussion

Before discussing the regression analysis, Figs. 2, 3, 4 provide an overview of the observed associations between child poverty and subsequent life outcomes, comparing those who answered that their income classes at age 15 belonged to the lowest groups 1 and 2, to those from higher income classes (3–5). It is clear from Fig. 2 that those from poor families tended to leave school education before college and a higher proportion of them did not go to high school. Fig. 3 divides all respondents into five income classes and compares the share of each income class between those from poor families and those from rich families. Income distribution is clearly skewed towards the lower end for those from poor families. The differences in population shares are most remarkable at the top and bottom ends of income distribution. Finally, Figs. 4 and 5 confirm the persistent effects of child poverty; those from a poor family feel less happy and assess their health as being poorer, even after they reach adulthood.

Next, Table 2 summarizes the estimation results from recursive models, Models 1 and 2, where child poverty is endogenous in the former and exogenous in the latter. This table presents how the probability of each outcome responds to a change in each dummy regressor from zero to one, while it reports the marginal effect only for real prefecture income per capita. The results for dummy variables for current prefectures, prefectures at age 15 and survey years are not shown because of space limitations.

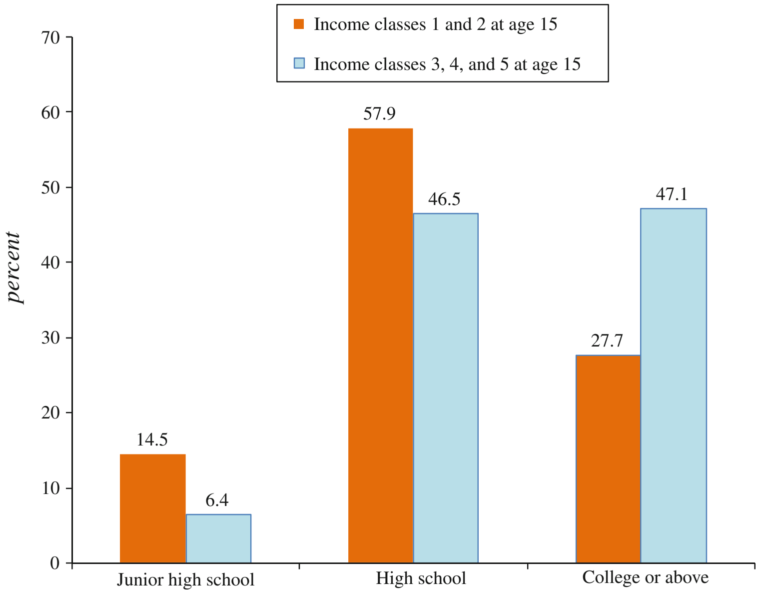

Fig. 2 Poverty at age 15 and educational attainment

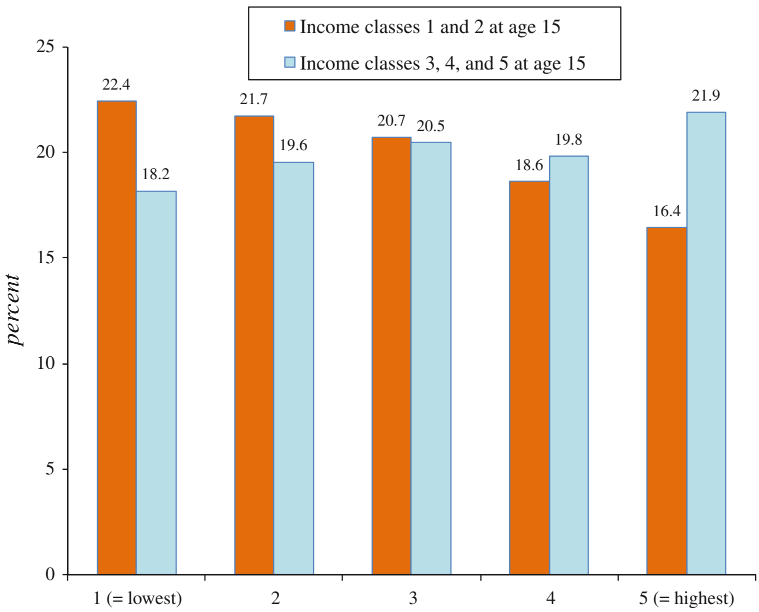

Fig. 3 Poverty at age 15 and income classes in adulthood

The first column at the top of the table shows the result of the "poor at age 15" equation in Model 1. In line with expectations, those from single-parent families tend to be poor in childhood. Low educational background and an unstable work status for the parents also raise the risk of child poverty. At the same time, the assessment of poverty in childhood is

