Chinese Poverty:
Assessing the Impact of Alternative Assumptions[1]

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This paper investigates how estimates of the extent and trend of income poverty in China between 1990 and 2001 vary as a result of alternative plausible assumptions concerning key parameters that influence the poverty line and estimated consumption levels. Our methodology focuses on the following sources of variation: alternative purchasing power parity conversion factors, alternative estimates of true per capita private incomes, alternative estimates of the share of income assumed to be consumed by the lower income groups, and alternative consumer price indices. We find that regardless of the assumptions we make within a reasonable range, a remarkable reduction in consumption poverty occurred in China during the 1990s. However, estimates of the extent of Chinese poverty in any year are greatly influenced by the assumptions made. China's record of reducing aggregate deprivations is encouraging, but must be interpreted with care, especially in view of some recent evidence concerning possible increases in consumption poverty (especially in urban areas) and worsening nutrition.

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I. Introduction

The extent and trend of poverty in China plays a crucial role in determining the extent and trend of poverty in the world. Recently, Chen and Ravallion (2004) (henceforth, CR) presented, based on their work at the World Bank using the "$1 per day" poverty concept a set of poverty estimates that attempts to be comprehensive in terms of time span and coverage of countries. They concluded that between 1981 and 2001, the $1/day poverty headcount (as a share of the developing world population) has fallen by half if China is included in the analysis (from 40.4 percent to 21.1 percent). However, when China's performance is not accounted for, the reduction in the poverty headcount ratio is from 31.7 percent to only 22.5 percent (see Table 1.1. in Appendix 1). Furthermore, the absolute number of "$1 per day" poor has risen slightly outside of China, from 848.1 million in 1981 to 877.4 million in 2001.

The purpose of this paper is to investigate the robustness of consumption poverty estimates for China for selected years between 1990 and 2001 to alternative choices of key parameters which influence poverty lines and the consumption profile (i.e. the distribution of absolute consumption levels). We examine the impact of alternative choices of a poverty line for China in a base year (1993) and alternative ways of translating this poverty line backwards and forwards in time. We similarly examine the impact of alternative procedures for estimating the consumption profile in each year. We estimate the extent of poverty (specifically, the headcount ratio) in China as a whole, unlike many recent studies, which have focused only on rural or on urban poverty.

We investigate the impact of variation in the following sources of variation which influence the level of the poverty line in the base year, its translation through time, and the estimation of the consumption profile in each year: alternative purchasing power parity conversion factors, alternative estimates of true per capita private incomes, alternative estimates of the share of income assumed to be consumed by the lower income groups, and alternative consumer price indices. Our methodology reflects the fact that there are no publicly available estimates of the Chinese consumption profile. Rather, these must be estimated indirectly.

Each alternative set of consumption poverty estimate we consider is fully defined by a vector of four parameters. The vector can be represented by

$$[PPP, Y_P, \theta, \pi]$$

where PPP is a consumption purchasing power parity conversion factor used in translating an international poverty line into its national currency "equivalent"; Y_P refers to the method of estimating *true* per capita private income, θ is the method of estimating the fraction of *true* per capita private income devoted to consumption by each income group, and π is the consumer price index used to describe consumption levels (or, alternatively, poverty lines) in constant prices. We draw on the literature and several data sources to define these alternatives and to assess how estimates of the extent and trend of poverty in China change when each is used. We use alternative PPPs to construct our alternative poverty lines in the base year in order that the range of poverty lines chosen

may reflect the debate on the appropriate PPP for China and maintain notional comparability with poverty estimates for other countries.

To estimate poverty headcount ratios given the data which is available to us (annual mean consumption levels for ten income deciles), we use the World Bank's POVCAL software, which uses parametric curve fitting techniques to interpolate a more detailed income distribution .[5] We test the accuracy of poverty estimates produced by the software by comparing the headcount ratios computed directly from a full household survey for China in 1995 against those based on applying POVCAL to consumption averages for deciles form the same survey (for details, see Appendix 2). The results give us some confidence that the parametric procedures for the estimation of the Lorenz curve produce poverty estimates which are relatively close to their survey counterparts, and we proceed to compute poverty headcount ratios with POVCAL in the paper.

The remainder of the paper is structured as follows. Section II contains a review of the literature on income and consumption poverty in China. Section III presents the raw data used in the paper. Section IV discusses the alternative assumptions; it introduces alternative poverty lines (associated with distinct PPP conversion factors) and discusses different estimates of the true per capita private consumption. It also presents further refinements of the estimates of the consumption profile drawn from survey data, including decile-specific consumption to income ratios and 'adjusted' inflation rates. The next section constructs consumption profiles for China, and shows how estimates of the $1/day headcount poverty ratio for China vary with our assumptions about underlying parameters. Section VI concludes.

II. Previous work

A large literature in development economics has produced poverty estimates both for China and for the (developing) world. We review here the existing proposals for the extent and trend of poverty in China, and briefly refer to those for the entire developing world. A critical assessment of the uncertainties associated with poverty estimates for China can be found in Riskin (2004). A critical assessment of the uncertainties associated with poverty estimates for the developing world as a whole can be found in Reddy and Pogge (2004).

China's National Bureau of Statistics (NSB) reports only rural poverty estimates (NSB, 2004). (See Table 1.2 in Appendix 1.) Official estimates indicate that the number of rural poor dropped from 250 million (headcount rate of 30.7%) in 1978 to 125 million (14.8%) in 1985. This has been widely considered to be the most successful era of poverty reduction in China's history (Pingping and Tiemin, 2004). During the 1990s, almost two thirds of the rural population were lifted out of poverty, with the number of poor falling from 85 million in 1990 to 32.1 million in 2000. A possible reversal of the trend of

[5] The program and documentation are available on http://www.worldbank.org/research/povmonitor/software.htm (Accessed: March 23, 2005)

poverty reduction observed since 1990 was encountered between 2002 and 2003 when rural poverty rose 3% according to official estimates, despite GDP growth of 8 percent.

These estimates are based on a national poverty line derived from China's representative rural household survey on the basis of a minimum energy intake requirement of 2,400 kcal/day (1984-1997) and 2,100 kcal/day (1998 to date) and a non-food expenditure estimate for basic necessities (Park and Wang, 2001). The poverty line was 206 Yuan in 1985, 300 Yuan in 1990, and reached 637 Yuan in 2003 (approximately $0.75/day at the 1993 PPP for consumption applied by the World Bank). A new poverty line which is meant "to reflect the steadily improving living standards of rural households"[6] (NBS, 2004) was set up in 2000 based on a 60 percent share of food in household consumption. This line is known as the "lower income line" and represented 882 Yuan in 2003 (approximately $1/day at the 1993 PPP for consumption applied by the World Bank). The poverty headcount rate based on this higher poverty line was 9.1 percent in 2003, representing 85.2 million rural inhabitants.

Yao (2000) contends that, in contrast to official statistics, more than 200 million people in China were lifted out of poverty between 1978 and 1995. The author claims that the poverty reduction was greater than that implied by government statistics, the discrepancy being mainly driven by a large understatement of poverty in 1978 by the government. The paper argues that the poverty headcount fell from 75.5-100 percent (596-790 million people) to 6.7-13.2 percent (57-114 million) over the period 1978-1996.

Park and Wang (2001) study sources of bias in the official rural poverty statistics. They allege that the official figures heavily underestimate rural poverty, while the pace of poverty reduction is grossly overestimated. Official statistics indicate a reduction in rural poverty headcount ratios of 27 percentage points between 1978 and in 2000. The authors argue that increases in the rural cost of living are inadequately accounted for, due to insufficient efforts to capture changes in prices induced by the marketization of the economy, and a failure to adequately account for regional price differences. They also suggest that urban poverty requires a careful assessment that has heretofore been lacking, and that the exclusive focus on rural poverty may provide a very incomplete picture of poverty in China.

