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Abstract

Between 1991 and 2000, both average incomes and income inequality grew rapidly in China. Although the average measurable health status of Chinese children also improved dramatically, changes in *average* health status may mask differential impacts within the distribution of health status. Using the China Health and Nutrition Survey[1] (CHNS) data for 1991, 1993, 1997 and 2000 on 4,400 households in 9 provinces, this paper examines the height-for-age of Chinese children aged 2 to 13, with particular emphasis on the growth of children living in poor households. It uses mean regression and quantile regression models to isolate the dynamic impact of poverty status and food coupon use on child height-for-age.

Our principal findings are: (1) controlling for standard variables (e.g., parents' weight, height and education) poverty is correlated with slower growth in height between 1997 and 2000 but not earlier; (2) in 2000, poverty primarily reduces the likelihood of strong growth in height-for-age; (3) food coupon use in earlier periods increases growth in height-for-age. The disappearance in the 1990s of subsidized food coupons in China has increased the importance of money income poverty in enabling consumption of basic foods by poor families. The general moral is the crucial social protection role that subsidized food programs can potentially play in maintaining the health of poor children.

[1] Conducted by the Carolina Population Center at the University of North Carolina – documentation available at http://www.cpc.unc.edu/china.

The Growth of Poor Children in China 1991-2000:

Why Food Subsidies May Matter

1. Introduction

Health is both a direct determinant of individual well-being and a precondition for enjoyment of material affluence. This paper focuses on the health status of children – specifically, on the height-for-age of Chinese children – because child health affects both the current well-being of children and their future health, economic productivity and personal well-being. It asks whether changes in the average height-for-age of Chinese children reflect the increase in China's per capita GDP, whether the poverty that remains in Chinese society adversely affects child health and whether the 1990s reforms to China's food subsidy system have increased the importance of income poverty in explaining child height-for-age.

Section 2 of the paper documents the general advances in average physical stature of Chinese children during the 1991-2000 period, and argues that changes in average height-for-age are a reliable indicator of improvements in the average physical well-being of Chinese children. However, as Koenker (2005:293) has remarked, the "average man" is the improbable person who "could be comfortable with his feet in the ice chest and his hands in the oven." Chinese society has experienced both rapid growth in average incomes and rising economic inequality. Greater inequality in money incomes and reduced social protection can both be expected to increase the real economic deprivation of the least well-off. Might this imply that income poverty and food price trends now matter more than they used to in explaining child health and individual height-for-age in China? We present some evidence on the decline in food subsidies and outline a framework for analysis of the determinants of child height-for-age.

Section 3 uses robust ordinary least squares regressions for growth in height (for the separate episodes 1991 to 1993, 1993 to 1997 and 1997 to 2000 and over the entire period 1991 to 2000) to argue that the role played by income poverty in influencing child height-for-age appears to be very different in 1997-2000 than in earlier years. It examines the hypothesis that because Chinese families in 1997-2000 had less social protection from low income shocks than previously, the role of income poverty in predicting low height-for-age may have increased.

Because heterogeneity across the distribution may be important, quantile regression models are then used to estimate the marginal impact of the determinants of growth in height. Section 4 summarizes and concludes.

2. Overview and Framework for Analysis

In 1980, GDP per capita in China was $708[2] but by 2003 that had risen six-fold to $4,344. Over the 1991-2000 period which we study, the average annual real growth rate of per capita GDP in China was 9.2%. This strong growth in average incomes has continued (2007 saw a further 11.7% increase[3]) but it has also passed some people by, and many questions can be raised about the relationship between growth in per-capita GDP and well-being – what do the data on child stature tell us about trends in health and well-being?

This paper uses the anthropometric measurement, height-for-age *z*-score, (*HAZ*) to indicate long term health status – as recommended by the World Health Organization (WHO) who see it as "the best system for analysis and presentation of anthropometric data."[4] As Mansuri (2006:3) has recently argued: "Child height, in particular, is a good indicator of underlying health status and studies have shown that children experiencing slow height growth are found to perform less well in school, score poorly on tests of cognitive function, and have poorer psychomotor skills and fine motor skills. They also tend to have lower activity levels, interact less frequently in their environments and fail to acquire skills at normal rates." In Sen's terminology of "capabilities" and deprivation, child height-for-age is both a direct measure of the capability of a population to grow to its physical potential and a correlate of the development within individuals of a wide range of cognitive and social capabilities.

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[2] World Bank PPP, constant 1995 international $. Unless otherwise noted, all aggregate data in this section are based on the PPP constant 1995 $, drawn from the World Bank web site. http://devdata.worldbank.org/dataonline/ .

[3] In the first quarter of 2007, GDP grew at a 11.7% annual rate. China Daily April 19,2007; People's Daily Online --- http://english.people.com.cn/

[4] http://www.who.int/nutgrowthhdb/about/introduction/en/index4.html Clearly, accurate measurement is essential – Strauss and Thomas (1996), Phipps, Burton, Lethbridge, and Osberg (2004) and others have emphasized the errors introduced by self-report data and the consequent importance of measurement by well-trained interviewers. In the CHNS, clinical measures of weight, height, and blood pressure were collected by interviewers or physicians. Most interviewers were post-secondary school graduates and many had four year degrees. Before working, all interviewers received 3 days of training in collecting health and nutrition data.

In this paper, height-for-age is normalized using data for US children collected by the National Center for Health Statistics as the growth standards reference population[5] - i.e., US data are used to calculate the median and standard deviation of the distribution of heights, by gender and by month of age.

$$HAZ_i = \frac{\text{(height of child i - median height of children of same sex and age)}}{\text{(standard deviation of height of children of same age and sex)}}$$

It is clear that Chinese children of any given age are now, on average, significantly taller than they were during earlier (and poorer) periods in China's history. On average, boys aged 2 to 13[6] in our data set were 5.78% shorter than American boys of a similar age in 1991, but by 2000 the differential had shrunk to 4.03%. The differential for girls was a bit larger in 1991 (5.85%) but decreased by a greater amount (to 3.35% in 2000). To put it another way, 30% of the average height-for-age differential between the USA and China for boys, and 43% of the average height-for-age differential for girls, disappeared in only nine years – i.e., between 1991 and 2000.

Figures 1M and 1F plot the average height in 1991 and 2000 of Chinese children, by age and gender, as a proportion of the US average for the same age and gender for ages 2 to 18.[7] The convergence in average height which is apparent in Figures 1M and 1F is exactly what one would predict that rising average incomes, and better nutrition, would produce.[8] GDP per capita in China grew from $422 in 1991 to $949 in 2000 (constant 2000 US$) – an increase of 124.8%. For our full cross-section of CHNS respondents, average height for age (*HAZ)* increased from -1.30 to -0.75 (see Table B2) – a 42.3% increase. The elasticity of average child height-for-age

[5] 2000 CDC Growth Charts: United States. http://www.cdc.gov/growthcharts/

[6] Dibley et al (1987) have emphasized the problems in assessing height-for-age in children under 2. This paper focuses on ages 2 to 13 because we want to explain individual variation in HAZ and differentials in timing of the onset of puberty may introduce substantial noise into the measurement of adolescent growth rates. Nevertheless, Figures 1M and1F include teens – to illustrate that there has been a *general* increase in average height-for-age among Chinese children.

[7] Figure A1 in Appendix A presents the distribution of height-for-age for the 2 to 13 age group in the two years.

[8] Alderman et al (2005), for example, conclude that the positive impact of GDP growth on indicators of child malnutrition, while varying somewhat by country, was just as strong in the 1990s as in the earlier decades. Thomas, Lavy, and Strauss (1996) examined the impact of public policies on children's height from the Cote d'Ivoire. In their study, basic services, such as immunizations and providing common drugs, are associated with child health improvement. High food prices harm the health of both children and adults. Sahn and Alderman (1997) have examined the impact of income on the height of children older than two from Mozambique.

with respect to real GDP per capita in this data is therefore about +0.34, which can be seen as anthropometric confirmation of an improvement in *average* well-being.

