Child Health and Parental Socioeconomic Status:

Evidence From Urban and Rural China

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1. Introduction

The interdependence between child health and parental socioeconomic status (household income, educational attainment, health status, occupations, etc.) has recently generated a considerable empirical literature in social sciences and particularly in economics (Bradley and Corwyn, 2002; Case et al., 2002; Currie et al., 2007). This relationship is important because childhood health conditions are likely to have a lasting impact on health and socioeconomic status in adulthood; children who experience poorer health have significantly lower educational attainment, poorer health and lower social status as adults (Case et al., 2005). The argument conforms to other studies (For example, see van den Berg et al., 2006) which also document the significance of the conditions in early life. Thus, childhood health may be an important mechanism for intergenerational transmission of socioeconomic status. As one of the leading studies, Case et al. (2002) point out that parents with higher earnings are able to make more investments in child health through purchasing medical care services, nutritious food, and other health-related products, as well as providing safer environments for their children. Consequently, children in wealthier households are likely to be healthier comparing to those in relatively poor households. In the meantime, other factors of parental background, such as educational attainment, health status, employment status and occupations can also influence child health (Currie and Moretti, 2003; Christiaensen and Alderman, 2004; Lindeboom et al. 2009). Furthermore, child-specific characteristics such as age and gender are also likely to affect child health status. In general, empirical literature has provided mixed evidence concerning the relationship between child health and parental background; and despite the plausibility of the above-mentioned rationale, the mechanism through which household and parental socioeconomic status is connected to childhood well-being is far from conclusive.

Child health has been on the public policy agenda of many developed and developing countries. As China is one of the most populous developing countries with fast economic development and dichotomized social structure, it is of particular interest that how the health status of Chinese children is related to parental socioeconomic status, and household condition in general. This paper attempts to shed some light on the relationship between parental socioeconomic status and child health in China from early 1990s to mid-2000s. Using a panel dataset constructed from the raw data of China Health and Nutrition Survey, there are several findings which may be suggestive for future research on child health in China. First, in contrast to some empirical results from US and UK, household income is not significantly related to subjectively-measured child health status. This is the case for both urban and rural children in China. On the other hand, there is a positive correlation between household income and rural children's nutritional status indicated by objective measures. Second, parental socioeconomic status plays an important role in child health, and in general maternal socioeconomic status has a greater impact on children's health status than paternal socioeconomic status. Third, in many cases the effects of parental socioeconomic status on children's health are different for urban and rural children. For example, parental health status has a larger impact on rural children's health status than on urban children's; the effects of both maternal education and maternal occupation are more prominent for rural children than for urban children; and paternal education is important for the health status of urban children but not that of rural children.

The remainder of the paper proceeds as follows. Section 2 reviews previous literature concerning the relationship between parental socioeconomic status and child health. Section 3 describes the sample used in this paper, and provides specific definitions and explanations of key variables used for the analysis. In section 4, the empirical approach is specified. Then, I present estimation results in section 5, followed by a discussion of the possible mechanisms that guide the relationship of interest in section 6. This paper ends with a brief conclusion in section 7.

2. Literature

2.1 Household income and childhood health

Among all potential determinants of health status in childhood, household income has been the core of numerous studies, and the possible mechanism through which household income is related to the health status of children has long been discussed and provoked controversies in the literature. On the one hand, wealthier parents have less binding budget constraint, which allows them to purchase health inputs of greater quantity or better quality for their children. On the other hand, parents with higher socioeconomic status are likely to spend more time in the market; consequently they may invest less time in child care (Currie, 2009). Therefore, the effects of household income on child health are neither necessarily positive nor negative.

Measures of child health vary from study to study in the empirical literature. First and foremost, some leading and inspiring works employ subjective measures of child health status as the dependent variable and generally show that higher household income is linked to better child health. Analyses of US data from National Health Interview Survey (NHIS) and Panel Study of Income Dynamics (PSID) have provided evidence that family income is a powerful determinant of childhood health. This income effect is referred as the "income-gradient" in children's health status (Case et al., 2002). Specifically, lower household income is associated with poorer child self-reported health status, and the effect of household income is larger for older children. The income-gradient also remains for all age groups after controlling for the parental background such as educational attainment, employment status, etc. Furthermore, based on data from National Health and Nutrition Examination Survey (NHANES), poorer children are also likely to have lower parent-assessed and physician-assessed health status. Correspondingly, studies based on the survey data from Health Survey for England (HSE) yield similar evidence as the US data (Currie et al., 2007). Household income has a significantly positive impact on subjectively-assessed child health status across all age groups for English children; however in contrast to Case et al. (2002), the income gradient does not increase with child age. Moreover, the income gradient is robust yet becomes smaller after controlling for the observed parental characteristics (education and employment status).

Second, there is also supporting evidence that the income gradient applies not only to the subjective measure of child health, but also to some objective measures. US children who live in poorer households tend to miss more days in school because of illness, have more days with their activities restricted or in bed, and suffer from longer hospitalization episodes (Case et al., 2005). Similarly, according to Currie et al. (2007), English children whose family income is low are at higher risk of low birth weight on average than other children. Besides, children's height and family income are also found to be positively correlated in England; however, this positive correlation vanishes after controlling for the height of the parents.

Studies of the income gradient focusing on the developing world mainly utilize anthropometric indicators of child health rather than subjective measures, presumably due to the limited information on self-reported child health status. A study of South Africa has shown that an increase in household income, because of the extension of the Old Age Pension program, is beneficial to child height given age (Duflo, 2000). Comparable evidence has been found in Central America, where per capita household income is likely to reduce child malnutrition (indicated by height-for-age and weight-for-age) in Nicaragua or western Honduras (David et al., 2004). Finally, concerning the child health in East Asia, Chinese children with higher household income are also found to have greater height-for-age z-scores (Bredenkamp, 2009), suggesting that rich children are on average in better nutritional status than the poor in China. Accordingly, one may generally expect that an exogenous increase in income can improve child health in developing countries, and direct income transfers to poor households are beneficial. However, Bredenkamp (2009) suggests that the impact of household income on Chinese children's nutritional status is mainly attributed to income variations between communities rather than between households. Therefore, the policies aimed at increasing income at community level might be more effective in improving child health in China.

2.2 Parental socioeconomic status and childhood health

In addition to household income, the interdependence between childhood health status and parental socioeconomic status is also of great interest in the empirical literature. Various indicators of parental socioeconomic status have been exploited; particularly, many studies pinpoint the impact of parental education, especially maternal education, on child health. There are different possible pathways by which parental educational background could relate to children's health (Desai and Alva, 1998; McCrary and Royer, 2005; Lindeboom et al., 2009). Higher educational attainment may increase the parents' ability to access and process information, and help parents to make better health investments for their children. One the other hand, higher level of education may result in higher earnings for parents; thus, more resources can be used to purchase health inputs for their children. Besides, more education may correlate with certain favorable behaviors, which could benefit the health of the offspring. However, the positive association between parental education and child health might also be through non-causal ways, and it can possibly due to some unobserved endowments that are transmitted across generations. Due to the possibility of assortative mating where individuals with higher level of education are likely to marry partners with higher level of education as well, separate analyses of maternal and paternal education may lead to inconsistent estimates (Lindeboom et al., 2009). Therefore, most empirical studies include the educational background of both parents in the same regression such that the estimation results may be interpreted as the direct effects of each parent's education.

With respect to the developed world, an important finding is that higher mother's and father's education is correlated with better self-reported health status of children across all age groups for both US (Case et al., 2002) and England (Curries et al., 2007), and maternal education generally has a greater impact than paternal education. However, conflicting evidence has been found in Doyle et al. (2005) where there are no parental education effects on English children's health except for both parents' education on girls aged 0 to 3 and maternal education on girls aged 13 to 15. Based on these results, whether parental educational attainment significantly correlates with child health is not yet conclusive for developed countries. Furthermore, in the cases where positive correlation between parental education and child health is identified, it is still controversial whether the relationship causal. If parental education does cause better child health, the public policy goals to improve child health may be achieved through increasing parental education. Thus, some studies not only emphasize the effects of improvements in parental education (especially female education) on child health, but also attempt to establish the causal link between the two. In the US, Mother's education is found to reduce the probability of low birth weight of the child if educational attainment is instrumented by college openings (Currie and Moretti, 2003), but is found to have no prominent impact on child birth weight if educational attainment is instead instrumented by school entry policy (McCrary and Royer, 2005). Evidence from UK data also fails to justify the causality from higher parental education to better child health (Lindeboom et al., 2009). Specifically, the schooling reform in UK in 1947 has significantly raised the educational attainment of the parents; however, increased parental education does not lead to improvement in child health status in terms of birth weight or height-for-age. Thus, based on the empirical studies above, it seems that the observed effect of parental education on child health is likely to be spurious in the developed world context.

In the developing world context, several works based on data of a single country have provided supporting evidence for the positive relationship between parental education and child health. For example, after controlling for the household income and community characteristics, maternal education is found to be significantly correlated with favorable outcomes of children's height in both rural and urban sectors of Northeast Brazil (Thomas et al., 1991). Similar evidence has also been discovered in Jamaica, where the children of more educated mothers are in better nutritional status on average than the others (Handa, 1999). Besides, according to the study of Chinese children by Bredenkemp (2009) discussed previously, mother's education plays a significant role in child nutritional status, but only at higher levels of educational attainment (upper middle school or above). However, father's education is not controlled in the analysis and as is mentioned in Lindeboom et al. (2009), the estimates could be biased. Alternatively, mother's education and father's education might be too highly correlated to be included in a particular specification simultaneously. When also investigated separately, increases in either mother's education or father's education is likely to result in lower probability of low birth weight for Taiwanese children (Chou et al., 2007). In addition to these single-country studies, a cross-country analysis using data of 22 developing countries from Demographic and Health Surveys (DHS) also shows that for a number of countries such as Kenya, Egypt and Thailand, there is evidence of a significantly positive correlation between maternal education and height-for-age of children aged 12 to 36 months, and this effect is attenuated after controlling for father's education and community effects (Desai and Alva, 1998). By comparison, there are no significant findings for other developing countries (for example, Morocco, Sri Lanka, Colombia, etc.); thus, it is still difficult to conclude that the link between maternal education and child health is generally strong and positive in the developing world.

