Evaluating Regional Poverty in China

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Abstract: This paper analyzes regional poverty in urban China during a period of rapid economic transition, 1988 to 1995. We adopt the "hybrid approach" to poverty measurement, which incorporates elements of both the subjective and objective approaches as well as dominance methodology. First, we use the subjectively determined minimum needs to estimate household equivalence scales. Second, we use objectively determined cost of living indices to adjust for regional differences in purchasing power. Third, we use alternative poverty lines to check for poverty dominance. We find that changes in regional poverty over time are sensitive to both the poverty line selected and the poverty index employed. In addition, the overall poverty rate in China is sensitive to adjustments in both equivalence scales and regional cost of living.

1. Introduction

Market-oriented economic reforms have substantially changed the Chinese economy. Before the reforms, China was a centrally planned economy in which the labor was bureaucratically allocated and wages were administratively regulated. The egalitarian wage system eliminated or minimized wage differences across regions, occupations and genders. A watershed event was Deng Xiaoping's famous 1992 southeastern tour in which he articulated a policy of 'allowing some to get rich earlier' on the premise that 'advanced and richer region could help less advanced and poorer region and both get rich together later.' This led to a clear policy of benefiting some regions of the country at the expense of the others. The purpose of this paper is to investigate changes in regional urban poverty during this period of policy transition.

The impact of Chinese market reforms on poverty and inequality has not escaped the attention of researchers. Kanbur and Zhang (1999) study inland-coastal inequality in China and find that regional inequality has increased many fold. Chang (2002) finds that the main reason for growing inequality in China is the widening rural-urban income gap.

Furthermore, Jones, Cheng and Owen (2003) survey and contribute to the growing literature on the impact of preferential treatment given to some cities on growth and inequality. Khan, Griffith, and Riskin (1999) argue, "economic reform in China has not succeeded in reducing urban poverty (p.298)." Gustafsson and Li (2001) investigate regional inequality and "cannot rule out the possibility that living standards in the west have deteriorated at the lower end of the income distribution and call for further study (p. 65)."

Khan and Riskin (2001) investigate regional poverty in China and find that the "rising trend in urban poverty is nearly universal among the 10 provinces for which we have estimates (p.76)." Gustafsson and Zhong (2000) find that poverty is "very much a rural problem" (p.1005), finding urban poverty rates of less than one percent. Fang, Zhang and Fan (2002) indicate that the trend in urban poverty is sensitive to the time period chosen. Using $1.50 per day as a the poverty line they find that "poverty incidence declined dramatically from 13.74 percent in 1992 to 8.41 percent in 1996, then increased to 9.21% in 1997 and 8.86% in 1998 (p. 441.)" Additionally, they find that the western region has the highest concentration of urban poverty, and the income gap between this region and rest of China has been widening over time.

Gustafsson, Li and Sato (2002, 2004) are the first researchers to apply the subjective poverty methodology to urban China. The subjective method uses survey respondents perceptions of income adequacy to construct poverty thresholds for different family sizes and regions. They find that the subjective methodology provides estimates that are "surprisingly close to the poverty line used for producing official estimates on poverty (p. 14)." Less encouraging, they find that the opinion of what constitute

"minimum needs" varies widely across regions (cities). For example, people in Beijing have minimum needs that are much higher than the rest of the country. In the end Gustafsson, Li, and Sato question the efficiency of a poverty policy based on the subjective method.

Yet it is difficult to deny the attraction of using survey information on income adequacy as opposed to asserting a set of basic needs without recognizing the inherent subjectivity of poverty thresholds. To overcome the shortcoming of both the subjective and objective approaches, Pradhan and Ravallion (2000) recommend a "hybrid approach" to poverty measurement in developing countries settings. Our paper blends these two approaches to analyze regional poverty in urban China. We use the subjective-qualitative method to estimate household equivalence scales. However, to avoid the problem that persons in rich regions tend to have higher perceived needs we use objectively determined cost of living indices to adjust for regional differences in purchasing power.[1] Additionally, we select multiple poverty lines to test the sensitivity of our results to the poverty cut-off income. Finally, we use alternative poverty indices, together with formal inference procedures, to construct poverty rankings.

This paper proceeds as follows. Section 2 discusses poverty measurement. Section 3 describes the Chinese Household Income (CHIP) data. Section 4 briefly introduces the intersection method, specifies two models for estimation of subjective equivalence scales, produces poverty thresholds and equivalence scales, and applies alternative equivalence scales to study overall urban Chinese poverty in 1988 and 1995.

[1] Chen and Ravallion (2004) use regional cost of living adjusted poverty thresholds in their analysis of China's progress against poverty.

Section 5 studies changes in regional poverty between 1988 and 1995. Section 6 concludes the paper.

2. Measuring Poverty

In any study of poverty four fundamental questions must be answered: 1) How to measure economic resources available? 2) How to adjust for household size (i.e. economies of scale)? 3) Where to set the poverty line? and 4) What is the appropriate poverty index? A fifth question, how to adjust for regional cost of living, must also be addressed in a study of regional poverty. The first question is usually answered by the data available (i.e., income vs. consumption).