[Figure 1 about here]

However, although between 1991 and 2000 height-for-age shifted up in China for most children, the shortest saw smaller increases than most others. In Table 1 all children aged 2 to 13 in the CHNS data set are ordered by height-for-age z-score (HAZ) and the absolute size of the increase in height-for-age z-scores for each height decile is compared with the HAZ change for the 10th (top) decile. From the 3rd to the 10th decile, there was a large and fairly uniform increase – an increase in HAZ of approximately 0.5. Over the 1991 to 2000 period, the third decile of Chinese children moved decisively into normal range, while the second decile made significant progress (a 0.42 increase in HAZ or about 84% of the HAZ change for the tenth decile). However, the shortest 10% of Chinese children remained very much below the US norm (on average with HAZ at – 3.22 in 2000 after a 0.16 increase from the 1991 level) and experienced the smallest change.

If the definition of "stunting" is taken to be height-for-age more than two standard deviations below the mean, about one sixth of Chinese children were in this category in 2000 – which was a substantial improvement over the 28% of 1991.[9] Children with height-for-age more than three standard deviations below the norm can be classified as 'severely malnourished' [see Mansuri (2006)]. In the early 1990s there was clear progress in reducing this percentage, but between 1997 and 2000 it actually rose marginally (from 3.9% to 4.3%). Although most Chinese children are catching up with rich nations' height norms very quickly, how can one explain those Chinese children who are clearly being left behind?

[9] **Percentage of the 2-13 age group with HAZ < -3 and HAZ < -2 in entire sample available in CHNS**

	'Severely Malnourished' HAZ < -3	**'Stunted' HAZ < -2**
1991	7.23%	28.49%
1993	6.27%	24.86%
1997	3.94%	19.71%
2000	4.27%	16.43%

[1991: n=1659; 1993: n=1390;1997:n=1123; 2000:n=813]
Svedberg (2006: Table 6) provides estimates of the prevalence of stunting in China as a whole which differ somewhat in level, but agree closely in trend, with the CHNS data.

[Table 1 about here]

Many authors have noted the dramatic increase in inequality of money incomes that has accompanied China's rapid economic growth (e.g., Khan and Riskin, 1998; Gustafsson and Li, 2002). For the period examined in this paper, Wu and Perloff (2005:29) estimate that the Gini index of inequality in money incomes rose from 0.345 in 1991 to 0.407 in 2000. To put this in context, Luxembourg Income Survey data[10] indicate that over the same period the Gini index of money income inequality rose from 0.281 to 0.302 in Canada and from 0.338 to 0.368 in the United States, while falling from 0.266 to 0.248 in the Netherlands and from 0.309 to 0.280 in Switzerland. China in 2000 had both a substantially higher level of income inequality than any developed country and a comparatively large rate of increase over the 1991 to 2000 period.[11]

The period of 1991-2000 that we study represents a period of many rapid social changes – and for the purposes of this paper, the elimination of food subsidies and ration coupons and food price increases were particularly important. Tables 2 and 3 document the subsidies and ration coupons received by Chinese households, and the shrinkage in coupon receipt over the period 1991 to 1997.[12] Among the subsidies available in 1991, the most common were food coupons enabling the purchase of rice, flour and cooking oil at below market prices. These coupons could be sold, and their value to recipients was equal to the differential between the market price and the coupon price. For recipient households, the average market value of coupons on rice, flour and cooking oil alone was approximately 543 Yuan – which would represent an appreciable fraction (about 16.5%) of the income of a three person family living at the $2US per day poverty line of about 1100 Yuan per person.

Meng, Gregory and Wang (2005) have emphasized the importance of the elimination of subsidies for poverty:

> "[T]he increase in the poverty rate in the 1990s is associated with the increase in the relative food price, and the need to spend on education, housing and medical care which were previously paid by the state. In addition, the increase in the saving rate of the poor due to an increase in income uncertainty contributes significantly to the increase in poverty measured in terms of expenditure. Even though income growth reduces poverty,

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[10] See http://www.lisproject.org/keyfigures/ineqtable.htm.

[11] In Appendix A, Figure A2 provides a picture of the greater dispersion that has accompanied higher average incomes in China – and at the same time as the distribution of money income in China has become more unequal, it has become more important.

[12] Unfortunately the 2000 CHNS data omits these variables.

the radical reform measures implemented in the 1990s have sufficiently offset this gain that urban poverty is higher in 2000 than in 1986."

However, although food coupons served to buffer the importance of money income and afforded a measure of social protection from market income fluctuations, they were not particularly targeted on the poor. As Table 2 indicates, rural households were much less likely than urban household to receive food coupons, even in 1991.[13] Within both rural and urban areas, non-poor households were actually somewhat *more* likely than poor households to receive ration coupons, as Table 3 shows.

[Tables 2 and 3 about here]

Du et al (2005) have used the detailed data on diet contained in the CHNS to analyze nutritional trends in China. They conclude that there has been a general shift to lower energy intake, but in an increasingly high-fat form, with more animal foods and edible oils and less consumption of traditional foods. The income elasticity for food groups consumption differs significantly by income level. They argue that "the current nutrition transition seems to be occurring faster among the poor than among the rich" and increasingly "the burden of disease relating to poor diets may be shifting to the poor" (2005: 1513, 1512). As Table 3 indicates, consumption of rice and wheat flour fell from 1991 to 1997 among poor and non-poor alike – but as the budget constraint on food consumption shifted from "cash income + food coupon" to "cash income," at least the non-poor could afford higher quality calorie sources.

Taken all together, these trends suggest that the role of income poverty, food coupons and food prices in influencing child height-for-age is complex, but may be worth investigating further.

2.1 Framework for Analysis

The Centers for Disease Control and Prevention/National Center for Health Statistics/World Health Organization (CDC/NCHS/WHO) have prepared child growth charts over the years [documented most clearly by WHO (2006)]. Child growth charts are prepared by

[13] The food ration coupons were distributed to the non-farming population - only those rural residents who had non-farming jobs were entitled to have food ration coupons.

CDC/NCHS are based on surveys of the US data for 2 to 20 years (also for 0 to 36 months) and are estimated according to a flexible Box-Cox power exponential (BCPE) distribution [see Rigby and Stasinopoulos (2004)]. This model is fairly general and is able to accommodate distributions of different location, scale and shape. However, as indicated in WHO (2006), the height-for-age data, when fitted for a BCPE distribution, appears to be normal.

Plotting height-for-age data is one thing – but explaining it is the more important issue. There have long been acrimonious debates in the literature on the relative importance of "Nature" and "Nurture" in explaining child outcomes[14] - debates which we cannot pretend to summarize. We simply note that height-for-age is measured and compared to the median height-for-age for a given age and sex, and we denote the height-for-age of child *i* at time *t*, whose age is *a* and sex is *s*, be $H_{a,s,i,t}$.

$H_{a,s,i,t}$ can be written as a function of age (*a*), sex (*s*), and

[1] person-specific influences, including genetic endowment – what some might call "Nature" (*X*);

[2] household specific influences, including socio-economic variables and nutrition, which vary over time – and might be called "Nurture" (*N*);

[3] general environmental conditions not specific to the household (*E*), and

[4] a random term (ε_{it}) which is a summary of various unknown factors. Some variables in [1]-[3] may be time-varying in their impact while some may be time-invariant. A general functional form may be written as:

$$H_{a,s,i,t} = f(a_i, s_i, X_{it}, N_{it}, E_{it}) + \varepsilon_{it} \qquad (1)$$

for all *i* and *t*.

In general, both current and past influences of factors *X*, *N*, and *E* will matter, hence these can be scalar variables as well as vectors of variables such as $X = [x_1, x_2, \cdots]$, $N = [n_1, n_2, \cdots]$, and $E = [e_1, e_2, \cdots]$. (Multiple lagged factors are restricted by the natural boundary of age.) Hence the model given by equation (1) is general enough for our purpose. Median child growth charts are plots of the forecasted height $h(a,s) = \hat{f}(a,s,\hat{X},\hat{N},\hat{E})$ against age a where $\hat{X}$, $\hat{N}$, and $\hat{E}$

[14] In the authors' opinion, Goldberger (1979) remains a classic statement of the identification problem, which still deserves careful reading.

are the factor values corresponding to the median height given age (measured in months) and sex. Typically, one chart is for male ($s = male$) and the other is for female ($s = female$) and surrounding the median growth charts, growth curves are graphed at various quantiles.