Factors of parental socioeconomic status other than educational attainment may also have independent effects on the health status of children. For US children, parental health has a large effect on child self-reported health status, and the effect of maternal health is larger comparing to that of paternal health (Case et al., 2002). Likewise, UK children of genetic parents with limiting chronic conditions are more likely to suffer from poorer health (Currie et al., 2007). Although few studies have examined the link between parental occupation and child health, Bradley and Corwyn (2002) point out that based on previous research, income, education and occupation together may represent socioeconomic status better, which is also in accordance with the argument in Alder et al. (1994) that socioeconomic status may function most powerfully in the combination of variables. Therefore, it is also reasonable to consider the potential effects of parental occupations and employment status on child health. Parents with higher occupational status are likely to purchase more or better health inputs that benefit their children; on the other hand, the working time varies from occupation to occupation, which may also affect the time spent on child care.

While the income-gradient on subjectively-reported child health status seems to be consistent and robust for the developed countries such as US and UK, there is little work exploring the similar relationship for some developing countries. I attempt to address this issue using available information on the self-reported health status of Chinese children. Furthermore, for both developed and developing countries, the interdependence between parental background and child health is still controversial and mixed due to either the complexity of the mechanism itself or the inconformity of using different measures for parental socioeconomic status and child health. Therefore, it is also of importance to reexamine what the evidence will be in China.

3. Data

3.1 Sample Description

The main source of data for this paper is the China Health and Nutrition Survey (CHNS). Collaboratively conducted by the Carolina Population Center at the University of North Carolina at Chapel Hill and the National Institute of Nutrition and Food Safety at the Chinese Center for Disease Control and Prevention, CHNS is a cross-sectional survey that collects yearly data on household social, economic and health information of a large representative sample of Chinese adults and children. Starting from 1989, the ongoing survey has already been conducted for 8 waves, namely 1989, 1991, 1993, 1997, 2000, 2004, 2006, and 2009. This paper draws six waves of the CHNS from 1991 through 2006, which includes data on households in nine provinces in China. Because CHNS collected information on every member in each household, and from wave 2004 on there were separate surveys on the adults and the children, each child can be matched with their parents. The resulting panel dataset consists of 11117 observations on Chinese children aged from 0 to 18. In particular, due to the social and economic differences between urban and rural China, this paper also interests in investigating whether the relationship between parental socioeconomic status and child health would be different for urban and rural children. Therefore, the sample is divided into two subsamples for urban and rural households, with 3372 and 7745 observations, respectively.

The main interest of this paper is to understand the relationship between parental socioeconomic status and child health in China. Several parental and household characteristics (parents' age, educational background, health status, household size, etc.) serve as indicators for socioeconomic status and may have direct or indirect effects on children's health. For this reason, the sample is restricted to children who live with both their biological parents, and for whom the information on child, parental and household characteristics are nonmissing. As a result, 470 and

875 cases are dropped respectively from the urban sample and the rural sample. Consequently, the core samples of Chinese children from CHNS are 2909 observations in the urban area and 6870 observations in the rural area.

3.2 Variables

Three dependent variables are used in this paper, namely child self-reported health status, child height-for-age z-score, and child weight-for-age z-score. The dependent variables are defined as follows. *Child self-reported health status*: is the answer to the question: "Right now, how would you describe your health compared to that of other people your age? " The possible answers are: excellent (1); good (2); fair (3); and poor (4). The question is asked to all children from wave 1991 through wave 1997, and to the children aged 12 years old and above from wave 2000 to wave 2006. *Height-for-age z-score*: is the number of standard deviations from the median height of a reference population. *Weight-for-age z-score*: is the number of standard deviations from the median weight of a reference population. These two variables are anthropometric indicators of growth achievement and nutritional status, and are used as proxies for child health. In this paper the references used to construct the z-scores are WHO global database on child growth for the children aged zero to five and WHO 2007 growth reference for the children that are older than 5 years old. The z-scores are calculated using the STATA code provided by WHO Anthro Team.

The parental socioeconomic status indicators are: household income, employment status, educational attainment, health status and occupations. The definitions and explanations of the variables are provided below.

Real household income last year: is the sum of various earnings last year, including mother's wage income; father's wage income; yearly bonus; other cash income and subsidies; the market value of home production consumed, various gifts and coupons; as well as in-kind income, with each component adjusted for spatial and temporal inflation using the consumer price index ratio from National Bureau of Statistics of China. Unfortunately, individuals were not very anxious in revealing their incomes; and consequently, almost each component of household income consists of a considerable proportion of missing values. For example, roughly 44.5% and 68.3% of the data on mother's wage and approximately 33.3% and 55.1% of the data on father's wage are missing for urban and rural sample respectively. Moreover, about 60% of the households did not report the market value of the subsidies; and nearly 25% of the data on income from other sources (in-kind income, friends, etc.) are also missing. As a result, the added real household income turns out to be an empty set. In order to maintain the size of the dataset and to apply the standard complete-data methods, the components of household income with missing values are jointly imputed based on an explicit model. The multivariate imputation model includes the age, employment status and educational background of the parents, family size, as well as the year and the province dummies.

Multiple imputation is employed such that for each missing datum multiple values are imputed, and multiple complete data sets are created. In this paper, for both urban and rural samples, 10 imputations are created for the analysis. Based on the imputed data, real household income is then calculated as the sum of all the income-related components. *Log real household income*: is the logarithm of real household income last year.

Indicators for mother's (father's) socioeconomic status are a set of dummy variables. *Mother's (father's) employed*: equals 1 if the parent is currently employed; 0 otherwise. With respect to educational attainment, the following dummy variables are used. *No education:* equals 1 if the parent is not educated; 0 otherwise. *1-3 years primary school*: equals 1 if the parent has received up to 1 to 3 years of primary school education; 0 otherwise. *4-6 years primary school*: equals 1 if the parent has received up to 4 to 6 years of primary school education; 0 otherwise. *1-3 years lower middle school*: equals 1 if the parent has received up to 1 to 3 years of lower middle school education; 0 otherwise. *High school*: equals 1 if the parent has received up to high school or technical school education; 0 otherwise. *College or above*: equals 1 if the parent has attended college or above; 0 otherwise. The sum of the above six variables is 1.

Mother's (father's) health status excellent or good: equals 1 if the parent's health is excellent (1) or good (2); 0 if the parent's health is fair (3) or poor (4).

Mother's (father's) occupation *Group 1*: equals 1 if the parent work as senior professional/technical worker and administrator/executive/manager; 0 otherwise. *Group 2*: equals 1 if the parent work as junior professional/technical worker, office staff and skilled worker; 0 otherwise. *Group 3*: equals 1 if the parent is a farmer, fisherman, hunter or engaging in small commercial household business, handicraft, etc.; 0 otherwise. *Group 4*: equals 1 if the parent work as non-skilled worker, driver and service worker; 0 otherwise. *Group 5*: equals 1 if the parent is a soldier, policeman, athlete, actor, musician or takes other occupations; 0 otherwise. *Group 1 + Group 2 + Group 3 + Group 4 + Group 5* =1.

Other control variables are child age, gender, household size, whether the child has siblings, whether the child has medical insurance, as well as the age and anthropometrical measures (height, weight) of parents. *Child age*: is measured in years according to the solar calendar. *Mother's (father's) age*: isdefined similarly as child age. *Mother's (father's) height*: is measured by physicians in centimeters. *Mother's (father's) weight*: is measured by physicians in kilograms. *Household size*: is the number of family members in a household. *Log household size*: is the logarithm of household size. Besides, there are also three dummy variables corresponding to child-specific characteristics. *Male*: equals 1 if the child is male; 0 if female. *Have siblings*: equals 1 if a child is not the only child; 0 otherwise. *Have insurance*: equals 1 if a child has medical insurance; 0 if not. Finally, year and province dummies are generated corresponding to each wave and province.

Table 1. Descriptive Statistics

	All		Urban		Rural	
	Mean	Std dev.	Mean	Std dev.	Mean	Std dev.
Real household income last year (yuan)	8092.301	14737.93	12272.570	19732.940	6143.190	11179.530
Household size	4.381	1.723	4.101	1.504	4.502	1.797
Child age (years)	9.760	5.036	9.920	5.021	9.690	5.042
Have insurance (%)	0.224	0.417	0.312	0.463	0.186	0.389
Have siblings (%)	0.395	0.489	0.263	0.440	0.452	0.498
Male (%)	0.555	0.497	0.538	0.499	0.563	0.496
Child self-reported health status (excellent = 1 to poor = 4)	1.956	0.595	1.984	0.598	1.943	0.594
Child's health status excellent or good (%)	0.860	0.347	0.842	0.365	0.869	0.338
Height-for-age z-score	-0.676	1.470	-0.413	1.470	-0.790	1.450
Weight-for-age z-score	-0.222	1.387	0.180	1.450	-0.325	1.345
Mother's age (years)	36.183	7.385	36.199	7.150	36.176	7.487
Mother's employed (%)	0.845	0.362	0.808	0.394	0.861	0.346
Mother's health status excellent or good (%)	0.746	0.435	0.712	0.453	0.761	0.426
Mother's height (cm)	155.677	8.798	156.078	8.864	155.498	8.764
Mother's weight (kg)	54.835	11.124	55.769	10.485	54.419	11.373
Mother's education (%)						
No education	0.131	0.337	0.066	0.249	0.159	0.366
1-3 years primary school	0.072	0.259	0.056	0.230	0.080	0.271
4-6 years primary school	0.219	0.413	0.156	0.363	0.246	0.431
1-3 years lower middle school	0.378	0.485	0.383	0.486	0.376	0.484
High school	0.172	0.377	0.266	0.442	0.130	0.337
College or above	0.029	0.167	0.073	0.260	0.009	0.096
Mother’s occupation (%)						
Group 1	0.041	0.197	0.092	0.289	0.019	0.137
Group 2	0.138	0.344	0.243	0.429	0.094	0.292
Group 3	0.601	0.490	0.331	0.471	0.714	0.452
Group 4	0.193	0.395	0.299	0.458	0.149	0.356
Group 5	0.028	0.164	0.034	0.182	0.025	0.156
Father's age (years)	37.912	7.856	38.315	7.550	37.724	7.988
Father's employed (%)	0.933	0.250	0.895	0.306	0.949	0.219
Father's health status excellent or good (%)	0.782	0.413	0.737	0.440	0.802	0.399
Father's height (cm)	166.479	22.577	167.610	37.877	165.950	8.724
Father's weight (kg)	63.323	45.375	64.437	13.117	62.802	54.232
Father's education (%)						
No education	0.031	0.174	0.019	0.137	0.037	0.188
1-3 years primary school	0.046	0.209	0.042	0.201	0.047	0.212
4-6 years primary school	0.197	0.398	0.128	0.334	0.227	0.419
1-3 years lower middle school	0.454	0.498	0.423	0.494	0.468	0.499
High school	0.223	0.416	0.275	0.447	0.199	0.400
College or above	0.049	0.217	0.113	0.316	0.021	0.144
Father’s occupation (%)						
Group 1	0.101	0.301	0.175	0.380	0.070	0.255
Group 2	0.170	0.376	0.259	0.438	0.133	0.339
Group 3	0.472	0.499	0.247	0.431	0.567	0.496
Group 4	0.214	0.410	0.268	0.443	0.191	0.393
Group 5	0.043	0.202	0.051	0.220	0.039	0.194

