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Decomposing Income Inequality and Policy Implications in Rural China

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Abstract

Using village data from samples covering 6 provinces, 36 counties and 216 townships, the income inequalities within and between townships in rural China are assessed. The Theil index and the mean logarithmic deviation methods enable us to test income inequality at the township level, and to decompose it into intra-regional and inter-regional at county and provincial levels. In the present paper, we also decompose income inequalities between and within the nationally designated poor counties (NDPC). The results show that approximately two-thirds of the income inequality in rural China would be eliminated if measures and policies were targeted at the county level. This study also confirms the rationale that China's poverty alleviation strategy of focusing on poor counties based on the inequalities between NDPC and non-NDPC accounts for the most inter-province inequality.

Key words: decomposition, income inequality, rural China

JEL codes: D63, O53, R58

1. Introduction

Market-oriented economic reforms, initiated by farm household responsibility in 1978, have stimulated rapid rural economic growth and provided significant improvement in the living conditions of farmers. The annual growth rate of GDP has been maintained between 8 and

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10 percent, whereas the annual growth rate of agricultural output was approximately 23 percent between 1980 and 2004. Rural per capita income increased from 110 yuan in 1978 to 2936 yuan in 2004. However, one of the negative consequences of fast growth has been the increase in income inequality. According to the National Bureau of Statistics of China, the Gini coefficient for rural China in 1979 was 0.21; however, the number had reached 0.29 in 1987 and further increased to 0.35 by 2002 (NBS,1998,& 2003).

Given the increase of income inequality in rural China, many researchers have investigated the trends of income inequality among regions or provinces since the late 1980s. For example, Friedman believes that the differences among regions in China were widening before the opening-up policy. Aguighier (1988) concludes that the uneven developmental strategy implemented after the open-door policy lead to greater income disparities between eastern and western regions in China. Based on the index of per capita national income, Tsui (1991) finds that the changes in regional differences were not obvious between 1952 and 1970 in China, but the gaps between regions enlarged between 1970 and 1985. Lyons (1991) analyzes the changes of difference in incomes in various areas measured by per capita net production value, and shows that the differences were reduced between 1978 and 1987. Regardless of these results, the main reasons for this inconsistency, as pointed out by Fan (1997) and Hansen (1995), are that different geographic scales, time periods, indicators of well-being, and indices of inequality measure have been used in those empirical studies.

Recently, some studies have used new approaches to investigate income inequality and decompose it at different levels. Rozelle (1994) demonstrates that income inequality within east coast provinces rapidly widened between 1984 and 1989, and suggests rural industrialization was the main cause. Rivi and Zhang (1999) show that the income inequality between rural and urban areas was higher than that between inland and coastal regions during the periods between 1983 and 1995 in terms of the Gini coefficient and the Theil index. Yao (1997) calculates and decomposes the inter-provincial per capita income Gini coefficient in rural China from 1986 to 1992 and finds that income distribution in rural China became skewed over this period as a result of economic reforms. Lee (2000) compares the major sources of China's regional inequality with regard to both per capita gross value of industrial and agricultural output and per capita consumption between 1982 and 1994. The major finding of his paper is that inter-province inequality accounted for 63 percent of inter-county inequality. Using household data covering 18 provinces in 1988 and 1995, Bjorn and Li (2002) show that most income inequality in rural China in 1995 was spatial and that the uneven development of mean income across counties stood for most, but not all, of the rapid increase in income inequality.

Few studies have shed much light on issues concerning township inequalities in

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economic development as represented by village per capita net income. Furthermore, no previous studies have compared the income inequality of nationally designated poor counties (NDPC) and non-NDPC. The objective of the present paper is to present an inequality decomposition based on village net income in rural China from 1997 to 2002. Using the Theil index and the mean logarithmic deviation (MLD) index, we consider two three-level hierarchical structures: township–county–province and township–county–NDPC.

To achieve our objectives, this paper is organized as follows. The next section presents the methodology adopted in the present study, including the usage of the Theil index and the MLD index. Section III introduces the dataset used in the inequality decomposition analysis. Section IV provides general results regarding income inequality in rural China and discusses the effects of inequality on each hierarchical level. Finally, in Section V, conclusions are drawn and policy implications outlined.

