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CHILDHOOD MALNUTRITION IN CHINA: CHANGE OF INEQUALITY IN A DECADE

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Abstract: A concentration index methodology to analyze the inequality in childhood malnutrition in China is outlined. Height-for-age *z* score is used as a measure of childhood malnutrition. Using household survey data from nine Chinese provinces, it is found that per-capita household income, household head's education, urban residence and access to a bus stop reduced malnutrition. Child's age had a nonlinear effect on the malnutrition status. Income growth and access to public transportation reduced the inequality, while rural-urban gap, provincial differentiation, and unequal distribution of household head's education increased inequality in childhood malnutrition. Gender is not a factor in either malnutrition status or inequality. Investments in infrastructure and welfare programs are recommended to reduce the inequality.

Key words — Asia, childhood malnutrition, China, concentration index, decomposition, health inequality

JEL Classification: D63, I12, J13

Although China has experienced a high rate of economic growth for more than two decades, a large number of Chinese households are living with earnings below the state poverty line, which is roughly $77 of per capita annual income. Despite the continuing GDP growth of 8 percent, rural poverty rose 3% during 2002-2003 according to official estimates (Reddy & Minoiu). With the phasing out of the Rural Cooperative Medical System, medical expenses have become significant burdens on rural Chinese households. Many of the households that recently fell below the poverty line were, in fact, health-stricken rather than poverty-stricken (Gustafsson and Li; Banister and Zhang). The equity of access to health service in urban China has been discussed in Gao *et al*., Zhang and Kanbur, and Liu *et al*.. The unequal distribution of health adversely affects the labor supply and productivity of lower income households and, consequently, further exacerbates income inequality. This development contradicts the egalitarian principle of the state and may sow the seeds of social unrest. The situation suggests that a study of the health inequality in China is timely and important.

Childhood malnutrition is strongly associated with health risks in later life. Its measurements include, height-for-age (or stunt), weight-for-age (underweight), and weight-for-height (weaning). Based on a sample from rural Yunnan province, Li *et al*. found that the prevalence of protein-energy malnutrition was relatively high among rural minority children and that chronic socioeconomic underdevelopment and genetic effects, instead of a severe or immediate lack of food, might have led to the protein-energy malnutrition. Jamison found that malnutrition hindered children's school performance.

Analysis of the inequality of childhood malnutrition can reveal how it is related to household income and urban-rural disparity, as well as regional differences. Earlier studies of inequality in health or malnutrition status of the Chinese population were mostly descriptive. Stunting is believed to reflect the accumulation of long-term malnutrition, while underweight and weaning are easily affected by temporary shortages of food. This article follows Wagstaff, van Doorslaer and Watanabe in using stunting as a measure of childhood malnutrition and examines the inequality of stunt. To our knowledge, it is the first to measure and decompose the inequality of childhood malnutrition in the Chinese population.

The rest of the article is organized as follows. Section 2 briefly reviews the literature. Section 3 introduces the methodology. Section 4 describes the data, and section 5 presents the results and discussion. Conclusions are found in the last section.

Childhood Malnutrition and Health Equity in China

The effects of childhood malnutrition on child mortality have been reported extensively. Recent quantitative analyses suggest that mild and moderate malnutrition are implicated in many more child deaths than previously recognized (USAID). Childhood malnutrition is correlated with health status in later life and intellectual abilities (e.g., Jamison). Inequality in childhood malnutrition may, therefore, lead to future unequal distribution of human capital measured in both physical health and intellectual ability. Du *et al*. studied the impact of income change on dietary behavior over time and by socioeconomic level. They found that increased income might have affected diets and body composition in a manner detrimental to health, with those in low-income groups having the largest effects due to increased income. Liu, Hsiao and Eggleston indicated that financial constraints restricted patients' access to health care. Equity in childhood malnutrition, therefore, is a pressing research and policy issue.

Health inequality is usually related to household and individual-level characteristics, as well as community characteristics, such as road accessibility, rural-urban gap, and regional differences. Household and individual-level characteristics usually include household income, education, as well as age and gender.

Previous studies found that lower socioeconomic status might lead to poor health. Ettner found that increased income improved mental and physical health. Wagstaff and Watanabe explored alternative measures of socioeconomic status (SES) and suggested that it made little difference to the measured degree of equity whether per capita consumption or an asset-based wealth index was used as the indicator of SES.

Education was related to allocative efficiency in household production (Huffman). Whether household education, average education among household members, or highest educational attainment among household members better represented the educational level of the household in the analysis of household agricultural production has been discussed in Cheng and Yang. However, for household health production, especially when the subject is childhood malnutrition, educational attainment of the household head might be more relevant (Wagstaff, van Doorslaer and Watanabe). Banister and Zhang examined the effects of the illiteracy rate on mortality in China using an aggregate provincial dataset.

Age and gender of the child are important in determining the nutritional status of the child. It is not uncommon that younger siblings receive more attention from the household. It is also well-known that in many under-developed countries boys are preferred to girls. Wagstaff, van Doorslaer and Watanabe investigated both the effects of a binary indicator of being a boy and the nonlinear effects of age and found them significantly related to the stunting of a child. Infant mortality is higher for baby girls than baby boys in China (Banister & Zhang).