Source: China Health and Nutrition Survey (CHNS), 1991-20

3.3 Descriptive Statistics

Descriptive statistics are provided in Table 1. Overall the average age of children is 9.76 years; the urban children are on average 9.92 years old and the rural children are on average 9.69 years old. The complete sample shows that 55.5% of the children are male, and 22.4% of the children have medical insurance. The proportion of children with siblings is 45.2% in the rural areas and is much lower in the urban areas, which is about 26.3%. The children are on average in excellent or good health, with only 14% reporting they are in fair or poor health. The proportion of children to report excellent or good health is higher among rural households (86.9%) than among urban households (84.2%). The mean height-for-age z-score is -0.676 and mean weight-for-age z-score is -0.222; in other words, an average Chinese child is 0.676 standard deviations and 0.222 standard deviations below the median height and weight respectively, for a child of the same age and sex from the reference population. Particularly, the mean height-for-age z-score is -0.413 for urban children and is -0.790 for rural children; the mean weight-for-age score is 0.180 for urban children and -0.325 for rural children. This implies that rural children are generally more stunted than urban children in China. The average number of household member is 4.1 persons in the urban areas and 4.5 persons in the rural areas. After the imputations, on average the real household income from the previous year is approximately 12272.57 yuan for urban households, and is 6143.19 yuan for rural households.

The mothers are on average 36.2 years old, with 84.5% are presently employed; and the fathers are on average 37.9 years old, with 93.3% are presently employed. In general 74.6% of the mothers and 78.2% of the fathers have reported that they are in excellent or good health; and rural parents tend to report excellent or good health status more frequently than urban parents. Roughly about 13% of the mothers and 3.1% of the fathers do not have any formal education. The proportion of the mothers and the fathers who have completed college or above is only 2.9% and 4.9%, respectively. In addition, the percentage of parents to complete higher levels of education (high school or college) is much higher in the urban areas than in the rural areas for both parents. More than half of the rural parents (71.4% of the mothers and 56.7% of the fathers) are farmers, fishermen, hunters or engaging in small commercial household business (occupation group 3). In the urban area, by comparison, the proportion of parents who work as farmer, fisherman or hunter is much smaller. Besides, less than one third of the parents work as non-skilled workers, drivers (occupation group 4) or service workers or office staff and skilled workers (occupation group 2). For both urban and rural area, the fewest work as musician, soldier, actor or athlete (occupation group 5).

4. Empirical Approach

4.1 The Ordered Response Model

The first dependent variable is child self-reported health status, which is of discrete values with a logical ordering. The linear regression model is generally inappropriate; instead, an ordered response model can be used. Specifically, the self-reported health status H_{it} for child *i* in year *t* has 4 possible outcomes which are assumed to be determined by the latent health status H_{it}^*. The model is defined as follows:

$$H_{it}^* = X_{it}'\beta + \alpha_i + u_{it}, \quad i = 1, \dots, N, \quad t = 1, \dots, T$$
$$H_{it} = j \quad \text{if} \quad m_{j-1} < H_{it}^* \le m_j, \qquad j = 1, \dots, 4 \qquad (1)$$

where the boundaries $m_0 = -\infty$ and $m_4 = \infty$. X_{it} is a vector of all explanatory variables (household income, parental socioeconomic status indicators, child-specific characteristics, etc.), including a constant term. Some of the explanatory variables are time-varying, for example the age, the employment status, the occupation and the health status of the parents; whereas some other explanatory variables are time-invariant, such as parental educational background and the gender of the child. u_{it} is the error term and is assumed to follow a certain distribution with mean 0 and variance σ^2. As will be discussed later, only the logistic distribution is considered in this paper. Furthermore, X_{it} and u_{it} are assumed to be uncorrelated such that consistent estimator can be obtained. Two different specifications with respect to the individual effect α_i are employed, namely the random effects (RE) and the fixed effects (FE).

First, for the random effects ordered logit model, the assumptions concerning the individual effect α_i are: 1) α_i follow a normal distribution with mean 0 and variance σ_α^2 ; 2) α_i are independent of $X_{i1}, \dots, X_{iT}$ and $u_{i1}, \dots, u_{iT}$. The estimation is based on maximum likelihood and the contribution of respondent *i* to the likelihood function is:

$$L_i(\beta, \sigma_\alpha^2) = \int_{-\infty}^{\infty} \left[\prod_{t=1}^{T} \left\{ F_\sigma(m_{H_{it}} - X_{it}'\beta - \alpha_i) - F_\sigma(m_{H_{it}-1} - X_{it}'\beta - \alpha_i) \right\} \right] g(\alpha_i) d\alpha_i \qquad (2)$$

where $g(\alpha_i)$ is the density of distribution function of α_i and F_σ is the logistic distribution function of u_{it} . The boundaries m_j (j = 1,…,4) are assumed to be constant across individuals (Das and van Soest, 1999). Maximizing the joint likelihood function provides consistent estimates for β under the assumptions above. One advantage of the RE model is that the effects of time-invariant variables can be estimated. For instance, the educational background of parents does not change over time, and in order to understand the effects of parental educational background on child health status, the random effects model may be preferred.

Second, because individual effects α_i may correlate with one or more of the explanatory variables such that assumption (2) of the RE model is likely to be violated, a fixed effects (FE) model is also estimated. One example of such time-invariant factor could be certain health-related genes of the child which may impose a direct effect on the self-reported health status and also be correlated with the health status of the parents. In this specification, α_i is treated as fixed unknown parameters and the model places no assumptions upon α_i. Because FE model only concentrates on differences within individuals, the coefficients are only identified if the corresponding regressors vary over time. Accordingly, the effects of all time-invariant variables, such as the gender of the child, parental educational background and province dummies, cannot be estimated. Besides, the observations that do not display differences in health status over time are also excluded from the sample. In particular, with a discrete dependent variable, estimating a FE model is more complex because one may come across the so-called incidental parameter problem. When *T* is fixed and *N* approaches to infinity, the number of parameters grows with *N* and the estimates of α_i are not consistent. The inconsistency of estimators for α_i will pass on to the estimator for β. One solution, as suggested by Chamberlain (1980) is to use the conditional maximum likelihood (CML) strategy, where when conditional on a set of statistics t_i, the individual likelihood contribution no longer depends on α_i. As a result, one can maximize the conditional maximum likelihood function to get consistent estimator for β. The existence of sufficient t_i depends on the distribution of u_{it}, and it has been shown that CML only works with the logistic distribution. Consider a binary dependent variable model first.

$$\begin{aligned} & y_{it}^{*} = X'_{it}\beta + \alpha_i + u_{it}, \ i = 1,\ldots,N, \ t = 1,\ldots,T \\ & y_{it} = 1 \ \ if \ \ y_{it}^{*} \geq 0 \end{aligned} \tag{3}$$

Based on Chamberlain (1980), a sufficient statistic for α_i in this paper is $\sum_t y_{it}$, and the individual contribution to the conditional likelihood is:

$$L_i(\beta) = \text{Prob}(y_{i1},\ldots,y_{iT} \mid \textstyle\sum_{t=1}^{T} y_{it}) = \dfrac{\exp\left[\sum_{t=1}^{T}(X'_{it}\beta)y_{it}\right]}{\sum_{d\in B_i}\exp\left[\sum_{t=1}^{T}(X'_{it}\beta)d_t\right]} \tag{4}$$

$$\text{where } B_i = \left\{d = (d_1,\ldots,d_T) \mid d_t = 0 \text{ or } 1, \text{ and } \textstyle\sum_t d_t = \sum_t y_{it}\right\}$$

Since individual likelihood contribution (4) does not depend on α_i, the CML estimator for β is consistent. However, the extension of this approach to the ordered response model is not straightforward. A possible solution is to dichotomize the ordered variable into two categories based on a specific cutoff point *j* such that one is back to the binary dependent variable model. Specifically, the model (1) can be reconstructed in the following way:

$$\begin{aligned} & Y_{it}^{j*} = (H_{it}^{*}) = X'_{it}\beta + \alpha_i + u_{it} \\ & Y_{it}^{j} = \begin{cases} 0 & if \ \ H_{it} < j \\ 1 & if \ \ H_{it} \geq j \end{cases} \quad \text{for} \ \ j = 2,3,4, \end{aligned} \tag{5}$$

where Y_{it}^{j} is the new binary dependent variable defined at the cutoff point *j*. Then, the CML approach described above can be directly applied (For example, see Winkelman and Winkelman, 1998). Nevertheless, the estimator for β based on the simple dichotomization does not exploit all the variations in the ordered variable; thus, the estimator is not likely to be efficient. Alternatively, researchers attempt to use more information from the ordered variable by trying to combine all possible dichotomizations. Baetschmann et al. (2011) propose that rather than firstly performing separate CML estimation on all possible dichotomizations and then combining the resulting estimates (Das and van Soest, 1999), one can estimate all dichotomizations jointly.[1] Accordingly, the estimator for β is the solution to the conditional log-likelihood.

$$\max_{\beta} \log L\left(\beta\right) = \max_{\beta} \sum_{j=2}^{4} \log L^{j}\left(\beta\right) \tag{6}$$

where $\log L^{j}\left(\beta\right) = \sum_{i=1}^{N} L_i\left(\beta\right)$ at a particular cutoff point *j*.