Khan and Riskin (2001) construct poverty lines for rural and urban areas based on the costs of attaining adequate nourishment (interpreted in terms of a given caloric requirement, lower in urban areas) and an allowance for non-food consumption expenditure (set in accordance with non-food expenditures of households at the food poverty line). The poverty line used by these authors is related to its nutritional anchor constructed with greater transparency than is the official poverty line. The analysis is based on data from the 1988 and 1995 Chinese Household Income Project surveys. The authors identify a rural headcount of 35.1 percent in 1988 and 28.6 percent in 1995, and an urban headcount of 8.2 percent in 1988 and 8.0 percent in 1995. The authors also adjust the official consumer price index so as better to reflect changes over time in the

[6] Needless to say, this is a somewhat unsettling motivation since a poverty line ought to be used to assess rather than reflect living standards.

cost of achieving a nutritional minimum. Poverty estimates based on the 'unadjusted' CPI suggest that rural poverty decreased by 19 percent, and urban poverty fell by 2.4 percent between 1988 and 1995. In contrast, the use of the 'adjusted' CPI leads to estimates that poverty fell in the period by only 13 percent in rural areas, and *increased* in urban areas by almost one fifth.

An assessment of the evolution of urban poverty in China was also addressed in other related studies. For example, Fang Zhang and Fan (2002) produce urban poverty estimates using the $1 and $1.5/day poverty lines, as well as the Chinese official poverty line for the period from 1992 to 1998.[7] They conclude that the incidence of urban poverty first declined until 1996, only to increase subsequently, and that this result is robust across poverty lines. For 1998, they propose an urban "$1.50 per day" poverty headcount of 8 percent and contrast this to the 1 percent headcount ratio estimated by Chen and Wang (2001). The discrepancy between the estimates is possibly explained by the fact that Chen and Wang (2001) use grouped income data in constructing their poverty estimates. These are reported for poverty lines ranging from $0.50/day to $2.50/day for rural, urban and the entire China.

Using household-level survey data, Xue and Zhong (2003) estimate a poverty headcount for urban China of 11.6 percent in 1999 (using a poverty threshold of 2,152 Yuan, which they apply nationally without spatial price adjustments)[8]. They offer estimates for six provinces (Beijing, Liaoning, Jiangsu, Henan, Sichuan and Gansu) which indicate that urban poverty has been on the rise since 1988. Specifically, their estimates suggest that in these provinces urban poverty has increased by 36 percent between 1988 and 1995, and by almost 35 percent between 1995 and 1999. Their average poverty headcount ratio for the six provinces is 6.7 percent.

Gibson, Huang and Rozzelle (2003) investigate (using data from China's Household Income and Expenditure Survey for 1999, a follow-up to the 1988 and 1995 surveys run under the auspices of the Chinese Household Income Project) whether poverty (and inequality) estimates vary in accordance with the method of recording consumption (e.g. diaries vs. recall and extrapolation) and the method of extrapolation used to obtain estimates of annual consumption from survey responses. They conclude that if China switched to estimating consumption based on annual figures extrapolated from several monthly responses instead of the current, more costly diary method, the result would be a high overestimation of poverty. In a cross-country setting, the effect of implementing this more cost-effective methodology would be an underestimation of China's poverty rates in comparison to other countries' due to differences in survey methodology.

A series of studies propose poverty headcounts for both China and the entire (developing) world. For example, Berry and Serieux (2004) estimate poverty headcount ratios for China and the world for 1980, 1990 and 2000. The paper concludes that the number of

[7] The authors use poverty lines published, beginning in 1997, in the China Development Report for more than 300 cities.

[8] The language used in the paper suggests that this threshold is based on a minimal nutritional standard, but is ambiguous and unspecific.

people living under $500 per year at 1985 international dollars has decreased in China by a factor of 4.5. At the same time, the number of people living under $1500 per year at 1985 international dollars has halved. Furthermore, world poverty incidence fell from 25.7 in 1980 to 14.6 in 1990 and to 12.1 in 2000.

Chen and Ravallion (2001) also find a net decrease in world consumption poverty rates between 1987 and 1998 (at the $1.08/day and the $2.15/day 1993 PPP adjusted poverty lines) driven mainly by high growth in China. In their more comprehensive study, Chen and Ravallion (2004) conclude that the number of $1 poor people in the world was 1.1 billion in 2001, having decreased from 1.5 billion in 1980. Critically, the number of poor people declined in China by over 400 million since 1980, but more than half of that fall was achieved during the early 1980s. The authors state that if the current observed trends continue then the $1 poverty rate for 1990 will be halved by 2015 (which would represent the achievement of the first millennium development goal on poverty reduction for the East and South Asia region).

Finally, Sala-i-Martin (2002) uses data on income shares to estimate income poverty headcounts for the $1/day and $2/day (income) poverty lines for the entire world between 1976 and 1998. Using these poverty lines, which substantially depart from previous methodological norms in referring to income rather than consumption, and to estimates of income based on national income accounts (as opposed to surveys) he contends that the $1 poor have declined by 235 million between 1976 and 1998. For China, the income poverty rate is alleged by Sala-i-Martin to have been 26.7 percent in 1970, and to have steadily declined to 19.8 percent in 1980, 9.7 percent in 1990 and 2.6 percent in 1998. Thus, according to Sala-i-Martin the number of persons in China under his chosen lower poverty line fell from 218.3 million in 1970 to 32.4 million in 1998.

III. Data

The concept of poverty utilized in this paper is the international $1/day consumption poverty line. To obtain consumption poverty estimates for China, we use distributional data for income rather than consumption, since the latter is unavailable. [9] We use income shares available for the years 1990 and 1992 to 2001, which we report below: [10]

[9] As Khan and Riskin (2001) note (p. 63), "A second issue is that income, rather than expenditure, is the variable in terms of which the poverty threshold is defined. It has been argued that expenditure is a better measure of "permanent income" than is current income. A discussion of the validity or otherwise of this argument is operationally irrelevant because distributional data in China are available only for income."

[10] Source: WB Global Poverty Monitoring http://www.worldbank.org/research/povmonitor/PPP1993.htm (accessed: October 22, 2003). The income shares are from the Chinese National Statistical Bureau and are based on the China Rural/Urban Household Surveys conducted in the respective years (with the exception of the data for 1996, 1997 and 2001, for which the data sources were not listed on the website).

Table 1. Income shares, China, 1990, 1992-1998 and 2001

Year →	1990	1992	1993	1994	1995	1996	1997	1998	2001
Deciles ↓									
Bottom	3.08	2.57	2.31	2.03	2.22	2.38	2.32	2.39	1.80
Second	4.25	3.60	3.31	3.32	3.28	3.51	3.52	3.47	2.86
Third	5.36	4.64	4.33	4.34	4.34	4.62	4.65	4.55	3.92
Fourth	6.49	5.73	5.40	5.40	5.48	5.75	5.80	5.65	5.08
Fifth	7.65	6.95	6.60	6.57	6.70	6.95	7.00	6.86	6.36
Sixth	8.97	8.34	7.99	7.91	8.15	8.32	8.36	8.24	7.86
Seventh	10.55	10.1	9.74	9.55	9.93	10.01	10.01	9.93	9.74
Eighth	12.66	12.51	12.18	11.79	12.41	12.31	12.27	12.27	12.39
Ninth	16.01	16.55	16.36	15.47	16.61	16.19	16.05	16.23	16.93
Top	24.98	29.01	31.78	33.62	30.88	29.96	30.02	30.41	33.06

The next section presents alternative values for the parameters of interest; these will enable us to transform the income shares above (i.e., the relative income distribution in each year) into an income profile (i.e., an average income level attributed to each decile in each year), and finally into a consumption profile (i.e., an average consumption level attributed to each income decile). Furthermore, the parameter choices will also affect the range of poverty lines used in the subsequent analysis.

