Evaluating Regional Poverty in China With Subjective Equivalence Scales

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Abstract

This paper analyzes the poverty in urban China in 1995 using 1995 Chinese Household Income Projects (CHIP) data. It applies the intersection method to estimate the minimum poverty thresholds and the implicit equivalence scales that differentiate according to family sizes and regional characteristics. The Sen Index of Poverty and Headcount Index are estimated at four distinct poverty thresholds for 1995. Using formal statistical inference procedures and equivalence scales based on household composition only we find that the Coastal region has the lowest poverty. In contrast, the Coastal region shows the highest poverty level if we control for region.

Keywords: poverty, Intersection method, equivalence scales, Headcount Index, Sen Index

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1. Introduction

Beginning with the urban reforms in the 1990s in China, researchers and policy makers have expressed growing concern about the relationship between economic growth and urban poverty. Fang, Zhang and Fan (2002) 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. They also argue that the rapid economic growth has been major force behind reduction in urban poverty. However, their study does not consider economies of scale within households. The use of household consumption expenditure per capita data implicitly assumes each person should receive an equal weight of one. This approach represents an extreme treatment of the problem of household size.

Poverty researchers in U.S. claim that choosing a diving line between the poor and non-poor is difficult, and specific poverty lines and equivalence scales are arbitrary. Bishop, Formby and Zheng (1997) state that from the perspective of unanimous agreement, concerning whether a person is poor, there are two related issues, both of which are somewhat intractable. The first involves defining basic needs and establishing a minimum standard of living below which a person is poor. The second is the problem of how to account for differences in family size, composition and circumstance. This is the equivalence scale issue.

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 (see Van Praag, 1968; Hagenaars, 1986) attempts to measure a minimum standard of living for alternative family structures. Garner et al. survey the literature on subjective poverty measures. We follow Garner et al. and apply the intersection method to estimate poverty thresholds, with using the 1995 Chinese Household Income Projects (CHIP) Survey data.

This paper improves upon the earlier study of poverty in China in three ways: (i) we analyze the poverty in urban China in 1995 using CHIP survey data to estimate the minimum poverty thresholds and the equivalent scales. (ii) to incorporate all relevant 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 (GINI), we apply the Sen index of poverty. (iii) we apply formal statistical inference procedures to test for significant differences in poverty measures and to determine whether changes in poverty rankings are sensitive to the variations in the poverty lines chosen.

This paper proceeds as follows. Section II describes the data and variables used in the various model specifications considered. Section III briefly introduces the intersection method to produce the minimum living threshold and specification of model. Section IV includes the regression results, estimated thresholds, implicit equivalence scales and Sex indices. Section V discusses inference based dominance methods for evaluating regional poverty and provides some reasons for observed trends. Section VI concludes the paper.

2. Data

This study of poverty in China uses the 1995 Chinese Household Income Projects (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 analysis and a second in which the household is the unit of analysis.

In this paper, we use the urban sample which includes 21,698 observations in urban individual data and 6931 observations in urban household data for eleven provinces during the survey year. We focus on the households' answer to two survey questions, 'the monthly

cost of maintaining a minimum standard of living for the whole family in 1995' and 'the total consumption expenditures in 1995'. We combine the information from the household and individual files to create seven family size variables and four regional variables. To obtain the family size variables, we categorize the household data set according to the age of the household head and the number of persons with or without children in each household. See Section III for precise definition of family size and regional variables[2].

Table 1 shows the descriptive statistics of main variables. On average, households' annual minimum spending in 1995 is CNY8124.65, which is about 66.5% of households' annual total consumption expenditure. We can find that three-person household with children is the most common family size in our data set. We note the low frequency of one-person households. It suggests that further division of the one-person households by four different regions may result in non-economies of scales in our study[3].

3. The Intersection Method

Our approach to threshold estimation is the regression-based intersection method. The intersection method is used to estimate the threshold with the resulting coefficients from regression using 1995 CHIP data. Goedhart and colleagues (1977) first introduced the intersection method of producing subjective minimum thresholds. The threshold (Y^*) is calculated as the intersection of the relationship:

[2] Since there is no any variable indicating the number of persons in each household, the individual data is used to count it in each household, along with the number of adults and the number of children. According to the regulation of legal age to be considered adults in China, we define the adults in one household as persons whose age are larger than or equal to 18 years old. In order to get the data set that includes the record of the household head with these three variables from the urban individual data, we deal with the families that have two head records and no head records. For urban household data set, in order to avoid the selection error, we consider two kinds of problems with it, one is that there are three families with two observations which means they are recorded two times, the other is that there exist 270 observations in which the respondents' answer to one of the two questions we mentioned above is zero. Therefore, the final household data set we got includes 6,656 observations.

[3] Comparison of equivalence scales by using various model specifications clarifies such concern.

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

with the line $Y_{\min} = Y$ for different values of z_n. Figure 1. shows the determination of poverty threshold[4].

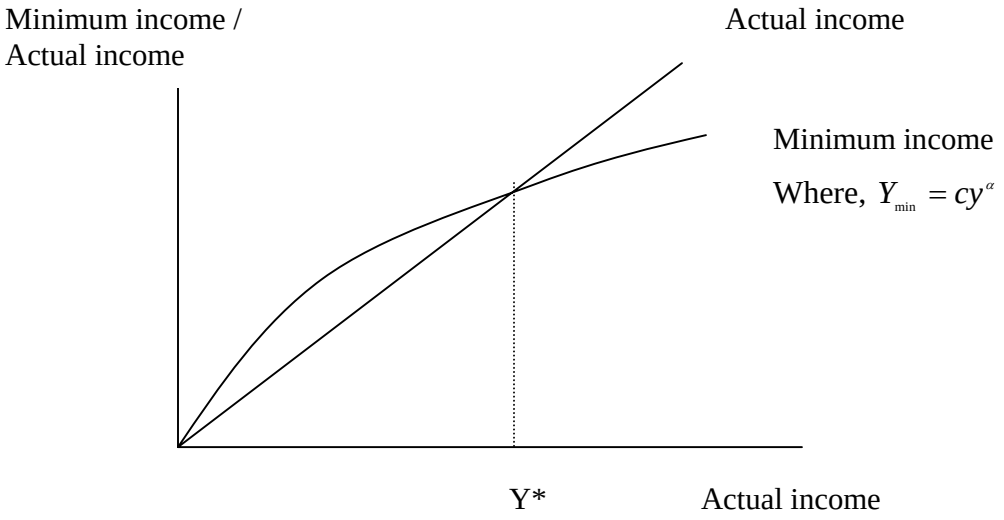

Figure 1. Determination of the poverty threshold

We assume that the error term, ε, satisfied the classical assumptions for simplicity. $Y_{\min}$ represents the answer to the question about the minimum income that the respondent thinks is needed for the family to make ends meet, or some variation of that question. Previous research indicates that a log-linear model fits SIPP data (the U.S. Survey of Income and Program Participation) when $Y_{\min}$ represents the answer to a question about the minimum income fairly well. In this paper $Y_{\min}$ is the annual minimum spending that the respondent thinks is needed for the family to maintain a minimum standard of living. Y is the total consumption expenditure in 1995, which we believe is a better measure of household welfare than income.

[4] See Page 31 on A.J.M. Hagenaars's book named "The Perception of Poverty" (1986) for details.