How to account for families of different size is the equivalent scale question. There are two major approaches to the equivalence scale issue. The first, based on expert opinion, is embodied in the U.S. poverty statistics. The second one is the subjective method, based on personal assessment using survey data. The survey approach attempts to measure a minimum standard of living for alternative family structures. Garner and Short (2003; 2004) survey the literature on subjective poverty equivalence scales.

Very little attention has been given to the sensitivity of Chinese poverty results to the equivalence scale used. For example, both Khan and Riskin (2001) and Fang, Zhang and Fan (2002) ignore economies of scale within households, using per capita income as their recipient unit. The exception to this trend are Gustafsson and Zhong (2000) who use an expert based equivalence scale and Gustafsson, Li, and Sato (2002) who use subjectively determined equivalence scales. Like Gustsfsson, Li, and Sato we use the

intersection method to estimate subjective poverty thresholds. We compare our results to the expert scales of Gustafsson and Zhong.

The third question is that of setting the poverty threshold. Khan and Riskin (2001) provide three levels of poverty lines, their highest being 966 yuan in 1988 and 2291 yuan in 1995. Gustafasson and Zhong (2000) use 908 yuan for 1988 and then scale up their poverty line to 1995 using retail price indices. Fang, Zhang and Fan (2002) suggest $1 per day or 2988 yuan per year for the 1990's. An additional advantage of the subjective poverty method is that it provides poverty thresholds as well as equivalence scales. Given that no single poverty line will garner universal approval we will consider alternative poverty lines to test our results for sensitivity to the poverty threshold. This approach is often referred to as poverty dominance.

To measure poverty, we follow Sen (1976) who argues that poverty should be measured and evaluated using an approach that combines three dimensions of poverty, the headcount of a population living below the poverty line, the income shortfalls of the poor (poverty gap), and the inequality of incomes among the poor. An acceptable measure of poverty must be distribution sensitive, which means that a redistribution of income among families below the poverty line must affect the poverty index. To see the need for a distribution sensitive poverty measure, consider a transfer from the poorest of the poor to families just below the poverty line. This transfer always increases relative inequality among the poor (and this is reflected in distribution sensitive measures) but does not change the universally employed headcount poverty measure.

Due to the limitations of the headcount measure, Sen proposes a poverty index, called the Sen index, which equals the aggregated income gaps between each poor

income and the poverty line, weighted by each individual's relative rank among the poor. Sen Index, which is denoted as *S*, can be written as:

$$S = H\left[I + (1 - I)\, G_P (q / q + 1)\right],$$

where H is the headcount poverty ratio, I is the ratio of the average income shortfall-to-the poverty line (hereafter referred to as poverty gap), G_p is the Gini coefficient of income inequality among the poor, and q is the number of people below the poverty threshold.

Sen's index is simultaneously sensitive to headcount poverty, the income shortfall of the poor (poverty gap) and the distribution of income among the poor. When the head count ratio and average income shortfall (poverty gap) of the poor are both constants, a rise in income inequality among the poor necessarily increases the economic deprivation among the poor. Formal inference procedures for Sen's index and its components are developed in Bishop, Formby and Zheng (1997). The advantage of formal inference procedures is that it allows us to identify cases in poverty levels differ only due to sampling variability.

The final measurement issue is adjusting for regional differences in cost of living. Again, there are two approaches, the subjective method and the objective method. With the subjective method the researcher includes regional controls in the regression analysis and uses them to construct regional price indices. A limitation of this method is that households in rich regions often perceive themselves as having higher minimum needs

than those in poorer regions. This is indeed true in our data and we discuss this in the results section below.[2]

In order to correct for regional cost of living we follow Bishop, Formby, and Zheng (1996) and use the regional price and expenditure data in the *The 1987 Survey of Income and Expenditure of Urban Households in China.* We update the data to 1995 using provincial price indices provides by the China State Statistical Bureau. The appendix provides a further explanation of the provincial price indices.

We divide China into four regions: the Coast region which includes Liaoning, Beijing, Jiangshu, and Guangdong Provinces; the Central region which includes Henan, Hubei, and Anhui; the South West region which includes Yunnan Province; and the North West region which includes Shanxi and Gansu.[3] Table 1 provides the regional cost of living indices. As expected the rapidly developing Coastal region has the highest cost of living in both years while the remote North West region has the lowest cost of living.

3. Data

To study poverty during the period of economic reforms in China we use the 1988 and 1995 Chinese Household Income Project (CHIP) data. The CHIP data was collected as a part of major research program of the Chinese Academy of Social Sciences (CASS). CHIP data comes from two distinct samples of both rural and urban surveys in cooperation with the State Statistical Bureau (SSB) that collects significantly larger samples. Each survey consists of two data files; one in which the individual is the unit of

[2] Garner and Short (2003) find higher poverty in the US Northeast than the South due to the higher perceptions of needs. Pan (2003) uses the subjective method and finds the greatest poverty in Coastal China.

[3] The 1995 data includes Sichuan (a Southwest province). When presenting data for China as a whole we include Sichuan. However, when comparing the Southwest between 1988 and 1995 we omit Sichuan.

analysis and a second in which the household is the unit of analysis.[4] We focus on the urban sample as it provides a monetary measure of minimum needs.