The subject of our analysis is the height-for-age z-scores of individual children over time. Let HAZ_{it} be the height for age z-score of individual child i at time t, which is derived from

$$HAZ_{it} = \frac{H_{a,s,i,t} - h(a,s)}{\sigma_{H_{a,s}}}, \tag{2}$$

where $H_{a,s,i,t}$ is the height of individual child i at time t, and $\sigma_{H_{a,s}}$ is the standard deviation of the height variation from the median height of the reference population (for a given age and sex).

Using the information in equation (2), we can modify equation (1) into

$$HAZ_{it} = \frac{H_{a,s,i,t} - h(a,s)}{\sigma_{H_{a,s}}} = \frac{1}{\sigma_{H_{a,s}}}[f(a_i, s_i, X_{it}, N_{it}, E_{it}) - h(a,s) + \varepsilon_{it}] \tag{3}$$

Linearizing $f(a_i, s_i, X_{it}, N_{it}, E_{it}) - h(a,s)$ and permitting fixed individual and time effects, we have

$$f(a_i, s_i, X_{it}, N_{it}, E_{it}) - h(a,s) = g(a_i, s_i, X_{it}, N_{it}, E_{it}) = a_i + b_t + cX_{it} + dN_{it} + fE_{it} \tag{4}$$

and rewrite the right-hand side of equation (3)

$$HAZ_{it} = \alpha_i + \beta_t + \gamma X_{it} + \delta N_{it} + \eta E_{it} + v_{it} \tag{5}$$

where $\gamma = \frac{c}{\sigma_{H_{a,s}}}$, $\delta = \frac{d}{\sigma_{H_{a,s}}}$, $\eta = \frac{f}{\sigma_{H_{a,s}}}$, and $v_{it} = \frac{\varepsilon_{it}}{\sigma_{H_{a,s}}}$. Note that the right-hand-side variables can be scalars or vectors and hence the coefficient associated with these variables can be scalars or vectors. The model can accommodate interaction terms as well.

If we examine $\Delta HAZ_{it} = HAZ_{it} - HAZ_{it-1}$ over a particular period, we can "difference out" permanent unobserved variables and the earlier impact of person-specific influences. If any variable from X, N and E is individually specific and time-invariant, differencing it between t and $t-1$ will eliminate it from the dynamic model. However, if a variable is not time-invariant, differencing will show its impact for the span of time under consideration. Our target population is the children aged 2-13 years in 1991, 1993, 1997, and 2000, but a crucial issue addressed in this paper is whether and how the changes in social protection have any impact on the dynamics of *HAZ* between 1991 and 2000.

If we want to analyze the dynamics of HAZ_{it}, we can obtain, from equation (5),

$$\Delta HAZ_{it} = (\beta_t - \beta_{t-1}) + \gamma \Delta X_{it} + \delta \Delta N_{it} + \eta \Delta E_{it} + u_{it} \tag{6}$$

where $u_{it} = v_{it} - v_{it-1}$. Sometimes, equation (6) is better estimated as

$$HAZ_{it} = (\beta_t - \beta_{t-1}) + \lambda HAZ_{it-1} + \gamma \Delta X_{it} + \delta \Delta N_{it} + \eta \Delta E_{it} + u_{it} \tag{7}$$

The above model is readily estimated by the short panel data we have.

In this study we use a set of variables such as parent height/weight for X_{it}, a set of variables such as income, poverty status, poverty gap, health insurance for N_{it}, and a set of variables such as tap water and geographical region for E_{it}.

Our specific hypothesis is that during the 1991-2000 period, children's overall health condition (as measured by HAZ_{it}) might have became more sensitive to poverty status and food price trends, because food and housing subsidies were gradually eliminated in the 1990s and income distribution became less equal in 2000 compared to that in 1991. We hypothesize that the decrease in social protection implies that $\delta < 0$ in equation (7) if $(N_{it} - N_{it-1})$ measures poverty status during the 1997-2000 period, but the earlier presence of some food subsidies implies δ may not be significantly negative during the earlier periods.

What offsetting factors might prevent poverty trends from adversely affecting child health? A unique aspect of the Chinese context is the concentration of family resources on one child which is inherent in China's "One Child" policy – a factor which may tend to mitigate the adverse effect of income poverty on child health that is apparent in other countries' data. In common with other countries, the secular trend to higher levels of maternal education can also be expected to affect child health positively – but the decline in medical insurance coverage and the increase in female labour force participation may work in the opposite direction.

3. Data, Variables and Results

The China Health and Nutrition Surveys (CHNS) were conducted by the Carolina Population Center at the University of North Carolina in 1989, 1991, 1993, 1997, and 2000. Data was collected on about 4,400 households (16,000 individuals) in nine provinces. Within each province, 4 counties were selected using a multistage, random cluster process. The provincial capital and a lower income city were selected when feasible. Villages and townships within the counties and urban and suburban neighbourhoods within the cities were selected randomly. The data set provides extremely detailed data on many variables of interest – but item non-response can be a problem. This paper uses observations on children between 2 and 13 years in the 1991 and 2000 data waves – a period when GDP per capita increased by 125% (expressed in 1990 Yuan, from 1,760 in 1991 to 3,960 in 2000).[15]

The emphasis of this paper is on the possible role that money income poverty – as measured by household income – food coupons and food prices could play in explaining children's height-for-age,[16] but there are a number of possible measures of poverty. Because the "$2 per day per person" criterion is familiar in the development literature, the main body of the text focuses on the econometric results obtained when this criterion of poverty is used (which we calculate as being equivalent to 1072 Yuan per person in 1990 prices). In this paper we use the crudest possible measure of poverty – a simple dummy variable indicating whether income was, or was not, above the $2 per day poverty line in a particular year.[17]

However, other socio-economic variables also play a clear role. In estimating the role played by time varying socio-economic factors in the determination of height [N_{it} in the terminology of Equation (1)], it is essential to control for the continuing influence of predetermined variables (X_i). A prime example is the height and weight of the father and mother.

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[15] Data in survey year 1989 are not used because the variable that indicates child-parents relation and some parents' variables (i.e., smoker or drinker) were not collected. Full data documentation is available at http://www.cpc.unc.edu/china.

[16] See also Wagstaff et al (2002a, 2002b).

[17] An advantage of this measure is the fact that correct differentiation of the 'poor' from the 'non-poor' depends only on accurate measurement of household income in the vicinity of the poverty line. There may be some concern with income measurement in the CHNS data since the trend in per capita income numbers reported in Table 3 of Wagstaff and Lindelow (2005) using CHNS data is not congruent with the observed trends from the Chinese national statistics. Reddy and Miniou (2006) examine some of the implications of the thirteen alternative poverty lines used in the literature in analysis of Chinese data. We have also used two alternative definitions of the poverty line (half the national median equivalent income and half the median equivalent income in urban and rural areas), but the results of which are not reported here.

The exact role that genetics plays in determining height may be complex, but the heights of parents correlate with the height of their children, either because of genetic endowments (Strauss, 1990) or due to family background effects such as ethnic differences, household diet preferences and previous favourable or unfavourable environmental influences unmeasured by current data. Genetic inheritance can be expected to influence both height-for-age and the growth rate, at any point in time, of height-for-age.