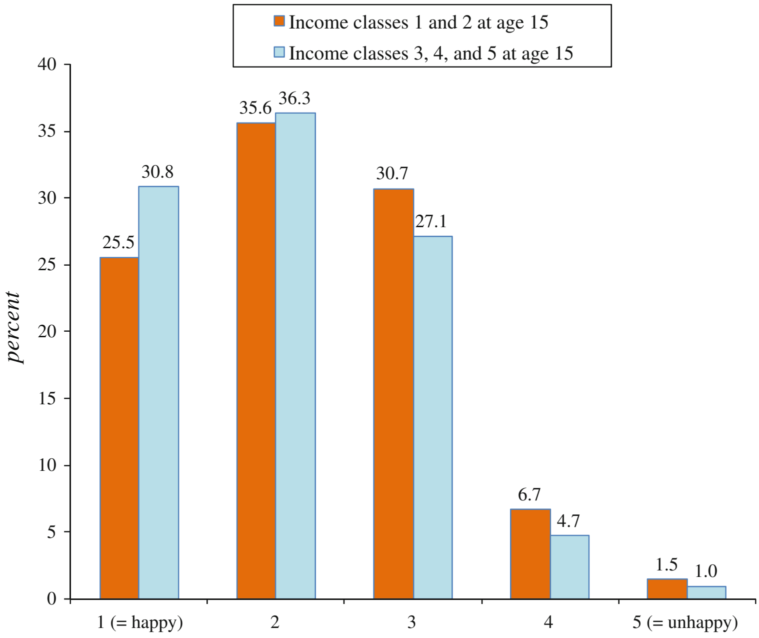

Fig. 4 Poverty at age 15 and happiness in adulthood

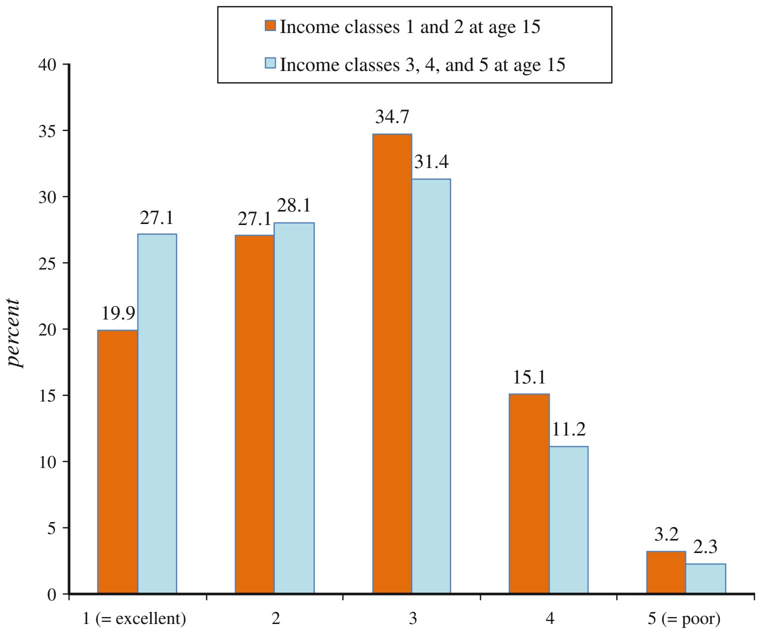

Fig. 5 Poverty at age 15 and self-rated health in adulthood

Table 2 Estimation results from Models 1 and 2

	Model 1		Model 2	
	d*Pr*/dx	Robust Std. Err.	d*Pr*/dx	Robust Std. Err.
1. Poor at age 15				
Situations at age 15				
Single-mother family	0.327	(0.068)***		
Single-father family	0.294	(0.105)***		
Father: graduated from college or above	−0.135	(0.023)***		
Father: graduated from junior high school	0.052	(0.019)***		
Mother: graduated from college or above	−0.086	(0.032)***		
Mother: graduated from junior high school	0.057	(0.019)***		
Father: non-regular employee	0.519	(0.087)***		
Father: self-employed	0.062	(0.018)***		
Father: non-working	0.445	(0.061)***		
Father: other jobs	0.074	(0.061)		
Mother: non-regular employee	0.080	(0.022)***		
Mother: self-employed	−0.048	(0.023)**		
Mother: non-working	−0.034	(0.021)		
Mother: other jobs	−0.136	(0.079)*		
Living in a large city at age 15	−0.032	(0.024)		
Living in a small town/village at age 15	0.013	(0.016)		
Demographic factors and current situation				
Female	−0.036	(0.014)**		
Aged 30–39 (reference = age 20–29)	0.089	(0.025)***		
Aged 40–49	0.127	(0.026)***		
Aged 50–59	0.143	(0.026)***		
Never married	−0.039	(0.028)		
Divorced/widowed	0.066	(0.030)**		
One child	−0.032	(0.026)		
Two children	−0.036	(0.024)		
Three children or more	−0.035	(0.026)		
Retired	0.012	(0.098)		
Home	−0.029	(0.020)		
Unemployed	0.117	(0.052)**		
Living in a large city	−0.082	(0.092)		
Living in a small town/village	−0.008	(0.020)		
Real prefecture income per capita	0.017	(0.019)		
2. Graduated from college or above				
Poverty at age 15	−0.208	(0.036)***	−0.125	(0.014)***
Female	−0.065	(0.013)***	−0.062	(0.013)***
Aged 30–39 (reference = age 20–29)	0.017	(0.023)	0.012	(0.023)
Aged 40–49	0.023	(0.023)	0.014	(0.023)
Aged 50–59	−0.081	(0.022)***	−0.092	(0.022)***

Table 2 continued

	Model 1		Model 2	
	d*Pr*/dx	Robust Std. Err.	d*Pr*/dx	Robust Std. Err.