There are several important differences between the 1988 and 1995 data. First of all, the key question for our study, "according to actual conditions in your household, please estimate the monthly cost of maintaining a minimum standard of living for the whole family" is available only for 1995. This means that we must construct poverty thresholds and household size equivalence scales for 1995 and use them with the 1988 data. Second, a measure of total consumption expenditures is available only for 1995 so we must use income to measure poverty across time. Third, the 1988 data does not contain estimates of imputed rent (housing subsidies in-kind) or the value of owner occupied housing so our definition of income does not include these items. Given these exceptions we believe the data is comparable over time, especially for our purpose which is constructing regional poverty orderings.[5] We note that the data excludes the "floating population" of unregistered rural migrants. For a detailed discussion of data comparability over time see Riskin, Zhao, and Li (2001).

Table 2 provides a brief look at the data used in our study. First, we note reasonable sample sizes of 8,929 households (with nonzero incomes) in 1988 and 6,925 households in 1995. Per capita income increases sharply over time from 3,397 yuan (in 1995 yuan) to 4,728 yuan in 1995. However, this rise in income is accompanied by an equally sharp increase in inequality, with the per capita Gini coefficient rising from

[4] Riskin et al (2001a, b) and Griffin and Zhao (1993) provide detailed discussion of the CHIP data. Pan (2003) describes the process of merging the CHIP household and individual sets.

[5] Khan and Riskin (1998, Table 3) estimate that housing subsidies in-kind and owner –occupied rental value are approximately 20 percent of per capita income in both 1988 and 1995. We note that we do not know the distributional impact of housing policy changes over time.

0.2252 in 1988 to 0.2830 in 1995. We also observe a significant decline in family size from 3.53 persons in 1988 to 3.13 persons.

Each of these factors is expected to influence our analysis of poverty over time. First, we anticipate that rising per capita incomes should reduce poverty over time. Secondly, we note that while the relationship between poverty and inequality is not always straightforward the increased inequality may be a signal of rising poverty. Finally, and less obvious is the decline in family size. A decline in family size, everything else equal, will result in a rise in poverty given any economies of scale in household consumption.

4. The Intersection Method of Estimating Thresholds and Equivalence Scales

The intersection method for estimating subjective poverty thresholds and equivalence scales was first developed by Goedhart et al. (1977). Garner and Short (2003) provide a detailed description of the intersection method.

Following Garner and Short we estimate the threshold (Y^*) as the intersection of the relationship:

$$\ln(Y_{\min}) = a_0 + a_1 \ln(Y) + a_2 z_2 + a_3 z_3 + ... + a_n z_n + \varepsilon \qquad (1)$$

with the line $Y_{\min} = Y$ for different values of z_n ($Y_{\min}$ is the answer to the minimum needs question). An important feature of the intersection approach is that it identifies the 'true' minimum-spending threshold from those households who have spending that is at that minimum. As the 'true' minimum is not known a priori, data are collected from a sample of the whole population. Using equation (1) the predicted threshold at the intersection, $Y_{\min} = Y$ is:

$$Y^*(z_2 \ldots z_n) = \exp\left[\frac{a_0 + a_2 z_2 + \ldots + a_n z_n}{1 - a_1}\right] \qquad (2)$$

When households have different family sizes, the responses would be expected to be different. For example, a three-person household without children would be expected to report a higher minimum spending need than a three-person household with children. Variation in responses would also result when the households face the different prices. For example, if the costs of living are higher in the Coastal region than in the Central region then the thresholds will increase. Furthermore, if perceived needs are higher in the Coastal region than in the Central region then the thresholds will also increase.

Model Specification

Table 3 provides descriptive statistics of variables used to estimate subjective equivalence scales. On average, households' annual minimum spending in 1995 is 8,125 yuan, which is about two-thirds of the average households' annual total consumption expenditure. Three-person households with children are the most common family size in our data set and one-person households are uncommon .

We are interested in the two models. Model (1) is the simplest model with family structure indicator variables only,

$$\begin{aligned}\ln(Y_{\min}) = {} & a_0 + a_1 \ln(Y) + a_2 (D2\_60^+) + a_3 (D2\_60^-) + a_4 (D3\_NK) \\ & + a_5 (D3\_K) + a_6 (D4^+\_NK) + a_7 (D4^+\_K)\end{aligned} \qquad (3)$$

In this model $Y_{\min}$ is the level of necessary spending to meet the minimum standard of living for the whole family in 1995. Y is the annual household total consumption. The omitted family size dummy variable is one-person household, denoted as D1. D2_60^+

represents two-person households with household head's greater than or equal to 60 years old. D2_60$^-$ represents two-person households with household head's less than 60 years old. D3_NK represents three-person households without children, while D3_K represents three-person households with children. D4$^+$_NK represents four or more person households without children, while D4$^+$_K represents four or more persons households with children.