Parents' ages when the child is borne may influence parenting skills (Paxson and Schady, 2005), which may also represent a continuing influence. Very young or very old mothers may have less healthy children, so the ages of father and mother at the child's birth and a quadratic form of mother's age are also included (Strauss, 1990). Education has often been found to play a significant role. Strauss (1990) found significant effects for both maternal and paternal education on children's weight, and strong impact of local wage rates, the health environment and the quality of health infrastructure in rural Cote d'Ivoire. Thomas, Strauss, and Henriques (1991) found that mother's education affects children's height significantly in both the rural and urban areas of Northeast Brazil. Alderman, Hentschel, and Sabates (2001) found both a direct link in rural Peru between the caregivers' education and their children's health and a shared knowledge effect of women's education on children's health in other households. The education variable available for this study is the number of years of formal education completed, which is available for both mother and father.

As general proxies for the possible influence of environmental factors, we include dummy variables for the province of residence. Among the time varying environmental variables (E_{ia}), we include access to tap water, since the importance of sanitary water supply has been emphasized by Dillingham and Guerrant (2004).

Measurement of income is done only in the survey years, so we are missing the income and poverty status of households in intervening years. The income variable reported is the logarithm of equivalent individual income,[18] but we have also experimented with other specifications (such as unadjusted household income, linear or in logs) – none of which affect the result that "income" is

[18] We use the LIS equivalence scale, which calculates the equivalent income of each household member as: $y_i = \frac{y_f}{{n_f}^{0.5}}$ where y_f is total household income and n_f is the number of persons in the household.

statistically insignificant in all specifications, for the population as a whole. (A result, of course, that is dominated by the majority of the population which is not poor, and does not exclude the possibility that having an especially low income may matter significantly.)

If one controls for initial height-for-age [as in Equation (7) above], one is estimating the correlation between a child's growth in height and their individual characteristics. Since height, at any age, is just the sum of growth in height over previous ages, a data set such as the CHNS that measures height at four different times can be seen as providing evidence on child growth:

i) over the entire 1991-2000 period – Table 4; or

ii) over the 1991-1993, 1993-1997 and 1997-2000 periods – Table 5.

Table 4 presents the full panel results for the 1991-2000 period. In order to focus our attention on the growth process over the 2 to 13 age range, we restrict the sample to children on whom we have full data who were continuously in this age range (i.e., children aged 2-4 in 1991 and aged 11-13 in 2000). This restricts the sample size drastically – to only 124 observations – hence we do *not* want to overstate the implications of Table 4 as being anything more than somewhat suggestive. Nevertheless, the suggestion of Table 4 is that only in the later years under observation (1997 and 2000) is poverty status significantly negatively correlated with growth in height-for-age.

In Table 5 we examine growth in height-for-age separately for the 1991-1993 period (when food subsidies were initially in place) and for the 1993-1997 and 1997-2000 periods (when food subsidies had largely been abolished). Since we are, for example, following the outcomes of children aged 2 to 11 in 1991, who aged to be 4 to 13 in 1993, the sample size for the results summarized in Table 5 is considerably larger.[19]

There are some notable changes in structure between the two periods – e.g., the importance of urban residence in 1997-2000, compared to its insignificance earlier. The insignificance of the 'female' dummy variable is also an important negative result – if gender preference in child nutrition were operative within Chinese households, one might have expected to observe Chinese girls making less rapid progress than boys in height-for-age, but none of our econometric results support this hypothesis.

[19] There were 1278 children aged 2 to 11 in 1991, who aged to be 4 to 13 in 1993, 655 children aged 2 to 9 in 1993, who aged to be 6 to 13 in 1997 and 587 children aged 2 to 10 in 1997 who were 5 to 13 in 2000.

In the 1991-1993 and 1993-1997 periods, poverty status in either initial year or final year is not statistically significantly associated with height-for-age. By contrast, poverty status in initial year is observed in the 1997-2000 period, and is negative and statistically significant (at 10%) in 1997. The estimated coefficient on 1997 poverty status implies that the empirical magnitude of the negative height differential associated with a one year poverty spell would be about 1.4 cm for a 13 year old boy. If poverty is even approximately linearly additive in its impacts, this would imply that long term poverty (e.g., 4 years) could have quite a substantial impact on the height of poor children.

In the 1991-1993 and 1993-1997 periods, the use of food coupons in the end year by the household is statistically significant (at 10%) and positively associated with growth in height-for-age. Since more rapid growth in the 1991-1993 period would increase a child's height-for-age in 1993, and thereby decrease the chances of rapid *growth* between 1993 and 1997, the observation of a statistically significant *positive* coefficient on 1993 food coupon use in the 1991-1993 regression and a statistically significant *negative* coefficient on the same variable in the 1993-1997 regression is entirely explicable – but as Table 3 noted, food coupon use in 1993 was very low. Although we use bootstrap methods to estimate standard errors, we would still be cautious in interpreting the results for 1993 food coupon use.

Based on Tables 3 to 5, we would argue that: (1) poverty status is not, before 1997, associated with slow growth in height-for-age; (2) in the 1997-2000 period household income poverty in initial year is correlated with poorer growth in height-for-age among children aged 2 to 13; and (3) in both 1991-1993 and 1993-1997 periods, food coupon use in the final year was positively associated with growth in height-for-age.

Mean regression models such as OLS models presume that "on average" the impact of an independent variable is much the same for all observations – but quantile regression models enable researchers to examine the heterogeneity in responses associated with covariates, at different points in the distribution. Quantile estimates are particularly interesting for the study of child growth because the social concern with child growth rates largely lies in a concern for the lower tail of the distribution – i.e., the stunted and malnourished. As well, if child growth in height normally comes in uneven spurts, analytically it is useful to know the extent to which a variable affects accentuates or dampens down such spurts. Figure 2 presents plots of some of the point estimates (and 95% confidence interval) of the impact of poverty status on *HAZ* in the quantile regressions corresponding to the OLS regressions numerically reported in Table 5.

Since our concern lies in the role played by poverty, Figure 2 graphs quantile estimates of the impact of poverty in 1997 and 2000,[20] Figure 2 indicates that the quantile point estimates of the impact of poverty status in 1997 vary relatively little and at most points in the distribution of *HAZ* outcomes lie fairly close to the OLS estimates (which are, by maintained hypothesis, equal at all points in the *HAZ* distribution) – hence little is gained by using quantile regression models, at least for understanding the impact of poverty. In 2000, however, the OLS estimates show that there is a negative impact of poverty on the *HAZ* distribution on average while quantile estimates show a large variation in the impact of poverty on the *HAZ* distribution. In particular, there appears to be an increasingly large negative impact of poverty on the children's height-for-age in the top percentiles of the *HAZ* distribution in 2000.

Broadly speaking, the OLS and quantile estimates concur in concluding that poverty in 1997 or 2000 negatively correlates with HAZ_i in 2000, controlling for HAZ_i in 1997 and other influences. A constraint of our data is the fact that we have no information on income in 1998 and 1999 – so poverty status in those years are omitted variables. To the extent, however, that our estimates capture the impact of poverty, a child who was poor in both 1997 and 2000 could expect the additive impact of both the impacts portrayed graphically in Figure 2.

4. Implications

Why might the poor growth of deprived children matter?

Height-for-age is a marker for the accumulated impacts of malnutrition and illness. In general, one of the implications of childhood malnutrition is a strong association with adult mental and physical health. Alderman et al (2006) analyse the consequences of childhood malnutrition and find that improvements in height-for-age in childhood are positively correlated with adult height and the number of years at school. Wadsworth and Kuh (1997) have argued that early-life development is associated with a range of adult outcomes, including blood

[20] Table 6 presents the 1997-2000 quantile estimates at four points in the distribution – 0.2, 0.4, 0.6, 0.8 – to save space we do not report here the corresponding tables of quantile regression results for the 1991-1993 and 1993-1997 periods.

pressure, respiratory function and schizophrenia. Cooper et al (2001) note that children with a low growth rate in height and weight have an increased risk of hip fracture in adulthood. Sawaya et al (2003) suggest an association between childhood nutritional stunting and increased risks of obesity and chronic degenerative diseases in later life. Chang et al (2002) have found that previously stunted children are likely to have poorer cognition and school achievement.