An underlying assumption for the intersection approach to estimate a minimum spending based threshold is that only those who have spending that is at the minimum know what the 'true' minimum is. Since that minimum is not known for a society a priori, data are collected from a sample representing the whole population. The predicted threshold based on equation (1) and the intersection of $Y_{\min} = Y$ is:

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

As the error term, ε, is not observable, there are different possible choices to deal with the term. One could produce the mean prediction and include a term to account for Jensen's inequality or one could assume a median prediction. In our model specification, z_2 to z_n are simple indicator variables, which results in no distinction between median and mean prediction.

An important assumption underlying the approach is that every respondent understands the wording used in the 1995 CHIP Survey in the same way. For example, 'the monthly cost of maintaining a minimum standard of living' is assumed to have the same meaning for every respondent. 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 for necessary commodities were higher in the coastal region than that in the central region, thresholds would increase. Furthermore, if perceived needs are higher in the coastal region than that in the central region, the thresholds will also increase. However, the regression intersection approach can control for differences in responses due to reference group effects.

Specification of Model and Explanatory Variable

In this paper, we are interested in questions such as: 'is there significant difference in the level of poverty among the various family sizes or in pair-wise comparison within the four selected regions?' 'Is there difference in the level of poverty within the various family size considering the different cost of living across different regions?' 'Is the regional poverty ranking sensitive to the poverty to the poverty line and equivalence scales used?'

To explore these questions, we use the various models, from the simplest one just with family size dummy variables to more complicated ones which include the interaction terms. However, since there are few observations in one-person household category as we mentioned in section II, when the interaction terms are considered in the model we cannot get the economies of scale within the various family size considering the cost of living across different regions. We don't report the regression results, threshold table and the equivalent scale table from these models[5].

Just including the family size variables and region variables in our model could lead to bias in the model. For example, the households with higher education level could have relatively higher minimum needs than those with lower education level. And coastal region could attract numbers of higher educated people to develop because of more challenging job chances than central region. However, in this paper we assume that region variables can capture all other factors that influence households' minimum needs and vary by regions.

Under this assumption, we are interested in the two models. Model (1) is the simplest model just with family size dummy variables. Since it does not control for the cost of living across the four selected regions, it results in the classical economies of scale across family size.

[5] These results of the alternative models can be reported if required.

$$\ln(Y_{\min}) = a_0 + a_1 \ln(Y) + a_2 DM2 + a_3 DM3 + ... + a_7 DM7 \quad (3)$$

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 which is noted as DM1. DM2 represents two-person household with the age of the household head larger than or equal to 60 years old. DM3 also represents two-person household, but the age of the household head is less than 60 years old. DM4 represents three-person household without children, while DM5 represents three-person household with children. DM6 represents more than four persons' household without children, while DM7 represents more than four persons' household with children.

Compared to Model (1), Model (2) adds three region dummy variables. Based on the data we got, we divide China into four regions: Coast, Central, Southwest and Northwest[6].

$$\ln(Y_{\min}) = a_0 + a_1 \ln(Y) + a_2 DM2 + a_3 DM3 + ... + a_7 DM7 + a_8 Coast + a_9 Central + a_{10} North\_West \quad (4)$$

In this regression, the omitted region dummy variable is named Southwest. The OLS coefficients are represented in Table 2 and Table3. The addition of the regional dummies shifts the thresholds for each family size, but does not change the economies of scales between any two family types.

4. RESULTS

The results of the OLS regression Model (1) and Model (2) will be used to produce minimum thresholds, equivalence scales (defined in equivalence scale section), adjusted annual household total consumption (defined in later section) and Sen Indices (including

[6] Coast region includes Liaoning, Beijing, Jiangshu, Guangdong. Central region covers Hunan, Hubei, Anhui. Southwest region covers Yunnan and Sichuan. Northwest region includes Shanxi and Gansu.

Headcount Index, Gap Index and Gini Index). The minimum threshold from regression of Model (2) is compared to three exogenous thresholds which will be introduced in threshold section. Based on these four selected thresholds, we conduct the statistical tests to make inferences about distribution sensitive poverty measures of China poverty in 1995.

4. a. Regression Results

The OLS regression coefficients for Model (1) and Model (2) are presented in Table 2 and Table 3. Both models give a somewhat reasonable explanation on the variation in responses, although Model (2) is somewhat better. Adjusted R^2 are 0.3109 and 0.2138 respectively. The p-value of t-statistics indicates that the coefficients for all variables in these two models are statistically significantly different from zero at any conventional significance level. The signs of the relationships between the family size dummy variables and reported minimum spending needs are the same for both models. The regression results of Model (1) indicate that 1 percent increase in the annual total consumption results in 0.27 percent increase in annual household minimum spending; two-person households with the age of the households' head greater than or equal to 60 years old (DM2) have 31.7% higher minimum needs than one-person household (DM1), while two-person households with the age of the households' head less than 60 years old (DM3) have 34% higher minimum needs than one-person household. Furthermore, Three-person households without children (DM4) have 50.3% higher minimum needs than one-person households, while three-person households with children (DM5) have 41.9% higher minimum needs than one-person households. Generally speaking, since the old people consume less than other adults, the minimum needs are lower; similarly, children consume less than the adults, so the households with children have lower minimum needs than the same size households without children. In Model (2), the

geographic variation in minimum spending needs are reflected in the coefficients for the region dummy variables. The reference region is Southwest. We obtain the similar results for the family size variables from Model (2) as in Model(1). Relative to the average households' minimum needs in Southwest, the average minimum needs are about 24.4% higher in Coastal region, 6.25% less in Central region and 17% less in Northwest, holding the family sizes factors constant. These regression results indicate that households living in Coastal region reported higher minimum spending needs than those in other areas. And the households in Central and Northwest had lower minimum spending needs than those in Southwest. These results are consistent with the basic situation in China in 1995.

4. b. Threshold Results

In this section we use the regression results of Table 2 and Table 3 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 of Table 4 provides the threshold for Model 1. On an annual basis the results in Panel a of Table 4 indicate that one-person households (for urban China as a whole) 'needs' CNY3,412.65 to meet his minimum spending requirement. Similarly, three-person households with children require CNY6,054.50 to meet their annual minimum needs.

Panel a of Table 5 provides the predicted thresholds which allow for regional variation in minimum needs. For one-person households, the annual requirement varies from CNY2,670.73 for the Northwest to CNY4,514.38 for the Coastal region. For three-person households with children, the minimum needs are CNY4,797.53 in the Northwest and CYN8,109.35 in the Coastal region.

4. c. Equivalence Scale

The equivalence scale implicit in the thresholds is used to reflect the relative needs in different family size, composition and circumstance. It is presented as ratios of amounts, needed by families or households of different size and/or structure relative to that need by the reference family size. This procedure allows us to check the sensitivity of our findings to variations in household size across regions in urban areas. In our paper, based on Model (1), one-person household is the reference family size, while based on Model (2), one-person household living in Northwest is the reference family size. Spending amounts ratios for different family or household types are used.

How can we interpret the equivalence scales? Additional person of a household adds extra costs for basic necessities, but there are clear economies of scales within households. For example, Panel b of Table 4 presents the equivalence scales implicit in the thresholds from Model (1) without considering the region division using 1995 Chinese data. A one-person household would need one unit of spending to maintain the minimum need of living compared to a two-person family composed of two adults with the age of the household's head larger than or equal to 60 years old who would need 1.54 times as much as a single adult, and three-person family without children who would need 1.99 times as much as a single person. In this table, all the equivalence scales are computed relative to the thresholds for one-person households.