Model 2 attempts to control for differing perceptions. Ideally, we would like to control for factors that affect tastes, but not costs. In order to control for perceptions of need without contaminating the family structure and income coefficients we include in Model 2 regional controls as well as five household control variables, head's Party membership, absence of toilet in household, presence of both toilet and bathtub, kitchen, and phone.[6]

Model (2) is based on four regions: Coast, Central, South West and North West,

$$\begin{aligned}\ln(Y_{\min}) = {} & a_0 + a_1 \ln(Y) + a_2 (D2\_60^+) + a_3 (D2\_60^-) + a_4 D3\_NK + a_5 D3\_K \\ & + a_6 (D4^+\_NK) + a_7 (D4^+\_K) + a_8 Coast + a_9 Central + a_{10} North\_West \\ & + a_{11}\text{Party Member} + a_{12}\text{ No Toilet} + a_{13}\text{Toilet/Bath} + a_{14}\text{Kitchen} + a_{15}\text{Phone}\end{aligned} \tag{4}$$

Regression Results

The OLS regression coefficients for Model (1) and Model (2) are presented in Tables 4 and Table 5. The adjusted R^2 for Model 1 is 0.21 and the coefficients for all variables are statistically significantly at conventional significance levels. The regression results of Model (1) indicate that a 10 percent increase in the annual total consumption

[6] For example, marital status is correlated with family size and education and age are correlated with income.

results in 2.7 percent increase in annual household minimum spending. Variation in the family size coefficients meets our expectations. For example, we find a larger coefficient for $D2\_60^-$ than for $D2\_60^+$ implying that younger two person households have higher minimum needs than older two person households. Similarly, we find the coefficient on D3_NK (three persons, no children) is larger than D3_K (three persons, with at least one child).

Model (2) allows geographic variation in minimum spending needs as well as household control variables. Adjusted R^2 increases to 0.32, mostly due to the addition of regional indicators. Relative to the North West, average minimum needs are higher in all other regions, which is consistent with the basic situation in China in 1995. Party members, those with phones, and those with bathtubs show higher minimum needs. Those without toilets and those with kitchens show lower minimum needs.

Poverty Thresholds and Equivalence Scales

We use the regression results of Tables 4 and 5 to construct minimum needs thresholds for seven family types (Model 1) and four regions (Model 2). The predicted thresholds are calculated using Equation (2). Panel A, Table 6 provides the threshold for Model 1. On an annual basis the results in Panel A indicate that one-person households (for urban China as a whole) 'needs' to consume 3,412 yuan to meet its minimum spending requirement. Interestingly, this is very close to the common $1/day poverty line (3,413 yuan per year equals $1.12 per day). Similarly, three-person households with children require 6,054 yuan to meet their annual minimum needs.[7]

[7] Gustafsson et al (2004) using a similar model find a 1 person threshold of Y3468, which is similar to our finding. Their larger household thresholds are slightly smaller than ours.

In Table 7, Panel A we present the predicted poverty thresholds by both region and family size. For one-person households, the annual requirement varies from 3,089 yuan for the North West to 5,012 yuan for the Coastal region. For three-person households with children, the minimum consumption needs are 5,324 yuan in the North West and 8,640 yuan in the Coastal region. In sum, a household in Coastal region would need about 1.62 times as much as a household in the North West. Households in the Central and South West regions require 1.13 and 1.23 times as much as the same household located in the North West. If we compare the regional thresholds of Table 7 to the regional cost of living indices in Table 1 we find that the thresholds imply much larger cost of living differences. However, much of this gap can be explained by the households in the richer regions perceiving higher needs in a manner similar to which higher income households in general perceive higher minimum needs.[8] We found similar regional differences in poverty thresholds in alternative models containing variables such as age, gender, education, marital status, etc.

In Panel B of Tables 6 and 7 we convert the thresholds into equivalence scales. We find that a two-person family composed of two adults with the age of the household's head greater than or equal to 60 years old ($D2\_60^{+}$) would need 1.54 times as much as a single adult, and three-person family without children (D3_NK) would need 1.99 times as much as a single person. Three persons with one child (D3_K) would need a little less, 1.77 times that of a single person. Finally, four or more person households with children ($D4^{+}\_K$) and without children ($D4^{+}\_NK$) have equivalence factors of 2.00 and 2.38.

[8] See Pan (2003) for 1995 poverty results based on consumption as opposed to income. She finds that the poverty rate is highest in the "rich" Coastal region.

Panel B of Table 7 presents the equivalence scales implicit in the thresholds from Model (2). The household size equivalence scales are very similar to Model 1. We do note that families without children have slightly smaller equivalence scales (greater economies of scale) than to those in Model 1.

Effect of Alternative Equivalence Scales on Chinese Urban Poverty

In addition to the subjective equivalence scales there are two other common approaches, the use of per capita income (no economies of scale in a household) and "expert-based" equivalence scales. Gustafsson and Li (2001) provide a set of expert based equivalence scales, which they use to measure the inequality in Chinese incomes.[9] Table 8 compares these different approaches to measuring the economies of scale in a family using income based headcount poverty measures for 1988 and 1995. In this table we use two poverty lines, 2,291 yuan, the poverty line recommended by Khan and Riskin (2001) and 2,988 yuan, or $1/day recommended by Fang et al. (2002), and similar to our subjective poverty threshold. Our purpose is to examine the effect of alternative equivalence scales on poverty headcounts. We use the subjective equivalence scale from Model 1 as it is similar to the scale from Model 2 with slightly smaller economies of scale.[10]

[9] Gustafsson and Li (2001) indicate that one person = 1.0, two persons = 1.88, three persons = 2.66, four persons = 3.54 and five-plus persons = 5.0

[10] One important modification is necessary in order to apply the subjective equivalence scales to the 1988 data. As Table 1 points out, family size fell rapidly between 1988 and 1995. In 1995, the year for which data is available to estimate subjective scales, there are very few families with 5 or more persons. This is not the case in 1988. To address this issue, we use the marginal differences between 3 and 4 person households to estimate the equivalence factor for 5 or more persons in 1988. Thus, for 1988 we assume that $D5^{+}\_NK$ equals 2.77 and $D5^{+}\_K$ = 2.23. We note that approximately 16 percent of households are in the open -ended class in both years.