Accessibility has been hypothesized to have a positive effect on childhood malnutrition. Easier access to the outer-world could lower the price of nutritional products and the cost of transportation. It may be positively related to information access. The role of road density in regional income inequality in China was examined in Zhang and Fan.

In China, infrastructure for health, transportation, information access, and education have traditionally been better in urban areas than rural areas. Differences also had existed across provinces. Banister and Zhang found rural residential status to be a positive determinant of mortality rates among young children and adults. Zhang and Kanbur suggested that the inequalities across provinces and within provinces, between rural and urban areas and within rural and urban areas, and social inequalities have increased substantially since the economic reforms began in China. They concluded the results were partially attributable to the change of foundations in education and healthcare provision.

Methodology

The concentration index (CI) was first introduced to measure health sector inequality by Wagstaff, van Doorslaer and Paci. Since then it has become a standard measure in the health equity literature. The CI and related concentration curve quantify the degree of income-related inequality in a specific health variable. It could be used to measure the degree to which health subsidies are better targeted toward the poor. The CI is related to the concentration curve, which graphs the cumulative percentage of the sample, ranked by (household/individual) income, beginning with the poorest, on the *x*-axis, and on the *y*-axis the cumulative percentage of the health variable corresponding to each cumulative percentage of the distribution of the living standard variable. If the health variable reflects a "bad", such as stunting, a negative value of the CI means ill health is higher among the poor and thus disfavors the poor.

Graphically, CI is the twice the area between the concentration curve and the diagonal. Figure 1 shows the concentration curve for stunting using the 2000 cross-section of the China Health and Nutrition Survey (CHNS). The concentration curve was close to the diagonal for the lowest 25% (ranked by per capita household income) but deviated from it after the 25th income percentile, which implies that children in median income households were more susceptible to malnutrition.

[Insert Figure 1 here]

Denote y as the negative of the height-for-age z score (or other health outcome variables), n as the sample size, $\bar{y}$ as the sample mean of y, and R the fractional rank of the ith person in the income distribution. Then the CI of y, denoted C, is calculated as

$$C = \frac{2}{n\,\bar{y}} \sum_{i=1}^{n} y_i R_i - 1. \qquad (1)$$

By construction it is a measure of relative inequality because multiplying everyone's health by a constant will not change C because both $\bar{y}$ and y_i are involved.

Wagstaff, van Doorslaer and Watanabe proposed a procedure for decomposing the causes of health sector inequalities. Oaxaca-type decomposition was used to examine the contribution of socio-economic and behavioral factors associated with the inequality

(Oaxaca). The decomposition procedure has three steps. The first step involves fitting a linear regression model, which represents the relationship between the variable of interest (y) to a set of k determinants (x_k):

$$y_i = \alpha + \sum_k \beta_k x_{ki} + \varepsilon_i \,, \tag{2}$$

where the β_ks are coefficients and ε_i is an error term. The second step is to calculate the concentration indices of the health outcome variable based on the means of the explanatory variables. From (2) the relationship between these indices is

$$C = \sum_k (\beta_k \bar{x}_k / \bar{y}) C_k + G_\varepsilon / \bar{y} \,, \tag{3}$$

where $\bar{x}_k$ is the sample mean of x_k, C_k is the concentration index for x_k, and G_ε is a generalized concentration index for ε_i defined as

$$G_\varepsilon = \frac{2}{n} \sum_{i=1}^{n} \varepsilon_i R_i . \tag{4}$$

In empirical applications, ε_i and β_k can be replaced by their estimates from the regression of equation (2). The relationship is assumed to hold in any time period t. The third and final step is to decompose C using the results calculated in previous steps. Three formulas provided in Wagstaff, van Doorslaer and Watanabe (2003) for this purpose are:

$$\Delta C = \sum_k (\beta_{kt} \bar{x}_{kt} / \bar{y}_t) C_{kt} - \sum_k (\beta_{k(t-1)} \bar{x}_{k(t-1)} / \bar{y}_{(t-1)}) C_{k(t-1)} + \Delta(G_{\varepsilon t} / \bar{y}_t), \tag{5}$$

$$\Delta C = \sum_k \eta_{kt} (C_{kt} - C_{k(t-1)}) + \sum_k C_{k(t-1)} (\eta_{kt} - \eta_{k(t-1\_}) + \Delta(G_{\varepsilon t} / \bar{y}_t), \tag{6}$$

$$\Delta C = \sum_k \eta_{k(t-1)} (C_{kt} - C_{k(t-1)}) + \sum_k C_{kt} (\eta_{kt} - \eta_{k(t-1)}) + \Delta(G_{\varepsilon t} / \bar{y}_t), \tag{7}$$

Equation (5) can be derived by simply taking the difference of equation (3) between different periods. Equations (6) and (7) are obtained by applying Oaxaca-type decomposition to equation (3). They reveal, for each explanatory variable x_k or for all x_k

combined, the percentage to which changes in health inequalities are associated with changes in inequality in the explanatory variables (the first term of the right-hand side), rather than to changes in their elasticities (the second term of the right-hand side). For example, the overall contribution of per capita household income to the change of inequality in childhood malnutrition is composed of two separate parts. The first is the change of the inequality in per capita household income times its elasticity, and the second is the change of elasticity times its concentration index. Equations (6) and (7) differ in the choice of time periods for elasticities in the first term and concentration indices in the second term.