Childhood height-for-age is thus a marker for the deprivation in early life that diminishes the future capabilities of adults, in a wide range of dimensions. As well, we would emphasize strongly that children are not just "future adults" – they are citizens in their own right, and their well-being *now* therefore has a direct claim to consideration in social decision making.

In discussing the implications of our results we are well aware of the audacity it would require to draw firm conclusions about the well-being of approximately 20% of the world's population based on these regressions run on this sample data. China's 1.3 billion people span an incredible diversity of life circumstances. Despite the many virtues of the CHNS data, we would not argue that 4,400 households in nine provinces can fully capture that diversity, and, due to sample selection and variable non-response, the sample size we can work with for analysis is much smaller. To preserve clarity, we have used a very crude indicator of income deprivation (poverty status) and a simple econometric specification. We therefore interpret our results as suggestive, rather than conclusive, and our hope is that further work, with larger data sets, can provide a more definitive conclusion.

Nevertheless, if it is the case that the shortest decile of Chinese children are being left behind as their compatriots catch up in stature with children in affluent nations, and if it is the case that income poverty can negatively affect height-for-age if appropriate food subsidies are not available, the number of Chinese children in the bottom decile (approximately 13 million[21]) makes the issue important. The role played by food coupons in the early 1990s in child growth – even given the very poor targeting of such coupons on poor households – and the role of income poverty in 1997-2000 may also be a reminder that the mechanisms of access to basic foodstuffs matter for child development.

[21] The China Statistical Yearbook 2004 reports the population aged 0 to 14 to be 165,645,000, implying that the 2 to 13 population is approximately 130 million.

Subsidies to basic food availability were a feature of social policy delivery until fairly recently in developed countries[22] and are still prominent in the social policy of many less developed countries. Hence, we think that there may be a general moral – that even when aggregate economic growth is as outstandingly robust as in China, subsidies to the availability of basic foods can fill an important social protection role. In reforming social policy in developing countries, the role that food subsidies play in mitigating the impacts which household income poverty would otherwise have on the long run growth and development of children should at least be considered. Some Chinese scholars (such as Gongcheng Zhang[23]) have suggested that China can now afford the cost of providing more social protection – this paper suggests that there may be significant benefits for the most vulnerable Chinese children.

[22] In the UK, Margaret Thatcher got her label as "Thatcher, Milk-Snatcher" by ending a free school milk programme in 1971, when she was Minister of Education. See http://news.bbc.co.uk/onthisday/hi/dates/stories/june/15/newsid_4486000/4486571.stm.

[23] See People's Daily (Overseas Edition) August 22, 2006, Page 5 "Can We Establish the Social Protection System with 300 Billion Yuan?"

Figure 1M
Height as % of CDC Norm for Males Age 2 to 18
(24-month moving average)

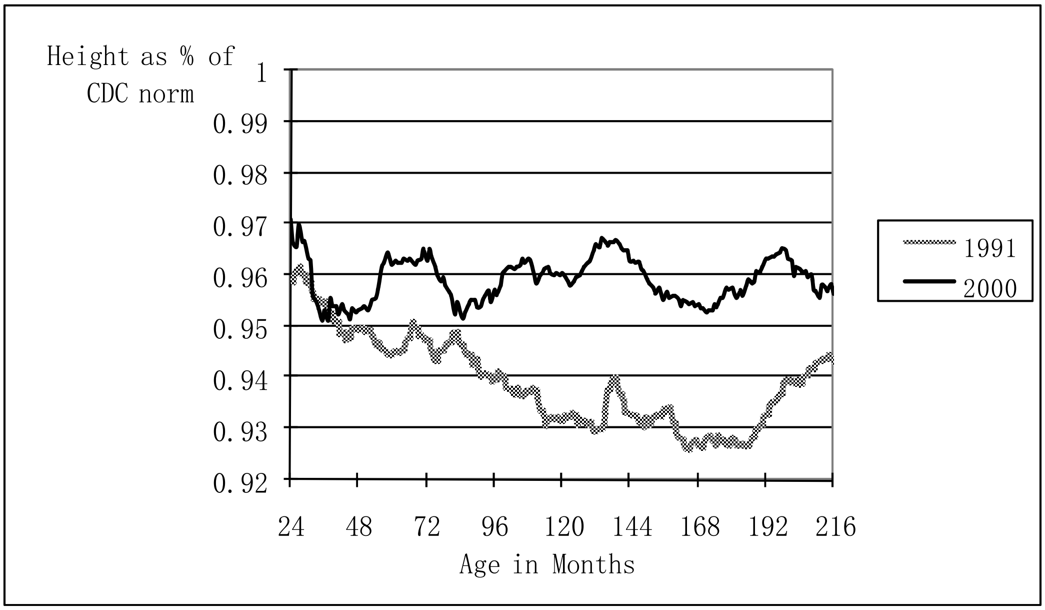


Figure 1F
Height as % of CDC Norm for Females Age 2 to 18
(24-month moving average)