Beginning with 2,291 yuan poverty line we find that per capita poverty fell from 22.81 percent in 1988 to 12.34 percent in 1995. Using the expert scale we find that poverty declines from 13.02 percent to 7.21 percent in 1995. However, at this low poverty line we find very little change in subjective poverty, with the headcount falling from 1.73 percent in 1988 to 1.34 percent in 1995. Raising the poverty line to 2,988 yuan provides similar results, massive declines in per capita and expert poverty and a modest decline in subjective poverty from 5.02 percent in 1988 to 4.09 percent in 1995.

It is quite apparent that the per capita and subjective approaches paint quite different pictures of poverty reduction in China during this period of rapid economic growth. Perhaps equally as astounding as the rapid income growth is the rapid decline in household size from 3.5 persons in 1988 to 3.1 persons in 1995. With fewer household members there are fewer economies of scale and hence less overall poverty reduction.

In the next section we examine the intensity of regional poverty in China at $1 per day as well as two higher poverty lines. While urban poverty as a whole showed little decline using the subjective poverty scales this conclusion may not hold for all of China's regions.

5. Regional Poverty Comparisons: Urban China, 1988 and 1995

Our purpose is to apply the subjective equivalence scales and regional cost of living deflators developed above to rank regional poverty in China for 1988 and 1995. Table 9 provides the regional equivalent (Model 1) adjusted for cost of living differences for 1988 and 1995. In 1988 we find that the Coast (6,134 yuan) and South West (6,223 yuan) regions have similar mean incomes, followed by the Central (5,826) and North

West (5,387 yuan) regions. However, the growth of mean equivalent income varies widely by region from 43.7 percent in the Coastal region to 11.3 percent in the South West. From Table 9 we can see that incomes in the Central region grew about twice as fast as those in the South West and North West. Likewise, incomes in the Coast region grew almost twice as fast as those in the Central region.

It is important to note that while the regional cost of living adjustments have no effect on the overall urban China mean income this is not the case for the poverty statistics. Previous to Table 9, we made no adjustments for regional cost of living; in all of the following tables each income is corrected using the provincial cost of living indices presented in the Appendix.

To see the impact of correcting for regional cost of living we compare the headcount ratios presented in Table 8 with those in Tables 10 and 11. Table 8 shows for 1988 5.0 percent of urban Chinese fall below a poverty line of 2988 yuan; however, Table 10 shows the headcount at the same poverty line as only 4.4 percent. Similarly, for 1995 Table 8 shows a 4.1 percent poverty count and Table 11 shows only 3.1 percent. We can explain this result by noting that adjusting for regional cost of living raises the incomes in the poor North West and Central regions and lowers incomes in the wealthier Coast, with the net result being an overall lower poverty rate. In sum, failing to adjust for regional cost of living in our data results in an overstatement of the poverty rate in urban China.[11]

Regional Poverty Orderings

[11] The urban China poverty rates unadjusted for regional cost of living are: at $1.25/ day—1988 12.2%, 1995 8.9%; at $1.50/day—1988 24.6%, 1995 17.1%

Tables 10 and 11 present the Sen index and its components for each region and urban China as a whole for 1988 and 1995. We consider three alternative poverty lines, ranging from $1.00 (2,988 yuan), $1.25 (3,725 yuan), and $1.50 (4,482 yuan) per day. As noted above, the subjectively determined poverty line (Model 1) lies in this range at 3,413 yuan for 1995. Using alternative poverty line allows us to examine the sensitivity of our findings to the choice of the poverty line. To account for sampling variability we construct standard errors as described by Bishop, Formby and Zheng (1997).

Tables 10 and 11 contain a great deal of information and we focus on the Sen index and headcount ratio. We begin by examining regional poverty at each point in time and then examine changes in regional poverty over time.

The regional poverty ordering for 1988 is quite transparent—at all poverty lines considered there is no statistically significant difference in Sen poverty between the Coast, Central and South West regions while the North West has remarkably higher Sen poverty. Our findings are similar for the headcount ratio at the $1.00 and $1.25 poverty lines. At $1.00 per day the Coast, Central and South West have poverty rates of about 3 percent; at $1.25 per day the poverty rates are just over 8 percent. The North West lags behind with poverty rates of 10 and 22 percent. At the highest poverty line ($1.50) the headcount poverty levels begin to diverge: the South West (0.163) dominates the Coast (0.184), the Coast dominates the Central (0.206), and the Central dominates the North West (0.356).

Table 11 presents the Sen index and its components for 1995. As with 1988, the North West region is clearly poorer than any of the other regions. By 1995 the Coast emerges as the lowest poverty region--at all three poverty lines the Coast has both lower

Sen and headcount poverty than the Central region. The point estimates for the South West region suggests that its poverty level lies between the Coast and Central regions; however, due to this region's smaller sample size (647 cases without Sichuan) many of these differences are not statistically significant.