II. Methodology

In the present paper, we use two inequality indices, both belonging to the generalized entropy family: the Theil index and the MLD index. Both indices are decomposable.

The Theil index, T, can be expressed as:

$$T = \sum_{v=1}^{n} \frac{y_v}{Y} * \log[(\frac{y_v}{Y})/(\frac{1}{n})], \quad (1)$$

where n is the number of individuals in the population, y_v is the income of the individual indexed by v, and Y represents the population total income, $Y = \sum_{v=1}^{n} y_v$.

Theil's measure has every desirable property of an inequality measure; that is, mean independence, population-size independence, and the Pigou–Dalton principle of transfers. An inequality index is said to be decomposable if total inequality can be written as the sum of between-group and within-group inequalities. So, if we define that the overall inequality can be completely and perfectly decomposed into a between-group component T^b and a within-group component T^w, then Equation (1) can be decomposed into:

$$T = T^b + T^w. \quad (2)$$

The self-similar nature of the Theil index becomes evident when one notes that:

$$T^b = \sum_{i=1}^{m} \frac{Y_i}{Y} * \log[(\frac{Y_i}{Y})/(\frac{n_i}{n})]. \quad (3)$$

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Now i indexes not an individual but a group, with n_i representing the population in group i, and Y_i representing the total income in group i. Note that the structure of Equation (3) is exactly the same as the structure of Equation (1), which defines inequality among individuals. Therefore, the structure of the Theil index in measuring inequality between individuals is similar to the structure of the Theil index in measuring inequality between groups.

There is yet another level to explore: the within-group component of overall inequality, T^w, which is given by a weighted average of the Theil indices for each group, the weights being each group's share of income:

$$T^w = \sum_{i=1}^{m} \frac{Y_i}{Y} * {}^iT . \tag{4}$$

The Theil index for each group, ${}^iT$, corresponds to the inequality only between those individuals that are members of group i and is given by:

$${}^iT = \sum_{v=1}^{n_i} \frac{y_{iv}}{Y_i} * \log[(\frac{y_{iv}}{Y_i}) / (\frac{1}{n_i})]. \tag{5}$$

In Equation (5) each individual is indexed by two subscripts: i for the unique group to which the individual belongs, and v, where, in each group, v goes from 1 to n_i. Because ${}^iT$ only measures inequality between the individuals of group i, the relevant shares to be compared are y_{iv}/Y_i and $1/n_i$. However, the structure of the inequality measure remains the same as the structure of the Theil index that accounts for the inequality between all the individuals in the population and the inequality between groups. The difference is that in Equation (5) inequality is limited to group i.

So far, we have considered only one grouping structure: we partitioned the population into m groups. However, these m groups can also be aggregated with a new grouping structure into a number of higher order groups. These groups may be aggregated with yet another grouping structure into even higher order groups, and so forth. At each level of aggregation, the Theil index can be used not only to compute inequality between groups, but also to link the inequality measured at one level with that at any other level.

We consider the following hierarchical structure in rural China: province–county–township. Figure 1 illustrates the specification of a sequence of grouping structures with three levels of aggregation. It is more convenient to go from highest to lowest level of aggregation. The highest-level grouping structure, the province level, has m groups, where p (which indexes the groups at this level) goes from 1 to m. In the immediate lower-level grouping structure, the county level, for each group c, c (which indexes the groups within p) goes from 1 to m_p. Continuing to an even lower level of aggregation, the township level,

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for each group *t* that is part of *c*, *t* goes from 1 to m_{pc}. Finally, at the village level, each village in *t* (where *t* is in *c* and *c* is in *p*) is indexed by *v*, where *v* goes from 1 to m_{pct}.

Consequently, each village income is indexed by four subscripts: Y_{pctv}. The total income for group *t*, Y_{pct}, is given by the summation of Y_{pctv} when *v* goes from 1 to $m_{pct.}$ More details on how to compute income and population at different levels of aggregation are displayed in Figure 1.