IV. Alternative parameter values

In this section we construct a plausible ranges of variation for each of the four previously identified concepts underlying the poverty analysis: purchasing power parity conversion factors (PPP s), estimates of the true per capita private income level ($\bar{Y}_P$), the share of consumption in total income (θ) and inflation rates (π).

a. Purchasing Power Parity Conversion Factors (PPPs)

First, we identify a set of alternative poverty lines to be used in our analysis of Chinese poverty. We wish these alternative poverty lines to enable us to assess the robustness of conclusions regarding the extent and trend of poverty in China. The poverty lines are constructed in accordance with the $1 per day international poverty standard and alternative PPPs for China.[11]

Since China has never participated in an official benchmark survey of the international comparison program, past judgments concerning the PPP for China have varied widely. These widely discrepant judgments concerning PPPs in turn may have large implications in regard to Chinese poverty levels (as discussed, for example, in Reddy and Pogge 2004). We therefore identify alternative specifications of the purchasing power parity conversion factor for consumption for China in 1993. We choose these particular specifications in order to accurately reflect the alternatives proposed in the literature. Our approach does not involve an endorsement of existing approaches to the construction of PPPs, which we consider to be at best rough and ready, but rather reflects our desire to

[11] Actually, $1.08/day (see Chen and Ravallion, 1999).

adopt a framework of analysis which is consistent with those used elsewhere, in order to facilitate comparisons and serve the purpose we have in mind.

Our strategy consists of the following steps. First we identify "real" per capita GDP estimates for China in 1990 at 1990 international prices from different sources (IMF, World Bank, Ruoen and Kai (1994) and the Penn World Tables Mark 5.5).[12] We obtain from these implicit GDP and consumption PPPs for China at 1993 prices, as well as corresponding "$1 per day" poverty lines. The smallest and largest alternative estimates of China's 1990 per capita GDP figures (at 1990 international prices) that we employ in the subsequent analysis, are: $2,695 and $1,300. We obtain the GDP purchasing power parity conversion factors by dividing the per capita GDP in 1990 local currency units by the "real" per capita GDP estimate in US$. The 1990 per capita GDP in 1990 local currency units was 1,634 Yuan (World Development Indicators, 2003). Therefore, the GDP PPPs (at 1990 international prices) which correspond to each per capita GDP estimate are: 0.6063 Y/$ and 1.2569 Y/$.

To obtain the consumption PPPs from these GDP PPPs, we use the 1993 World Bank estimate of China's consumption PPP of 1.419Y/$. There are two approaches to this: first, we move the 1990 GDP PPPs forward in time to 1993 using the GDP deflators for China and the U.S. We then assume that the 1993 GDP PPP to WB consumption PPP ratio is constant over time and obtain four 1993 consumption PPPs. These will be referred to as Method I consumption PPPs. The second method consists of first computing the ratio between the 1990 WB GDP PPP and the 1990 WB consumption PPP. Applying this ratio as a multiplicative factor to the other 1990 GDP PPP estimates enables us to obtain the corresponding 1990 consumption PPPs. These are moved forward to 1993 using the official Chinese CPI to transform the numerator (from 1990 Y to 1993 Y) and the U.S. CPI to transform the denominator (from 1990 $ to 1993 $) and are referred to as Method II consumption PPPs.

Method I and Method II 1993 consumption PPPs are reported in Table 2. We note that within each method, the PPPs vary by a factor of two, but across methods they are close in magnitude. Alternative estimates of the $1.08/day WB annual consumption poverty line at 1993 prices are obtained by multiplying $1.08 by each consumption PPP and 365 days. The poverty lines are also reported in Table 2. The alternative poverty lines vary significantly, with the highest poverty line being more than twice as high as the lowest poverty line, permitting an assessment of the robustness of estimates of the trend of poverty in China to alternative specifications of the poverty line. The two poverty lines reflect the variation in PPPs derived from existing GDP estimates for China, and are expressed in true per capita private Yuan-consumption units. [13]

[12] We discuss alternative real per capita GDP estimates for China in Appendix 3.

[13] In what follows we present poverty estimates based *only* on Method I PPPs and the corresponding poverty lines. Poverty estimates based on the Method II PPPs and the corresponding poverty lines are available from the authors upon request.

Table 2. Consumption PPPs and Poverty Lines (at 1993 prices)

	Consumption PPPs:	Poverty lines
		(official) 350.0000 Y/year
Method I	PPP_{LOW} = 1.0267 Y/$	404.7251 Y/year
	PPP_{HIGH} = 2.1285 Y/$	839.0547 Y/year
Method II	PPP_{LOW} = 0.9637 Y/$	379.8905 Y/year
	PPP_{HIGH} = 1.9978 Y/$	787.5328 Y/year

b. Per Capita Income Estimates

Since yearly distributional consumption data are not available for China, the task of computing consumption from income estimates is unavoidable. In this section, we discuss estimates of the per capita *true* private income (that is, the quantity which will enable us to obtain an income profile from income shares). Given an income distribution, choices of reasonable values for the parameter θ will then enable us to construct a consumption profile.

There are discrepant views in the literature on what constitutes an appropriate means of estimating *true* per capita real income; in particular, some authors take the view that per capita GDP estimates are the correct measure of private real incomes (see, for example, Bhalla 2002, Sala-i-Martin 2002a and 2002b); in contrast, others claim that National Accounts (NA) give a distorted measure of private real incomes, and advocate the use of survey-based income consumption estimates (see Deaton, 2004). Deaton presents an extensive analysis of differences between survey and NA estimates of consumption and income per capita. These discrepancies are observed for both levels and rates of growth. He shows that on average, survey-based mean income is 60 percent of GDP (based on data from 272 household surveys), and the same ratio is 51 percent in the East Asia and Pacific region (32 surveys). Furthermore, in non-OECD countries, consumption estimates from surveys in the 1990s appear to have grown slower than NA consumption estimates, while for income estimates the situation is reversed. Furthermore, Deaton argues that China's ratio of survey to NA consumption has been declining in the 1990s from 95 percent in 1990 to 80 percent in 2000. Household consumption series from the two sources also differ in terms of growth rates by 1.7 percent a year during the 1990s. Naturally, discrepancies of this nature between surveys and NA data can generate important distortions in the estimated mean income for different quantile groups, and consequently affect estimated poverty levels.

We assess the degree of distortion implied by the use of per capita aggregate income (GDP) as the measure of household income in China instead of a survey-based estimate of household income, using yearly data on per capita household disposable income from

the 2003 China Statistical Yearbook.[14] We find that the average annual growth rate of income from household surveys between 1990 and 2001 was 7.54 percent. [15] In contrast, the average annual growth rate of the per capita GDP was 8.74 percent.[16] This discrepancy in the growth rates of mean per capita income from the two sources is accompanied by a substantial difference in levels (the ratio between the two estimates varies in China between 1.81 (in 1990) and 2.11 (in 1997 and 1998)).

We accommodate both views concerning the appropriate method of estimating private per capita incomes. We consider national accounts income based consumption estimates (*NAICE*) as well as survey income based consumption estimates (*SICE*). Since the analysis becomes increasingly complex as the number of values of possible parameters increases, we simplify the presentation of the results using the following 'shortcut'. First, note that, for any *true* private consumption level (that is, either *NAICE* or *SICE*), four scenarios are now possible for the first two parameters of our vector: $(PPP_{LOW}, NAICE)$, $(PPP_{HIGH}, NAICE)$, $(PPP_{LOW}, SICE)$ and $(PPP_{HIGH}, SICE)$.