We summarize our findings by examining the headcount ratio at the poverty threshold of $1.25 per day. The North West is unambiguously the poorest region, but its poverty level is falling rapidly over time from 22 percent to 15 percent. The Coast has the lowest poverty rate in 1995 and the poverty rate fell nearly in half from 8.1 to 4.4 percent. The Central region experienced the smallest decline poverty falling from 8.6 to 7.2 percent The South West poverty rate fell from 8.1 to 5.8 percent between 1988 and 1995, although this change is not statistically significant at conventional levels.

Table 12 provides the results of inference tests on the Sen and headcount indices. A minus ("-") indicates a decline in poverty while a zero ("0") indicates no significant difference over time. The first entry is the Sen index results, followed by the head count result. We note that the Coast and North West enjoy declines over time in both poverty measures at each poverty line. The Central region enjoys declines in headcount poverty at all three poverty lines while the Sen poverty level does not change over time at the lowest two poverty lines. The Central region's Sen index remains unchanged due to increases in it's income gap, pointing out the need to look beyond the simple headcount ratio when evaluating poverty. Finally, the South West region shows no significant difference in poverty level between 1988 and 1995 except at the highest poverty threshold ($1.50/day).

6. Conclusion

This paper analyzes regional poverty in urban China during a period of rapid economic transition, 1988 to 1995. We adopt the "hybrid approach" to poverty measurement, which incorporates elements of both the subjective and objective approaches. We use the subjective method to determine poverty thresholds and equivalence scales. However, to avoid the problem that persons in rich regions tend to have higher perceived needs we use objectively determined cost of living indices to adjust for regional differences in purchasing power.

Using the subjective method, we find a poverty threshold of between $1 and $1.25 per day. In contrast to previous studies that use per capita income, we find substantial household economies of scale; for example, a four person household (two adults, two children) requires only twice that of a single adult household. Using the subjective equivalence scales, regional cost of living adjustments and a $1.25 per day poverty line we find poverty rates for urban China of 11 percent in 1988 and 8 percent in 1995. Our results suggest that declines in family sizes (fewer economies of scale) between 1988 and 1995 slowed the overall poverty reduction in urban China.

While regional cost of living adjustments have no effect on China's overall mean income they do impact the poverty statistics. We find that failing to correct for cost of living adds approximately one percentage point to the urban poverty rate in both years. We can explain this result by noting that adjusting for regional cost of living raises the incomes in the poor regions and lowers incomes in the wealthier regions, with the net result being an overall lower poverty rate.

We find important changes in regional poverty between 1988 and 1995. In 1988 we find little difference in poverty across three of the four regions, with the North West having significantly higher rates of poverty. In 1995, the Coast has the lowest poverty, followed by the South West and Central regions. At a poverty line of $1.25 per day the North West poverty rate fell from 22 percent to 15 percent, the Coastal poverty rate fell from 8.1 percent to 4.4 percent, the Central region poverty rate fell from 8.6 percent to 7.2 percent and the South West region's poverty rate declined from 8.1 percent to 5.8 percent. Finally, a careful evaluation of the changes in poverty in the Central region points out the need to look beyond the headcount at distribution–sensitive measures of poverty. While the Central regions headcount ratio fell at all three poverty levels, the income gap increased, resulting in no change in the Sen index at the lowest two poverty levels.

Appendix: Constructing Regional Cost of Living Indices

We use the regional cost of living indices constructed by Bishop, Formby, and Zheng (1996) for the 1988 data and escalate them using the overall urban provincial CPI's. Bishop, Formby, and Zheng use *The 1987 Survey of Income and Expenditure of Urban Households in China* price and expenditure data for food and nondurables to calculate cost of living for 15 provinces, nine of which are in our sample. The missing provinces, Beijing and Gansu we assume are the averages of nearby provinces. Although our analysis is based on regions we correct for cost of living at the provincial level.

Table A: Provincial Cost of Living Indices, 1988 and 1995

	1988	**1995**
Beijing .	1.00	1.12
Liaoning	1.03	1.03
Jiangsu	0.97	0.99
Guangdong	1.32	1.23
Hubei	0.94	0.98
Henan	0.88	0.81
Anhui	0.96	0.97
Gansu	0.94	0.93
Yunnan	0.97	1.01
Sichuan	0.93	0.97

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Table 1. Regional Cost of Living Indices, 1988 and 1995

	1988	1995
Coast	1.09	1.08
Central	0.92	0.92
Southwest	0.97	1.03
Northwest	0.94	0.93

Note: Urban China equals 1.

Table 2. Real Income and Gini Coefficients, Urban China 1988 and 1995

	1988	1995
Family Income	11,544 (58)	14,233 (103)
Family Gini	0.2286 (.0024)	.2797 (.0033)
Per Capita Income	3397 (17)	4728 (35)
Per Capita Gini	.2252 (.0025)	.2830 (.0035)
Equivalent Income	5924 (27)	7683 (53)
Equivalent Gini	.2085 (.0024)	.2682 (.0033)
Family Size	3.53	3.13
Sample Size	8929	6925
Urban CPI	1.00	2.229

Equivalent income uses subjective scales developed below.