Panel b of Table 5 presents the equivalence scales implicit in the thresholds from Model (2) considering the region division using the 1995 Chinese data. A one-person household living in Northwest would need the one unit of spending to maintain the minimum need of living compared to a two-person family composed of two adults with the age of the household's head larger than or equal to 60 years old who would need about 1.56 times as much as a single person living in the Northwest. However, due to the different cost of living in these four selected regions, a one-person household in Coastal region would need about

1.69 times as much as a single person living in the Northwest. All equivalence scales for this table are computed relative to the threshold for one-person households in the Northwest. Since Model (2) does not include the interaction terms, we assume that there is no difference in the household structure equivalence scales across regions.

To interpret our results, we consider the following two examples. Example one, for one-person households in column 1, we regard the function of the cost of living and the people's expectation on quality of life in order to escape from poverty in the Northwest as one. Then we obtain equation (i) for one-person households.

i) Coast versus Northwest: 1.69 = 1 * f (cost of living in Coast, people's expectation on quality of life to escape from poverty in Coast)

The ratio of the equivalence scales between Coast and Northwest for one-person households is 1.69/1 = 1.69. It means that one-person households need 1.69 additional spending in Coastal region relative to those in the Northwest.

For two-person household with the age of the household's head greater than 60 years old in column 2, we obtain equation (ii).

ii) Coast versus Northwest: 2.64 = 1.55 * f (cost of living in Northwest, people's expectation on quality of life to escape from poverty in Northwest)

The ratio of the equivalence scales between Coastal region and the Northwest is also 2.64/1.55 = 1.69. It indicates that such households in Coastal region also need 1.69 additional spending in Coastal region relative to those in the Northwest. With the same method, we can find that for any two regions, the ratio of the equivalence scales will be same within each type of the household size.

Example 2, we can compare the ratio of the equivalence scales for different household sizes across regions. In the Coast, for one-person households (DM1) and three-

person households without children (DM4), the ratio between them is 3.34/1.69 = 1.97. It means that in Coast 1.97 additional spending needed for three adults relative to one-person households.

In Central region, for the same two types of household size, the ratio between them is 2.27/1.15 = 1.97. It means that in Central a household with three adults relative to one-person household needs 1.97 additional spending. We can get the same ratio for the Southwest and the Northwest in this case. Therefore, there is no difference in equivalence scales between various family sizes across region.

4. d. Poverty Lines

The results in Panel a of Table 4 and Table 5 can be used to be normalized to produce equivalence scales or be used directly as poverty lines. We employ combination of these approaches. Using the equivalence scales in Panel b of Table 4 and Table 5, we adjust the data to the equivalence by dividing households' total consumption expenditure by the appropriate equivalence scales. We then choose four alternative poverty lines. The first one-CNY2,670.73 is the minimum annual needs at a single adult in the Northwest region. The other three China's national poverty thresholds in 1995 are based on the US$1.0, US$1.5 and US$2.0 per day[7], as Fang, Zhang and Fan (2002) did in their paper. Poverty line US$1.0 per day is initiated by the World Bank. Fang et al. argue that in the case of China, poverty measure of US$1.0 per day used by the World Bank is better to evaluate rural living conditions, so they pick up a higher poverty line – US$1.5 per day for urban China in the 1990s. We agree that a higher poverty line should be considered in urban China in the 1990s and also pick up this poverty line, because our data is Chinese urban data in 1995 as

[7] Fang, Zhang, and Fan (2002) indicated that poverty line US$2.0 per day was used by an Asia Development Bank study.

described in Data section. However, since we don't compare the poverty in China to that in other countries, we don't need using 1995 purchasing power parity and price indexes to convert these poverty lines in US dollar to those in domestic currency. In this paper, we just use the exchange rate between US dollar and Chinese Yuan in 1995 to convert the three poverty lines into those measured in annual domestic currency. The exchange rate we taken is CNY 8.3 to the dollar[8]. Therefore, we apply the four poverty lines - CNY2,670.73, CNY2,988, CNY4,482 and CNY5,976 per year in the following study.

4. e. Sen Indices

In Sen's view, poverty should be measured and evaluated using a three prong approach that considers 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. Because such transfer, from the most destitute of the poor to families ever so slightly below the poverty line, always increases relative inequality among the poor and this is reflected in distribution sensitive measures, although it can decrease the official measure of poverty, the headcount.

Due to the limit of the official headcount measure, Sen proposes a poverty index, called the Sen index, which is 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:

$$S = H\left[I + (1-I)G_P(q/q+1)\right] \qquad (5)$$

[8] We use the average exchange rate in 1995, because although there were fluctuations in 1994 and 1995, as the exchange rate gradually appreciated from an initial rate of CNY8.7 to the dollar at the beginning of 1994. After 1995, China's exchange rate has remained within a narrow band that is at around CNY 8.3 to the dollar.

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.

We use consumption rather than income because in the case of China in 1995, households' annual total consumption is more reliable than the household annual income. To compare the results of Sen Indices from Model 1 with those from Model 2, we used two sets of adjusted household annual total consumptions. One is named 'EQCONS1', which is calculated by dividing the annual household total consumption by the equivalent scales from Model 1. The other is named 'EQCONS2', which is calculated by dividing the annual total consumption by the equivalent scales from Model 2. Associated with each set of adjusted household annual total consumptions, we weighted the data with family size and used the four selected poverty thresholds mentioned in 'Threshold section'. The Sen Indices results from 'EQCONS1' and 'EQCONS2' are presented in Panel a and Panel b of Table 6 respectively.

In Panel a of Table 6, the results come from 'EQCONS1' by setting four selected poverty thresholds in each region. Arguably, it is not appropriate to make regional comparisons, because Model 1 does not control for region. However, by assuming there is no difference in cost of living and people's expectation on quality of life to escape from poverty for different regions, such comparison between regions can provide more valuable reference

to the results in Panel b of Table 6. In the following analysis we will focus on the official headcount index and Sen Index.

We obtain some interesting results from the simple 'numerical' comparison of poverty ordinates in these two Tables. In Panel a of Table 6 from 'EQCONS1', for every poverty threshold, Coast category has the lowest headcounts ratio, Southwest has the second lowest headcounts ratio, Central has the third lowest headcounts ratio, and Northwest category has the highest headcounts ratio. For example, under poverty line of CNY2,988, about 19.6% households in Northwest were poor in 1995 compared to about 5% households in Coast. Headcounts results tell us the Northwest has the highest poverty, while Coast is least poor region. Although for poverty line CNY2,670 and CNY2,988, Coast category has a little higher Sen Index than Southwest category does, we are not sure whether there is significant difference between them. We will discuss the inference test in later section. Sen Indices based on every poverty line provide the same information.

In Panel b of Table 6 from 'EQCONS2', there is a huge change in the results for Coast category. For poverty threshold CNY2,670 and CNY2,988, Coast has the highest Headcounts and Sen Index, but for poverty line CNY4,482 Northwest has a little higher Headcounts than the Coast. Increasing the poverty line to CNY5,976, we find that the Headcounts index are similar for the Coast, Central and Southwest regions with the Northwest slightly higher Headcount Index. The Southwest has the lowest Sen Index at poverty line CNY5,976 and we find that the highest poverty in the Coast and Northwest regions.

5. Poverty-dominance Significance Test

Under the assumption that the Sen Indices of any two regions are independent, we apply the inference procedures to judge the set of differences by comparing the test statistics to the Standard Normal Table.