We do not possess survey-based estimates of incomes for each year. However, we do possess national income account based estimates of the mean income for each year. In order to conduct the analysis that follows, we make the simplifying assumption, based on evidence from the years in which both survey and national income data is available, that *NAICE* and *SICE* are in the proportion of 2.07:1 throughout the decade. [17] We note that scaling up (down) all individuals' consumption by a fixed factor and raising (lowering) the poverty line by the same factor leaves the headcount ratio unchanged. It conveniently follows that, if the ratio of consumption to income is assumed to be unchanged, then there is an equivalence between computing the poverty headcount ratio from data given by the vectors $(PPP_{LOW}, SICE)$ and $(2.07 \times PPP_{LOW}, 2.07 \times SICE)$, that is $(PPP_{HIGH}, NAICE)$. We use this equivalence to reduce the number of calculations conducted and to report the data more economically in what follows.

c. Shares of Consumption in Total Income (θ)

Since reliable consumption surveys are not available for China, whereas existing international poverty lines are specified in terms of a level of consumption (in particular, $1 or $2 per day), simplifying assumptions with which to impute a consumption

[14] See Appendix 4.
[15] A figure of around 7 percent was documented by Chen and Ravallion (2001, p. 7).
[16] The finding that survey-based household mean incomes have grown only slightly less that official per capita GDP figures is relevant to the debate on whether China's GDP growth rates are overstated (see, for example, Rawski 2002). The small difference between the national accounts and survey-based average incomes' growth rates suggests that the amount by which China's economic growth rates during the 1990s may have been overstated is not likely to have been as substantial as argued by some analysts.
[17] The median ratio between the NA average per capita income and that reported from surveys between 1990 and 2001 was 2.07 while the average ratio was 2.02. We therefore judged it reasonable to assume that NA income estimates and survey estimates have been in the proportion of 2.07:1 between 1990 and 2001. This assumption happens also to have the convenient property that it makes possible the equivalence described later in this paragraph.

distribution to China have been applied in the literature on Chinese, regional and world poverty (e.g., Chen and Ravallion 1999, Chen and Wang 2001). Specifically, it has been assumed that the consumption to income ratio is constant across income deciles and equal to the share of total household consumption in GDP, as identified in the national income accounts. This estimate of our third parameter of interest θ, which we denote θ_{NA}, will serve as the first value of θ in our robustness analysis. We also adopt a more realistic set of consumption to income ratios calculated from household surveys, which we denote θ_S.

In particular, we use the 1995 Chinese Household Income Project rural and urban surveys to obtain consumption to income (C/I) ratios for each decile of the *national* income distribution.[18] In this way, we improve on the national accounts estimate θ_{NA} in two major ways: first, the C/I ratios are more appropriately based on a household survey rather than the National Accounts. Furthermore, the C/I ratios are specific to each decile of the income distribution, which increases their likelihood of being closer to their true counterparts as one moves towards the left tail of the income distribution. Finally, due to data limitations we make the assumption that these estimates are representative of the average propensity to consume of each income decile in China every year between 1990 and 2001, and therefore employ them on each year's income distribution.

d. Inflation Rates (π)

This section identifies alternative values for the last parameter in our vector: inflation rates (π). One immediate candidate is the official general consumer price index (π_{off}). The official CPI, however, does not reflect the differences in consumption patterns of different fractiles of the income distribution, since it gives fixed weights to expenditures of food and non-food items. In order to better account for the cost of consuming the basket of goods faced by the bottom deciles of the income distribution, we create a set of 'adjusted' consumer price indices. Specifically, we use data from the aforementioned surveys to estimate decile-specific food shares (and the implied non-food shares in total expenditure) which will permit constructing decile-specific 'adjusted' price indices.[19]

Two approaches are used: the first entails using the publicly available general and food CPI, as well as the average food share in total consumption from the 1995 surveys to obtain an 'implied' non-food CPI.[20] We obtain an 'adjusted' general CPI using this implied non-food CPI, the official food CPI, and food/non-food shares in total consumption from the surveys. The second approach uses the food CPI and a proxy for the non-food CPI, as well as decile-specific food shares to obtain decile-specific 'adjusted' general CPIs. Several CPIs may play the role of proxies for the non-food CPI, namely: (a) the ex-factory price index of industrial products, (b) the means of production

[18] We discuss the construction of the income variables from the 1995 surveys in Appendix 5a. Furthermore, a detailed description of the consumption measure used as well as the decile-specific C/I ratios is given in Appendix 5b.
[19] In Appendix 6 we report the alternative adjusted indices.
[20] Decile-specific food shares from the 1995 surveys are reported in Appendix 5c.

price index, and (c) a weighted average of the clothing, articles for daily use, and durable consumer price indices, where the weights are the average weights in total consumption of these items from the 1995 survey (namely, 60% for clothing, 30% for daily use items and 10% for durable consumer goods). Our preferred adjusted CPI is the last, since it does not rely on a proxy index for non-food items that may incorrectly attribute to consumer prices changes that are more relevant to producers.

We note that there are no substantial differences in the evolution of prices between the official CPI and the 'adjusted' CPIs. In particular, our preferred 'adjusted' CPI closest resembles the official CPI; at any given point in time, the gap between the two price indices varies, however this is unlikely to reverse the conclusion of a downward trend in estimated poverty headcount ratios, and will have little effect on the extent of poverty.[21]

The two alternative values for the inflation rate parameter π which we decide to use in the subsequent analysis, are the official general CPI π_{off} and the preferred adjusted CPI π_{adj}.

V. Consumption Distributions and Poverty Estimates

a. Consumption Distributions

As noted before, without any loss of generality, we estimate the mean levels of consumption of each decile of the income distribution using per capita GDP estimates. That is, we multiply each income share by 10 times the GDP per capita in current LCUs (local currency units):

Table 3. Mean income levels by decile (at current prices)

Year →	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**2001**
Deciles ↓									
Bottom	503.3	587.8	678.9	796.4	1077.6	1327.1	1404.5	1507.4	1377.2
Second	694.5	823.3	972.8	1302.4	1592.1	1957.2	2131.0	2188.5	2188.2
Third	875.8	1061.2	1272.6	1702.6	2106.6	2576.1	2815.1	2869.7	2999.2
Fourth	1060.5	1310.5	1587.1	2118.4	2660.0	3206.2	3511.3	3563.5	3886.7
Fifth	1250.0	1589.5	1939.7	2577.4	3252.2	3875.3	4237.8	4326.6	4866.0
Sixth	1465.7	1907.4	2348.3	3103.1	3956.0	4639.2	5061.1	5197.0	6013.7
Seventh	1723.9	2309.9	2862.6	3746.5	4820.0	5581.6	6060.1	6262.9	7452.1
Eighth	2068.6	2861.0	3579.7	4625.2	6023.8	6864.1	7428.3	7738.7	9479.6
Ninth	2616.0	3785.0	4808.2	6068.9	8062.5	9027.5	9716.7	10236.3	12953.1
Top	4081.7	6634.6	9340.1	13189.1	14989.2	16705.7	18174.1	19179.6	25294.2

[21] Khan and Riskin (2001) also construct adjusted price indices to better reflect living costs faced by individuals at or near the poverty line. They find that whereas the use of the official CPI leads to an apparent fall in urban poverty between 1988 and 1995, the substitution of an adjusted CPI leads to an apparent increase in urban poverty over the same period. A direct comparison between their results with ours is not possible since we analyze Chinese *national* poverty whereas they disaggregate the analysis at the urban and rural level.