Data

The analysis for this study is based on data extracted from the CHNS, an ongoing longitudinal project started in 1989 and followed up in 1991, 1993, 1997 and 2000.[1] A multistage, random cluster process was used to draw the sample in nine provinces in China. Counties in these provinces were stratified by income. In addition, the provincial capital and a low-income city were selected. Villages, townships (within the counties), and urban and suburban neighborhoods (within the cities) were selected randomly. The dataset contains detailed information on demographics, socio-economic variables, time-use, labor force participation, asset ownership, and expenditures. Income was calculated

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1. This study utilizes a unique dataset, for which credits go to the UNC-CPC (University of North Carolina, Carolina Population Center) and CDCC (Center of Disease Control and Prevention, China).

from reported components of income. Henderson *et al*. provided a detailed description of the first round of the survey.

The subjects used in this study are children under 10 years of age with complete information on height, household income, and gender. Older children were excluded because the height of children over 10 years old is strongly influenced by genetic factors. The five cross-sections are used separately in this study. We ignore the panel data structure because we are focusing on a certain age group, thus a balanced panel will not be representative, and in turn, the CI would be meaningful only for children in the panel. The numbers of children under 10 years old are given in Table 1. It is found that though there is an abrupt jump from 1989 to 1991, the number of children 10 years old and under has been declining since 1991, which largely reflects the effect of family planning rather than panel attrition. We examined the percentage of households remaining in the survey and found that panel attrition is negligible. The abrupt jump from 1989 to 1991 was examined further, and the average age in 1989 was found to be lower than those of other years. This may be the result of either a baby-boom like phenomenon after the economic reform or simply measurement errors in the age variable.

The explanatory variables in our study include the natural logarithm of per capita household income, child's age and its square term, household head's education, and dummy variables indicating boy, urban residence, whether there is a bus stop in the community, and provinces. Per capita household income is used as the measure of income. One might contend that income is endogenous. However, as Wagstaff, van Doorslaer and Watanabe argued, modeling income as an endogenous variable does have its virtues, but the resulting CI may not present the *true* inequality. Hence, for simplicity, we follow Wagstaff, van Doorslaer and Watanabe and treat income as exogenous. Household head's education is used as the indicator of education. The child's age and age squared are used to capture the potential nonlinear effects of age on the malnutrition status. We use a binary indicator of bus stop availability in the community as a proxy for road accessibility. Provincial dummy variables are used to accommodate regional differences. Because Liaoning and Heilongjiang are next to each other and share many characteristics, they are combined and called the Northeast. The combination was also motivated by Heilongjiang households dropping out of the survey in 1997, and several Liaoning communities being added as replacements.

Descriptive statistics are presented in Table 1. Per capita household income has been increasing except for 1993. The percent of the sample living in urban areas was relatively stable for the survey years. The average child's age jumped from about 40 months to 64 months during 1989-1991, but remained stable thereafter. The mean household head's education was fairly constant during the six years. Boys comprised slightly over half of the sample in each survey year. Access to a bus stop increased over the years, which reflects an improvement in infrastructure after the economic reform. The means of the provincial dummy variables are stable over the survey years, except those for the Northeast and Shandong for 1997 and 2000.

[Insert Table 1 here]

Results

The stunt (height-for-age) *z*-scores are calculated with reference to the Center for Disease

Control and Prevention (CDC) growth chart, which applies to Asian children.[2] The means of the *z*-scores (with a minus sign) for the five cross-sections are presented in Table 1. The decreasing trend, from 1.17 in 1989 to 0.84 in 2000, suggests an improvement in nutrition availability to Chinese children.

The childhood malnutrition CIs are −0.137, −0.113, −0.081, −0.152 and −0.136, respectively, for the five survey years. These values and their corresponding standard errors are also presented in Table 1. The series suggests an improvement of equity in early 1990s, but it deteriorated thereafter and suggests children were slightly better off in 2000. Figures 1-2 graph the concentration curves, which show a general trend that the lowest 20% of the income group had improved childhood nutrition status over time, but the median income groups are disfavored in terms of equity.

[Insert Figure 2 here]

Regression results

The regression results are presented in Table 2. The hypotheses of no provincial fixed effects are rejected for each year based on the *F*-statistics. Our use of provincial fixed effects instead of community fixed effects is based on the following reasons. First, in contrast to Wagstaff, van Doorslaer and Watanabe, we do have community level characteristics (i.e., urban and access to a bus stop), which are effects of interest. Second, the null hypothesis of no community fixed effects for the year 2000 could not be rejected

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2. Wagstaff, van Doorslaer and Watanabe experimented with different (CDC and UK) references and obtained similar results.

at the five percent significance level.[3] Similar tests for the other years led to rejection, but it is not clear whether the community fixed effects model is preferred over the model with provincial fixed effects and the two community characteristics because none of them is nested by the other. Here we choose the latter model.