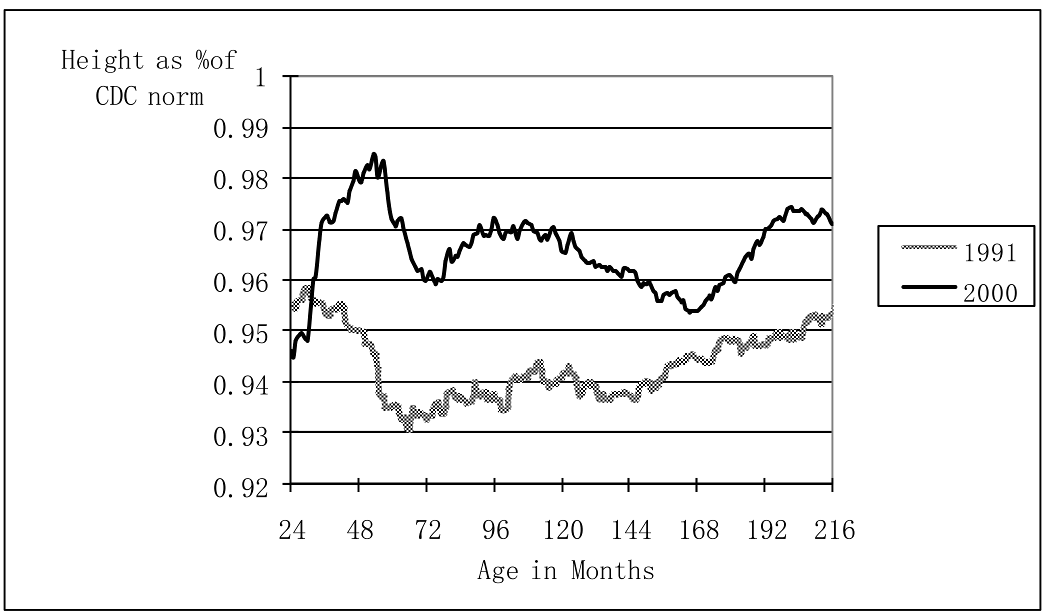


Figure 2
Quantile Estimates of the Impact of Poverty in 1997 and 2000

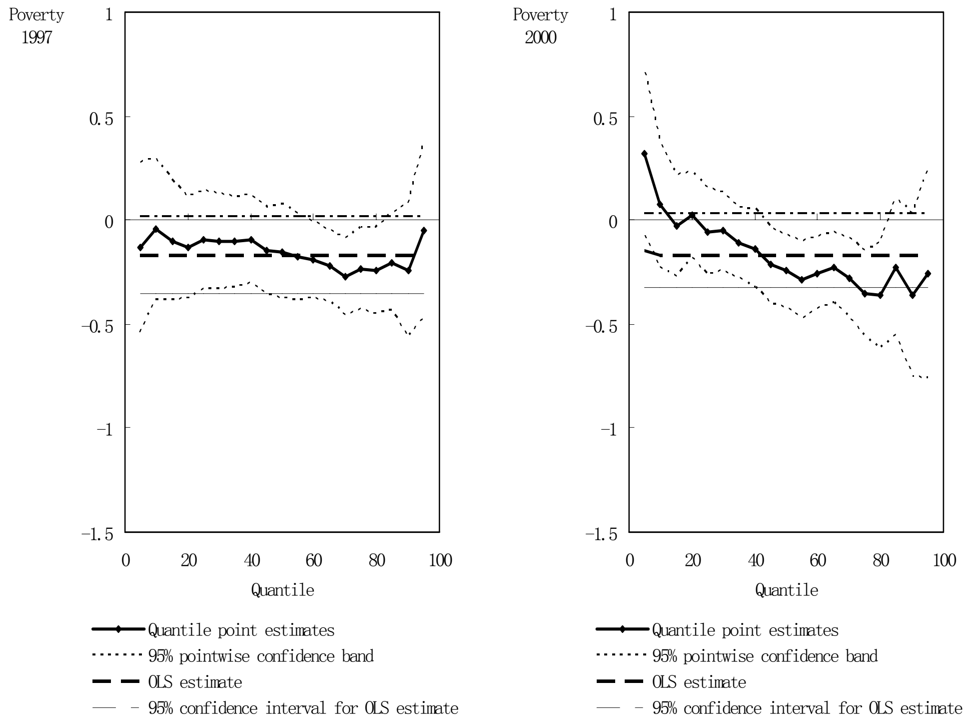


Table 1
Average Height-for-Age Z-Score (HAZ) by Decile from 1991 to 2000 (Age 2-13)

Decile	***Average HAZ 1991***	***Average HAZ 2000***	***Absolute Change***	***Percentage Change (base = 10th Decile)***
1	-3.39	-3.22	0.16	32%
2	-2.51	-2.09	0.42	84%
3	-2.12	-1.58	0.53	106%
4	-1.80	-1.25	0.55	110%
5	-1.50	-0.95	0.55	110%
6	-1.19	-0.62	0.56	112%
7	-0.87	-0.34	0.53	106%
8	-0.52	0.01	0.53	106%
9	-0.13	0.45	0.58	116%
10	0.80	1.30	0.50	100%
Number of Observations	2766	1735		

Table 2
Value of Food Coupons, 1991

Item	*% of Household*	*% of Urban Household*	*% of Rural Household*	*Average Annual Amount* [2]	*Average Market Value per Coupon (Yuan)*	*Total coupon value (Yuan)*
Rice	41.04%	68.66%	28.10%	690.32	0.43	296.84
Wheat Flour	33.89%	63.81%	19.85%	512.5	0.32	164
Other cereal grains	12.91%	28.83%	5.44%	334.9	0.24	80.38
Cooking oil	38.53%	70.13%	23.71%	32.36	2.53	81.87
Eggs	1.27%	3.20%	0.37%	25.98	1.63	42.35
Pork (or other meat)	4.56%	8.66%	2.64%	67.04	2.93	196.43
Chicken	0.14%	0.26%	0.08%	20	n/a	n/a
Sugar	1.71%	3.98%	0.65%	29.34	1.83	53.69
Other	2.05%	5.45%	0.45%	1185.74	0.78	924.88
Number of Observations	3618	1155	2463			

1. The percentage indicates % of households who received coupons.
2. Each coupon represents 500 grams of the corresponding item.

Table 3
Basic Food Items Purchased

Food Item	*Coupon Usage and Quantity of Food Purchased last month*								*Lowest Transaction Price (Yuan/KG)*[3]
	*Poor**				*Non-Poor**				
	Rural		*Urban*		*Rural*		*Urban*		
	%[1]	*KG*[2]	*%*	*KG*	*%*	*KG*	*%*	*KG*	
Rice 1991	11.80%	8.59	50.55%	8.52	32.39%	7.43	72.13%	6.59	0.35
		(8.59)		(8.52)		(7.43)		(6.59)	(0.14)
Rice 1993	1.42%	8.31	0.43%	7.53	2.86%	8.38	0.13%	7.35	0.63
		(6.85)		(5.92)		(6.26)		(6.07)	(0.13)
Rice 1997	1.00%	7.42	3.78%	6.99	2.50%	7.19	6.38%	6.44	1.33
		(6.60)		(5.86)		(5.74)		(4.28)	(1.21)
Wheat Flour 1991	9.89%	4.90	48.72%	4.78	27.04%	3.94	67.94%	3.61	0.38
		(4.90)		(4.78)		(3.94)		(3.61)	(0.13)
Wheat Flour 1993	1.42%	4.29	1.73%	3.66	2.68%	3.40	1.08%	2.27	0.63
		(6.52)		(5.75)		(5.83)		(3.24)	(0.17)
Wheat Flour 1997	1.00%	4.62	5.41%	4.33	4.87%	3.49	13.36%	2.27	1.30
		(6.79)		(7.12)		(4.60)		(3.18)	(0.83)

* Poverty line: $2 a day PPP per capita
1. The percentage indicates % of households who received coupons.
2. Quantity of food purchased is measured by per capita kilograms.
   Standard deviations are in parentheses.
3. For each food item, different prices existed in the market - including state store coupon price, state store negotiated price, and free market price. For each price system, we take the average and present here the lowest average price in 1990 Chinese Yuan per kilogram.

Table 4
Estimated Coefficients from Panel OLS 1991-2000
Poverty line = $2 / day

Variables	***1991-2000***	
Dependent variable	HAZ_2000	
HAZ_initial year	0.408***	(0.126)
Dummy=1 if child is female	0.296*	(0.167)
Dummy=1 if residence in urban area	0.557***	(0.170)
Father BMI_initial year	0.055*	(0.028)
Father height (cm) _initial year	0.030	(0.021)
Father age at child's birth	-0.027	(0.030)
Father number years formal education_initial year	-0.072***	(0.021)
Mother BMI _initial year	0.022	(0.026)
Mother height (cm) _initial year	0.059***	(0.013)
Mother age at child's birth	0.212**	(0.096)
Mother age at child's birth squared	-0.003**	(0.001)
Mother number years formal education initialyear	0.079***	(0.015)
Change of number of household members	-0.087	(0.079)
Log of total equivalent income in the period	-0.035	(0.205)
Dummy=1 if income <$2 / day_91	0.303**	(0.123)
Dummy=1 if income <$2 / day _93	0.625***	(0.185)
Dummy=1 if income <$2 / day_97	-0.739***	(0.137)
Dummy=1 if income <$2 / day _2000	-0.766***	(0.194)
Dummy=1 if household using tap water_91	0.289**	(0.133)
Dummy=1 if household using tap water_93	-0.501**	(0.203)
Dummy=1 if household using tap water_97	0.149	(0.232)
Dummy=1 if household using tap water_2000	-0.045	(0.230)
Dummy=1 if residence in Jiangsu	-0.065	(0.172)
Dummy=1 if residence in Shandong	0.329*	(0.181)
Dummy=1 if residence in Henan	0.321*	(0.182)
Dummy=1 if residence in Hubei	0.303**	(0.142)
Dummy=1 if residence in Hunan	-0.036	(0.227)
Dummy=1 if residence in Guangxi	0.610***	(0.211)
Intercept	-18.518 ***	(5.777)
Adjusted r^2	0.556	
Number of Observations	124	

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

Note: (a) Equivalent income and poverty line are converted in to 1990 Chinese Yuan value.
(b) Newey-West robust standard errors are reported