Next, we present several consumption distributions corresponding to various combinations of parameter values. First, we use the 'least refined' estimate of the share of consumption in income from the national accounts and assume it to be constant across the income distribution; in other words, we apply the ratio θ_{NA} to the income distribution from Table 3 to obtain a consumption distribution which we then express at 1993 constant Chinese prices with the use of the official general CPI, assuming that the official CPI is appropriate to adopt in an analysis of the changes in the real level of consumption of the populations in all income deciles:

Table 4. Mean consumption levels by income decile (θ_{NA} , π_{off})

Year →	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**2001**
Deciles ↓									
Bottom	308.3	317.5	305.5	286.7	341.9	397.3	410.0	445.6	407.1
Second	425.4	444.8	437.8	468.9	505.1	585.9	622.1	646.9	646.8
Third	536.4	573.3	572.7	612.9	668.3	771.2	821.8	848.3	886.6
Fourth	649.5	707.9	714.2	762.6	843.9	959.8	1025.0	1053.3	1148.9
Fifth	765.6	858.7	872.9	927.9	1031.7	1160.1	1237.1	1278.9	1438.4
Sixth	897.7	1030.4	1056.7	1117.1	1255.0	1388.8	1477.5	1536.2	1777.6
Seventh	1055.9	1247.9	1288.2	1348.7	1529.1	1670.9	1769.1	1851.3	2202.8
Eighth	1267.0	1545.6	1610.9	1665.1	1911.0	2054.8	2168.5	2287.5	2802.1
Ninth	1602.3	2044.8	2163.7	2184.8	2557.8	2702.5	2836.5	3025.8	3828.9
Top	2500.1	3584.2	4203.1	4748.1	4755.2	5001.1	5305.5	5669.4	7476.9

We also present the 'most refined' estimates of the consumption distribution, namely those based on the income distribution in Table 3, to which we apply decile-specific consumption to income ratios, and for which we use the decile-specific adjusted 'preferred' CPI to express the consumption levels at 1993 constant prices.

Table 5 Mean consumption levels by income decile (θ_S , π_{adj})

Year →	**1990**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**2001**
Deciles ↓									
Bottom	627.7	652.4	678.9	644.5	704.0	790.6	834.9	916.7	901.6
Second	666.9	703.7	749.1	811.6	800.9	897.8	975.4	1024.8	1103.0
Third	808.3	871.6	941.7	1019.6	1018.4	1135.7	1238.3	1291.4	1453.0
Fourth	925.8	1018.2	1110.9	1200.0	1216.4	1337.0	1461.0	1516.9	1781.1
Fifth	1060.1	1199.7	1319.0	1418.3	1444.8	1569.9	1713.0	1789.2	2166.2
Sixth	1389.3	1609.0	1784.7	1908.5	1964.2	2100.5	2286.4	2401.9	2992.1
Seventh	1548.0	1846.0	2061.1	2182.9	2267.2	2394.1	2593.6	2742.2	3512.6
Eighth	1831.8	2254.8	2541.6	2657.5	2794.1	2903.3	3135.0	3341.3	4406.2
Ninth	2186.0	2814.9	3221.5	3290.6	3529.0	3603.3	3869.8	4170.7	5681.6
Top	2799.9	4050.4	5137.1	5870.4	5385.8	5473.7	5941.7	6415.0	9107.6

Given that the official and 'adjusted' CPIs do not differ much, most of the difference on the consumption means presented in Tables 4 and 5 is explained by the difference between the national accounts, constant- and survey-based, decile-specific consumption to income ratios. When using survey-based C/I ratios, average consumption levels of the bottom income decile are twice as high as those based on the NA ratio. For the second income decile, the survey-based mean consumption levels are higher by approximately

fifty percent. This difference in estimated means will greatly affect the estimated poverty headcount ratios, as we shall see in the next section.

b. Poverty Estimates for China

The poverty headcount ratios corresponding to the two sets of consumption PPPs and the relevant $1.08/day poverty lines are summarized in the tables below. For purposes of comparison, we include Chen and Ravallion (2004) and Chen and Wang (2001) estimates in the same tables, the latter being available for a larger number of years.

First, we report $1/day poverty estimates for China based on the 'least refined' estimates of the consumption distribution (presented in Table 4):

Table 6 Poverty headcount ratios (Distribution given by: θ_{NA} , π_{off})

Set of parameters	1990	1992	1993	1994	1995	1996	1997	1998	2001
$(PPP_{LOW}, NAICE)$	13.2	11.8	12.5	11.7	8.8	5.40	4.70	3.0	4.9
Chen and Ravallion (2004)	33.0	n/a	28.4	n/a	n/a	17.4	n/a	n/a	16.6
Chen and Wang (2001)	31.5	29.6	29.4	25.0	22.0	17.2	17.0	17.1	17.4
$(PPP_{HIGH}, NAICE) = (PPP_{LOW}, SICE)$	50.8	43.8	43.0	39.5	34.8	28.7	25.8	24.6	23.0
$(PPP_{HIGH}, SICE)$	88.0	79.9	78.2	77.2	71.1	67.2	64.1	61.8	54.0

These results show that the trend of considerable poverty reduction identified elsewhere in the literature is robust to the choice among alternative poverty lines. The poverty headcount has fallen (between 1990 and 2001) by at least half if per capita GDP is taken to be an accurate measure of private incomes, and by 36 percent if survey estimates incomes are considered instead. Although this picture of the trend of poverty reduction is robust to the choice of poverty line, this is not true of the extent of poverty. In particular, poverty headcount estimates vary depending on the year by a factor of between 0.3 and 3.9 of the CR estimates.

Next, we report $1/day poverty headcount ratios for China based on the 'most refined' estimates of the consumption distribution (reported in Table 5):

Table 7 Poverty headcount ratios (Distribution given by: θ_S , π_{adj})

Set of parameters	1990	1992	1993	1994	1995	1996	1997	1998	2001
$(PPP_{LOW}, NAICE)$	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
$(PPP_{HIGH}, NAICE) = (PPP_{LOW}, SICE)$	n/a	21.1	18.4	16.2	15.6	11.0	8.4	6.2	6.1
Chen and Ravallion (2004)	33.0		28.4			17.4			16.6
Chen and Wang (2001)	31.5	29.6	29.4	25.0	22.0	17.2	17.0	17.1	17.4
$(PPP_{HIGH}, SICE)$	n/a	63.0	56.9	53.3	51.7	47.5	42.5	39.8	31.9

As expected, the scenario $(PPP_{LOW}, NAICE)$, corresponding to the lower of the two proposed PPPs (hence, poverty lines) and the higher per capita income estimates (from the national accounts), produces negligible headcount ratios. In contrast, the highest PPP poverty line in association with the lower per capita income estimates (from the household surveys) produces headcount ratios of a magnitude twice higher than CR. Again, the estimates robustly display a downward trend.

It is notable that our poverty estimates depart markedly in terms of magnitude from official statistics and those of CR. In particular, the scenario which is most comprehensive in reflecting a plausible and realistic set of underlying assumptions about income and consumption levels as well as poverty lines, results in estimates higher than CR by a multiplicative factor varying between 1.9 and 2.7.

Is the pace of poverty reduction (which we understand to refer to the year-on-year percentage decrease in the poverty headcount ratio) different according to the estimates constructed here than according to official statistics? According to the official statistics, the pace of poverty reduction has been uneven throughout the 1990s, with the highest achievements being between 1995 and 1999 when it varied between 13 and 20 percent annually. It has been suggested that this may have been a result of post-1994 grain marketing system reforms (which boosted procurement prices received by poor farmers).[22] We do not directly assess this causal claim here, but do note that the official data is consistent with it. However, there is no evidence of the pace of poverty reduction having fallen over the period considered. The rate of poverty reduction toward the end of the period is generally no lower than that at the beginning of the decade and sometime higher, according to the official statistics.

We report the rates of poverty reduction and elasticities of the headcount ratio with respect to aggregate income (often referred to misleadingly as the "growth elasticity of poverty") implied by our estimates (from Tables 6 and 7) in Appendix 7. We observe that, for estimates based on the unadjusted CPI, the pace of poverty reduction accelerated in 1995 and remained higher than at the beginning of the period until around 1997, regardless of the parameters adopted. However, when the 'adjusted' CPI is used the pace of poverty reduction fell between 1993/94 and 1994/95 and rose thereafter. Furthermore, under all of the combinations of assumptions considered, a trend of uninterrupted poverty reduction is observed until 2001, with one exception: the case corresponding to the lowest poverty line and the highest estimated consumption levels (which results from the use of the official CPI and the share of consumption in the national income accounts), for which an increase in poverty is observed between 1998 and 2001. In the official statistics, we note a possible reversal of the trend of falling poverty only later, between 2002 and 2003. Finally, there is no clear pattern throughout the 1990s in the reported "growth elasticities of poverty".