For example, to calculate the Z value of the difference in Headcount between Coast and Southwest based on any selected poverty line, we use the Headcount and the standard errors of the Headcount in these two regions. Under the assumption the Headcounts in these two regions are independent, the equation of Z value of the difference in these two regions is:

$$Z-value = \frac{Headcount(Coast) - Headcount(South\ West)}{se\left[Headcount(Coast) - Headcount(South\ West)\right]}$$
$$= \frac{Headcount(Coast) - Headcount(South\ West)}{\sqrt{se^2\left[Headcount(Coast)\right] + se^2\left[Headcount(South\ West)\right]}}$$

In this paper, we calculate all the Z values of the difference in Sen Indices between any two regions. However, instead of reporting all of them[9], we are interested in those for poverty Sen index and Headcounts Index.

Based on these Z-values, we conduct the significant test on the differences in Sen Indices between any two selected regions at 5% significant level for each poverty line. We will summarize the results from Table 7 to Table 9. Table 7 shows that the summary inference test results based on the poverty lines which are equal to or less than CNY2,988, while Table 8 shows that the summary results based on the poverty lines which are equal to or less than CNY4,882. Table 9 shows that the summary results based on the poverty lines which are equal to or less than CNY5,976. Substantial amount of information is conveyed by Table 7, Table 8 and Table 9 and its interpretation requires a brief explanation. We use an entry of '+' signify that we can find at least one poverty line at or below the specific poverty line where Region A in a particular row has significantly less poverty than Region B in a

[9] Z values can be provided if they are required

particular column, and no poverty line below this specific poverty line where Region B has significantly less poverty than Region A. Then we conclude that Region A 'poverty-dominates' Region B. Similarly, a '-' means the level of poverty in Region B is significantly less than that in Region A and Region B 'poverty-dominates' Region A; A '*O*' means that there is no significant difference between these two regions for any poverty line at or below the specific poverty line in each Table. If among the poverty lines below the specific one, for some poverty line Region A has a significantly greater or less poverty than Region B and for some other poverty line Region B has a significantly less or greater poverty than Region A, we conclude that no unambiguous poverty ranking exists and a 'X' is entered. But this kind of case does not exist in our study.

In each Table, Panel a shows the summary results of such statistical inference test on Headcount, while Panel b shows the summary results on the Sen Index. Above the diagonal line, the results implicit in pair-wise Sen Indices comparisons come from non-regional equivalent scale adjusted household annual total consumption named 'EQCONS1', while below the diagonal line the test results of pair-wise Sen indices comparisons come from regional equivalent scale adjusted household annual total consumption named 'EQCONS2'.

Comparing these three Tables we found that above the diagonal line, in Table 7 there are no significant differences in Headcount Index and Sen Index between Coast and Southwest, while in Table 8 and Table 9 Coast has significantly less poverty than Southwest based on the poverty line CNY4,482 and CNY5,976. Consistent with the results of Panel a of Table 5 that presents the numerical Sen Indices from 'EQCONS1' by regions, the level of poverty in Coast and Southwest is lower than in the Central and Northwest regions; the level of poverty in Central is lower than that in Northwest. We can also obtain the similar results from Figure 2. and Figure 4.

Below the diagonal line, Table 7 and Table 8 show the similar results for Headcount Index and Sen Index: Southwest has significantly less poverty than Northwest. There are no significant difference in Headcount Index between Central and Southwest at 5% significant level, while Southwest has significantly less poverty than Central according to Sen Index results which results from the combined effects of changes in the poverty gap and inequality factors among the poor. The most interesting results are: The level of poverty in the Coast is higher than that in Southwest and Central. According to the Sen Index the Northwest has significantly less poverty than Coast, although there are no significant difference in Headcounts Index between Coast and Northwest. Before further summarizing the results of the poverty-dominance analysis several comments concerning Table 7 and Table 8 warrant emphasis. Since the results below diagonal line in Tables come from regional equivalent scale adjusted annual household total consumption 'EQCONS2' category, we will not only consider the differences in economies of scale by the household size, but also account for the cost of living and people's expectation across the selected four regions. Cost of living is relatively explicit to be estimated numerically, but we cannot precisely separate the people's expectation in difference regions from subjective answers. However, such results indicate that poor households in Coast would expect more resources to escape poverty than those in other three regions. It is the factor that drives the Headcount and Sen index increase.

When we increase the poverty line increases to CNY5,976, the results below the diagonal line in Table 9 indicate two particularly interesting changes. One is in Headcount Index, there are no significant differences in Headcounts Index between Coast, Central, and Southwest based on the poverty line below CNY 5,976, while Coast reverts to have less poverty than Northwest again. Although we don't report the significant test results for poverty line CNY 5,976 individually, Panel a of Table 9 indicates that at or below poverty line CNY5,976, we can find at least one poverty line where Coast has significantly less

poverty than Northwest in Headcount Index. The other is in Sen Index, similarly, Panel b of Table 9 illustrates that at or below poverty line CNY5,976, we can find at least one poverty line where Northwest has significantly higher poverty than Central. Accounting for such changes in Headcounts Index with increase in poverty line, a more possible reason is that even though most households' actual minimum spending in Coast could be higher or slightly higher than poverty threshold CNY2,670, CNY2,988 and CNY4,482, they don't expect that such levels are high enough to lift them out of poverty. But due to the relative low cost of living and less inequality, such expectation of households in Southwest and Central plays less important role in the Headcounts Index. However, households who consider themselves poor are really below the specific poverty line in Northwest, because their expectations on the poverty threshold won't deviate much from their real level of life in Northwest. Therefore, relative to other three regions, the Headcount Index of poverty in Coast is higher than that in Southwest and Central, while there is no significant difference in the Headcount Index. When the poverty line is high enough to satisfy households' expectation about being grouped out of poor in Coast, the Headcount Index in Coast is statistically insignificant difference with that in Southwest and Central, and significantly lower than that in Northwest. Figure 3. graphically summarizes the statistical Headcount Index rankings in the four regions of China.

If we simultaneously account for headcount poverty, the income shortfall of the poor (poverty gap) and the distribution of income among the poor (Gini Index), Coast has significantly higher poverty Gap Index and Gini Index than the other three regions when poverty line increases even though households' expectation can be increasingly satisfied with increases in poverty line, except for the Northwest becomes no significant difference with Coast when poverty line increases to CNY5,976. The meaning of these is clear; First, the effects of significantly higher poverty Gap and inequality among the poor in Coast dominate those of households' expectations in pair-wise comparisons between Coast and Southwest,

and Central. Second, the effect of households' expectations dominates that of the relatively flat poverty Gap and inequality in comparison between Northwest and Coast. (Similarly, Sen Indices, indicate increase in poverty in Coast emanating from the combined effects of poverty Gap and Gini Index among the poor.) Figure 5. graphically summarizes the statistical Sen Index rankings in four regions of China.

6. Conclusion

In this paper, we apply a subjective measure of poverty to 1995 CHIP survey data. Following Garner et al. study, we consider the various family size variables and regional variables in two regression models to estimate the effect of these characteristics of the actual family on the minimum needs. The intersection method is used to obtain the poverty thresholds for various family types by regions and the equivalence scales implicit in these thresholds. According to the thresholds from the intersection method and those used by Fang, Zhang and Fan (2002), we choose four poverty lines, and adjust the income by appropriate equivalence scales to get the Sen Indices. Based on the numerical comparison of Headcount Index and Sen Index by the four poverty lines, the inference significance test are applied.

The paper's results have broader implications for our understanding of the households' perception of poverty across regions in China. Below the poverty line CNY5,976, if we control for region and adjust total consumption by these equivalence scales, the level of poverty in Coastal region is to be significantly higher than that in the other regions. It is because that higher cost of living and people's higher expectation of minimum needs to be grouped out of poverty drive the poverty index to increase significantly. Although we cannot tell which one plays a predominant role, this result indicates that the poverty level is very sensitive to people's perception of poverty in China.