Technically, every observation in the sample of this paper is replaced by three copies of itself; then each copy of the observation is dichotomized at a different cutoff point; finally CML logit is estimated using the entire sample with standard errors clustered at individual level. The corresponding STATA program provided in Baetschmann et al. (2011) is easy to implement and is applied in this paper.

4.2 The Linear Model

When using height-for-age and weight-for-age z-scores as the dependent variables, the linear regression model can be used. Again both random effects and fixed effects specifications are employed. The RE model is specified as follows:

$$Z_{it} = \gamma + X_{it}'\beta + \alpha_i + u_{it}, \quad i = 1, \dots, N, \quad t = 1, \dots, T \tag{7}$$

Where Z_{it} is the height- or weight-for-age z-score for child *i* at year *t*, X_{it} is again the vector of explanatory variables, but without the constant term in this model. γ is the constant term. α_i are individual effects and u_{it} is the error term. The model assumptions are: 1) u_{it} is independently and identically distributed with mean zero and variance σ_u^2; 2) α_i is independently and identically distributed across *i* with mean zero and variance σ_α^2; 3) α_i and u_{it} are independent, and they are uncorrelated with X_{is} for all *s*. The RE estimator is consistent when *N* approaches to infinity under these assumptions. Besides, standard errors clustered at community level are computed such that the arbitrary community level spatial correlations and possible serial correlations are allowed. The reason is that households in the same community are likely to have close socioeconomic status and suffer from common economic shocks.

As is mentioned in the ordered response model, α_i may be correlated with one or more regressors in X_{it}, which may lead to inconsistency in RE estimator. Hence, the FE model specified below is also estimated.

[1] Baetschmann et al. (2011) mention that the estimator by Das and van Soest (1999) may be subject to some small sample issues such that the performance of their estimator may be deteriorated when the overlap between samples contributing to CML estimation dichotomized at different cutoff points is very small. Their estimator, on the other hand, remains unbiased and consistent even under a very small sample size.

$$Z_{it} = \alpha_i + X_{it}'\beta + u_{it}, \quad i = 1, \ldots, N, \quad t = 1, \ldots, T \tag{8}$$

where there is no particular assumption with respect to the individual effects α_i .FE estimator is obtained through the within transformation of the data, where observations are produced in deviation from individual means.

$$Z_{it} - \overline{Z}_i = (X_{it} - \overline{X}_i)'\beta + (u_{it} - \overline{u}_i) \tag{9}$$

The transformed regression model does not include α_i . To obtain unbiased estimator β, X_{it} and u_{is} are assumed to be independent for all *t* and *s*, which is referred as strict exogeneity. Under this important assumption, FE estimator based on regression (9) is consistent for β.

Last but not the least, a Hausman test is performed to test whether the FE and RE estimators are significantly different for both the ordered response model and the linear model. The null hypothesis of Hausman test (H_0) is that all covariates and α_i are uncorrelated, and the alternative hypothesis (H_1) is that α_i are correlated with one or more of the covariates. Accordingly, RE estimators are consistent and asymptotically efficient under H_0 , and are inconsistent under H_1 . By comparison, FE estimators are consistent under both H_0 and H_1 . Therefore, the rejection of H_0 suggests that RE and FE estimators are significantly different and estimators from FE model are preferable. In particular, because time-invariant variables are not included in FE model, the Hausman test statistic is calculated based on the common estimators from RE and FE models; and the conclusion only applies to estimators on all time-varying variables.

5. Results

5.1 Child Self-reported health status

Based on the available information on child self-reported health status, observations on all children from wave 1991 through wave 1997 are estimated first, and then the subsample of children who are under 12 years old is estimated. Combined with the data from wave 2000 to wave 2006, the health status of youths who are 12 to 18 years old is then investigated. For each subsample, both RE and FE specifications are applied. Table 2 reports the RE ordered logit estimation and FE ordered logit estimation of model (1). The first three columns present the results for the urban sample, and the following three columns report the results for the rural sample. The results from specifications based on control group 1 to control group 4 are RE model estimates, and the results from the specification based on control group 5 are FE model estimates. The estimated coefficient of household income is negative for all age groups, which is in accordance with previous studies and expectations. However, controlling for parental socioeconomic status or not, the coefficient is statistically insignificant at any commonly used significance level (1%, 5% or 10%) across all specifications for both urban and rural sample. Thus,

Table 2. Child Self-Reported Health Status and Parental Socioeconomic Status

Dependent Variable	Urban Children Self-Reported Health Status			Rural Children Self-Reported Health Status		
Child ages	0-18	0-11	12-18	0-18	0-11	12-18
Waves	1991-1997	1991-1997	1991-2006	1991-1997	1991-1997	1991-2006
Observations	1693	1034	1214	4040	2349	2804
Independent Variable	(1)	(2)	(3)	(4)	(5)	(6)
Ordered Logit Model with Random Effects:						
			Control Group 1			
Log real household income	-0.105 (0.099)	-0.078 (0.148)	-0.135 (0.104)	-0.039 (0.064)	-0.015 (0.087)	-0.076 (0.058)
Child age	-0.004 (0.025)	0.024 (0.041)	-0.019 (0.047)	-0.026 (0.020)	-0.013 (0.034)	-0.057 (0.034)
Male	0.016 (0.135)	0.152 (0.178)	-0.081 (0.159)	-0.046 (0.098)	-0.109 (0.136)	0.061 (0.114)
Have siblings	0.137 (0.185)	0.277 (0.240)	0.115 (0.221)	0.193 (0.113)*	0.207 (0.164)	0.391 (0.138)***
Have insurance	0.033 (0.172)	0.029 (0.206)	0.203 (0.194)	-0.085 (0.155)	-0.346 (0.176)**	0.102 (0.170)
Log household size	-0.302 (0.292)	-0.251 (0.380)	0.115 (0.322)	0.006 (0.202)	0.083 (0.255)	-0.069 (0.227)
Mother's age	0.009 (0.020)	-0.001 (0.024)	0.006 (0.026)	-0.015 (0.017)	0.008 (0.030)	-0.015 (0.018)
Father's age	-0.022 (0.019)	-0.023 (0.025)	0.000 (0.023)	0.021 (0.017)	-0.012 (0.025)	0.044 (0.016)***
			Control Group 2			
Log real household income	-0.087 (0.103)	-0.066 (0.150)	-0.135 (0.109)	-0.036 (0.065)	-0.009 (0.090)	-0.047 (0.060)
Mother's education						
1-3 years primary school	0.174 (0.426)	0.103 (0.700)	0.010 0..436	-0.051 (0.228)	-0.136 (0.387)	0.016 (0.228)
4-6 years primary school	-0.160 (0.368)	-0.531 (0.674)	-0.008 (0.370)	-0.223 (0.183)	-0.427 (0.347)	-0.058 (0.197)
1-3 years lower middle school	0.060 (0.364)	-0.334 (0.596)	0.245 (0.370)	-0.505 (0.203)**	-0.608 (0.320)*	-0.261 (0.206)
High school	-0.020 (0.384)	-0.464 (0.608)	0.222 (0.386)	-0.747 (0.224)***	-0.767 (0.355)**	-0.673 (0.248)***
College or above	-0.253 (0.482)	-0.769 (0.720)	0.149 (0.503)	-0.119 (0.726)	0.231 (0.925)	-1.185 (0.603)**
Father's education						
1-3 years primary school	0.087 (0.711)	0.475 (1.355)	0.166 (0.659)	-0.007 (0.349)	-0.525 (0.687)	0.297 (0.364)
4-6 years primary school	0.124 (0.640)	0.977 (1.284)	0.109 (0.572)	-0.088 (0.321)	-0.030 (0.609)	0.011 (0.297)
1-3 years lower middle school	-0.044 (0.648)	0.826 (1.280)	-0.174 (0.579)	0.114 (0.303)	0.316 (0.597)	0.009 (0.298)
High school	0.019 (0.661)	0.828 (1.290)	0.000 (0.586)	0.079 (0.322)	0.169 (0.605)	0.047 (0.328)
College or above	-0.007 (0.694)	0.885 (1.327)	-0.366 (0.634)	-0.287 (0.466)	-0.632 (0.779)	0.129 (0.444)