In the present study, the Theil index is given by:

$$T = \sum_{p=1}^{m}\sum_{c=1}^{m_p}\sum_{t=1}^{m_{pc}}\sum_{v=1}^{m_{pct}} \frac{Y_{pctv}}{Y} * \log[(\frac{Y_{pctv}}{Y})/(\frac{1}{n})]. \quad (6)$$

However, the Theil index given in Equation (6) can be decomposed, at any level of aggregation *t*, into a between-group and a within-group component, as we saw in Equation (2) above:

$$T = T_t^b + T_t^w. \quad (7)$$

The subscript *t* is a number between *v* and *p* identifying which of the grouping structures in the sequence G was chosen for a breakdown of the Theil index. In other words, *t* provides the level of aggregation at which between-group/within-group decomposition of the Theil index is performed. Here we choose township level as the breakdown of the Theil index. The definitions of T_t^b and T_t^w are similar to Equation (3) and (4), which are extended to three hierarchical groups.

One important result, which will be useful for determining the information gain or loss when we measure inequality with even more disaggregated groups, is that, at any level, the following expression is valid:

$$T_t^b = T_{t-1}^b + T_{t-1}^w. \quad (8)$$

The intuition behind this decomposition of the between-group component can be understood with the help of Figure 2. In words, the between-group Theil at level *t* is the summation of the between-group Theil at the immediate higher level of aggregation ($t-1$ £½ *c*) plus the within group inequality at this higher level that measures the dispersion across the groups at level *t*.

Again, using the example mentioned above, where villages are aggregated across Chinese provinces, Equation (8) tells us that the between-township inequality is equal to the between-county inequality plus the within-county inequality.

Given Equation (8), overall inequality, *T*, can be partitioned into these components:

$$T = T_t^b + T_t^w$$

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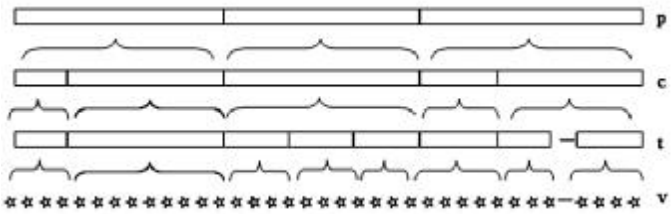
Figure1. Specifying Hierarchic Grouping Structures with Three Levels of Aggregation



Nested and Hierarchic Grouping sequence with Three Levels:
Highest Level Grouping Structure: Province level, p goes from 1 to m
Middle Grouping Structure: County level, for each group p, c goes from 1 to m_p
Lowest Grouping Structure: Township level, for each group c, t goes from 1 to m_{pc}
Village Level: In each village, there are m_{pctv} population
Income and Population at Each level:
-Income at Village Level: Y_{pctv}

-Income for Group t: $Y_{pct} = \sum_{v=1}^{m_{pct}} Y_{pctv}$ -Population in Group t: $n_{pct} = \sum_{v=1}^{m_{pct}} m_{pctv}$

-Income for Group c: $Y_{pc} = \sum_{t=1}^{m_{pc}} Y_{pct}$ -Population in Group c: $n_{pc} = \sum_{t=1}^{m_{pc}} n_{pct}$

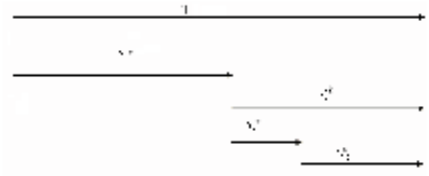
-Income for Group p: $Y_{p} = \sum_{c=1}^{m_{p}} Y_{pc}$ -Population in Group p: $n_{p} = \sum_{c=1}^{m_{p}} n_{pc}$

-Total Income: $Y = \sum_{p=1}^{m} Y_p = \sum_{p=1}^{m}\sum_{c=1}^{m_p} Y_{pc} = \sum_{p=1}^{m}\sum_{c=1}^{m_p}\sum_{t=1}^{m_{pc}} Y_{pct} = \sum_{p=1}^{m}\sum_{c=1}^{m_p}\sum_{t=1}^{m_{pc}}\sum_{v=1}^{m_{pct}} Y_{pctv}$

-Total population: $n = \sum_{p=1}^{m} n_p = \sum_{p=1}^{m}\sum_{c=1}^{m_p} n_{pc} = \sum_{p=1}^{m}\sum_{c=1}^{m_p}\sum_{t=1}^{m_{pc}} n_{pct} = \sum_{p=1}^{m}\sum_{c=1}^{m_p}\sum_{t=1}^{m_{pc}}\sum_{v=1}^{m_{pct}} m_{pctv}$

Source: adapted from Conceio *et al.* (2000).