In this paper, we focus on the analysis of Chinese poverty in 1995, which not only presents the objective difference in poverty, but also the subjective difference in perception of poverty by regions. However, the study of poverty in certain year restricts our version to get the trend of the poverty level in China across time horizon. Therefore, in our further work, applying the equivalence scales to other years' China data will provide us a broader picture about poverty trend in urban China. Furthermore, to gauge the effects of the people's perception of poverty on the poverty level, we will consider adjusting the household consumptions for interarea variations in the cost of living.

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Table 1. 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	677.0544	455.2074
Annual minimum spending (Ymin)	6656	8124.6500	5462.4900
Annual Total consumption expenditure (Y)	6656	12224.9600	10462.8200
DM1 (1 person)	53	0.0080	0.0889
DM2 (2 persons, household head >= 60)	529	0.0795	0.2705
DM3 (2 persons, household head < 60)	623	0.0936	0.2913
DM4 (3 persons, no children)	844	0.1268	0.3328
DM5 (3 persons with children)	2951	0.4434	0.4968
DM6 (4 persons or more, no children)	530	0.0796	0.2707
DM7 (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

Note:
N represents the number of observations for each variable
DM1 is the dummy variable which represents one-person household
DM2 is the dummy variable which represents two-person household with the age of the head > = 60
DM3 is the dummy variable which represents two-person household with the age of the head < 60
DM4 is the dummy variable which represents three-person household without children
DM5 is the dummy variable which represents three-person household with children
DM6 is the dummy variable which represents more than four persons' household without children
DM7 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, Hunan, Anhui
SOUTH_WEST is the region hummy variable which represents Yunan, Sichuan
NORTH_WEST is the region dummy variable which represents Sanxi, Gansu

TABLE 2. Regression Results from 1995 China Annual Minimum Needs Regression Using Model (1)

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
DM2	0.31736	0.06224	5.1	<.0001
DM3	0.34046	0.06187	5.5	<.0001
DM4	0.50312	0.06134	8.2	<.0001
DM5	0.41857	0.05995	6.98	<.0001
DM6	0.63343	0.06247	10.14	<.0001
DM7	0.5061	0.06085	8.32	<.0001

Note: See Table 1 for the definition of the dummy variables; LOGH53 is the Logarithem of the Total Consumption for each household in 1995;

TABLE 3. Regression Results from 1995 China Annual Minimum Needs Regression Using Model (2)

Variable	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	6.39592	0.08405	76.1	<.0001
LOGH53	0.21096	0.00728	28.96	<.0001
DM2	0.35065	0.05833	6.01	<.0001
DM3	0.38798	0.05796	6.69	<.0001
DM4	0.53779	0.05748	9.36	<.0001
DM5	0.46218	0.05618	8.23	<.0001
DM6	0.67797	0.05855	11.58	<.0001
DM7	0.56756	0.05709	9.94	<.0001
COAST	0.24387	0.01363	17.89	<.0001
CENTRAL	-0.0625	0.01432	-4.36	<.0001
NORTHWEST	-0.17031	0.01658	-10.27	<.0001

Note: See Table 1 for the definition of the dummy variables; LOGH53 is the Logarithem of the Total Consumption for each household in 1995;

Table 4.

Panel a: PREDICTED THRESHOLD FROM REGRESSION OF MODEL (1)

DM1	DM2	DM3	DM4	DM5	DM6	DM7
3412.65	5270.76	5440.19	6797.87	6054.50	8126.20	6825.67

Panel b: EQUIVALENCE SCALE FROM REGRESSION OF MODEL (1)

DM1	DM2	DM3	DM4	DM5	DM6	DM7
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 5.

Panel a: PREDICTED THRESHOLD FROM REGRESSION OF MODEL (2)

	DM1	DM2	DM3	DM4	DM5	DM6	DM7
COAST	4514.38	7040.43	7381.52	8924.88	8109.35	10660.04	9268.05
CENTRAL	3061.75	4774.97	5006.30	6053.04	5499.93	7229.86	6285.78
SOUTHWEST	3314.13	5168.58	5418.98	6552.01	5953.30	7825.83	6803.93
NORTHWEST	2670.73	4165.15	4366.94	5280.00	4797.53	6306.53	5483.02

Panel b: EQUIVALENCE SCALE FROM REGRESSION OF MODEL (2)

	DM1	DM2	DM3	DM4	DM5	DM6	DM7
COAST	1.69	2.64	2.76	3.34	3.04	3.99	3.47
CENTRAL	1.15	1.79	1.87	2.27	2.06	2.71	2.35
SOUTHWEST	1.24	1.94	2.03	2.45	2.23	2.93	2.55
NORTHWEST	1.00	1.56	1.64	1.98	1.80	2.36	2.05

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

Table 6. 1995 Indices of Poverty and Its Components in China

Panel a: EQCONS1

Poverty Line	Region	Sen Index	Components		
			Headcount	Income Gap	Gini (poor)
CNY2,670	COAST	0.017515	0.028916	0.4178	0.32278
		(.00256)	(.003449)	(.040892)	(.04164)
	CENTRAL	0.028796	0.0748	0.25388	0.1757
		(.003516)	(.00622)	(.022631)	(.021823)
	SOUTHWEST	0.015689	0.034483	0.28671	0.23589
		(.003223)	(.004775)	(.047068)	(.046748)
	NORTHWEST	0.037487	0.13841	0.18398	0.10646
		(.00398)	(.010672)	(.013833)	(.010148)
CNY2,988	COAST	0.022519	0.045917	0.32293	0.24738
		(.002873)	(.004308)	(.030295)	(.029579)
	CENTRAL	0.038394	0.10116	0.26039	0.16111
		(.003812)	(.007129)	(.017559)	(.016791)
	SOUTHWEST	0.020797	0.054579	0.24378	0.18151
		(.003527)	(.005945)	(.031841)	(.031621)
	NORTHWEST	0.057331	0.196	0.20792	0.10678
		(.004712)	(.012268)	(.011123)	(.008054)
CNY4,482	COAST	0.058470	0.1498	0.26753	0.16764
		(.00393)	(.007346)	(.012437)	(.011094)
	CENTRAL	0.133290	0.3829	0.24348	0.13828
		(.005634)	(.011493)	(.007452)	(.005803)
	SOUTHWEST	0.085591	0.27906	0.21313	0.11893
		(.005187)	(.011739)	(.009066)	(.00755)
	NORTHWEST	0.208910	0.56274	0.27261	0.13558
		(.00755)	(.01533)	(.007207)	(.004501)
CNY5,976	COAST	0.127650	0.3419	0.25978	0.15343
		(.005064)	(.009764)	(.007423)	(.005917)
	CENTRAL	0.270360	0.64844	0.31075	0.15407
		(.006516)	(.011288)	(.00558)	(.004057)
	SOUTHWEST	0.204730	0.55606	0.26994	0.13455
		(.006553)	(.013003)	(.006256)	(.004472)
	NORTHWEST	0.376580	0.80958	0.35999	0.16431
		(.007938)	(.012134)	(.006318)	(.003928)

Note: Panel a reports the Sen indices and the corresponding standard errors by using the adjusted household annual total consumptions named 'EQCONS1' which is calculated by dividing the annual household total consumption by the equivalent scales from Model 1. Standard errors of each Index are reported in the parentheses. See Table 1 for the definition of the region dummy variables.