			Control Group 3			
Log real household income	-0.024 (0.099)	-0.026 (0.125)	-0.079 (0.109)	-0.016 (0.063)	0.008 (0.092)	-0.017 (0.061)
Mother's health status excellent or good	-2.381 (0.29)***	-2.764 (0.386)***	-0.985 (0.197)***	-2.308 (0.210)***	-2.741 (0.315)***	-1.229 (0.169)***
Father's health status excellent or good	-0.942 (0.280)***	-1.223 (0.368)***	-0.902 (0.209)***	-1.503 (0.206)***	-1.604 (0.308)***	-0.907 (0.180)***
			Control Group 4			
Log real household income	-0.088 (0.102)	-0.087 (0.152)	-0.162 (0.105)	-0.041 (0.064)	-0.023 (0.094)	-0.023 (0.075)
Mother's occupation						
Group 1	0.080 (0.494)	-0.889 (0.662)	0.523 (0.522)	-0.503 (0.397)	-0.224 (0.558)	-0.230 (0.459)
Group 2	0.303 (0.454)	-0.722 (0.547)	0.899 (0.481)*	-0.611 (0.326)*	-0.291 (0.421)	-0.484 (0.400)
Group 3	0.497 (0.480)	0.006 (0.628)	0.768 (0.500)	-0.448 (0.328)	0.047 (0.451)	-0.452 (0.379)
Group 4	0.374 (0.429)	-0.270 (0.528)	0.450 (0.458)	-0.436 (0.316)	0.190 (0.414)	-0.500 (0.386)
Father's occupation						
Group 1	-0.484 (0.459)	-0.624 (0.601)	-0.146 (0.491)	0.154 (0.323)	0.418 (0.433)	-0.204 (0.349)
Group 2	-0.152 (0.434)	-0.236 (0.553)	0.089 (0.465)	0.309 (0.304)	0.484 (0.389)	0.183 (0.343)
Group 3	0.100 (0.484)	-0.073 (0.603)	0.239 (0.492)	0.511 (0.326)	0.647 (0.470)	0.226 (0.332)
Group 4	0.247 (0.432)	0.070 (0.549)	0.327 (0.456)	-0.092 (0.299)	-0.237 (0.391)	0.167 (0.342)
Ordered Logit Model with Fixed Effects:						
			Control Group 5			
Log real household income	-0.055 (0.258)	0.015 (0.443)	0.064 (0.407)	0.005 (0.147)	0.061 (0.222)	0.054 (0.208)
Mother's health status excellent or good	-2.369 (0.658)***	-3.658 (1.483)**	-1.216 (0.691)*	-2.466 (0.523)***	-3.043 (1.425)**	-1.717 (0.567)***
Father's health status excellent or good	-0.413 (0.710)	0.450 (1.475)	-1.483 (1.023)	-1.001 (0.520)*	-0.453 (1.308)	-0.867 (0.536)
Hausman Test (p-value)	33.97 (0.037)	20.17 (0.062)	12.21 (0.429)	22.86 (0.351)	42.26 (0.000)	25.90 (0.169)

Notes: Robust standard errors in parentheses, except for Hausman test that p-values are in parentheses. *, **, *** denote significance level at 10%, 5% and 1%, respectively. Under the label "Control Group 1," each regression includes child age and child gender; indicators for whether the children have siblings, whether the children have medical insurance; the logarithm of household size; mother's age, father's age; and two complete sets of wave and province dummies. Under "Control Group 2," each regression includes covariates in Control Group 1 plus indicators for parental employment status and educational background. The dummy variables "mother (father) has no education" are omitted. Under "Control Group 3," each regression includes covariates in Control Group 2 plus indicators for whether the mother's (father's) health status is excellent or good. Under "Control Group 4," each regression includes covariates in Control Group 2 plus the indicators for parental occupation categories. Occupation group 5 is omitted. Under "Control Group 5", each regression includes all covariates in Control Group 1 with the exclusion of child gender and province dummies, plus parental health status and occupation groups. Source: CHNS 1991-2006.

unlike the results from previous studies of some developed countries such as US and UK, there is little evidence based on both RE and FE model that increases in household income have a significantly positive effect on child self-reported health status in either urban or rural area in China.

With respect to parental socioeconomic status, neither mother's nor father's educational attainment is significantly correlated with self-reported health status of urban children across the two age groups. On the contrary, a significant correlation is found between mother's education and rural children's self-reported health status. Specifically, the estimated coefficient of whether mother has received 1 to 3 years of lower middle school education is negative and statistically significant at 10% level for rural children aged 0 to 11, but is not statistically significant for rural youths. This implies that in rural China, younger children of mothers who received lower middle school education are more likely to report better health status. Furthermore, for rural children of all ages, those of mothers having high school education are also on average more likely to be healthier. Finally, the coefficient of whether mother has attended college is negative and statistically significant at 5% level for rural children aged 12 to 18 years old only. Accordingly, rural youths of highly educated mothers have a larger probability to report good health. In all specifications, Father's education remains insignificant for the self-reported health status of both urban and rural children.

The effect of parental health status on child health status is large and significant for both urban and rural children across all age groups. Children of parents who report excellent or good health status are more likely to report better health status as well. The impact of mother's health is found to be greater than that of father's health on child health status across all specifications. Based on the results in column (2) for instance, for urban children aged 0 to 11, the estimated coefficient of father's health (-1.223) is only less than half size of that of mother's health (-2.764). Furthermore, both maternal and paternal health effect is larger for the young children than for the youths. Besides, the health effects of both parents are larger for rural children than for urban children in most cases, except for that mother's health effect on child health status is greater for urban children aged 0 to 11 than for rural children of the same ages. There is little evidence that parental occupation has a significant effect on child health status, with the exception that for the urban youths, if their mothers work as junior professional/technical worker, office staff or skilled worker, they are more likely to report better health status. By comparison, rural children of mothers who take similar occupations tend to report poorer health status.

The results of FE ordered logit model show that in most cases the coefficient on maternal health status is larger than that in RE model, except for the grouped age sample of urban children from wave 1991 to 1997. On the other hand, father's health effect becomes smaller and insignificant. Based on the results of Hausman test, FE estimators are preferred to RE estimators for the following sample:1) all urban children from wave 1991 to 1997; 2) urban children aged 0 to 11; and 3) rural children aged 0 to 11. Meanwhile, there is no evidence that FE estimators are preferred to RE estimators for the other samples.

Child age and gender do not significantly correlate with self-reported health status of both urban and rural children. For rural children aged 12 or above, there is a significant negative association between having sibling(s) and health status. Accordingly, the child who is not the only child in the household is more likely to report poorer health status comparing to the only child. Furthermore, medical insurance also has a significantly positive impact on child health status for rural children aged 0 to 11. In addition, father's age is found to be negatively correlated with health status of the rural children aged 12 and above; thus, youths in rural areas with older fathers have greater probability to suffer from poor health. Regarding to urban children of both age groups, no child-specific characteristics are found to significantly relate to the self-reported health status.

5.2 Other measures of child health

Table 3 reports the estimation results of model (7) and (8) with child height-for-age z-score as the dependent variable. Columns (1) to (3) and (5) to (7) present results of the RE models with different sets of explanatory variables for the urban sample and rural sample, respectively; estimation results of the FE model are presented in column (4) for the urban sample and column (8) for the rural sample.

For the urban children, the estimated coefficients on household income show little evidence for a significant income gradient on child height-for-age z-score. On the other hand for the rural children, household income significantly correlates with favorable outcomes of child nutritional status. According to the results in column (5) for example, 1% rise in household income will increase the child height-for-age z-score by 0.00046, which indicates an improvement of child nutrition. This income effect remains but becomes smaller after controlling for the educational attainment of parents, suggesting that the household income effect might be partly attributed to parental education effect. Furthermore, for both the urban and the rural sample, the coefficient of income in the FE model is statistically insignificant. Thus, based on RE model estimates, the effects of household income on child nutritional status are different for urban and rural children. Notice that since the income effect is found in the RE model but not in the FE model, the positive relationship between household income and rural children's nutritional status may be mostly credited to the income variations between individuals rather than within individuals.

In general, parental socioeconomic status has a greater impact on rural children's height-for-age than that on urban children's; and maternal background is found to play a more important role than paternal background. Specifically, there is a significantly positive correlation between mother's age and rural children's nutritional status, controlling for educational attainment and occupations or not. This implies rural children with mothers of older age may on average enjoy better nutritional status relative to those with younger mothers. By comparison, after controlling for education and occupations, father's age significantly correlates with urban children's height-for-age, but not with rural children's. Either due to genetic connections or unobserved common factors, mother's height has a significant and positive relationship with child height-for-age z-score for both urban and rural children; whereas father's height is linked to favorable outcomes of child nutritional status for rural children only.

There is strong evidence that maternal education is positively correlated with rural children's nutritional status. Almost each level of mother's educational attainment is found to significantly affect the height-for-age of rural children, except for whether mother has received 1 to 3 years of primary school education. Take a specific example, rural children of mothers who have received college education or above have height-for-age z-scores 0.516 greater than those of mothers do not have college education, keeping other variables constant. After controlling for parental occupations, only whether mother has received high school education remains important for rural children's height-for-age. Father's educational attainment, on the contrary, does not have significant impact on rural children's nutritional status given that the estimated coefficients for all five education dummy variables are statistically insignificant at any commonly used significance level. Nonetheless, the opposite case is found for the urban children. Urban children of highly educated fathers are on average in better nutritional status than those of poor or less educated fathers. Besides, there is little evidence of a significantly positive relationship between mother's education and urban children's height-for-age.

While parental employment status does not significantly affect height-for-age z-score of children in both areas, maternal occupation is found to be important for the nutritional status of rural children. Among all occupations, rural children of mothers who work as farmer, fisherman, and hunter or engage in small commercial household business are in better nutritional status, comparing to those of mothers who take other occupations. This significant effect remains in the FE model, indicating that the variations of maternal occupation within individuals (children) matter for rural child health. Other occupations of mothers do not significantly correlate with child height-for-age; and father's occupation is found to be of little significance to child nutritional status.