[Insert Table 2 here]

The estimated coefficients of the logarithm of per capita household income are negative across all years (though not significant for the year 2000), which suggest that higher household income reduces the likelihood of stunting. However, the absolute value of the coefficient has declined over time. The coefficients of household head's education have remained a little less than −0.010 and statistically insignificant, except for 1991 for which it is −0.028 and statistically significant. The implication is that increased household head's education reduces childhood malnutrition. Child's age has an inverted U-shaped effect on the *z*-scores during the survey period, but the effect is not statistically significant in 1991. The turning points are slightly more than 4 years old, which is consistent with the fact that young children receive more attention in Chinese households. It is also possible that the cumulative effects of malnutrition start to exhibit themselves after this age. Wagstaff, van Doorslaer and Watanabe reported similar findings for Vietnamese children. Being a boy, surprisingly, does not make a child less likely to be stunted because the coefficient estimates for the 1989, 1991 and 1993 regressions are negative but insignificant. Its coefficient estimates for 1997 and 2000 are positive but

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3. Separate regressions for each survey year were performed using community fixed effects and with the two community-level characteristics. Results of these regressions are used to test the significance of community fixed effects and are available upon request.

only marginally significant for 1997. This lack of gender effect on stunt may reflect the diminishing discrimination of girls in China.

The coefficient estimates for the urban dummy variable are all significant and negative for the five years, which suggests that urban children achieved better nutritional status than their rural counterparts. The absolute values of the estimates suggest that the rural-urban gap increased over time. Access to a bus stop is estimated to have reduced the incidence of childhood malnutrition, for the first three cross-sections. The coefficients are not significant for 1997 and 2000, suggesting the importance of access to a bus stop has declined over years, which is likely due to more communities having access to bus stops. Coefficients for the provincial dummy variables suggest that provincial differences in childhood malnutrition existed in the first three years but diminished after 1993, which is attributable to the fact that most provinces have become more similar with the economic development. Types of diets and genetic factors across provinces may have affected the typical child's height. It is also believed that northern Chinese people are taller than those residing in other parts of China. Indeed, the coefficient estimates for the dummy indicators for residing in Shandong and Northeast have relatively small values for 1989, but the coefficients are smaller in later years, i.e., most of the coefficient estimates are not significant in 1997 and 2000, which suggests the effects of inter-province migration or economic development have outweighed genetic differences. Children residing in Guizhou were consistently behind those in other provinces given fixed level of other covariates, which may be associated with the fact that Guizhou had remained underdeveloped during the survey time period.

Decomposition results

The elasticities of the explanatory variables calculated based on the regression results and concentration indices of the explanatory variables are presented in Table 3. Table 4 gives the decomposition results based on equation (5), which are estimates of the contributions of explanatory variables to the childhood malnutrition concentration indices as well as the change for year 2000 with respect to previous years. Per capita household income and household head's education disfavor the poor in the five survey years. Additional years for a child's age have a slightly positive contribution to the equity in childhood malnutrition after accounting for its nonlinearity. Being a boy virtually has no contribution to the inequality. Access to a bus stop disfavors the poor, but the magnitude has diminished and is close to zero in 2000. Residing in an urban area disfavors the poor, and the effect has been stronger over time. Residing in the Northeast, Shandong, or Jiangsu favors the poor except in 1993. Residing in Henan, Hubei, Hunan, or Guangxi has mixed effects on the inequality, and residing in Guizhou disfavors the poor, which may indicate children in poor Guizhou households were more susceptible to stunting.

[Insert Table 3 here]

[Insert Table 4 here]

Oaxaca-type decomposition results based on equation (6) and (7) provide more information. Because Oaxaca-type decomposition compares the inequality of two periods, there exist 10 combinations of different starting and ending years. We have chosen two comparisons (between 2000 and 1991 and between 2000 and 1993). The year 2000 is chosen in both comparisons because we want to have the estimates for the most recent years. The year 1993 is chosen because the CI of 1993 is the lowest in absolute value.

The year 1991, instead of 1989, is chosen to reflect the long-run changes because the 1989 cross-section has the previously mentioned data irregularities.[4]

The results of 2000-1993 decomposition are presented in Table 5. For a given explanatory variable, the columns with header "dC*n" are the contributions of the respective explanatory variable to the change in inequality in childhood malnutrition due to the change of concentration index of the explanatory variable itself, and the columns with header "dn*C" indicate the contribution due to the change in elasticity of the explanatory variable. The estimated contribution of income is small and favors the poor, largely due to a slight improvement of income inequality. Household head's education has contributed to the inequality, and the effects mostly came from the inequality in the covariate itself. Estimated overall effects of a child's age improved the inequity, but the effects seem to have come from the change in its elasticities. Being a boy has negative contribution to the malnutrition inequality. Access to a bus stop improves the equity via the change in estimated elasticity. Residing in an urban area disfavors the poor through its change in elasticity. The contributions of provincial dummy variables are estimated in a similar fashion. The sum of their contributions to the change is −0.035, which is 53% of ΔC. The provincial difference disfavors the poor.