[22] For a detailed description of the reforms, for example, Cheng (1996).

VI. Conclusions

The record of poverty reduction in China has a substantial impact on assessments of world poverty. In this paper we have analyzed the extent to which the most recent $1.08/day consumption poverty estimates (Chen and Ravallion, 2004) are sensitive to the choice of underlying parameters such as purchasing power parity conversion factors, consumption to income ratios, inflation rates, and the means of constructing an income profile from income shares (i.e., national accounts versus surveys). In particular, we have identified in the literature different estimates of per capita GDP for China and have inferred a set of alternative consumption PPPs, with their associated poverty lines at 1993 prices. We have shown that the level of poverty is very sensitive to whether surveys or national accounts are used to estimate income levels. Furthermore, we have used consumption to income ratios from both the National Income Accounts, and the Chinese Household Income Project 1995 surveys to translate income levels into consumption levels. Finally, we have expressed the quantities of interest in 1993 constant prices using both the Chinese official consumer price index (which assumes that the food and nonfood shares in total expenditure are the same for individuals with different income levels), as well as 'adjusted' price indices which more closely reflect the variation in consumption patterns across the income spectrum.

We conclude in this study that the conclusion that China has had substantial success in reducing consumption poverty over the 1990s is robust to plausible variation in key assumptions. On the whole, China appears to have enjoyed a truly remarkable reduction in consumption poverty over the decade, with no clear evidence that the rate of poverty reduction has fallen over time.

The extent of poverty we identify as prevailing in any year is greatly influenced by the assumptions made, however, and often differs markedly from estimates produced in specific sources, such as Chen and Ravallion (2004). In particular, the set of assumptions which reflect the revisions to underlying parameter values result in poverty estimates which are as large as 2.7 times Chen and Ravallion's. However, in view of the prevailing uncertainties concerning the appropriate parameters to apply in analysis of the Chinese economy, there is reason for caution in accepting any one set of poverty estimates as correct. The poverty statistics presented here may be interpreted as 'confidence bounds' for the levels proposed by other authors and may serve in interpreting them.

In light of these findings, it is important to know whether China's success in reducing consumption poverty is matched by achievements in other dimensions of development. Some evidence on health outcomes is given by Minoiu and Reddy (2005), who note that province-level rates of improvement in male and female life expectancy have accelerated during the 1990s as compared to the previous two decades. However, the authors show that it took China a larger number of years to obtain the same improvements as other countries have obtained, starting with the same initial life expectancy and at similar levels of initial income.

When interpreting the patterns found at the aggregate level, one must exercise caution as such figures may conceal important micro-level variations (at the individual, county or even regional level), which we have not considered at all in this analysis, and which are likely to be of great importance for China. Meng et al. (2004) offer evidence based on survey data in urban China that the nutritional intake for lower income groups has been *decreasing* throughout the 1990s. Rising food prices between 1993-1996 induced by the liberalization of the grain marketing system and the abolition of the food coupon system are cited as the main causes of nutrition worsening. Evidence on rising urban consumption poverty in the 1990s is also provided by Khan and Riskin (2001), Zhang and Fan (2002), and Xue and Zhong (2003).

We hope that further research will shed light on the extent to which China's aggregate poverty reduction in the 1990s has been shared in all regions, has been accompanied by improvements in other achievements in human well-being such as improvements in education, health, and access to basic services, and has continued.

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APPENDIX 1. Chinese, East Asian and developing world poverty estimates

Table 1.1 Chen and Ravallion (2004); Poverty line: $1.08/day at PPP

	Poverty headcount index, $1.08/day 1993 consumption PPP adjusted poverty line							
Year →	**1981**	**1984**	**1987**	**1990**	**1993**	**1996**	**1999**	**2001**
East Asia	57.7	38.9	28.0	29.6	24.9	16.6	15.7	14.9
China[23]	63.8	41.0	28.5	33.0	28.4	17.4	17.8	16.6
East Asia w/out China	42.0	33.5	27.0	21.1	16.7	14.7	11.0	10.8
World	40.4	32.8	28.4	27.9	26.3	22.8	21.8	21.1
World w/out China	31.7	29.8	28.4	26.1	25.6	24.6	23.1	22.5

Table 1.2 Official rural poverty estimates (NBS, 2004); Poverty line: approximately $0.75/day at PPP

Year	Poverty headcount ratio	Poverty head-count ratio[24]	Number of poor (mil.)	Number of poor [25] (mil.)	Year on year percentage decrease in headcount ratio	Average percentage points decrease in head-count ratio	Per capita GDP in constant LCUs	Average annual per capita GDP[26] growth rate	"Growth elasticity of poverty"
1978	30.7		250.0				688.14		
1984	15.1		128.0		-0.11	-2.6	1079.34	0.08	-1.43
1985	14.8		125.0		-0.02	-0.3	1208.48	0.12	-0.17
1986	15.5		131.0		0.05	0.7	1295.41	0.07	0.66
1987	14.3		122.0		-0.08	-1.2	1422.68	0.10	-0.79
1988	11.1		96.0		-0.22	-3.2	1558.16	0.10	-2.35
1989	11.6		102.0		0.05	0.5	1597.36	0.03	1.79
1990	9.4		85.0		-0.19	-2.2	1633.91	0.02	-8.29
1992	8.8		80.0		-0.03	-0.3	1985.50	0.10	-0.32
1994	7.7		70.0		-0.06	-0.6	2480.29	0.12	-0.55
1995	7.1		65.4		-0.08	-0.6	2711.10	0.09	-0.84
1997	5.4		49.6		-0.13	-0.9	3166.56	0.08	-1.58
1998	4.6		42.1		-0.15	-0.8	3380.96	0.07	-2.19
1999	3.7		34.1		-0.20	-0.9	3589.79	0.06	-3.17
2000	3.4		32.1		-0.08	-0.3	3846.54	0.07	-1.13
2001	3.2	9.7	29.2	90.3	-0.06	-0.2	4105.10	0.07	-0.88
2002	3.0	9.2	28.2	86.5	-0.06	-0.2	4403.91	0.07	-0.86
2003	3.1	9.1	29.0	85.2	0.03	0.1	4774.83	0.08	0.40

[23] The estimates for China's poverty headcount ratio are obtained using income profiles (p. 8, Chen and Ravallion 2004)
[24] Based on the national "lower income line" representing approximately $1/day at PPP.
[25] Based on the national "lower income line" representing approximately $1/day at PPP.
[26] Source: WDI 2003.

APPENDIX 2. POVCAL

To estimate the poverty headcount ratio from grouped data, we use the World Bank's POVCAL software. The software fits the Lorenz curve via two parametric interpolation methods: the General and the Beta model (Datt, 1998). The results reported in this paper are based on the first method since POVCAL systematically indicated that it provides a better fit to the data.[27]

The two estimation techniques fit the Lorenz curve from grouped income data (e.g., from income means for ten quantiles of the income distribution). We investigate here how well the two parametric estimation methods perform in replicating certain features of the distribution of income (such as the poverty headcount ratio for a given poverty line), when grouped income data is available instead of the full underlying survey. To do so, we use the full survey obtained by pooling together the 1995 Chinese Income Project urban and rural surveys.[28] We compute poverty headcount ratios for a range of poverty lines between the median and the one fifth of the median of the underlying survey income, in order to reflect the range of variation of poverty lines used later on in the paper.