Estimation results also provide evidence that child-specific characteristics may affect the nutritional status. The height-for-age z-score significantly declines with child age at a decreasing rate for rural children; as is mentioned in Bredenkamp (2009), rural children appear to suffer from growth failure which associates with age. On the other hand, urban children's height-for-age z-score is not significantly correlated with age. For both urban and rural children, those with sibling(s) have lower height-for-age z-scores, indicating that having immediate brothers or sisters deteriorates anthropometric health outcomes. Additionally, rural children with medical insurance are found to have higher height-for-age z-scores than those who are not insured. With respect to the children's gender, in contrast to Bredenkamp (2009) and in accordance with Handa (1999), boys' height-for-age z-scores are not significantly higher than girls'. Despite the possible correlation between unobserved child-specific characteristics and one or more of the explanatory variables, Hausman test provides no evidence that FE model is the preferable one to estimate the relationship between child height-for-age z-score and

Table 3. Child Height-for-age Z-score and Parental Socioeconomic Status

Dependent Variable	Urban Children Height-for-age Z-score				Rural Children Height-for-age Z-score			
Independent Variable	(1) RE	(2) RE	(3) RE	(4) FE	(5) RE	(6) RE	(7) RE	(8) FE
Log real household income	0.036 (0.042)	0.021 (0.043)	0.032 (0.045)	0.002 (0.062)	0.046 (0.022)**	0.038 (0.022)*	0.017 (0.025)	0.001 (0.055)
Child age	-0.057 (0.042)	-0.057 (0.042)	-0.061 (0.047)	-0.037 (0.064)	-0.133 (0.03)***	-0.140 (0.031)***	-0.117 (0.032)***	-0.132 (0.044)***
Child age squared	-0.000 (0.002)	-0.000 (0.002)	-0.000 (0.002)	-0.004 (0.002)	0.004 (0.001)***	0.005 (0.001)***	0.004 (0.001)**	0.004 (0.002)**
Male	0.076 (0.067)	0.079 (0.068)	0.099 (0.067)		0.009 (0.050)	0.017 (0.050)	0.027 (0.052)	
Have siblings	-0.281 (0.088)***	-0.226 (0.086)***	-0.200 (0.088)**	-0.106 (0.198)	-0.184 (0.058)***	-0.144 (0.057)**	-0.136 (0.060)**	-0.103 (0.106)
Have insurance	0.077 (0.072)	0.063 (0.071)	-0.007 (0.080)	0.048 (0.111)	0.215 (0.064)***	0.213 (0.006)***	0.206 (0.068)***	0.080 (0.099)
Log household size	-0.126 (0.157)	-0.058 (0.159)	0.006 (0.203)	-0.101 (0.276)	-0.018 (0.105)	0.031 (0.104)	0.094 (0.108)	-0.038 (0.215)
Mother’s age	0.008 (0.010)	0.006 (0.010)	0.000 (0.012)	-0.126 (0.018)	0.018 (0.006)***	0.019 (0.006)***	0.015 (0.006)**	0.021 (0.013)
Mother’s height	0.015 (0.005)***	0.013 (0.005)***	0.015 (0.006)**	0.001 (0.005)	0.016 (0.005)***	0.014 (0.005)***	0.016 (0.005)***	0.007 (0.007)
Mother’s employed		0.061 (0.109)	0.282 (0.263)	-0.281 (0.179)		-0.064 (0.077)	0.089 (0.180)	0.139 (0.266)
Mother’s education								
1-3 yrs primary		-0.111 (0.181)	0.002 (0.202)			0.118 (0.116)	0.059 (0.122)	
4-6 yrs primary		0.020 (0.153)	0.066 (0.166)			0.166 (0.092)*	0.114 (0.096)	
1-3 yrs lower middle		0.014 (0.157)	0.047 (0.173)			0.316 (0.100)***	0.162 (0.108)	
High school		0.266 (0.166)	0.302 (0.186)			0.516 (0.110)***	0.290 (0.126)**	
College or above		0.222 (0.198)	0.202 (0.232)			0.561 (0.234)***	0.385 (0.235)	
Mother’s occupation								
Group 1			0.008 (0.229)	-0.087 (0.427)			-0.073 (0.195)	-0.131 (0.369)
Group 2			-0.029 (0.206)	-0.057 (0.369)			-0.075 (0.141)	-0.282 (0.283)
Group 3			-0.225 (0.223)	-0.204 (0.394)			0.411 (0.132)***	0.525 (0.264)**
Group 4			0.035 (0.199)	0.035 (0.351)			-0.081 (0.129)	-0.430 (0.262)
Father’s age	0.014 (0.010)	0.015 (0.010)	0.022 (0.011)*	0.040 (0.029)	-0.005 (0.006)	-0.001 (0.007)	-0.003 (0.007)	-0.011 (0.013)
Father’s height	0.014 (0.014)	0.013 (0.013)	0.011 (0.012)	0.008 (0.010)	0.022 (0.004)***	0.020 (0.004)***	0.018 (0.003)***	0.006 (0.004)
Father’s employed		0.057 (0.117)	-0.16 (0.266)	0.157 (0.200)		-0.011 (0.125)	-0.197 (0.223)	-0.145 (0.344)
Father’s education								
1-3 yrs primary		0.323 (0.329)	0.231 (0.331)			0.021 (0.146)	0.038 (0.147)	

4-6 yrs primary		0.583 (0.335)*	0.548 (0.320)*			-0.030 (0.138)	0.038 (0.138)	
1-3 yrs lower middle		0.599 (0.337)*	0.495 (0.311)			0.052 (0.135)	0.060 (0.132)	
High school		0.570 (0.344)*	0.381 (0.315)			0.078 (0.142)	0.029 (0.142)	
College or above		0.81 (0.358)**	0.657 (0.332)**			0.288 (0.194)	0.049 (0.196)	
Father's occupation								
Group 1			0.091 (0.185)	0.160 (0.338)			0.241 (0.160)	0.011 (0.013)
Group 2			-0.009 (0.183)	0.020 (0.302)			0.173 (0.146)	0.255 (0.233)
Group 3			-0.076 (0.173)	0.289 (0.342)			0.012 (0.161)	0.157 (0.236)
Group 4			0.005 (0.177)	0.108 (0.291)			0.046 (0.152)	0.059 (0.221)
Provinces Dummies	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Constant	-5.776 (2.276)**	-5.952 (2.123)**	-5.936 (2.027)***	-2.381 (2.432)	-6.857 (1.068)***	-6.404 (1.008)***	-6.051 (1.044)***	-2.316 (1.373)*
Observations	2909	2909	2909	2909	6870	6870	6870	6870
Hausman Test (p-value)				14.32 (0.999)				39.38 (0.242)

Notes: Height-for-age z-score is calculated using WHO 2007 reference. The dummy variables "mother (father) has no education" are omitted. Occupation group 5 is omitted. Robust standard errors clustered at community level are in parentheses, except for Hausman test that p-values are in parentheses. *, **, *** denote significance level at 10%, 5% and 1%, respectively. Source: CHNS, 1991-2006

Table 4. Child Weight-for-age Z-score and Parental Socioeconomic Status

Dependent Variable	Urban Children Weight-for-age Z-score				Rural Children Weight-for-age Z-score			
Independent Variables	(1) RE	(2) RE	(3) RE	(4) FE	(5) RE	(6) RE	(7) RE	(8) FE
Log real household income	0.029 (0.051)	0.006 (0.051)	0.005 (0.057)	-0.008 (0.116)	0.025 (0.036)	-0.001 (0.038)	0.007 (0.037)	-0.011 (0.077)
Child age	-0.383 (0.071)***	-0.384 (0.073)***	-0.410 (0.087)***	-0.362 (0.118)***	-0.273 (0.055)***	-0.282 (0.055)***	-0.300 (0.060)**	-0.375 (0.120)***
Child age squared	0.022 (0.006)***	0.023 (0.006)***	0.024 (0.007)***	0.024 (0.009)***	0.014 (0.004)***	0.015 (0.004)***	0.017 (0.005)***	0.017 (0.009)*
Male	0.104 (0.084)	0.112 (0.084)	0.089 (0.089)		0.161 (0.063)**	0.169 (0.063)**	0.143 (0.067)**	
Have siblings	-0.292 (0.137)**	-0.183 (0.134)	-0.145 (0.151)	0.209 (0.368)	-0.240 (0.066)***	-0.190 (0.065)***	-0.161 (0.075)**	-0.074 (0.237)
Have insurance	0.223 (0.096)**	0.194 (0.095)**	0.196 (0.105)*	0.196 (0.166)	0.019 (0.076)	0.033 (0.076)	0.007 (0.076)	0.055 (0.135)
Log household size	-0.173 (0.167)	-0.126 (0.167)	-0.209 (0.177)	-0.545 (0.520)	0.018 (0.113)	0.013 (0.113)	0.060 (0.124)	-0.191 (0.331)
Mother’s age	0.006 (0.018)	0.004 (0.018)	0.003 (0.022)	0.039 (0.043)	0.000 (0.007)	0.000 (0.007)	-0.002 (0.008)	0.001 (0.016)
Mother’s weight	0.017 (0.006)***	0.017 (0.007)***	0.014 (0.008)*	0.005 (0.013)	0.019 (0.004)***	0.019 (0.004)***	0.020 (0.004)***	0.012 (0.013)
Mother’s employed		-0.030 (0.136)	0.074 (0.401)	0.219 (0.287)		0.012 (0.096)	0.253 (0.224)	-0.076 (0.726)
Mother’s education								
1-3 yrs primary		0.161 (0.319)	0.094 (0.345)			0.217 (0.177)	0.268 (0.183)	
4-6 yrs primary		0.464 (0.332)	0.282 (0.373)			0.043 (0.149)	0.011 (0.151)	
1-3 yrs lower middle		0.607 (0.291)**	0.465 (0.323)			0.127 (0.137)	0.020 (0.144)	
High school		0.761 (0.300)**	0.599 (0.340)*			0.251 (0.146)*	0.087 (0.153)	
College or above		0.866 (0.328)***	0.786 (0.376)**			0.557 (0.230)**	0.360 (0.253)	
Mother’s occupation								
Group 1			-0.083 (0.386)	-0.112 (0.691)			-0.340 (0.243)	-0.813 (0.588)
Group 2			-0.119 (0.321)	-0.148 (0.643)			-0.117 (0.191)	-0.105 (0.459)
Group 3			-0.218 (0.318)	-0.256 (0.552)			-0.441 (0.190)**	-0.369 (0.484)
Group 4			-0.062 (0.324)	-0.102 (0.635)			-0.215 (0.181)	-0.363 (0.445)
Father’s age	0.021 (0.019)	0.019 (0.020)	0.022 (0.023)	-0.043 (0.055)	0.010 (0.006)	0.010 (0.006)	0.004 (0.006)	0.005 (0.031)
Father’s weight	0.014 (0.005)***	0.013 (0.004)***	0.013 (0.004)***	0.005 (0.008)	0.012 (0.003)***	0.011 (0.003)***	0.011 (0.003)***	0.010 (0.007)
Father’s employed		-0.279 (0.153)*	-0.163 (0.379)	-0.443 (0.255)*		-0.169 (0.146)	0.050 (0.251)	0.035 (0.673)
Father’s education								
1-3 yrs primary		-0.167 (0.527)	-0.139 (0.579)			-0.082 (0.269)	-0.132 (0.278)	