[Insert Table 5 here]

Results of Oaxaca-type decomposition for 2000-1991 are presented in Table 6. The long-term change indicates that deteriorated income inequality has contributed to the

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4. The decomposition result of 2000−1989 is found to be similar to that of 2000−1993 though the magnitude of the percentage changed due to the small difference between the concentration indices of 2000 and 1989. The result is available upon request.

unequal distribution of childhood malnutrition while the increasing income outweighed such effects. Implications for a child's age, gender difference, and household education are similar to earlier results for 2000-1993. The inequality of urban residence further disfavored the poor, while access to a bus stop favored the poor. The sum of the percentage of the contribution of provincial dummy variables is −0.023, which is 35% of ΔC.

[Insert Table 6 here]

Conclusion

Results obtained in this study can be summarized as follows. First, income growth appears to have ameliorated the inequality in childhood malnutrition, while household head's education has disfavored children in low-income households, which is largely due to the unequal distribution of household head's education. Second, the inequality of malnutrition among elder children is estimated to be less than that of younger children. This may reflect the ability of wealthier families to provide better care for young children or infants. Gender does not contribute significantly to the inequality in childhood malnutrition. Third, access to a bus stop seems to have reduced the inequality. The rural-urban gap was found to have contributed to the inequality in childhood malnutrition, which agrees with previous studies (e.g., Zhang and Kanbur) for inequality in access to health care, and warrants attention from policy makers. Provincial differences in childhood malnutrition did exist and contributed to the inequality.

Policy implications can be drawn from the decomposition results. The ameliorating effects of income suggest that an income transfer program may help to reduce the inequality in childhood malnutrition.[5] Although welfare programs exist in China, many of these programs are likely to have diminishing impacts on general welfare because of recent economic and institutional reforms, and none of these programs has targeted improving childhood nutrition status like the Special Nutrition Supplement Program for Women, Infants and Children (WIC) does in the US.[6] Through providing pregnant women, infants, and children with nutrition food, the WIC program seeks to improve fetal development and reduce the incidence of low birth weight, short gestation, and anemia. See Currie for a detailed review of the history, rules, program statistics, and evaluations of the US food and nutrition programs. Similar programs may be established in China to improve general welfare thought further studies are necessary to assess the potential welfare gains.

The results regarding the household head's education suggest that further efforts on providing low-income households with access to education would be beneficial. The

5. The U.S. has operated a number of food nutrition assistance programs, including the Special Nutrition Supplement Program for Women, Infants and Children (WIC), School breakfast (lunch) program, and Food stamp program. These programs have greatly reduced malnutrition and improved health status among low-income American families; see, e.g., Carlson and Senauer.

6. As an example of welfare program in China, Wubaohu includes three types of families/individuals (elderly, disabled and orphaned minors who are without support and income sources), that enjoy free provision of food and fuel, clothing, housing, health care, and funeral services (Ministry of Civil Affairs).

results for access to a bus stop suggest that investment on infrastructure improves equity. Although additional investment in improving access to bus stop may not have additional gain in the equity in childhood nutrition status, its positive effects in earlier years suggest other types of infrastructure investment, e.g., communication infrastructure, are worthy of further study. The increasing effect of the rural-urban gap on the inequality of childhood malnutrition may also relate to the different levels of infrastructure investment. The Chinese government may have to shift the focus of welfare programs to rural areas in the near future to improve the equity. Between province transfers may help to improve equity. Non-governmental organizations and programs aimed at reducing poverty and improving education in certain provinces should be encouraged.

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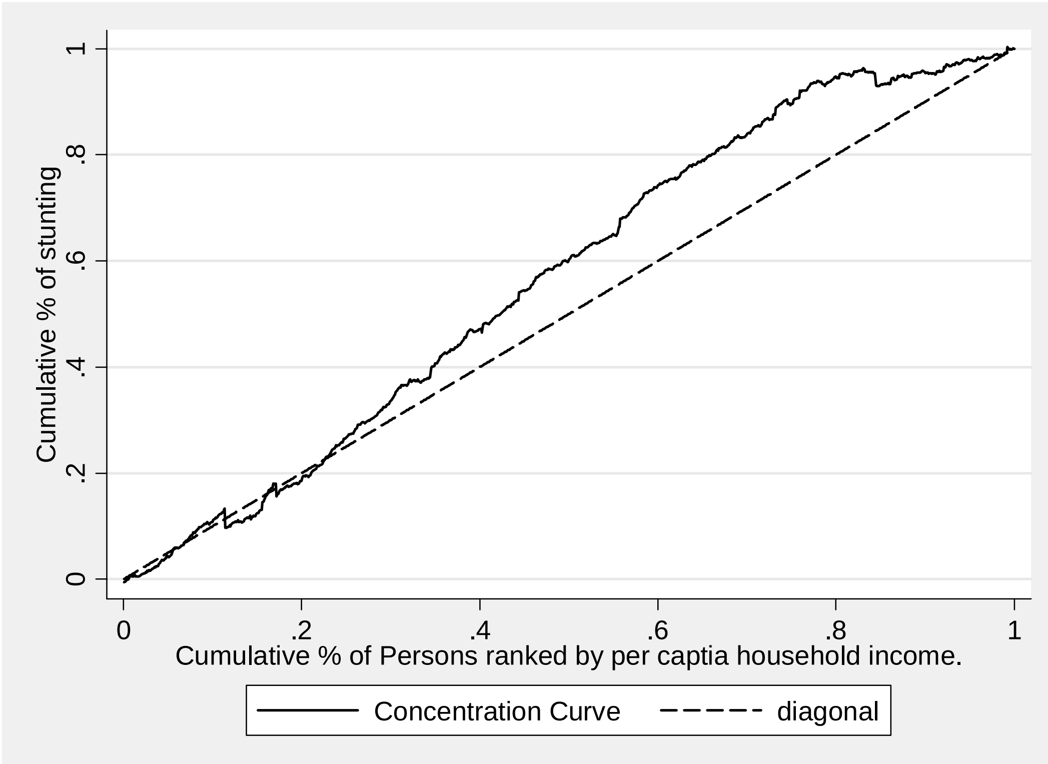