Table 5
The Growth of Chinese Children Aged 2-13
Estimated Coefficients from OLS

Dependent variable = Z-score for height-for-age (HAZ) at final year

Variables	**1991-1993**	**1993-1997**	**1997-2000**
HAZ_initial year	0.711***	0.545***	0.533***
	(0.045)	(0.057)	(0.041)
Dummy=1 if child is female	-0.053	0.047	0.083
	(0.041)	(0.066)	(0.057)
Dummy=1 if residence in urban area	0.043	0.107	0.167**
	(0.068)	(0.091)	(0.073)
Father BMI_initial year	0.000	0.054***	0.044***
	(0.010)	(0.014)	(0.013)
Father height (cm)_initial year	0.010**	0.016*	0.016**
	(0.005)	(0.007)	(0.006)
Father age at child's birth	0.009	-0.010	0.000
	(0.010)	(0.012)	(0.013)
Father number of years formal education_initial year	0.011	0.020	-0.005
	(0.010)	(0.013)	(0.013)
Mother BMI_initial year	0.014	0.045***	0.017
	(0.009)	(0.015)	(0.010)
Mother height (cm)_initial year	0.007	0.029***	0.025***
	(0.006)	(0.008)	(0.007)
Mother age at child's birth	0.012	0.024	0.105**
	(0.040)	(0.043)	(0.049)
Mother age at child's birth squared	-0.000	-0.000	-0.002**
	(0.001)	(0.001)	(0.001)
Mother number of years formal education_initial year	-0.006	0.008	0.017*
	(0.008)	(0.011)	(0.010)
Change of number of household members	0.027	0.093***	-0.030*
	(0.048)	(0.030)	(0.017)
Log of equivalent income	-0.011	-0.169*	-0.074
	(0.048)	(0.071)	(0.071)
Dummy=1 if income <$2 / day_initial year	-0.081	-0.061	-0.169*
	(0.070)	(0.087)	(0.093)
Dummy=1 if income <$2 / day_final year	0.038	-0.143	-0.146
	(0.081)	(0.123)	(0.090)
Dummy=1 if use food coupon in initial year	0.088	-1.054***	-0.107
	(0.070)	(0.306)	(0.132)
Dummy=1 if use food coupon in final year	0.333*	0.341*	
	(0.184)	(0.133)	
Dummy=1 if household using tap water_initial year	0.061	-0.052	0.109
	(0.084)	(0.113)	(0.099)

Table 5
(continued)

Variables	**1991-1993**	**1993-1997**	**1997-2000**
Dummy=1 if household using	-0.003	0.212**	-0.060
tap water_final year	(0.077)	(0.105)	(0.099)
Dummy=1 if residence in	0.197*		
Liaoning	(0.109)		
Dummy=1 if residence in			0.361***
Heilongjiang			(0.117)
Dummy=1 if residence in	0.045	0.046	0.382***
Jiangsu	(0.096)	(0.138)	(0.120)
Dummy=1 if residence in	0.230*	0.206	0.101
Shandong	(0.134)	(0.173)	(0.210)
Dummy=1 if residence in	0.057	0.494***	0.102
Henan	(0.089)	(0.130)	(0.125)
Dummy=1 if residence in	0.113	0.049	0.232**
Hubei	(0.092)	(0.133)	(0.118)
Dummy=1 if residence in	0.060	0.382***	0.250
Hunan	(0.103)	(0.133)	(0.167)
Dummy=1 if residence in	0.274***	0.349***	0.191*
Guangxi	(0.092)	(0.122)	(0.107)
Intercept	-3.714*	-9.011***	-9.095***
	(1.527)	(2.250)	(1.799)
Adjusted r^2	0.595	0.541	0.604
Number of Observations	1230	638	583

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

Note: (a) Equivalent income and poverty line are converted in to 1990 Chinese Yuan value.

(b) Newey-West robust standard errors are reported.

Table 6
The Growth of Chinese Children Aged 2-13
Estimated Coefficients from Panel Quantile Regression 1997-2000

Dependent variable=Z-score for height-for-age (HAZ) at final year

Variables	**20%**	**40%**	**60%**	**80%**
HAZ_initial year	0.594***	0.684***	0.623***	0.573***
	(0.083)	(0.056)	(0.045)	(0.050)
Dummy=1 if child is female	-0.006	0.0252	0.038	0.030
	(0.094)	(0.0650)	(0.059)	(0.076)
Dummy=1 if residence in	0.154	0.0724	0.128*	0.050
urban area	(0.103)	(0.092)	(0.071)	(0.097)
Father BMI_initial year	0.043**	0.015	0.042***	0.030**
	(0.021)	(0.015)	(0.012)	(0.015)
Father height (cm)_initial year	0.018*	0.014**	0.009	0.008
	(0.010)	(0.006)	(0.007)	(0.009)
Father age at child's birth	0.001	0.004	-0.003	-0.005
	(0.020)	(0.014)	(0.014)	(0.016)
Father number of years	-0.010	-0.009	-0.006	-0.010
formal education_initial year	(0.024)	(0.014)	(0.012)	(0.014)
Mother BMI_initial year	-0.004	0.028**	0.024**	0.019
	(0.020)	(0.013)	(0.011)	(0.013)
Mother height (cm)_initial	0.015	0.012*	0.023***	0.032***
year	(0.010)	(0.007)	(0.007)	(0.009)
Mother number of years	0.016	0.017	0.006	0.007
formal education_initial year	(0.018)	(0.014)	(0.009)	(0.015)
Mother age at child's birth	0.115	0.073	0.090	0.094
	(0.072)	(0.061)	(0.057)	(0.071)
Mother age at child's birth	-0.002	-0.001	-0.002*	-0.002
squared	(0.001)	(0.001)	(0.001)	(0.001)
Change of number of	-0.001	-0.027	-0.022	-0.011
household members	(0.059)	(0.034)	(0.032)	(0.048)
Log of equivalent income	-0.057	-0.020	-0.092	-0.137
	(0.095)	(0.076)	(0.067)	(0.087)
Dummy=1 if income <$2 /	-0.134	-0.091	-0.193**	-0.242**
day_initial year	(0.129)	(0.111)	(0.090)	(0.108)
Dummy=1 if income <$2 /	-0.025	-0.136	-0.255***	-0.364***
day_final year	(0.125)	(0.095)	(0.092)	(0.125)
Dummy=1 if use food coupon	-0.240	-0.063	-0.087	0.034
at 1997	(0.212)	(0.123)	(0.090)	(0.139)
Dummy=1 if household using	0.109	0.081	0.136	0.154
tap water_initial year	(0.130)	(0.099)	(0.086)	(0.130)
Dummy=1 if household using	-0.085	-0.049	0.004	0.044
tap water_final year	(0.134)	(0.109)	(0.087)	(0.123)

Table 6 (Continued)

Variables	20%	40%	60%	80%
Dummy=1 if residence in	0.397**	0.254*	0.302**	0.265*
Heilongjiang	(0.178)	(0.146)	(0.132)	(0.202)
Dummy=1 if residence in	0.524***	0.318**	0.293**	0.110
Jiangsu	(0.201)	(0.139)	(0.130)	(0.186)
Dummy=1 if residence in	-0.281	-0.096	0.280	0.495**
Shandong	(0.360)	(0.250)	(0.263)	(0.246)
Dummy=1 if residence in	-0.170	0.202	0.274*	0.262
Henan	(0.251)	(0.159)	(0.153)	(0.200)
Dummy=1 if residence in	0.217	0.210*	0.231*	0.189
Hubei	(0.179)	(0.124)	(0.121)	(0.190)
Dummy=1 if residence in	0.112	0.245*	0.273*	0.352
Hunan	(0.231)	(0.144)	(0.166)	(0.227)
Dummy=1 if residence in	0.234	0.132	0.192	0.208
Guangxi	(0.178)	(0.120)	(0.118)	(0.147)
Intercept	-8.403***	-6.459***	-6.984***	-7.275***
	(3.099)	(1.874)	(2.041)	(2.574)
Number of Observations	583			

*** Significant at 1%, ** Significant at 5%, * Significant at 10%

Note: (a) Equivalent income and poverty line are converted in to 1990 Chinese Yuan value.

(b) Bootstrapping standard errors are reported.