Table 6. 1995 Indices of Poverty and Its Components in China

Panel b: EQCONS2

Poverty Line	Region	Sen Index	Components		
			Headcount	Income Gap	Gini (poor)
CNY2,670	COAST	0.061035	0.155560	0.27101	0.16648
		(.003982)	(.007461)	(.012048)	(.010757)
	CENTRAL	0.043006	0.115940	0.25341	0.15742
		(.003949)	(.007569)	(.016021)	(.014869)
	SOUTHWEST	0.030378	0.094999	0.20834	0.14076
		(.003921)	(.007674)	(.020107)	(.019381)
	NORTHWEST	0.040048	0.147520	0.18577	0.10527
		(.004085)	(.010959)	(.013229)	(.009726)
CNY2,988	COAST	0.082184	0.213250	0.26693	0.16158
		(.004396)	(.008432)	(.009888)	(.008346)
	CENTRAL	0.060635	0.172400	0.24043	0.14652
		(.004416)	(.00893)	(.012258)	(.010647)
	SOUTHWEST	0.045718	0.154600	0.19707	0.12286
		(.004362)	(.009462)	(.013695)	(.012571)
	NORTHWEST	0.060698	0.204820	0.2112	0.10795
		(.00482)	(.012472)	(.01089)	(.007827)
CNY4,482	COAST	0.23201	0.560780	0.30082	0.1615
		(.005835)	(.010216)	(.005587)	(.0042)
	CENTRAL	0.19891	0.526270	0.27384	0.14339
		(.006209)	(.011805)	(.006188)	(.004652)
	SOUTHWEST	0.17509	0.495780	0.25722	0.12917
		(.006326)	(.013085)	(.006552)	(.00483)
	NORTHWEST	0.21622	0.573610	0.27835	0.13664
		(.007621)	(.015284)	(.007132)	(.004472)
CNY5,976	COAST	0.38423	0.770550	0.38466	0.18525
		(.005978)	(.008655)	(.004709)	(.003456)
	CENTRAL	0.35977	0.779880	0.35095	0.17004
		(.006512)	(.009796)	(.005216)	(.003623)
	SOUTHWEST	0.33976	0.775980	0.33283	0.1574
		(.006865)	(.010912)	(.005512)	(.003642)
	NORTHWEST	0.38458	0.814870	0.36752	0.16511
		(.007925)	(.012004)	(.006255)	(.003937)

Note: Panel b reports the Sen indices and the corresponding standard errors by using the adjusted household annual total consumptions named 'EQCONS2' which is calculated by dividing the annual household total consumption by the equivalent scales from Model 2. Standard errors of each Index are reported in the parentheses. See Table 1 for the definition of the region dummy variables.

Table 7.

Panel a: HEADCOUNT 5% SIGNIFICANT TEST BASED ON POVERTY LINE – CNY2,988 OR BELOW

	COAST	SOUTHWEST	CENTRAL	NORTHWEST
COAST		*O*	+	+
SOUTHWEST	+		+	+
CENTRAL	+	O^2		+
NORTHWEST	*O*	-	-	

NOTE: ' + ' means row dominates column;
' – ' means column dominates row;
' O ' means no significantly difference;
Superscript ' 1 ' means row dominates column at 10% significant level;
Superscript ' 2 ' means column dominates row at 10% significant level;
'A dominates B' means that A has less poverty than B.

Panel b: SEN INDEX 5% SIGNIFICANT TEST BASED ON POVERTY LINE – CNY2,988 OR BELOW

	COAST	SOUTHWEST	CENTRAL	NORTHWEST
COAST		*O*	+	+
SOUTHWEST	+		+	+
CENTRAL	+	-		+
NORTHWEST	+	-	*O*	

NOTE: ' + ' means row dominates column;
' – ' means column dominates row;
' O ' means no significantly differenc;
Superscript ' 1 ' means row dominates column at 10% significant level;
Superscript ' 2 ' means column dominates row at 10% significant level;
'A dominates B' means that A has less poverty than B.

Table 8.

Panel a: HEADCOUNT 5% SIGNIFICANT TEST BASED ON POVERTY LINE – CNY4,482 OR BELOW

	COAST	SOUTHWEST	CENTRAL	NORTHWEST
COAST		+	+	+
SOUTHWEST	+		+	+
CENTRAL	+	O^2		+
NORTHWEST	*O*	-	-	

NOTE: ' + ' means row dominates column;
' – ' means column dominates row;
' O ' means no significantly differenc;
Superscript ' 1 ' means row dominates column at 10% significant level;
Superscript ' 2 ' means column dominates row at 10% significant level;
'A dominates B' means that A has less poverty than B.

Panel b: SEN INDEX 5% SIGNIFICANT TEST BASED ON POVERTY LINE – CNY4,482 OR BELOW

	COAST	SOUTHWEST	CENTRAL	NORTHWEST
COAST		+	+	+
SOUTHWEST	+		+	+
CENTRAL	+	-		+
NORTHWEST	+	-	O^2	

NOTE: ' + ' means row dominates column;
' – ' means column dominates row;
' O ' means no significantly differenc;
Superscript ' 1 ' means row dominates column at 10% significant level;
Superscript ' 2 ' means column dominates row at 10% significant level;
'A dominates B' means that A has less poverty than B.

Table 9.