Table 3. Sample Means and Standard Deviations of Variables Included In the 1995 China Annual Minimum Spending Regressions of Ln(Ymin)

Variable	N	Mean	Std Dev
Reported monthly minimum spending	6656	677.1	455
Annual minimum spending (Ymin)	6656	8124.6	5462
Annual Total consumption expenditure (Y)	6656	12224.9	10462
D1 (1 person)	53	0.0080	0.0889
D2_60^{+} (2 persons, household head >= 60)	529	0.0795	0.2705
D2_60^{-} (2 persons, household head < 60)	623	0.0936	0.2913
D3_NK (3 persons, no children)	844	0.1268	0.3328
D3_K (3 persons with children)	2951	0.4434	0.4968
D4^{+}_NK (4 persons or more, no children)	530	0.0796	0.2707
D4^{+}_K (4 persons or more with children)	1126	0.1692	0.3749
COAST	2360	0.3546	0.4784
CENTRAL	1789	0.2688	0.4434
SOUTH_WEST	1460	0.2194	0.4138
NORTH_WEST	1047	0.1573	0.3641
Party Member	2264	0.3402	0.4738
No Toilet	2159	0.3243	0.4681
Toilet and Bath	2362	0.3549	0.4785
Kitchen	5574	0.8374	0.3690
Phone	2014	0.3026	0.4594

Note:

N represents the number of observations for each variable

D1 is the dummy variable which represents one-person household

D2_60^{+} is the dummy variable which represents two-person household with the age of the head > = 60

D2_60^{-} is the dummy variable which represents two-person household with the age of the head < 60

D3_NK is the dummy variable which represents three-person household without children

D3_K is the dummy variable which represents three-person household with children

D4^{+}_NK is the dummy variable which represents more than four persons' household without children

D4^{+}_K is the dummy variable which represents more than four persons' household with children

COAST is the region dummy variable which represents Beijing, Liaoning, Jiangshu, Guangdong

CENTRAL is the region dummy variable which represents Hubei, Henan, Anhui

SOUTH_WEST is the region hummy variable which represents Yunan, Sichuan

NORTH_WEST is the region dummy variable which represents Shanxi, Gansu

TABLE 4. Model 1 Regression Results
(Dependent Variable, Minimum Consumption Needs)

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	5.93946	0.08784	67.62	<.0001
LOGH53	0.26991	0.0075	35.98	<.0001
D2_60$^+$	0.31736	0.06224	5.1	<.0001
D2_60$^-$	0.34046	0.06187	5.5	<.0001
D3_NK	0.50312	0.06134	8.2	<.0001
D3_K	0.41857	0.05995	6.98	<.0001
D4$^+$_NK	0.63343	0.06247	10.14	<.0001
D4$^+$_K	0.5061	0.06085	8.32	<.0001

Adjusted R^2 = .21

Note: See Table 2 for the definition of the dummy variables; LOGH53 is the Logarithm of the Total Consumption, 1995;

TABLE 5. Model 2 Regression Results
(Dependent Variable, Minimum Consumption Needs)

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	6.56336	0.08465	77.54	<.0001
LOGH53	0.18321	0.00736	24.91	<.0001
D2_60$^+$	0.32332	0.05728	5.64	<.0001
D2_60$^-$	0.36460	0.05688	6.41	<.0001
D3_NK	0.51056	0.05643	9.05	<.0001
D3_K	0.44473	0.05513	8.07	<.0001
D4$^+$_NK	0.65049	0.05749	11.32	<.0001
D4$^+$_K	0.55579	0.05602	9.92	<.0001
COAST	0.39544	0.01552	25.48	<.0001
CENTRAL	0.09744	0.01567	6.22	<.0001
NORTHWEST	0.16800	0.01668	10.07	<.0001
Party Member	0.04582	0.01044	4.39	<.0001
No Toilet	-0.13471	0.01315	-10.25	<.0001
Toilet and Bath	0.01155	0.01215	0.95	<.0001
Kitchen	-0.06687	0.01448	-4.62	<.0001
Phone	0.09273	0.01114	8.32	<.0001

Adjusted R^2 = .34

Note: See Table 1 for the definition of the dummy variables; LOGH53 is the Logarithm of the Total Consumption, 1995;

Table 6.

Panel A: PREDICTED THRESHOLDS—MODEL 1

D1	D2_60^{+}	D2_60^{-}	D3_NK	D3_K	D4^{+}_NK	D4^{+}_K
3412.65	5270.76	5440.19	6797.87	6054.50	8126.20	6825.67

Panel B: EQUIVALENCE SCALES-- MODEL 1

D1	D2_60^{+}	D2_60^{-}	D3_NK	D3_K	D4^{+}_NK	D4^{+}_K
1.00	1.54	1.59	1.99	1.77	2.38	2.00

Note: See Table 1 for the definition of the dummy variables.

Table 7.

Panel A: PREDICTED THRESHOLDS By REGION—MODEL 2

	D1	D2_60^{+}	D2_60^{-}	D3_NK	D3_K	D4^{+}_NK	D4^{+}_K
COAST	5012	7216	7833	9365	8640	11115	9899
CENTRAL	3480	5149	5438	6502	5999	7718	6873
SOUTHWEST	3794	5614	5929	7089	6540	8414	7493
NORTHWEST	3089	4570	4827	5771	5324	6850	6100

Panel B: EQUIVALENCE SCALES by REGION-- MODEL 2

	D1	D2_60^{+}	D2_60^{-}	D3_NK	D3_K	D4^{+}_NK	D4^{+}_K
	1.00	1.48	1.56	1.87	1.72	2.22	1.97

Note: See Table 1 for the definition of the dummy variables.