Figure 2. Decomposition of the Theil Index for a Generic Grouping Structure *t*



Source: adapted from Conceio *et al.* (2000).

$$= T_t^w + T_c^b + T_c^w$$

$$= T_t^w + T_c^w + T_p^w + T_p^b . \quad (9)$$

All above discussions are related to the definition and principles of the Theil index.

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Next is a simple introduction to the MLD index. The MLD index is defined as:

$$M = \frac{1}{n}\sum_{v=1}^{n}\log(\frac{U_Y}{y_v}), \tag{10}$$

where n is the total number of individuals, U_Y is the mean income and y_v is the income of the individual indexed by v. The decomposition of the MLD index is the same as the Theil index, so we will not repeat it.

III. Data

At the heart of our analysis is our dataset. We use a unique set of data covering a wide range of regions in rural China collected by the authors in 2003. The authors and several Chinese and foreign collaborators designed the sampling procedure and final survey instrument with the village as the unit of analysis. The field work team, made up of the 3 authors and 30 graduate students and research fellows from Chinese and North American educational institutions (all with Chinese citizenship and an average education level of a master's degree or higher), chose the sample and implemented the survey in 6 provinces and 36 counties in a nearly nationally representative sample.

The entire sampling process was aimed at randomly selecting representative provinces that have agro-ecological representation. The sample provinces were randomly selected from each of China's major agro-ecological zones. We selected Jiangsu, Sichun, Shaanxi, Gansu, Hebei, and Jilin as our sample provinces. Jiangsu represents the eastern coastal areas (Jiangsu, Shandong, Shanghai, Zhejiang, Fujian and Guangdong); Sichuan represents the southwestern provinces (Sichuan, Guizhou and Yunnan) plus Guangxi; Shaanxi represents the provinces in the Loess Plateau (Shaanxi and Shanxi) and neighboring Inner Mongolia; Gansu represents the rest of the provinces in the northwest (Gansu, Ningxia, Qinghai and Xinjiang); Hebei represents the north and central provinces (Hebei, Henan, Anhui, Hubei, Jiangxi and Hunan); and Jilin represents the northeastern provinces (Jilin, Liaoning and Heilongjiang). Although we recognize that we have deviated from the standard definition of China's agro-ecological zones, the realities of survey work justified our compromises. Pre-tests in Guangdong demonstrated that data collection was extraordinarily expensive and the attrition rate was high. One of our funding agencies demanded that we choose at least 2 provinces in the northwest. Our budget did not allow us to add another central province (e.g. Hunan or Hubei) to the sample.

The sample villages were selected by a process that the survey teams implemented uniformly in each of the sample provinces. We randomly selected 6 counties from each

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province, 2 from each tercile of a list of counties arranged in descending order according to the gross value of industrial output (GVIO). GVIO was chosen for use here based on Rozelle's (1996) conclusion that it is one of the best predictors of standard of living and development potential and is often more reliable than net rural per capita income. Within each county, we chose 6 townships, following the same procedure as the county selection. When our enumerator teams visited each of the 216 townships (6 provinces by 6 counties by 6 townships), officials asked each village to send two representatives (typically the village leader and accountant) to a meeting in the township. On average, enumerators surveyed 11 villages in each township. The number of villages per township ranged from 2 to 29. On average, the attrition rate was only 6 percent. In no case did we leave a township until at least 80 percent of the villages had been enumerated. To examine if the villages that were not enumerated (due to attrition) were systematically different from those that participated, we collected a set of variables regarding no-show villages from the township and ran a probit regression with the dependent variable represented as an indicator variable where the variable equaled one if the village did not come and zero otherwise. There were no variables that were significant. If a village had more than 25 villages, we randomly selected 25 of them. This affected fewer than 5 townships. In total, we selected and surveyed 2459 sample villages. The distribution of sample villages in sample provinces is presented in Table 1. According to our sample, there were 12 NDPC in 36 sample counties and the other two-thirds were non-NDPC. Table 2 gives the distribution of NDPC in sample provinces. Shaanxi has the largest number of NDPC counties (4) among all sample provinces. There are 3 NDPC counties in the Gansu and Hebei Provinces, respectively, and 1 each for the Sichuan and Jilin Provinces. No NDPC is found in Jiangsu Province.