Table 2.1. Estimates of headcount ratios based on grouped income data versus underlying survey data (%)

Poverty line	Full underlying survey	Grouped income data	
		GQ method	Beta method
Median	50.01	49.62	50.53
3/4ths of median	33.63	34.26	34.46
1/2 of median	18.25	19.65	18.07
1/3rd of median	11.20	11.42	9.55
1/4th of median	8.59	7.85	6.52
1/5th of median	6.95	5.89	5.10

Table 2.2. Estimates of headcount ratios based on grouped income data versus underlying survey data (expressed as ratio = grouped data estimate / survey estimate)

Poverty line	GQ method	Beta method
Median	0.992	1.010
3/4ths of median	1.019	1.025
1/2 of median	1.077	0.990
1/3rd of median	1.020	0.853
1/4th of median	0.913	0.759
1/5th of median	0.848	0.735

[27] The results based on the second interpolation method are available from the authors upon request.
[28] The income variable is discussed in detail in Appendix 5a.

APPENDIX 3. China's per capita GDP figures

In this section we provide evidence supporting the alternative per capita GDP estimates for 1990 at 1990 international prices, which we use in the derivation of the corresponding $1.08/day poverty line Yuan equivalents. We use the GDP estimates for 1991 at 1991 international prices, for China, summarized in Gulde and Schulze-Ghattas (1993, p.117):

Table 3.1 Alternative estimates of China's 1991 total GDP* (US$ billions at 1991 international prices)

IMF (World Economic Outlook)	$ 1,413
World Bank (1993)	$ 1,931
Penn World Tables Mark 5.5	$ 3,439

* Source: Gulde and Schulze-Ghattas (1993, p.117)

China's population in 1991 was 1.15078 billion (WDI, 2003). This implies the per capita GDP estimates for 1991 (at 1991 international prices) shown in Table 3.2, to which we add Ruoen and Kai's (1994, p. 390) estimate:

Table 3.2 Alternative estimates of China's 1991 per capita GDP (1991 international prices)

IMF (World Economic Outlook)	$ 1,227.86
World Bank (1993)	$ 1,677.99
Rouen and Kai (1994)	$ 1,680.00
Penn World Tables Mark 5.5	$ 2,988.41

We obtain an estimate of China's per capita GDP at 1990 international prices using the US GDP deflator for 1990 (88) and 1991 (91) (WDI, 2003). Applying the ratio between the GDP deflators to China's per capita GDP estimates, we obtain:

Table 3.3 Alternative estimates of China's 1991 per capita GDP (1990 international prices)

IMF (World Economic Outlook)	$ 1,187.38
World Bank (1993)	$ 1,622.67
Rouen and Kai (1994)	$ 1,624.62
Penn World Tables Mark 5.5	$ 2,889.89

Finally, we use the per capita real GDP growth rate for the year 1990, of 2.288% (WDI, 2003) to obtain the 1990 per capita GDP at 1990 prices.

Table 3.4 Alternative estimates of China's 1990 per capita GDP (1990 international prices)

IMF (World Economic Outlook)	$ 1,160.82
World Bank (1993)	$ 1,586.38
Rouen and Kai (1994)	$ 1,588.27
Penn World Tables Mark 5.5	$ 2,825.25

APPENDIX 4. Survey-based vs. National Accounts income estimates

The source of the National Accounts data is the WDI database 2003. We find that the average annual growth rate of per capita GDP (in constant LCUs) between 1990 and 2001 was 8.74 percent. Based on the per capita disposable income estimates for rural and urban households, and rural and urban population shares in China's total population reported in the 2003 China Statistical Yearbooks (Tables 10-3[29] and 4-1), we find that the mean per capita income level based on surveys has grown between 1990 and 2001 by 7.5 percent per year on average. [30]

Table 4.1 Comparison of levels and growth rates of national accounts and survey-based national income levels (constant 1990 prices, official China CPI)

Year	NA per capita GDP in constant LCUs (Yuan)	Survey-based per capita income (Yuan)	Ratio between NA and survey-based incomes
1990	1633.91	903.89	1.81
1991	1760.05	943.76	1.86
1992	1985.50	1022.76	1.94
1993	2227.78	1097.60	2.03
1994	2480.29	1193.89	2.08
1995	2711.10	1288.75	2.10
1996	2940.38	1416.87	2.08
1997	3166.56	1503.61	2.11
1998	3380.96	1604.83	2.11
1999	3589.79	1741.45	2.06
2000	3846.54	1851.35	2.08
2001	4105.10	2010.21	2.04
	Average annual growth rate: 8.74%	Average annual growth rate: 7.54%	Average ratio: 2.02 Median ratio: 2.07

[29] The 2003 China Statistical Yearbook states (p. 340) that survey-based mean income estimates are obtained from annual rural surveys covering 68,000 households and urban surveys covering 40,000 households. Furthermore, "the respondent [urban] households are selected by the two stage stratified systematic random sampling scheme" and respondent rural households are selected by "a combination of various sampling approaches".

[30] We used the general official CPI to evaluate national income at constant 1990 prices. Using the separate rural and urban CPIs to first express the rural and urban mean incomes at constant prices, and subsequently obtaining an estimate of the national mean income by weighting the resulting sectoral incomes by rural/urban population shares, does not change the main conclusions. In particular, employing the latter procedure we find that the average annual growth rate of survey-based per capita income is 7.44 percent between 1990 and 2001. Furthermore, the average national accounts to survey mean income ratio is 2.07, while the median ratio is 2.12.

APPENDIX 5a.

The income variables from the Chinese Household Income Project Surveys 1995

The Chinese Household Income Project 1995, as well as the SAS codes for constructing measures of disposable rural and urban per capita income, are publicly available through the Inter-university Consortium for Political and Social Research, 2000. A related publication which makes use of income components obtained from this survey is Khan, A. R., and Riskin, C. (2001). We have been able to replicate most of the variables used in this publication; however, we have found that the per capita income from the rural surveys did not include the value of self-consumption of farm products (mnemonic: RY4), which led to an underestimation of disposable rural income. Correspondence with the authors indicates that the value of self-consumption of farm products is included in 'net farm income' (mnemonic: RY3C). This is also mentioned in the documentation accompanying the surveys ("Estimating Household Income" file). The publication indicates that (p. 31): "RY4 (self-consumption of food) is a category that was separately identified in 1988 and is included in RY3A in 1995". According to the documentation, RY3A is the mnemonic for "net cash income from the sale of farm products", while RY3C = RY3A + RY4.

Two observations are in order:

- RY4 is the (gross) value of self-consumption. It is a 'gross' value in that the costs associated with producing food for self-consumption are not subtracted from it. Therefore, RY4 can enter total consumption measures[31], but it is its 'net' form which should be treated as a component of income;
- The Chinese Household Income Project 1995 does not attempt to identify separately the costs associated with producing agricultural output for sale vs. that for self-consumption. This is standard practice in household level surveys, since the separate identification of these costs may be practically impossible by farmers. Therefore, identifying the 'net' value of self-consumption is in practice a difficult task.

The cash income from sales of agricultural output is a ready-made variable in the survey. We attempted to re-construct this variable from scratch by summing up the cash income from the following household farming operations: grains, economic crops, forestry, animal husbandry, fishing and other agricultural activities. The costs of production are those associated with all these activities, and also include the costs associated with producing food for self-consumption. The measure of RY3A obtained from this exercise is identical to that obtained by the authors for 65 percent of the individuals in the rural sample. We can find no explanation for the discrepancy for the remaining 35 percent of the individuals (10,107 observations). [32]

We proceeded to include RY4 in the measure of total consumption, and in that of total income. This is justified on the basis that, according to the SAS codes, RY4 is neither directly included in

[31] The only caveat to this procedure is that we cannot separately identify and subtract the value of produce which is used as input into the production of self-consumed food (for example, corn).

[32] Despite this discrepancy, however, the food shares in total expenditure are very similar to those based on the income variable produced with the SAS codes, to which we add RY4. Furthermore, the consumption to income ratios are very similar to those obtained by adding RY4 to the income variable (based on the SAS codes) for the lowest six deciles. Therefore, using the ready-made cash income from sales of agricultural output or the one constructed from scratch would make little difference to poverty estimates, and we decide to use the former.

total income, nor did we find any conclusive evidence that it is included in any of the components of total income (such as RY3A). Furthermore, once we subtract the total costs of agricultural production (where the production may be either sold or self-consumed), RY4 is also the correct variable to be added to the total income variable.