Figure 1. Stunting concentration curve, CHNS 2000 sample

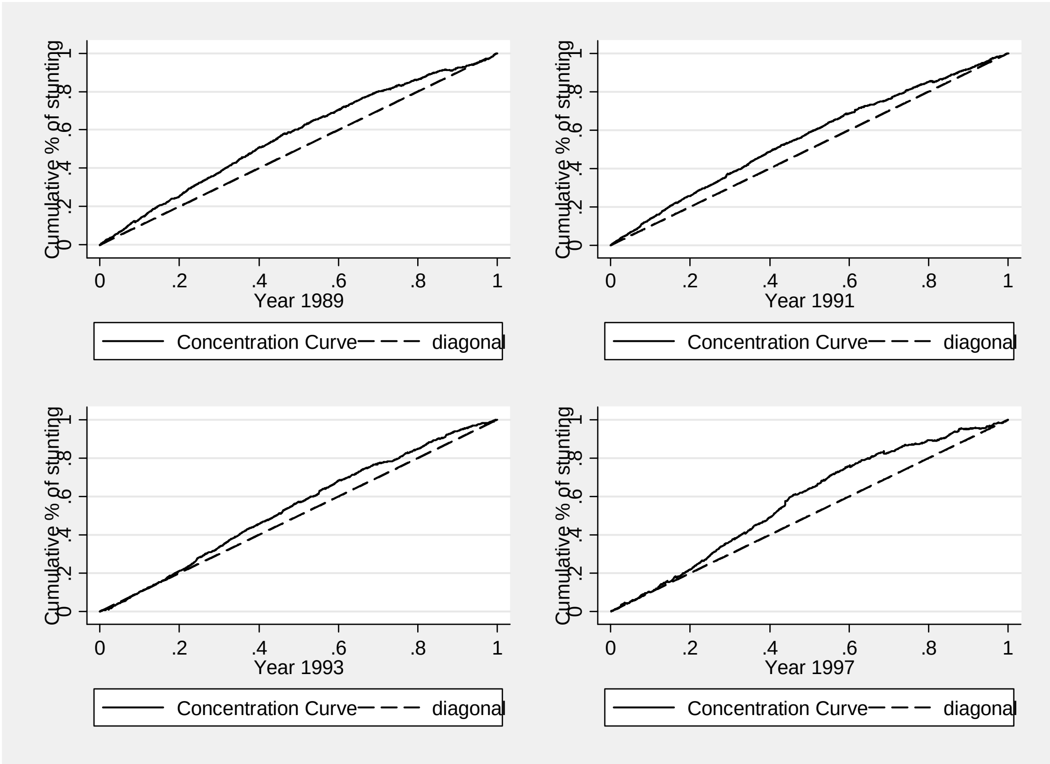

Figure 2: Stunting concentration curve, 1989-1997

Table 1. Sample statistics and concentration indices of the CHNS dataset

	1989		1991		1993		1997		2000	
Variable	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Household income (1000 Yuan)	0.804	0.595	1.921	1.284	1.333	1.172	3.021	2.426	2.686	2.192
Household head's education (yr)	6.229	3.971	6.302	3.851	5.962	3.817	5.823	4.143	5.837	4.267
Child's age (in months)	39.364	22.917	64.248	31.488	69.253	29.739	74.532	33.492	69.271	32.890
Boy	0.527		0.531		0.539		0.543		0.541	
Urban	0.250		0.237		0.216		0.241		0.238	
Access to bus stop	0.402		0.552		0.558		0.585		0.655	
Northeast	0.126		0.116		0.114		0.139		0.208	
Jiangsu	0.090		0.086		0.099		0.129		0.113	
Shandong	0.098		0.107		0.078		0.072		0.042	
Henan	0.120		0.120		0.135		0.163		0.131	
Hubei	0.170		0.147		0.158		0.133		0.110	
Hunan	0.102		0.123		0.114		0.074		0.072	
Guangxi	0.149		0.156		0.161		0.137		0.137	
Guizhou	0.145		0.143		0.142		0.154		0.187	
Stunt *z*-score	1.171		1.296		1.145		0.816		0.844	
# of children age 10 and under	1534		2260		1891		1439		1083	
	Estimate	Std. err.	Estimate	Std. err.	Estimate	Std. err.	Estimate	Std. err.	Estimate	Std. err.
Concentration index	−0.137	0.018	−0.113	0.016	−0.081	0.017	−0.152	0.028	−0.136	0.049