In every sampling village, the respondents answered questions about the economic, political and demographic conditions of their villages in 1997 and 2002. In this way, we obtained information on per capita net income and total population of all sample villages for 2 years: 1997 and 2002. An important characteristic of the Theil index is that it is decomposable. If individuals are grouped in a mutually exclusive, completely exhaustive way, overall inequality can be separated into a between-group component and a within-group component. There are several reasons why it might be of interest to have a decomposable measure of inequality. One might be associated with geography (e.g. different regions, states or countries, which was explored by Theil in 1967). However, in our data, because the population of villages can be aggregated by township, using the Theil index permits the decomposition of overall inequality in China into between-township and within-township components. Moreover, townships can be aggregated into counties, and counties can be aggregated into provinces. Therefore, the Theil index allows the within/between decomposition of inequality to be performed at ever-higher levels of aggregation.

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Table 1. Distributions of Sample Villages

Province	Number of the surveyed villages	Percentage of surveyed villages in total sample villages (%)
Jiangsu	457	18.6
Gansu	328	13.3
Sichuan	365	14.8
Shaanxi	369	15.0
Jilin	367	14.9
Hebei	573	23.3
Total	2459	100

Source: authors' survey.

Table 2. Distribution of Nationally Designated Poor Counties in Sample Counties

Province	Number of nationally designated poor counties
Jiangsu	0
Gansu	3
Sichuan	1
Shaanxi	4
Jilin	1
Hebei	3
Total	12

Source: authors' survey.

The descriptive statistical analysis on income and population of sample villages is presented in Table 3. The average per capita net income of sample villages was 1807 yuan in 1997 and 2432 yuan in 2002, an increase of 34.6 percent. According to a report by the National Bureau of Statistics of China, per capita net income of farmers was approximately 2000 yuan in 1997 and approximately 2500 in 2002. Our results were close to these results. In contrast to income, the average population of sample villages increased from only 1430 people in 1997 to 1436 people in 2002, or by 0.4 percent. Furthermore, the total number of NDPC counties was 12 in terms of our sample, approximately one-third of all sample counties. However, there were 592 NDPC counties out of the 2000 counties nationally. The proportion of NDPC was approximately 30 percent. When comparing it with our sampling result, we found that these proportions were similar.

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Table 3. Income and Population of Sample Villages, 1997 and 2002

Variables	Observation	Mean	Standard deviation	Minimum	Maximum
Per capita net income in 1997 (yuan)	2459	1806.6	979.6	80	8000
Population in 1997	2459	1430.1	1073.6	76	8700
Per capita net income in 2002 (yuan)	2459	2432.1	1173.9	100	9400
Population in 2002	2459	1436.3	1075.9	62	8650

Source: Authors' survey

IV. Empirical Results: Decomposing the Income Inequality within and across Townships in Rural China, 1997 and 2002

We decompose income inequality within and across townships for our samples using Stata 8.2 statistical software from Stata Corporation, USA. With the definitions chosen, income inequality in rural China decreased a little between 1997 and 2002 (Table 4). The Theil index decreased from 0.21 to 0.20, whereas the MLD index decreased from 0.23 to 0.22. These numbers support the view that the changes in income inequality in rural China should not be a major concern when considering communities (villages or townships) rather than individual households. The results actually show a slight improvement in income disparities.

In Table 4, we report the significance in contribution of each of components to total inequality in terms of the Theil index and the MLD index as defined in Section II. Inter-township inequality stood for 78 and 73 percent of total inequality, measured by the Theil index and the MLD index, respectively, in 1997. The corresponding contributions to the total rural inequality increased to 82 and 77 percent in 2002. In other words, the proportion of total inequality in rural China attributed to inter-township inequality was approximately three-quarters and increasing over time. Therefore, the results imply that if there were measures to ensure all townships in rural China should have the same mean income, while inequality within each township was unchanged, more than three-quarters of inequality in rural China would disappear in 1997 and 2002.