Panel a: HEADCOUNT 5% SIGNIFICANT TEST BASED ON POVERTY LINE – CNY5,976 OR BELOW

	COAST	SOUTHWEST	CENTRAL	NORTHWEST
COAST		*O*	+	+
SOUTHWEST	+		+	+
CENTRAL	+	O^2		+
NORTHWEST	-	-	-	

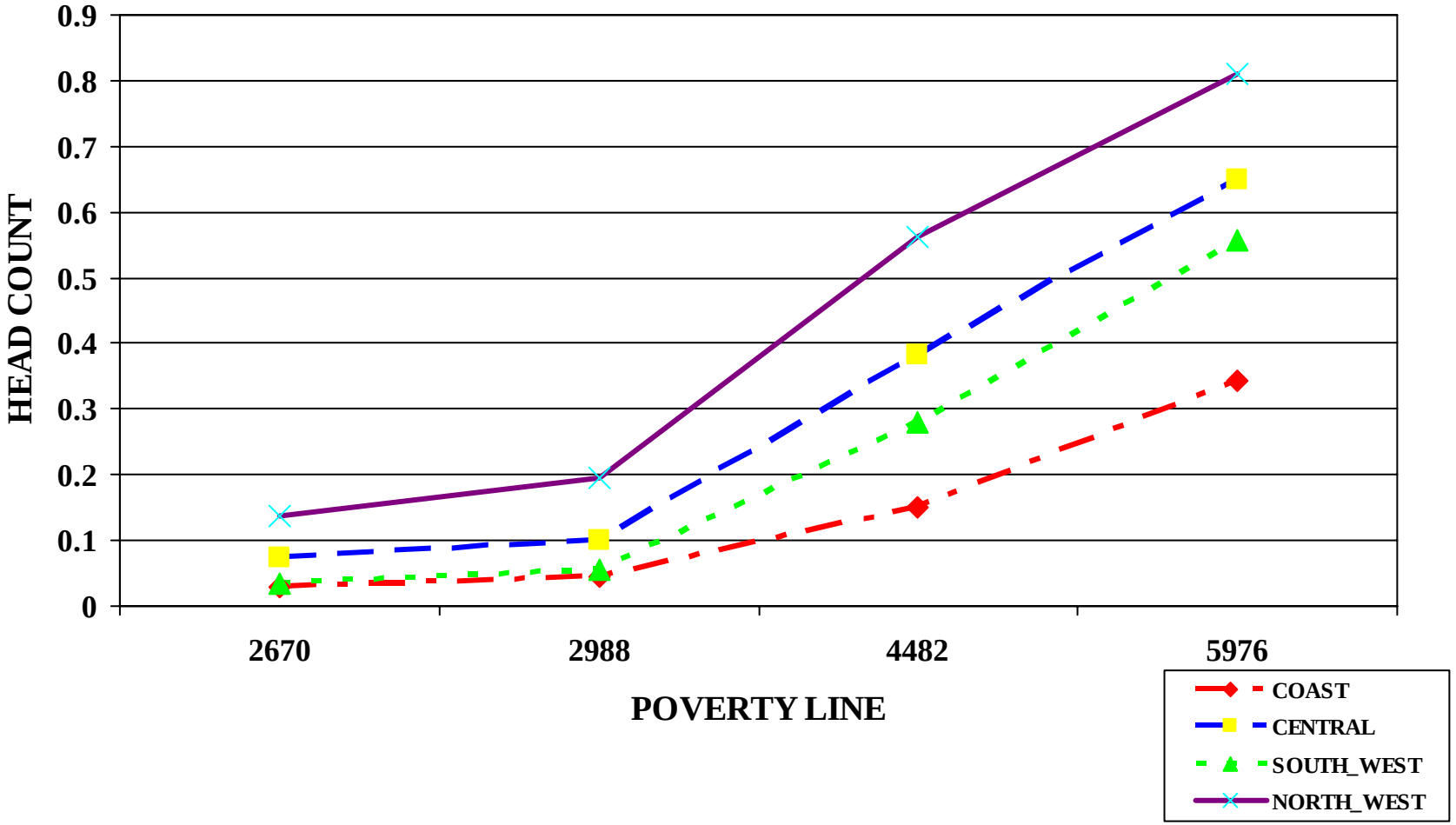
NOTE: ' + ' means row dominates column;
' – ' means column dominates row;
' O ' means no significantly differenc;
Superscript ' 1 ' means row dominates column at 10% significant level;
Superscript ' 2 ' means column dominates row at 10% significant level;
'A dominates B' means that A has less poverty than B.

Panel b: SEN INDEX 5% SIGINIFICANT TEST BASED ON POVERTY LINE – CNY5,976 OR BELOW

	COAST	SOUTHWEST	CENTRAL	NORTHWEST
COAST		*O*	+	+
SOUTHWEST	+		+	+
CENTRAL	+	-		+
NORTHWEST	+	-	-	

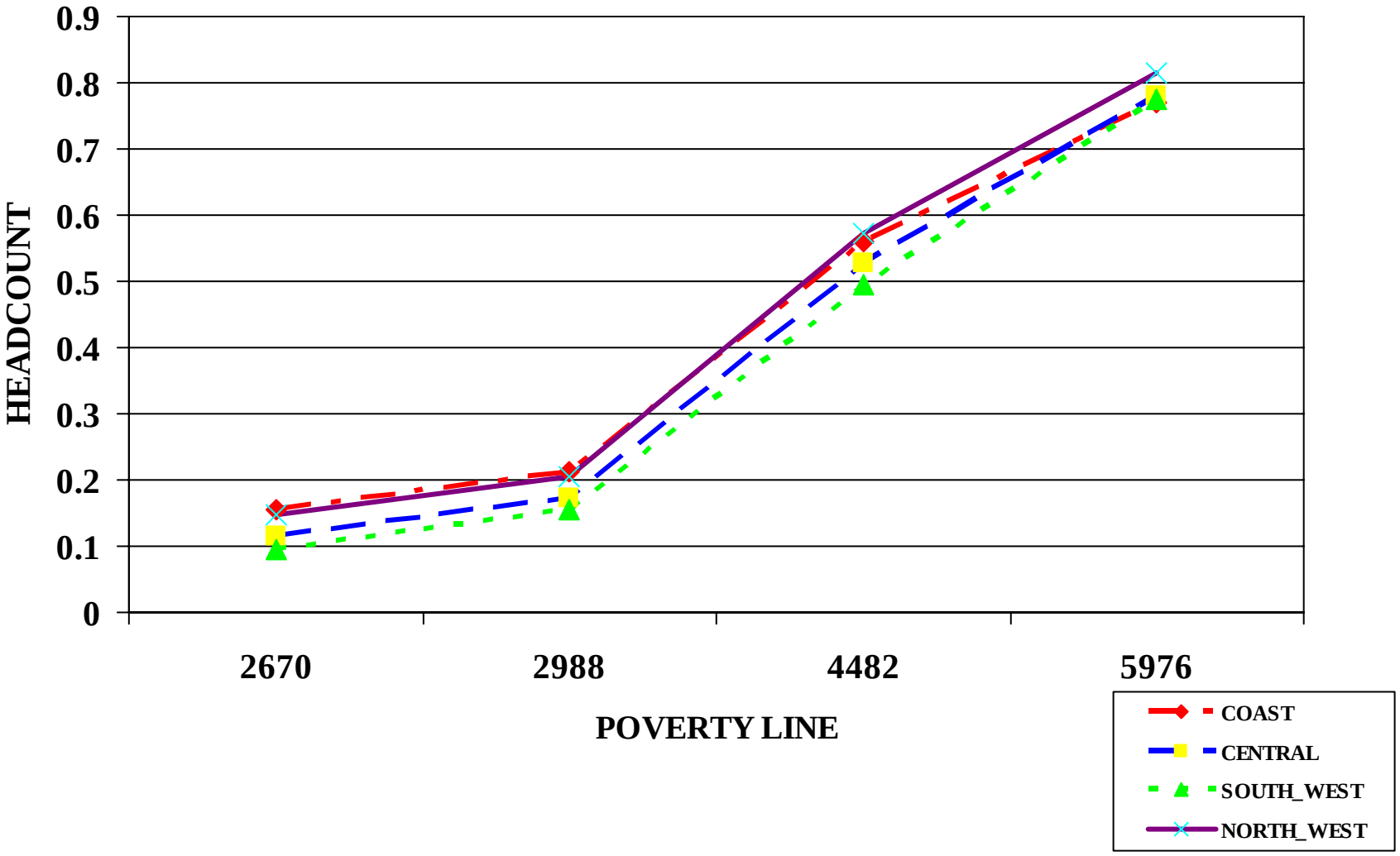
NOTE: ' + ' means row dominates column;
' – ' means column dominates row;
' O ' means no significantly differenc;
Superscript ' 1 ' means row dominates column at 10% significant level;
Superscript ' 2 ' means column dominates row at 10% significant level;
'A dominates B' means that A has less poverty than B.