Appendix A
The Distributions of Income and Height-for-Age

Figure A1: HAZ Distribution Comparison

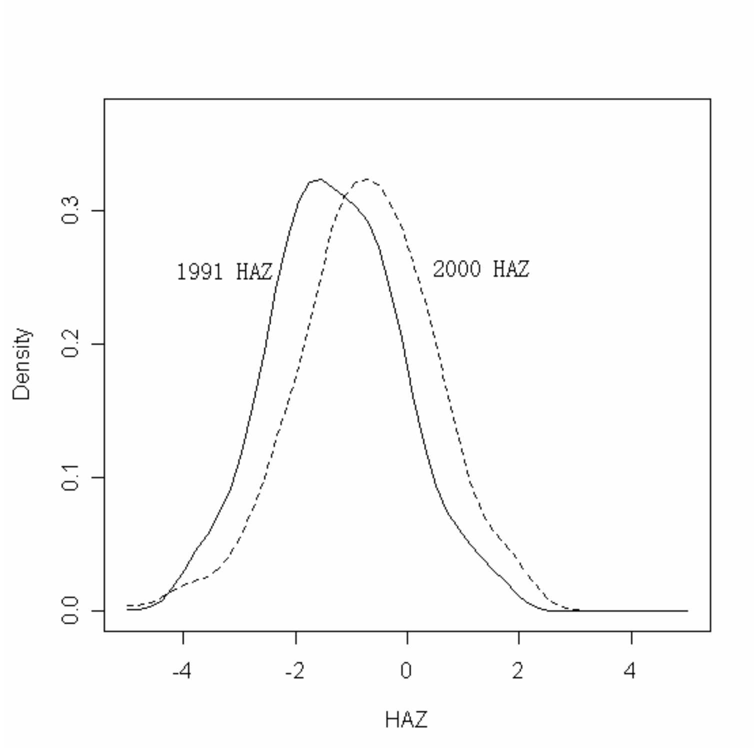
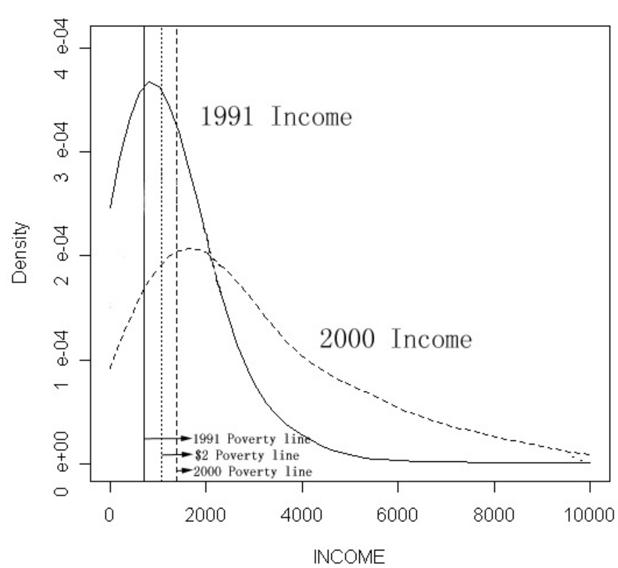


Figure A2: Overall Income Distribution Comparison [equivalent individual income, 1990 yuan]



Appendix B **Table B1. Mean and Proportion – Panel Samples**

Variable Name	*Mean/Proportion*			
	4 waves	*91-93*	*93-97*	*97-2000*
Child Characteristics				
HAZ initial year	-1.53	-1.30	-1.30	-1.04
Last year	-1.11	-1.15	-1.20	-0.84
Dummy=1 if child is female	47.58%	46.18%	46.71%	43.22%
Parent's Characteristics				
Father BMI_initial year	20.77	21.48	21.52	22.30
Father height (cm)_initial year	165.80	165.94	165.61	166.25
Father age at child's birth	28.23	28.21	28.15	27.33
Father number of years formal education initial year	8.66	8.13	8.26	8.53
Mother BMI_initial year	20.94	21.54	21.43	22.12
Mother height (cm) _initial year	154.52	155.46	154.46	155.64
Mother age at child's birth	26.70	26.46	26.30	25.82
Mother age at child's birth squared	736.16	720.32	713.51	687.17
Mother number of years formal education initial year	6.54	6.51	6.51	7.21
Household Characteristics				
Dummy=1 if residence in urban area	25.00%	29.11%	26.18%	32.76%
Change of number of household members	-0.08	-0.03	-0.15	-0.07
Log of total equivalent income in the period	8.77	7.65	7.90	8.35
Dummy=1 if income <$2 / day_91	58.87%	51.63%		
Dummy=1 if income <$2 / day _93	51.61%	47.24%	51.72%	
Dummy=1 if income <$2 / day_97	39.52%		34.64%	31.39%
Dummy=1 if income <$2 / day _2000	20.97%			23.33%
Dummy=1 if use food coupon at 1991	31.45%	36.67%		
Dummy=1 if use food coupon at 1993	4.03%	3.33%	2.66%	
Dummy=1 if use food coupon at 1997	12.90%		11.29%	12.35%
Community Characteristics				
Dummy=1 if household using tap water_91	34.68%	34.72%		
Dummy=1 if household using tap water_93	38.71%	35.93%	33.86%	
Dummy=1 if household using tap water_97	49.19%		46.55%	41.85%
Dummy=1 if household using tap water_2000	46.77%			39.79%
Dummy=1 if residence in Liaoning		11.87%		
Dummy=1 if residence in Heilongjiang				18.87%
Dummy=1 if residence in Jiangsu	12.90%	8.94%	12.23%	12.18%
Dummy=1 if residence in Shandong	12.10%	11.71%	9.56%	6.86%
Dummy=1 if residence in Henan	7.26%	6.83%	10.50%	11.66%
Dummy=1 if residence in Hubei	21.77%	17.15%	19.75%	12.18%
Dummy=1 if residence in Hunan	12.10%	12.76%	10.97%	7.55%
Dummy=1 if residence in Guangxi	16.94%	15.53%	21.32%	12.86%
Residence in Guizhou (baseline case)	16.93%	15.21%	15.67%	17.84%
Number of Observations	124	1230	638	583

Table B2. Means and Proportions: Cross-Sectional Samples

Variable Name	*Mean/Proportion*	
Child Characteristics	1991	2000
Height (cm)	117.36	127.48
Z-score for height-for-age (HAZ)	-1.30	-0.75
Age in months	92.84	107.49
Dummy=1 if child is female	47.62%	45.14%
Dummy=1 if child has health insurance	21.71%	19%
Parents Characteristics		
Father weight (kg)	59.47	63.43
Father height (cm)	165.89	166.83
Father age at child's birth	28.16	27.37
Father number of years formal education	7.87	8.96
Dummy=1 if father smokes cigarettes	77.43%	69.99%
Dummy=1 if father drinks alcohol	72.85%	68.76%
Dummy=1 if father has health insurance	28.32%	18.94%
Mother weight (kg)	52.33	54.90
Mother height (cm)	155.31	156.08
Mother age at child's birth	26.51	25.87
Mother number of years formal education	6.20	7.92
Dummy=1 if mother smokes cigarettes	1.79%	1.35%
Dummy=1 if mother drinks alcohol	13.30%	8.98%
Dummy=1 if mother has health insurance	22.20%	15.74%
Household Characteristics		
Number of household members	4.58	4.31
Equivalent income 1990 yuan	1267.56	3511.29
Dummy=1 if income <$2 poverty line	53.68%	19.19%
Dummy=1 if girl and income <$2	25.05%	8.00%
Total value of assets	2501.37	5094.73
Community Characteristics		
Dummy=1 if residence in urban area	25.11%	25.34%
Dummy=1 if household using tap water	32.59%	41.70%
Dummy=1 if household has flush toilet	15.34%	32.47%
Dummy=1 if residence in Liaoning	12.99%	12.79%
Dummy=1 if residence in Heilongjiang	n/a	15.74%
Dummy=1 if residence in Jiangsu	9.89%	11.56%
Dummy=1 if residence in Shandong	13.05%	5.66%
Dummy=1 if residence in Henan	6.62%	7.13%
Dummy=1 if residence in Hubei	13.17%	11.07%
Dummy=1 if residence in Hunan	12.62%	6.27%
Dummy=1 if residence in Guangxi	16.82%	13.04%
Dummy=1 if residence in Guizhou	14.84%	16.74%
Number of Observations	1617	813

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