Corresponding to Equation (8) in Section II, the inter-township inequality can be further decomposed into intra-county inequality and inter-county inequality. Looking at Table 4, intra-county inequality made up 12–14 percent of total income inequality in rural China in both years. However, it was still much less than inter-county inequality. Results show that approximately two-thirds of total income inequality was attributed to inter-county inequality

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Table 4. Total Inequality and Its Decomposition in Rural China, 1997 and 2002

	1997		2002	
	THEIL	MLD	THEIL	MLD
Total inequality	0.21	0.23	0.20	0.22
(%)	100	100	100	100
Total inequality due to:				
Intra-township	0.05	0.06	0.04	0.05
(%)	22	27	18	23
Inter-township	0.16	0.17	0.16	0.17
(%)	78	73	82	77
Inter-township inequality due to:				
Intra-county	0.03	0.03	0.02	0.03
(%)	12	14	11	13
Inter-county	0.14	0.14	0.14	0.14
(%)	66	59	71	64
Inter-county inequality due to:				
Intra-province	0.06	0.06	0.06	0.07
(%)	28	27	32	31
Inter-province	0.08	0.08	0.08	0.08
(%)	38	32	39	33
Inter-county inequality due to:				
Intra-nationally designated poor counties	0.08	0.07	0.08	0.07
(%)	37	30	39	33
Inter-nationally designated poor counties	0.06	0.07	0.06	0.07
(%)	29	29	31	32

Source: authors' survey.

in terms of the Theil index in 1997 (Table 4). Also, unlike the intra-county inequality, which provided a stable contribution to total rural inequality, the inter-county inequality increased as a proportion of total rural inequality to 71 and 64 percent, respectively, in the Theil index and the MLD index in 2002. Therefore, approximately two-thirds of income inequality in rural China would have been eliminated if measures had been taken to equalize the average income at the county level.

Following the approach shown in Table 4, we now turn to the highest spatial provincial level. As shown in Equation (9), the inter-county inequality can be decomposed into intra-province inequality and inter-province inequality. With the results of this decomposition,

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we are able to find out how large a proportion of inequality between counties was a result of differences in mean income across counties within a particular province and how large a proportion was a result of different means between the 6 provinces. According to Table 4, the proportion of inter-province inequality is higher than that of intra-province inequality using both the Theil index measure and the MLD index measure. For example, the inter-province inequality accounted for 38 percent of inter-county inequality in 1997, whereas the contribution of intra-province inequality to inter-county inequality was only 28 percent in the same year measured by the Theil index. The situation in 2002 was similar.

As discussed earlier, one of our tasks is to measure inequality at another high spatial level-NDPC versus non-NDPC. Because our sample counties can be divided into NDPC and non-NDPC, the inter-county inequality can be easily decomposed into intra-NDPC inequality and inter-NDPC inequality according to Equation (8). The results are also listed in Table 4, which shows that the proportion of intra-NDPC inequality was higher than that of inter-NDPC inequality in both the Theil index and in the MLD index. However, when comparing the contribution of the intra-province inequality to inter-county inequality with that of inter-NDPC inequality, we found that they were similar in both 1997 and 2002. This finding implies that inequality between counties within provinces was caused mainly by the inequality between NDPC and non-NDPC. These results indicate that if the poverty alleviation strategy were aimed at a provincial level, efforts should be targeted at NDPC.

We also report the average income and the results of income inequality of the 6 sample provinces in 1997 and 2002 in Table 5. All sample provinces experienced a rising mean income and a decreasing or at least constant income inequality. However, the Theil index of Gansu Province, which lies in western China, was the highest, up to 0.31. In contrast, the Theil index of Jiangsu Province, which is located in eastern China, was the lowest at only 0. 07. Therefore, the situation of income inequality for each of the sample provinces is different, especially considering provincial differences between the eastern and western regions.