Figure 2. HEADCOUNT, EQCONS1



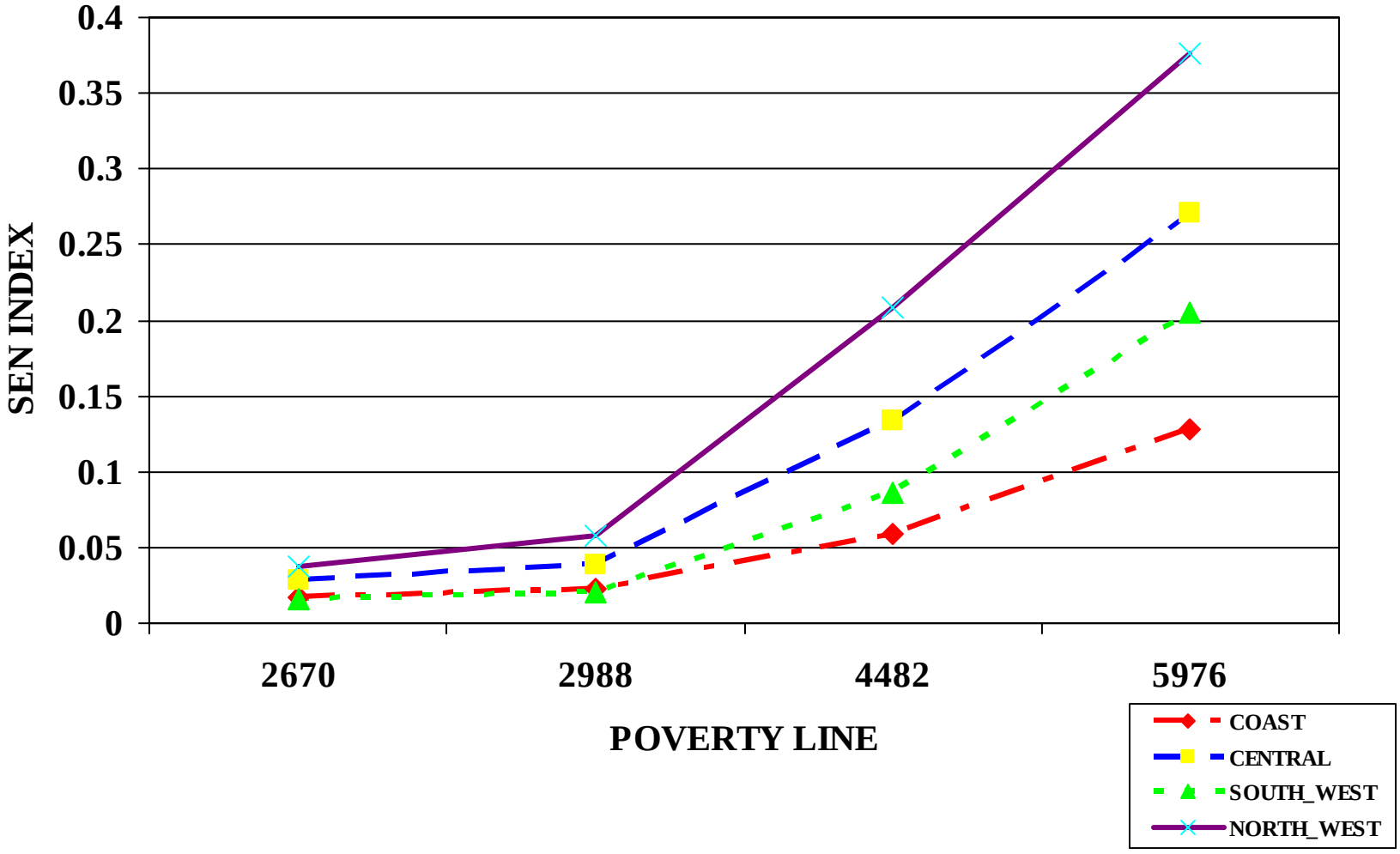
Note: See Panel a of Table 6 for the calculation of 'EQCONS1'; see Table 1 for the definition of the regional variables.

Figure 3. HEADCOUNT, EQCONS2



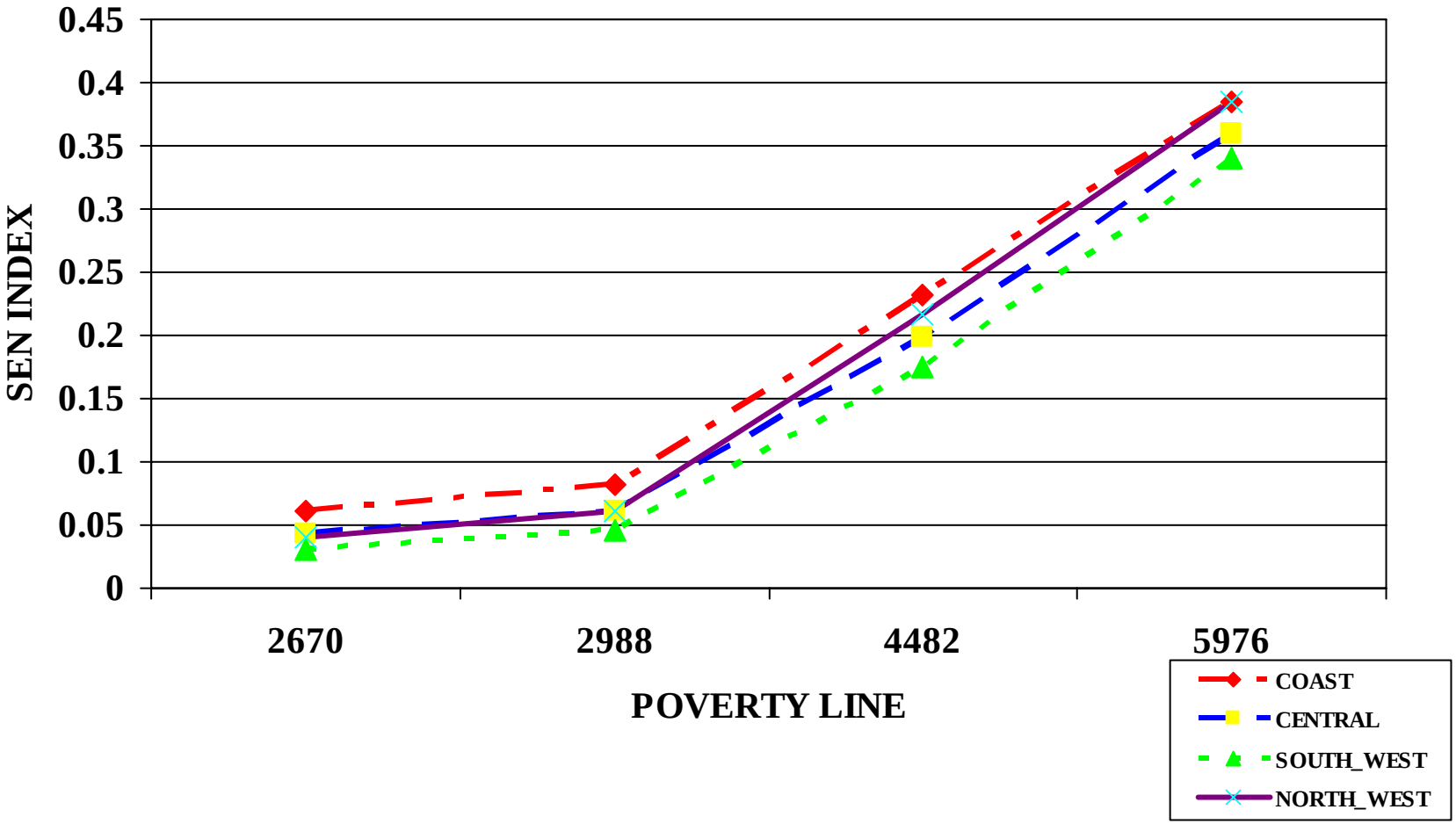
Note: See Panel b of Table 6 for the calculation of 'EQCONS2'; see Table 1 for the definition of the regional variables.

Figure 4. SEN INDEX, EQCONS1



Note: See Panel a of Table 6 for the calculation of 'EQCONS1'; see Table 1 for the definition of the regional variables.

Figure 5. SEN INEX, EQCONS2



Note: See Panel b of Table 6 for the calculation of 'EQCONS2'; see Table 1 for the definition of the regional variables.