Father: graduated from college or above	0.267	(0.024)***	0.281	(0.023)***
Father: graduated from junior high school	−0.039	(0.020)**	−0.041	(0.019)**
Mother: graduated from college or above	0.188	(0.031)***	0.196	(0.031)***
Mother: graduated from junior high school	−0.111	(0.019)***	−0.118	(0.019)***
Living in a large city at age 15	0.052	(0.024)**	0.055	(0.024)**
Living in a small town/village at age 15	−0.045	(0.015)***	−0.046	(0.015)***
3. Below the poverty line				
Poor at age 15	0.030	(0.014)**	0.004	(0.007)
Graduated from college or above	−0.049	(0.011)***	−0.052	(0.010)***
Female	0.040	(0.007)***	0.039	(0.007)***
Aged 30–39 (reference = age 20–29)	−0.063	(0.008)***	−0.061	(0.008)***
Aged 40–49	−0.070	(0.008)***	−0.067	(0.008)***
Aged 50–59	−0.053	(0.009)***	−0.050	(0.009)***
Living in a large city	0.024	(0.011)**	0.023	(0.011)**
Living in a small town/village	−0.001	(0.009)	−0.001	(0.009)
Real prefecture income per capita	−0.023	(0.043)	−0.024	(0.042)
4. Feel happy				
Poor at age 15	−0.061	(0.033)*	−0.023	(0.013)*
Graduated from college or above	0.132	(0.026)***	0.145	(0.025)***
Below the poverty line	−0.143	(0.065)**	−0.150	(0.066)**
Female	0.024	(0.012)*	0.027	(0.012)**
Aged 30–39 (reference = age 20–29)	−0.104	(0.024)***	−0.107	(0.024)***
Aged 40–49	−0.178	(0.025)***	−0.184	(0.025)***
Aged 50–59	−0.167	(0.025)***	−0.172	(0.024)***
Never married	−0.306	(0.029)***	−0.305	(0.029)***
Divorced/widowed	−0.137	(0.026)***	−0.140	(0.026)***
One child	−0.013	(0.026)	−0.011	(0.025)
Two children	0.006	(0.023)	0.007	(0.023)
Three children or more	0.029	(0.025)	0.030	(0.025)
5. Good health				
Poor at age 15	−0.101	(0.050)**	−0.058	(0.015)***
Graduated from college or above	0.063	(0.041)	0.085	(0.034)**
Below the poverty line	−0.054	(0.077)	−0.059	(0.077)
Female	0.036	(0.014)**	0.039	(0.014)***
Aged 30–39 (reference = age 20–29)	−0.103	(0.025)***	−0.106	(0.025)***
Aged 40–49	−0.135	(0.026)***	−0.141	(0.025)***
Aged 50–59	−0.143	(0.026)***	−0.147	(0.025)***
Never married	−0.045	(0.021)**	−0.045	(0.021)**
Divorced/widowed	0.016	(0.029)	0.013	(0.028)