Similar results for NDPC and non-NDPC are reported in Table 6. Average income and income inequality are listed in terms of the Theil index and the MLD index. The mean income in NDPC increased from 796 yuan in 1997 to 992 yuan in 2002, or by 24.6 percent. The average income in non-NDPC increased from 1810 yuan in 1997 to 2280 yuan in 2002, or by 26 percent. At the same time, the total income inequalities of NDPC and non-NDPC were similar. The Theil index for both groups was 0.15 in 1997. The total income inequality both in NDPC and non-NDPC decreased in 2002 according to the Theil index and the MLD index measures, although changes were very small, implying that both NDPC and non-NDPC counties maintained similar economic development trends during this study period. This indicates that anti-poverty efforts such as anti-poverty funds and projects have been effective.

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Table 5. Income Inequality in Sample Provinces, 1997 and 2002

Province	1997			2002		
	Average income (yuan)	THEIL	MLD	Average income (yuan)	THEIL	MLD
Jiangsu	2660	0.07	0.08	3320	0.06	0.06
Gansu	765	0.31	0.26	969	0.30	0.24
Sichuan	1370	0.07	0.09	1790	0.06	0.08
Shaanxi	972	0.13	0.14	1310	0.13	0.14
Jilin	1310	0.09	0.09	1650	0.08	0.08
Hebei	1360	0.22	0.26	1620	0.22	0.26

Source: authors' survey.

Table 6. Income Inequality in NDPC and non-NDPC, 1997 and 2002

	1997			2002		
	Average income (yuan)	THEIL	MLD	Average income (yuan)	THEIL	MLD
Total inequality in NDPC counties	796	0.15	0.17	992	0.13	0.15
Total inequality in non-NDPC counties	1810	0.15	0.17	2280	0.14	0.15

Source: authors' survey.

Note: NDPC, nationally designated poor counties.

V. Concluding Remarks

Based on the per capita net income and population data from more than 2400 sample villages covering 6 provinces, the present study estimates income inequality within and between townships in rural China by applying the Theil index and the MLD index methods. Our approach enables us to aggregate average income and income inequality at the levels of townships, counties, and provinces, focusing on NDPC. Generally, the changes in income inequality in rural China are not obvious during the study period (1997 to 2002), and the Theil index was maintained at a level of approximately 0.2 in both 1997 and 2002. However, it is worth noting that our data capture only the village level situation and not the household level scenario, as in other studies. Therefore, an

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implied assumption is that the differences between households within villages are zero. Given the discussions in other studies regarding the rise of intra-household and inter-household income differences, the total income inequality in the prepsent study might be underestimated. Results show that inter-township inequality accounted for more than 75 percent of total income inequality, which was much larger than the proportion of intra-township inequality.

According to our results, more than 10 percent of the total income inequality in rural China was made up of differences in mean income within counties. However, the proportion of total rural inequality as a result of differences in average income across counties was much larger, approximately two-thirds. Although it is beyond the scope of the present study to understand the nature or the courses of inequalities in China's townships, counties and provinces, the implication of this result is that if we dedicated our efforts to alleviating income inequality at the county level, most income inequality in rural China would be eliminated. Of course, obtaining additional information on inter-county inequality by further decomposing the variation in mean income between the provinces as well as a variation in mean income within the provinces would also be useful in considering targeting measures. Furthermore, decomposing such variation between and within NDPC and non-NDPC would also be useful information for the various poverty offices when the new poverty alleviation strategies are considered.

Furthermore, although the overall income inequality in rural China has not obviously increased over time in terms of the Theil index and the MLD index measures, differences in income inequality across provinces do exist. For example, the values of the Theil index and the MLD index measures in Gansu Province are larger than those in Jiangsu Province. Again, it is beyond the scope of the present study to make arguments on why such differences exist. However, results from other studies show that these differences are, to a large extent, a result of the spatial differences and uneven development of regions in China. Because of the limitations on the number of sample provinces, we can not decompose income inequality across provinces further. Given unequal distribution of natural resources and transportation facilities, some regional income disparities are inevitable from the perspective of efficiency. Now China is still at a relatively early stage of economic development and, therefore, income-enhancing economic activities tend to be concentrated in a few counties in each province in order to take advantage of agglomeration economies. Caution needs to be taken regarding such approaches as this will eventually lead to widened income inequality and, consequently, will result in new obstacles for future economic development for the region as a whole.

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