Table 8. Headcount Poverty for Alternative Equivalence Scales, 1998 and 1995

A. Poverty Line 2291 Yuan

	1988	1995
Per Capita	.2281 (.0044)	.1234 (.0039)
Expert	.1302 (.0035)	.0721 (.0031)
Subjective	.0173 (.0014)	.0134 (.0014)

B. Poverty Line 2988 Yuan

	1988	1995
Per Capita	.4896 (.0053)	.2756 (.0054)
Expert	.3333 (.0059)	.1774 (.0046)
Subjective	.0502 (.0023)	.0409 (.0024)

Table 9. Regional Equivalent Mean Income

	1988	1995	Percentage Change
Coast	6134 (40)	8870 (92)	43.7
Central	5826 (40)	7167 (70)	23.0
Southwest	6223 (72)	6683 (90)	7.4
Northwest	5387 (71)	6038 (79)	12.1

Incomes deflated by regional cost of living indices (see Table 1).

Table 10. Sen Indices of Poverty and Components, 1988

Poverty Line	Region	Sen Index	Components		
			Headcount	Income Gap	Gini (poor)
2,988($1.00)	COAST	0.008 (.001)	0.032 (.003)	0.174 (.014)	0.096 (.010)
	CENTRAL	0.008 (.001)	0.030 (.003)	0.174 (.018)	0.105 (.011)
	SOUTHWEST	0.010 (.002)	0.033 (.006)	0.212 (.032)	0.118 (.024)
	NORTHWEST	0.033 (.003)	0.103 (.008)	0.223 (.013)	0.119 (.003)
	CHINA	0.013 (.002)	0.044 (.002)	0.198 (.008)	0.111 (.006)
3735($1.25)	COAST	0.022 (.006)	0.081 (.005)	0.187 (.009)	0.100 (.006)
	CENTRAL	0.022 (.006)	0.086 (.006)	0.174 (.009)	0.098 (.006)
	SOUTHWEST	0.024 (.003)	0.081 (.009)	0.199 (.020)	0.117 (.014)
	NORTHWEST	0.071 (.004)	0.219 (.011)	0.227 (.010)	0.125 (.006)
	CHINA	0.031 (.001)	0.108 (.003)	0.199 (.005)	0.111 (.003)
4482($1.50)	COAST	0.049 (.002)	0.184 (.006)	0.182 (.006)	0.102 (.004)
	CENTRAL	0.052 (.003)	0.206 (.008)	0.175 (.006)	0.095 (.004)
	SOUTHWEST	0.048 (.005)	0.163 (.012)	0.205 (.013)	0.119 (.009)
	NORTHWEST	0.124 (.006)	0.356 (.012)	0.250 (.008)	0.133 (.005)
	CHINA	0.064 (.002)	0.220 (.004)	0.202 (.004)	0.112 (.002)

Table 11. Sen Indices of Poverty and Components, 1995

Poverty Line	Region	Sen Index	Components		
			Headcount	Income Gap	Gini (poor)
2,988($1.00)	COAST	0.005 (.001)	0.019 (.003)	0.185 (.022)	0.102 (.014)
	CENTRAL	0.008 (.001)	0.026 (.004)	0.188 (.025)	0.106 (.022)
	SOUTHWEST	0.006 (.002)	0.021 (.006)	0.190 (.042)	0.098 (.013)
	NORTHWEST	0.020 (.003)	0.067 (.008)	0.216 (.018)	0.108 (.008)
	CHINA	0.006 (.001)	0.031 (.002)	0.200 (.010)	0.108 (.007)
3735($1.25)	COAST	0.013 (.001)	0.044 (.004)	0.200 (.015)	0.105 (.009)
	CENTRAL	0.020 (.002)	0.072 (.006)	0.185 (.014)	0.107 (.010)
	SOUTHWEST	0.016 (.003)	0.058 (.009)	0.181 (.026)	0.104 (.016)
	NORTHWEST	0.047 (.004)	0.149 (.011)	0.225 (.013)	0.116 (.008)
	CHINA	0.022 (.001)	0.078 (.003)	0.200 (.007)	0.109 (.004)
4482($1.50)	COAST	0.026 (.002)	0.090 (.006)	0.200 (.011)	0.117 (.007)
	CENTRAL	0.043 (.006)	0.180 (.009)	0.180 (.009)	0.104 (.006)
	SOUTHWEST	0.033 (.005)	0.121 (.013)	0.193 (.018)	0.104 (.012)
	NORTHWEST	0.087 (.006)	0.263 (.014)	0.235 (.010)	0.126 (.006)
	CHINA	0.045 (.002)	0.152 (.005)	0.205 (.005)	0.114 (.003)

Table 12. Regional Poverty Comparisons Across Time

	Poverty Line					
Region	***2988 ($1.00)***		***3735 ($1.25)***		***4482 ($1.50)***	
COAST	–	–	–	–	–	–
CENTRAL	0	–	0	–	–	–
SOUTHWEST	0	0	0	0	-	-
NORTHWEST	–	–	–	–	–	–

NOTE: *1st entry is Sen index, 2nd entry is headcount. '0' implies no change, '–' implies decline in poverty.*