Table 2. OLS regressions (dependent variable = stunt)

	1989		1991		1993		1997		2000	
Variable	Coeff.	*t-value*[a]	Coeff.	*t-value*	Coeff.	*t-value*	Coeff.	*t-value*	Coeff.	*t-value*
Household income (logarithm)	−0.177	−3.97	−0.226	−4.97	−0.096	−2.35	−0.095	−1.85	−0.064	−0.69
Urban	−0.358	−4.09	−0.499	−5.90	−0.458	−5.40	−0.457	−4.33	−0.545	−2.54
Child's age (in months)	0.061	9.09	0.007	0.82	0.016	2.34	0.031	3.79	0.027	2.98
Child's age squared /100	−0.054	−7.45	−0.006	−1.14	−0.011	−2.42	−0.021	−4.06	−0.021	−3.46
Boy	−0.008	−0.11	−0.085	−1.23	−0.020	−0.30	0.124	1.62	0.081	0.58
Access to bus stop	−0.151	−2.02	−0.189	−2.16	−0.272	−3.85	−0.050	−0.52	−0.004	−0.02
Household head’s education (yr)	−0.010	−1.07	−0.028	−2.89	−0.009	−1.02	−0.009	−0.85	−0.008	−0.53
Northeast	0.685	1.83	2.800	6.68	1.369	3.03	0.578	1.12	0.143	0.17
Jiangsu	1.215	3.31	2.924	6.61	1.341	3.36	0.641	1.25	0.940	1.06
Shandong	0.801	2.11	3.117	6.76	1.394	3.40	0.434	0.83	0.305	0.21
Henan	1.114	3.08	2.999	7.37	1.293	3.31	0.542	1.07	0.755	1.06
Hubei	1.248	3.21	3.341	7.53	1.705	4.42	0.898	1.79	1.079	1.45
Hunan	1.368	3.54	3.560	7.87	1.743	4.36	0.955	1.69	0.942	1.24
Guangxi	1.436	3.95	3.424	8.36	1.803	4.49	0.888	1.68	0.853	1.04
Guizhou	1.738	5.02	3.839	9.20	2.186	5.74	1.464	2.94	1.518	2.08
R^2	0.5077		0.4258		0.411		0.305		0.167	
F for regression	147.28		190.3		140.41		70.090		43.100	
Degrees of freedom for *F* test	(15, 1519)		(15, 2245)		(15, 1876)		(15, 1424)		(15, 1068)	
F for provincial fixed effects	15.50		21.20		15.53		7.48		8.98	
Degrees of freedom for *F* test	(8, 1519)		(8, 2245)		(8, 1876)		(8, 1424)		(8, 1068)	

[a] Robust standard errors are used in calculating the *t*-values.

Table 3. Elasticities and concentration indices calculated based on the stunt regressions

	Elasticities					Concentration indices				
	1989	1991	1993	1997	2000	1989	1991	1993	1997	2000
Household income (logarithm)	−0.96	−1.28	−0.58	−0.90	−0.57	0.08	0.05	0.07	0.06	0.07
Urban	−0.08	−0.09	−0.09	−0.14	−0.15	0.39	0.20	0.31	0.31	0.28
Child's age (in months)	2.05	0.34	0.95	2.80	2.23	0.01	0.02	0.01	0.00	0.02
Child's age squared /100	−0.95	−0.25	−0.53	−1.75	−1.48	0.03	0.03	0.02	0.00	0.02
Boy	0.00	−0.03	−0.01	0.08	0.05	−0.01	−0.01	0.00	0.00	−0.01
Access to bus stop	−0.05	−0.08	−0.13	−0.04	0.00	0.06	0.04	0.06	0.11	0.08
Household head’s education (yr)	−0.05	−0.14	−0.05	−0.07	−0.06	0.05	0.07	0.05	0.09	0.09
Northeast	0.07	0.25	0.14	0.10	0.04	0.04	0.08	0.21	0.08	0.03
Jiangsu	0.09	0.19	0.12	0.10	0.13	0.14	0.06	0.11	0.33	0.44
Shandong	0.07	0.26	0.10	0.04	0.02	0.20	0.08	−0.09	0.00	0.17
Henan	0.11	0.28	0.15	0.11	0.12	0.00	−0.13	−0.31	−0.23	−0.36
Hubei	0.18	0.38	0.23	0.15	0.14	−0.13	0.23	−0.04	−0.03	−0.05
Hunan	0.12	0.34	0.17	0.09	0.08	−0.04	0.13	0.11	0.14	0.11
Guangxi	0.18	0.41	0.25	0.15	0.14	0.15	−0.16	0.07	0.11	0.08
Guizhou	0.21	0.42	0.27	0.28	0.34	−0.23	−0.23	−0.03	−0.24	−0.16