4-6 yrs primary		-0.447 (0.496)	-0.248 (0.548)			-0.253 (0.243)	-0.373 (0.248)	
1-3 yrs lower middle		-0.297 (0.492)	-0.314 (0.543)			-0.221 (0.239)	-0.320 (0.243)	
High school		-0.253 (0.492)	-0.302 (0.544)			-0.094 (0.234)	-0.222 (0.244)	
College or above		-0.170 (0.502)	-0.345 (0.556)			0.234 (0.310)	-0.002 (0.326)	
Father's occupation								
Group 1			0.208 (0.235)	0.170 (0.509)			0.054 (0.184)	-0.079 (0.471)
Group 2			0.184 (0.210)	0.134 (0.442)			0.085 (0.152)	0.163 (0.407)
Group 3			-0.017 (0.248)	-0.020 (0.422)			-0.019 (0.163)	0.204 (0.413)
Group 4			0.080 (0.225)	0.060 (0.420)			-0.078 (0.158)	-0.081 (0.406)
Provinces Dummies	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Constant	-1.534 (0.830)*	-1.294 (1.046)	-1.050 (1.227)	-1.210 (3.589)	-1.744 (0.529)***	-1.242 (0.682)*	-1.074 (0.659)	0.786 (1.724)
Observations	2909	2909	2909	2909	6870	6870	6870	6870
Hausman Test (p-value)				51.29 (0.022)				39.97 (0.222)

Notes: Height-for-age z-score is calculated using WHO 2007 reference. The dummy variables "mother (father) has no education" are omitted. Occupation group 5 is omitted. Robust standard errors clustered at community level are in parentheses, except for Hausman test that p-values are in parentheses. *, **, *** denote significance level at 10%, 5% and 1%, respectively. Source: CHNS, 1991-2006.

parental socioeconomic status. Therefore, the discussions in section 6 are mostly based on results from RE models.

In Table 4, the estimation results of model (7) and (8) with weight-for-age z-score as the dependent variable are presented. Similar to Table 3, columns (1) to (3) and (5) to (7) report estimation results of RE model for urban and rural sample, respectively; and columns (4) and (8) present results of FE model estimation. Different from the estimation results of height-for-age z-scores, the household income effect on child health is hardly found for both urban and rural children, based on both RE and FE models.

Estimation results show that some factors of parental socioeconomic status are significantly correlated with child weight-for-age, while others are not. For both urban and rural children, neither mother's age nor father's age imposes a significant impact on child weight-for-age. Also for children of both areas, the weight-for-age z-scores are significantly higher if either mother's or father's weight is greater, with mother's weight having a slightly larger effect relative to father's. While for both samples there is little evidence that mother's employment status associates with child weight-for-age z-score, urban children with fathers currently working tend to have relatively unfavorable anthropometric health outcomes. Maternal education of higher levels (high school, and college or above) is significantly correlated with greater weight-for-age z-score for both urban and rural children. After controlling for parental occupations, the education effect remains and becomes smaller for urban children, but disappears for rural children. This may suggest that part of the maternal education effect can be attributed to differences in occupations. Besides, urban children of mothers who have received 1 to 3 years of lower middle school education have higher weight-for-age z-scores. Contrarily but as expected, father's education has no significant effect on child weight-for-age z-score. Finally, mother's occupation matters for rural children but not for urban children, and the only occupation group that matters for rural children's weight-for-age is group 3 (farmer, fisherman, hunter, etc.). Rural children of mothers whose occupations categorized into group 3 have lower weight-for-age z-scores than those of mothers whose occupations are not in group 3. Father's occupation is found not significantly correlated with child weight-for-age z-score in either sample.

For both urban and rural children, weight-for-age z-score again deteriorates with child age at a decreasing rate, and children with sibling(s) on average have lower weight-for-age z-scores than those without. Moreover, boys' weight-for-age z-scores are significantly higher than those of girls in rural area. In addition, medical insurance significantly affects urban children's nutritional status; urban children with medical insurance tend to have higher weight-for-age z-scores comparing to those who do not have insurance. Last but not the least, according to the results of Hausman test, FE model is the preferable one for the urban sample; but RE model estimators and FE model estimators are not significantly different for the rural sample. Therefore, for the urban sample, the unobserved individual-specific factors are not uncorrelated with explanatory variables. Based on the results from FE model, there is little supporting evidence for the any significant association between urban children's health and parental socioeconomic status (indicated by income, employment status and occupations, but not educational background). On the other hand, the assumption that unobserved individual effects are uncorrelated with covariates is not rejected for the rural sample; and RE model estimation suggests that maternal education and occupation is strongly correlated with rural children's health.

6. Discussion

6.1 Household income and child health

One of the main findings in this paper is that although no income gradient is identified on the self-reported health status of all children, rural children's nutritional status appears to significantly correlate with household income. A limitation of the subjectively-assessed child health status is that children or parents of different backgrounds may perceive and report current health status in systemically different ways, which makes the true disparities of health status between the rich and the poor children ambiguous. It is possible that this measure is subject to the characteristics of the respondent and thus may also reflect difference in reporting behaviors in addition to the health status. With different perceptions of the descriptions of health status such as *excellent*, *good* or *poor*, whether the children reporting the same health status are indeed in similar health status could be questionable. In other words, the relationships between the covariates and the self-reported health status may not represent the true underlying effects of these factors on child health. Therefore, one should not rush to a conclusion that household income does not affect child health in both urban and rural China.

The above-mentioned limitation of the subjectively-assessed health status does not apply to height-for-age and weight-for-age z-scores. Rural children in rich households tend to have higher height-for-age z-scores than those of the same age and sex in relatively poor households; yet for urban children, changes in household income appear not to have significant effects on their height-for-age z-scores. In other words, household income plays an important role in rural children's nutritional status but not in urban children's. Considering the direct impact of household income on child health, one possible reason for such distinction is the differences in costs to access child health-related inputs (for instance nutritious food, medical care services, etc.) between urban and rural areas in China. The availability of health-related inputs is high in urban areas such that the costs to access those inputs may be affordable to the majority. As a result, even relatively poor households are able to make at least some basic investments in child health. On the contrary, with relatively low availability of health inputs in rural areas, the investments in child health must also include extra costs for households to simply access those inputs. Consequently, poor households may not afford to make any investments in child health, which enlarges the gap of the nutritional status between rich and poor children. In this sense, household income could matter more to rural children's health status than to urban children's.

A possible problem with the objective measures of child health status is that these two z-scores are calculated based on the child growth reference provided by WHO rather than a national reference. Recent research has pointed out that the WHO reference may be most valuable for cross-population comparisons, and the application to a specific population (in this case to the population of nine provinces in China) might generate misleading results of child growth in that particular population (Wright et al., 2008; van Buuren and van Wouwe, 2008; Kulaga et al., 2010). Therefore, more preferably the z-scores should be calculated using a reference based on a national representative sample of China. However, presumably due to the geographical extensity and the large population, as well as the resulting difficulties in continuously surveying a representative sample, there is no such updated growth reference currently available in China. Future research may reevaluate the relationship between household income and child nutritional status should such reference is eventually constructed.

Finally, the significantly positive correlation between household income and child nutritional status in rural China does not necessarily imply causality. At the first place, previous studies (Case et al., 2002; Currie, 2009) have pointed out that there is possibly a third factor which causes both low household income level and poor child health. However, the example of parental health status as the third factor may not apply to the results in this paper since no income gradient is found on child subjectively-assessed health status. Besides, there is no evidence that parental self-reported health status is related to child nutritional status. Second, the correlation between household income and child health may be due to reverse causality from poor child health to low income. The possible rationale is that when children are sick, parents may have to spend more time to care for the children, which will reduce the labor time and correspondingly lower the household earnings. However, since I only find income effects on rural children's nutritional status, whether the similar mechanism can be applied to the relationship between low income and child malnutrition requires a second thought. Child malnutrition might not be easily detected by parents and thus may hardly be seen as a disease that can be diagnosed more regularly through acute or chronic conditions. Thus, it seems unlikely that parents will reduce labor time (which may lead to lower earnings) in order to improve child nutritional status. A third point refers to that household income may be subject to measurement error. If the nonmissing values for the various components of income are measured with error, the imputed household income may also be problematic. One related point worth mentioning is that based on the program description, there was no evidence that the households had been paid for participating in the survey; thus, the reported income components may not be directly affected by program participation. However, it is still possible that some respondents were unwilling to reveal their true earnings and then reported false values. Hence, one should be careful about drawing a conclusion of the relationship between household income and child health since the reported income may not be the true underlying income.

6.2 Parental Education and child health

Based on the analyses of both subjective and objective measures of child health, mother's education, especially at higher levels, is strongly associated with better child health status in rural China but not in urban China. By comparison, father's education at higher levels is found to matter only for nutritional status of the urban children. Given the mixed results, several questions are worth discussing.

First, why it is the parental education at higher levels that plays a significant role to child health? Some studies focus on the detailed effects of maternal education on child health in middle-income or low-income country and suggest that the health/nutritional knowledge could be the key pathway by which maternal education leads to better child health (Glewwe, 1999; Christiaensen and Alderman, 2004). Accordingly, one possible interpretation for the positive impact of maternal education on child health is that higher level education (high school or college) is likely to provide more health and nutritional knowledge, which could help future parents to take better care of their children. Moreover, the contribution of higher level education to the acquirement of health/nutritional knowledge may be indirect. Future parents obtain more advanced literacy and numeracy through higher levels of education, which may assist them in accessing and learning health knowledge that is not taught in school. This could also be an advantage comparing to those who only receive primary school education.