Table 2 continued

	Model 1	Robust Std. Err.	Model 2	Robust Std. Err.
ρ_{21}	0.147	(0.057)***		
ρ_{31}	−0.117	(0.051)**		
ρ_{41}	0.066	(0.053)		
ρ_{51}	0.070	(0.071)		
ρ_{32}	−0.015	(0.041)	0.003	(0.041)
ρ_{42}	−0.094	(0.047)**	−0.122	(0.043)***
ρ_{52}	−0.036	(0.065)	−0.074	(0.051)
ρ_{43}	0.069	(0.089)	0.081	(0.090)
ρ_{53}	−0.039	(0.096)	−0.030	(0.095)
ρ_{54}	0.353	(0.019)***	0.354	(0.020)***

1. d*Pr*/d*x* Change in the probability of each outcome in response to a change in each dummy variable from 0 to 1. For real prefecture income per capita, it indicates its marginal effect

2. Dummy variables for prefectures and survey years are included in parts 2–5, and dummy variables for prefectures at age 15 are included in parts 1 and 2, but their results are not reported to save space

3. The null hypthotehis that all $\rho_{gk} = 0$ can be rejected for both Model 1 (χ^2 (10) = 1.3e+09), and Model 2 (χ^2 (6) = 1.0e+09)

4. ***, **, and * are significant at the 1, 5, and 10% level, respectively

affected by the respondent's demographic factors and current situation. Females tend to assess income conditions in childhood more positively. An increase in age tends to add to the negative assessment of them. Improving standards of living along with increased age are likely to affect the subjective assessment of income in childhood relative to other families. Divorced or widowed respondents tend to provide more negative assessments of their childhood, and an increasing number of children somewhat improves the retrospective assessment. Finally, currently unemployed respondents tend to report that their families were poor when they were young. The fact that reported child poverty is significantly affected by a respondent's current situation points to the risk that estimation results are biased if endogeneity is not properly dealt with.

The second part of Table 2 compares the results of "graduated from college or above" between Models 1 and 2. Poverty at age 15 reduces the probability of graduating from college or above by 20.8% in Model 1 and by 12.5% in Model 2, indicating that the endogeneity of child poverty puts a downward bias on its estimated impact on educational attainment. There is no substantial difference between the two models in relation to the estimated effects of other explanatory variables and their statistical significance. Women and older cohorts tend to have lower educational attainment, while those whose parents have higher educational attainment tended to graduate from college or above. Living in a large city versus a small town or village at age 15 made going to college a more likely prospect. These findings are all reasonable.

The third part of Table 2 relates to poverty in adulthood, which is explained by child poverty and educational attainment as well as other controls. The impact of child poverty is not significant in Model 2, consistent with the result in Oishi (2007), but controlling for the endogeneity of its retrospective assessment makes it positive (3.0%) and significant at the

5% level in Model 1. It should be noted that this impact is observed even after controlling for the negative and significant impact of educational attainment. As in the case of educational attainment, there is no substantial difference in the observed impacts of gender and age. Females and younger individuals tend to face higher poverty risks. The factors related to the residential area have a limited impact.

The fourth part of Table 2 covers the impact on happiness. In both models, higher education attainment raises happiness and poverty reduces it, this is in line with expectations and the results of previous studies. In addition to these effects, child poverty has a negative impact on happiness, although it is significant only at the 10% level, and is much stronger in Model 1 in relation to endogenous child poverty. Female and younger individuals tend to feel happier, and marriage contributes to happiness. The number of children does not matter in this estimation.

The fifth part of Table 2 shows the impact on self-rated health. Most strikingly, child poverty has a strong, negative impact on it, while the negative impact of current poverty is not significant. Many previous studies indicate the negative effect of current poverty on self-rated health, but most of them did not add child poverty as an explanatory variable. Our estimation results point to the persistent and traumatic effect of poverty experiences in childhood, although more detailed analyses are needed to distinguish it from the effect of current poverty. As in the case of happiness, females, younger, and married individuals tend to assess their health status more positively.

Finally, we notice strong correlations between the disturbances of the equations for (1) child poverty and educational attainment, (2) child poverty and poverty in adulthood, (3) educational attainment and self-rated health, and (4) happiness and self-rated health. Indeed, the likelihood ratio test can reject the null hypothesis that all ρ's equal zero for both Models 1 and 2. These results imply that non-recursive models may lead to biased estimations.