APPENDIX 5b. Survey-based consumption to income ratios

To obtain consumption to income ratios for each income decile, we use the Chinese Household Income Project 1995 survey. For rural areas, the measure of total consumption includes the expenditure on staple food, non-staple food, cigarettes and alcoholic beverages, clothing, transport and communications, daily use consumption goods, durable goods, medical care, education, housing, supporting parents or aged relatives, gifts, medical insurance, fines, as well as the expenditure on purchasing fixed capital for production, and taxes and fees. Total consumption also includes the gross value of self-consumption of farm products. We validate the quality of this consumption variable by correlating it to the total cash expenditure on consumption (available in the survey); the correlation is 0.9885. For urban areas, the total consumption expenditure is available in the survey and is the summation of expenditures on consumption categories that include: food, cigarettes and alcohol, clothing, daily consumer goods, durable consumer goods, non-commodities, labor and other services, educational and reference materials, tuition and fees, children's education, adult education and training, child care, alimony, gifts, transportation, water and electricity, fuel, telephone use, and medical care. The income variables on the basis of which we construct deciles are computed using the publicly available SAS code which accompany the survey.

To obtain consumption to income ratios for each decile of the income distribution, we put together the rural and the urban surveys in a national survey, which contains 56,437 observations. It is interesting to note that more than 6,400 individuals are dis-saving and are primarily concentrated in the bottom decile:

Table 5b. Consumption to income ratios, 1995

Income deciles ↓	Average consumption to income ratio
Bottom	124%
Second	77%
Third	74%
Fourth	70%
Fifth	68%
Sixth	76%
Seventh	72%
Eighth	71%
Ninth	67%
Top	55%

Individuals in the bottom income decile appear to consume, on average 124 percent of their income. We need to assume that this ratio is representative of the true consumption to income ratio throughout the 1990s, therefore 124% is an implausibly high ratio. Furthermore, to ensure that the consumption levels monotonically increase with higher income deciles, we assume that the consumption to income ratio for the bottom decile is 100 percent. This yields the consumption levels reported in Table 5.

APPENDIX 5c. Food shares in total expenditure

To obtain consumption to income ratios for each income decile, we use the Chinese Household Income Project 1995 survey. The total consumption variables are those introduced in Appendix 5b. The rural income variable is discussed in Appendix 5a, while the urban income variable is produced with the SAS codes (from the documentation). To obtain food shares in total expenditure for each decile of the income distribution, we put together the rural and the urban surveys in an overall, national survey, which contains 56,437 observations:

Table 5c.1 Food shares in total expenditure, 1995

Income deciles ↓	**Food share in total expenditure**
Bottom	62%
Second	63%
Third	62%
Fourth	61%
Fifth	59%
Sixth	58%
Seventh	56%
Eighth	54%
Ninth	52%
Top	49%

APPENDIX 6. 'Adjusted' Consumer Price Indices

To construct adjusted consumer price indices, we use two approaches. The first approach entails using the publicly available general CPI and food CPI, as well as the average food shares from the 1995 survey to obtain the implied non-food CPI. Then we use the implied non-food CPI, as well as the food CPI and the decile-specific food shares to obtain the 'adjusted' general CPI. (The food share in total expenditure for the bottom 20% of the population is 62.5% and the food share for the national sample is 57.7%.) The second approach uses the food CPI and different proxies for the non-food CPI, as well as decile-specific food shares to obtain the 'adjusted' general CPI. The proxies for the non-food CPI will be the ex-factory price index of industrial products, the means of production index, as well as an index constructed from scratch using the 1995 surveys.

2(a). First proxy: *ex-factory price index of industrial products* (also known as the total industry products price index).

2(b). Second proxy: *means of production price index*

2(c). Third proxy: *a weighted average of the clothing, articles for daily use, and durable consumer goods price indices, where the weights are those in total consumption of these items from the 1995 survey* (10% for durable goods, 60% for clothing, and 30% for daily use consumer goods). Preferred 'adjusted' CPI (see explanation in text).

Table 6.1 'Adjusted' CPIs (1993=100):

Year	Official CPI	'Adjusted' CPIs			
		1	**2(a)**	**2(b)**	**2(c)** - preferred -
1990	79.25	78.65	74.13	72.26	80.18
1991	81.94	81.21	76.85	74.48	82.95
1992	87.18	86.96	84.09	82.13	90.09
1993	100.00	100.00	100.00	100.00	100.00
1994	124.10	125.37	127.67	126.73	123.57
1995	146.07	148.70	153.71	152.12	153.07
1996	158.19	160.85	163.23	161.86	167.86
1997	162.62	164.52	162.96	161.60	168.23
1998	161.32	162.51	157.33	155.79	164.44
1999	159.06	159.46	151.54	150.35	157.73
2000	159.70	159.29	149.99	149.75	152.95
2001	158.42	158.23	149.40	149.21	152.75
Increase in prices b/w 1990-2001	199.91%	201.18%	201.55%	206.48%	190.51%

APPENDIX 7. Pace of poverty reduction

Table 7.1 Average annual percentage change in headcount ratios (Distribution given by: θ_{NA} , π_{off})

Set of parameters	90/92	92/93	93/94	94/95	95/96	96/97	97/98	98/01
$(PPP_{LOW}, NAICE)$	-5.5%	5.9%	-6.4%	-24.8%	-38.6%	-13.0%	-36.2%	17.8%
$(PPP_{HIGH}, NAICE) = (PPP_{LOW}, SICE)$	-7.1%	-1.8%	-8.1%	-11.9%	-17.5%	-10.1%	-4.7%	-2.2%
$(PPP_{HIGH}, SICE)$	-4.7%	-2.1%	-1.3%	-7.9%	-5.5%	-4.6%	-3.6%	-4.4%

Table 7.2 "Growth elasticity of poverty" (Distribution given by: θ_{NA} , π_{off})

Set of parameters	90/92	92/93	93/94	94/95	95/96	96/97	97/98	98/01
$(PPP_{LOW}, NAICE)$	-0.53	0.49	-0.56	-2.66	-4.57	-1.69	-5.34	2.66
$(PPP_{HIGH}, NAICE) = (PPP_{LOW}, SICE)$	-0.70	-0.15	-0.72	-1.28	-2.07	-1.31	-0.69	-0.33
$(PPP_{HIGH}, SICE)$	-0.46	-0.17	-0.11	-0.85	-0.65	-0.60	-0.53	-0.66

Table 7.3 Average annual percentage change in headcount ratios (Distribution given by: θ_{S} , π_{adj})

Set of parameters	90/92	92/93	93/94	94/95	95/96	96/97	97/98	98/01
$(PPP_{LOW}, NAICE)$	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
$(PPP_{HIGH}, NAICE) = (PPP_{LOW}, SICE)$	n/a	-12.8%	-12.0%	-3.7%	-29.5%	-23.6%	-26.2%	-0.5%
$(PPP_{HIGH}, SICE)$	n/a	-9.7%	-6.3%	-3.0%	-8.1%	-10.5%	-6.4%	-7.1%

Table 7.4 "Growth elasticity of poverty" (Distribution given by: θ_{S} , π_{adj})

Set of parameters	90/92	92/93	93/94	94/95	95/96	96/97	97/98	98/01
$(PPP_{LOW}, NAICE)$	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
$(PPP_{HIGH}, NAICE) = (PPP_{LOW}, SICE)$	n/a	-1.05	-1.05	-0.40	-3.49	-3.07	-3.87	-0.08
$(PPP_{HIGH}, SICE)$	n/a	-0.79	-0.56	-0.32	-0.96	-1.37	-0.94	-1.06