Alternatively, the mechanism through which higher level parental education benefits child health may not be health/nutritional knowledge. Provided that the income coefficient on rural children's height-for-age z-score becomes smaller after controlling for parental education, it is possible that mother's education affects the rural children's nutritional status through higher income due to higher levels of educational attainment. Furthermore, as is also mentioned by Glewwe (1999), formal education provides greater opportunities for future parents to interact with modern society, which makes them more receptive to modern medical treatments. This may be especially true for the Chinese in terms of higher level education such as college or graduate school. According to relevant regulations of the educational system, while most individuals finish primary and secondary school education at their birth places; they can choose to attend college in any places in China after completing the college entrance exam. As there are a large number of universities and colleges clustering in some of the most modern cities in China such as Beijing and Shanghai, the exposure to the modern society would be much greater for these college students comparing to those who do not receive higher education. Consequently, when facing health problems of their children in the future, they may be relatively open to modern medications that are presumably more beneficial to child health than traditional treatments. Besides, highly educated mothers are also more likely to use health services such as prenatal care visit or postnatal check-up (Anson, 2004), which could be beneficial to infant health and build a solid foundation for their offspring's health during the entire childhood. In addition, because of the privatization of many health stations in rural China, the rural practitioners are subjective to lower level of supervision and receive less professional training (Liu, 2004). Because these practitioners are usually the rural residents' immediate contact of rural health care system, this means that rural children could suffer from medications that are relatively unsafe. In this case, highly educated parents may have a better judgment of whether a practice is licensed and well supervised, and thus be able to avoid unsafe treatments for their children.

Second, why in rural China mother's education is more important to child health whereas in urban China father's education seems to be of greater importance? This question arises because there seems to be a well-developed literature that maternal education is more important than paternal education for child development such as health and educational attainment (for example, see Chevalier et al., 2005); while there is supporting evidence found in rural China, the opposite case is found in urban China. The findings in rural China context are not surprising, as also suggested by Chou et al. (2007) in a study of infant health in Taiwan, that the role of the mothers in prenatal periods and childhood is more important than that of the fathers. However, this claim seems to be very general and it cannot explain why maternal education is more important to rural children's health than urban children's. Referring to the above-mentioned point that mother's health knowledge seems to play a crucial role in child health, a possible interpretation for such difference is the channel through which mothers obtain knowledge about health and nutrition. In modern urban areas mothers may be able to learn such knowledge through channels other than previous formal education, while in rural areas with lower economic development and much less exposure to modern science, formal education might be one of the very few sources of health/nutritional knowledge. Consequently, mother's formal education may be more important to rural children's health. With respect to the significant effects of father's education on urban children's nutritional status, the mechanism seems to be even ambiguous. Historically in the Chinese urban context, the father usually contributes more to household income than the mother; and if the household income is measured with error and father's education is associated with income, the father's education effect might reflect the household income effect.

Last but not the least, similar to the caveat concerning the causality from household income to child nutritional status, parental education and child health can also correlate with each other through non-causal pathways. The relationship can be spurious in the sense that certain factors may jointly determine parental education and child health. For example, educational opportunities are better in urban areas where products benefiting child health and nutritional status are also more abundant. This may provide an alternative explanation for the positive correlation between father's education and urban children's nutritional status. All in all provided the importance of parental education, a policy aiming at promoting educational attainment, especially for the female, could be favorable to child health; however due to the possibility of spurious correlation, such policy does not necessarily improve child health status in China.

6.3 Other parental socioeconomic status indicators and child health

There are several possible explanations which could be applied to the strong correlation between parental self-reported health status and their offspring's subjectively-assessed health status. Firstly, the relationship may be due to some unobserved diseases or health-related conditions inherited by the children from their parents. These factors are likely to be inborn for the children and do not vary over time. As is mentioned in the last section, FE model estimates show that maternal health effect remains significant while paternal effect disappears. This may imply that father's health seems to affect child health only through child-specific inherited factors; on the other hand, the driving forces for the strong association between maternal health and child health are more than genetic links. The second possible explanation is that, parental health, especially maternal health, directly affects child health through for instance, poorer child care. Chinese children are less independent and tend to rely on more their parents through the childhood; as a result, parental effect may be more prominent and important in China. Thirdly, the association could also be due to possible reporting biases. For some children the subjectively-assessed health status is reported by the parents, and healthier parents may think of their children healthier. According to the original questionnaire of CHNS, the respondent of the survey for each household was asked; however, the information is missing in the raw data for some waves (for example the separate child survey of 2006 wave), which makes it difficult to control for the respondent throughout the whole panel dataset as what is done in Case et al. (2002). Consequently, the different driving factors behind the link between parental health status and child health cannot be completely unraveled in this paper.

Mother's health has a greater impact than father's health on child health status, which is consistent with results from previous studies (Case et al., 2002; Currie et al., 2007; Chou et al., 2007). Additionally, maternal health effect is much larger for the younger children than for the youths in China. One possible interpretation is that in China many high schools and lower middle schools offer catering and more importantly, accommodation services at a fee such that students can live on campus on school days for convenience. Thus, some older children live with their parents and depend on parental care only on weekends. Consequently, the direct health effect of parents on child health through lower quality child care may be attenuated; the health status of the children can also be affected by the living environment on campus or other places.

The estimation results of the effect of parental occupations also provide some support for the claim that maternal background is more important than paternal background with respect to child development. Maternal occupations that belong to group 2 (junior professional/technical worker, office staff and skilled worker) or group 3 (farmer, fisherman, hunter and those who engage in small commercial household business, handicraft, etc.) matter for child health. Two relevant points are worth mentioning. First, occupational group 3 is significantly correlated with child nutritional status in rural China, yet the effect is not robust across measures of child nutritional status. Specifically, children with mothers who work as farmer, fisherman, etc. have larger height-for-age z-scores, but smaller weight-for-age z-scores. The positive effect may be because that these occupations are mostly household-based, such that mothers may have more time at home and probably to provide more child care; whereas the negative effect appears unclear. Secondly, maternal occupation of group 2 has a positive effect on self-reported health status of rural children and a negative effect on that of urban youths (aged 12 to 18). It is possible that maternal occupation affects child health through different mechanisms for rural and urban children. On the one hand, in urban areas a job as junior professional/technical worker, office staff and skilled worker is usually not home-based or self-employed, and takes considerable time and energy; thus, mothers are required to be away from household. Consequently, the amount or the quality of parental care for urban children may be deteriorated. On the other hand, as in rural China more than 70 percent of the mothers work as farmer, fisher, etc., those whose job belongs to occupational group 2 may enjoy a significant income advantage comparing to the others. A study of occupational prestige in China by Li (2005) shows that based on a survey, the job as a fisherman only gets 25.17 points out of 100; whereas an office staff at government gets 66.58 points. Therefore, rural mothers with occupations in group 2 may have significantly more resources to contribute to child health investments and thus are more likely to have healthier children.

6.4 Child-specific characteristics and health

The effect of having siblings on child health conforms to expectations. If the investments by parents in their children such as financial resources and caring time are treated as constant, having siblings means that a child can only enjoy a limited fraction of the total resource; while the only child gets all. This may lead to the disparity of health status between the only child and the child with siblings. The policy implication, as also stressed by Bredenkamp (2009), is that a policy which aims at encouraging parents to have fewer children could benefit child health. Since the one-child policy has already been put forward and implemented over years in China, strengthening the implementation could be helpful in improving child health at the current time. There is also robust evidence that medical insurance relates to favorable outcomes of child health. Given the increasing medical costs in China (Liu, 2004), medical insurance could ease the financial burden of a household and facilitates the utilization of health care services Thus, policies which aim to increase the coverage of child medical insurance or to reduce the financial barriers to public health care services may to some extent help to improve the health and well-being of Chinese children. In addition, since in general the gender of the child does not significantly correlate with health or nutritional status, the policies can be equally applied to boys and girls.

7. Conclusion

To summarize, this paper examines the relationship between child health and parental socioeconomic status in China for more than a decade using a panel dataset constructed from CHNS. Different from several previous studies for developed countries, my data shows no strong correlation between children's self-reported health status and household income. However, due to the possible problems of using subjectively-measured child health status, and the lack of direct measurement for household income, as well as the nonresponse issue in the survey, one may not rush to a conclusion that household income does not affect child health in China. The nutritional status is found to be positively correlated with household income for rural children but not for urban children, which provides some evidence of a possible income gradient on Chinese children's health. In line with most of the empirical literature, maternal educational attainment, especially at higher levels, is positively linked to favorable outcomes of child health for rural children; while higher levels of paternal education is found to matter for urban children's nutritional status only. Besides, healthier parents are more likely to have healthier children; the maternal health effect is larger than the paternal health effect, and in most cases both effects are larger for rural children. The differences between urban and rural results further indicate that the dichotomization of the Chinese society is deeply-rooted and should always be taken into account in empirical analysis. While parental employment status appears to be of little importance, part of the disparities between children's health status may be attributed to the different occupations that mothers have. Additionally, child-specific characteristics are also found to significantly correlate with child health. The nutritional status deteriorates with age at a decreasing rate, suggesting a possible age-related growth failure among Chinese children. Children with direct siblings tend to have poorer health or nutritional status, which calls for tighter implementation of the one-child policy in China, especially in rural areas. Moreover, medical insurance appears to associate with better health outcomes of rural children, indicating that increases in insurance coverage in the rural areas may improve rural children's health status.

Given the possibility of spurious correlation, where there may be common factors that simultaneously affect child health and parental socioeconomic status, the results and policy implications in this paper are mostly suggestive rather than definitive. Nevertheless, the evidence should not be discarded simply because the mechanisms underlying the relationship between child health and parental socioeconomic status are still yet to be determined. Furthermore, due to the specialty of the Chinese context in the sense of population, political and economic policies, culture and social structure, etc., the conclusions of this paper may only apply to a national level rather than to the entire developing world. Future studies that aim at generating more precise policy implications may focus on identifying the causality between the variable of interest and child health. Besides, better measurements of household income in Chinese households are also called for such that the relationship between household income and child health may be further understood.

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