Table 4. Regressor's contributions to concentration indices and changes of concentration indices

	Contributions to *C*					Change			
Variable	1989	1991	1993	1997	2000	2000−1989	2000−1991	2000−1993	2000−1997
Household income (logarithm)	−0.073	−0.066	−0.039	−0.052	−0.038	0.035	0.028	0.001	0.014
Urban	−0.030	−0.019	−0.026	−0.042	−0.042	−0.013	−0.024	−0.016	0.000
Child's age (in months)	0.022	0.007	0.010	−0.009	0.042	0.019	0.035	0.032	0.051
Child's age squared /100	−0.025	−0.007	−0.008	0.006	−0.035	−0.011	−0.028	−0.027	−0.041
Boy	0.000	0.000	0.000	0.000	0.000	−0.001	−0.001	0.000	−0.001
Access to bus stop	−0.003	−0.003	−0.008	−0.004	0.000	0.003	0.003	0.008	0.004
Household head's education (yr)	−0.003	−0.009	−0.002	−0.006	−0.005	−0.003	0.004	−0.003	0.001
Northeast	0.003	0.021	0.028	0.008	0.001	−0.002	−0.020	−0.027	−0.007
Jiangsu	0.013	0.011	0.013	0.033	0.056	0.042	0.044	0.043	0.023
Shandong	0.013	0.021	−0.008	0.000	0.003	−0.011	−0.018	0.011	0.002
Henan	0.000	−0.036	−0.047	−0.025	−0.042	−0.042	−0.006	0.005	−0.017
Hubei	−0.024	0.087	−0.010	−0.005	−0.007	0.017	−0.094	0.003	−0.002
Hunan	−0.005	0.043	0.018	0.012	0.009	0.013	−0.034	−0.009	−0.003
Guangxi	0.028	−0.065	0.019	0.017	0.011	−0.017	0.076	−0.008	−0.006
Guizhou	−0.049	−0.097	−0.008	−0.066	−0.052	−0.004	0.045	−0.045	0.013
Residual	−0.132	−0.112	−0.068	−0.132	−0.103				

Table 5. Oaxaca-type decompositions for change in inequality 1993 and 2000

	Equation (6)		Equation (7)		Total	
Variable	d*C***n*	d*n***C*	d*C***n*	d*n***C*	Total	Percent
Household income (logarithm)	0.001	0.000	0.001	0.000	0.001	−2%
Urban	0.005	−0.021	0.003	−0.019	−0.016	29%
Child's age (in months)	0.019	0.013	0.008	0.024	0.032	−59%
Child's age squared /100	−0.013	−0.014	−0.005	−0.023	−0.027	50%
Boy	−0.001	0.000	0.000	−0.001	0.000	1%
Access to bus stop	0.000	0.008	−0.003	0.011	0.008	−14%
Household head's education (yr)	−0.002	0.000	−0.002	−0.001	−0.003	5%
Northeast	−0.006	−0.021	−0.025	−0.003	−0.027	51%
Jiangsu	0.042	0.001	0.039	0.004	0.043	−79%
Shandong	0.004	0.007	0.024	−0.013	0.011	−20%
Henan	−0.006	0.011	−0.008	0.012	0.005	−9%
Hubei	−0.001	0.004	−0.002	0.005	0.003	−5%
Hunan	0.000	−0.010	0.001	−0.010	−0.009	17%
Guangxi	0.000	−0.009	0.001	−0.009	−0.008	15%
Guizhou	−0.043	−0.002	−0.034	−0.010	−0.045	82%
Residual					−0.019	36%
Total	−0.002	−0.033	−0.003	−0.032	−0.035	64%

Table 6. Oaxaca-type decompositions for change in inequality 1991 and 2000

	Equation (6)		Equation (7)		Total	
	d*C***n*	d*n***C*	d*C***n*	d*n***C*	Total	Percent
Household income (logarithm)	−0.009	0.037	−0.019	0.047	0.028	−121%
Urban	−0.011	−0.013	−0.007	−0.017	−0.024	103%
Child's age (in months)	−0.001	0.036	0.000	0.035	0.035	−153%
Child's age squared /100	0.006	−0.034	0.001	−0.029	−0.028	122%
Boy	0.000	−0.001	0.000	−0.001	−0.001	4%
Access to bus stop	0.000	0.003	−0.003	0.007	0.003	−13%
Household head’s education (yr)	−0.001	0.005	−0.003	0.007	0.004	−18%
Northeast	−0.002	−0.018	−0.014	−0.006	−0.020	86%
Jiangsu	0.048	−0.004	0.075	−0.031	0.044	−193%
Shandong	0.001	−0.020	0.022	−0.041	−0.018	80%
Henan	−0.027	0.021	−0.063	0.057	−0.006	26%
Hubei	−0.039	−0.055	−0.107	0.012	−0.094	410%
Hunan	−0.001	−0.033	−0.006	−0.028	−0.034	148%
Guangxi	0.032	0.043	0.097	−0.021	0.076	−329%
Guizhou	0.025	0.020	0.031	0.014	0.045	−194%
Residual					−0.032	140%
Total	0.022	−0.013	0.004	0.005	0.009	−40%