Table 3 compares the estimated impact on the probability of each outcome for key explanatory variables across four models in order to check how sensitive the estimation results are sensitive to model specifications. Models 1 and 2 are recursive while Models 3 and 4 are not, and child poverty is endogenous in Models 1 and 3 and exogenous in Models 2 and 4. Three things are noteworthy from Table 3 in terms of the estimated impact of child poverty. First, the impact of child poverty tends to be smaller in the recursive models (Models 1 and 2) than in the non-recursive models (Models 3 and 4). This is a reasonable result, given that the recursive models explicitly capture the indirect impact of child poverty that works through the outcomes at earlier stages. Second, the impact of child poverty tends to be larger in the models with endogenous child poverty (Models 1 and 3) than in the models with exogenous child poverty (Models 2 and 4). The endogeneity of reported child poverty engenders a downward bias on its estimated impact on life outcomes. Third, the impacts of educational attainment and poverty in adulthood on self-rated health are strongly significant in the non-recursive models but insignificant or less significant in the recursive models. This suggests that their impacts, which have been reported by many previous studies, originate largely from child poverty rather than from themselves.

Finally, based on the estimated results from Model 1, let us roughly calculate the total impact of child poverty on subsequent life outcomes. As illustrated in Fig. 1, child poverty affects life outcomes in multiple ways. For example, child poverty leads to lower education attainment, and lower education attainment leads to poverty risks in adulthood, while child poverty affects poverty risks in adulthood directly—not through educational attainment—as well.

Table 3 Estimated impact of child poverty, low education attainment, and poverty in adulthood

	Recursive models		Non-recursive models	
	Model 1	Model 2	Model 3	Model 4
1. Poor at age 15	Endogenous	Exogenous	Endogenous	Exogenous
2. Graduated from college or above				
Poor at age 15	-0.208^{***}	-0.125^{***}	-0.461^{***}	-0.128^{***}
	(0.036)	(0.014)	(0.037)	(0.015)
3 Below the poverty line				
Poor at age 15	0.030^{**}	0.004	0.163^{***}	0.004
	(0.014)	(0.007)	(0.040)	(0.007)
Graduated from college or above	-0.049^{***}	-0.069^{***}	-0.047^{***}	-0.053^{***}
	(0.011)	(0.013)	(0.008)	(0.007)
4. Feel happy				
Poor at age 15	-0.061^{*}	-0.023^{*}	-0.093^{***}	-0.035^{***}
	(0.033)	(0.013)	(0.029)	(0.013)
Graduated from college or above	0.132^{***}	0.145^{***}	0.084^{***}	0.090^{***}
	(0.026)	(0.025)	(0.013)	(0.013)
Below the poverty line	-0.143^{**}	-0.150^{**}	-0.091^{***}	-0.092^{***}
	(0.065)	(0.066)	(0.023)	(0.023)
5. Good health				
Poor at age 15	-0.101^{**}	-0.058^{***}	-0.111^{***}	-0.063^{***}
	(0.050)	(0.015)	(0.037)	(0.014)
Graduated from college or above	0.063	0.085^{**}	0.039^{***}	0.043^{***}
	(0.041)	(0.034)	(0.014)	(0.014)
Below the poverty line	−0.054	−0.059	-0.082^{***}	-0.082^{***}
	(0.077)	(0.077)	(0.024)	(0.024)

1. This table summarizes changes in the probability of each outcome in response to a change in each dummy variable from 0 to 1

2. All models use the same explanatory variables as reported in Table 2

3. The figures in the parentheses are robust standard errors

4. The null hypothesis that all covariances of disturbances equal zero can be rejected at the 1% level for all models

5. ***, **, and * are significant at the 1, 5, and 10% level, respectively

As presented in the top two panels of Table 4, let m_{ij} denote the estimated impact of variable j on the probability of outcome i, where $i = 1$ for "poor at age 15"; =2 for graduated from college or above; =3 for "below the poverty line"; =4 for "feel happy"; and =5 for "good health." Let M_i denote the total impact of child poverty on the probability of outcome i. Then, M_i is calculated as

$$\begin{aligned}
\text{Graduated from college or above:}\quad & M_2 = m_{21}, \\
\text{Below the poverty line:}\quad & M_3 = m_{31} + M_2 m_{32}, \\
\text{Feel happy:}\quad & M_4 = m_{41} + M_2 m_{42} + M_3 m_{43}, \\
\text{Good health:}\quad & M_5 = m_{51} + M_2 m_{52} + M_5 m_{53},
\end{aligned}$$

Table 4 Subsequent life outcomes after child poverty

	$i = 2$ Graduated from college or above	3 Below the poverty line	4 Feel happy	5 Good health
Impact of variable j on the probability of outcome i (m_{ij})				
$j = 1$ Poor at age 15	m_{21}	m_{31}	m_{41}	m_{51}
2 Graduated from college or above		m_{32}	m_{42}	m_{52}
3 Below the poverty line			m_{43}	m_{53}
Impact of poverty at age 15				
Poor at age 15	m_{21}	m_{31}	m_{41}	m_{51}
Graduated from college or above		M_2m_{32}	M_2m_{42}	M_2m_{52}
Below the poverty line			M_3m_{43}	M_3m_{53}
Total	M_2	M_3	M_4	M_5
Based on Model 1				
Estimated values of mj				
$j = 1$ Poor at age 15	−0.208	0.030	−0.061	−0.101
2 Graduated from college or above		−0.049	0.132	0.063
3 Below the poverty line			−0.143	−0.054
Estimated impact of poverty at age 15				
Poor at age 15 (A)	−0.208	0.030	−0.061	−0.101
Graduated from college or above		0.010	−0.027	−0.013
Below the poverty line			−0.006	−0.002
Total (B)	−0.208	0.040	−0.094	−0.117
((A)/(B), %)	(100.0)	(74.8)	(64.6)	(86.8)

m_{ij} Change in the probability of outcome i in response to a change in the dummy variable j from 0 to 1

where the first term on the right of each equation indicates the direct impact, and the second and third terms indicate indirect impacts.

The bottom two panels report the estimation results obtained from Model 1, which has a recursive structure with endogenous child poverty. Child poverty reduces the probability of graduating from college or above by 20.8%, close to the result in Fig. 2, which shows that the share of college graduates is 19.5% lower for those from poor families than those from a wealthier background.

Then, child poverty raises the probability of falling below the poverty line by 3.0%. To be sure, those from poor families can overcome the adverse impact of child poverty; if they graduate from college or above, they can reduce the probability of falling below the poverty line by 4.9%, which dominates the direct impact of child poverty of 3.0%. Without any additional effort by the individual or policy support, however, lower educational attainment adds 1.0% point to the negative impact of child poverty on poverty in adulthood, raising its total impact to 4.0%.

In the same way, child poverty reduces the probabilities of feeling happy and of having good health by 6.1 and 10.1%, respectively. The estimated magnitudes of the impact are in line with those observed in Figs. 4 and 5, which show that the probabilities of feeling happy (happiness = 1 or 2) and having good health (self-rated health = 1 or 2) are 6.0 and

8.2% lower, respectively, for those from poor families relative to those from a wealthier background.

More strikingly, 75% of the impact of child poverty on poverty risk in adulthood is attributable to an impact that is not related to education attainment. Similarly, 65 and 87% of the impact of child poverty on happiness and self-rated health, respectively, do not result from education attainment or poverty risk. To be sure, if our recursive structure includes additional pathways through which child poverty affects life outcomes, the direct impact of child poverty could decrease. At the same time, however, the indirect impact could become more important, probably leaving the total impact of child poverty largely intact. In all, our estimation results reveal that child poverty has a persistent, negative impact on subsequent life outcomes.

5 Conclusion

We examined how poverty in childhood adversely affects success in adulthood, using micro data from nationwide surveys in Japan. Having no longitudinal data on household income, we used retrospective assessments of income class at age 15. Our empirical analysis has three features. First, we control for the endogeneity of reported child poverty by using information about the respondent's parents and his/her current socioeconomic condition. Second, we extend the analysis to two outcomes of subjective well-being—happiness and self-rated health—from educational attainment and poverty. Finally, we explicitly investigate the processes through which child poverty affects subsequent life outcomes by estimating recursive, multivariate probit models.

Our empirical analysis found that child poverty has a persistent impact on subsequent life outcomes. In line with conventional wisdom and the results from many previous studies, those from poor families tend to have lower educational attainment, face more poverty risk, and consider themselves to be less happy and to assess their health as being poorer. In addition, we found that child poverty strongly affects life outcomes even after controlling for its impacts on previous outcomes. These empirical results suggest that the adverse effect of child poverty cannot be easily overcome and that policy measures to reduce child poverty are required to ensure that children have equal opportunities to achieving success in life.

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