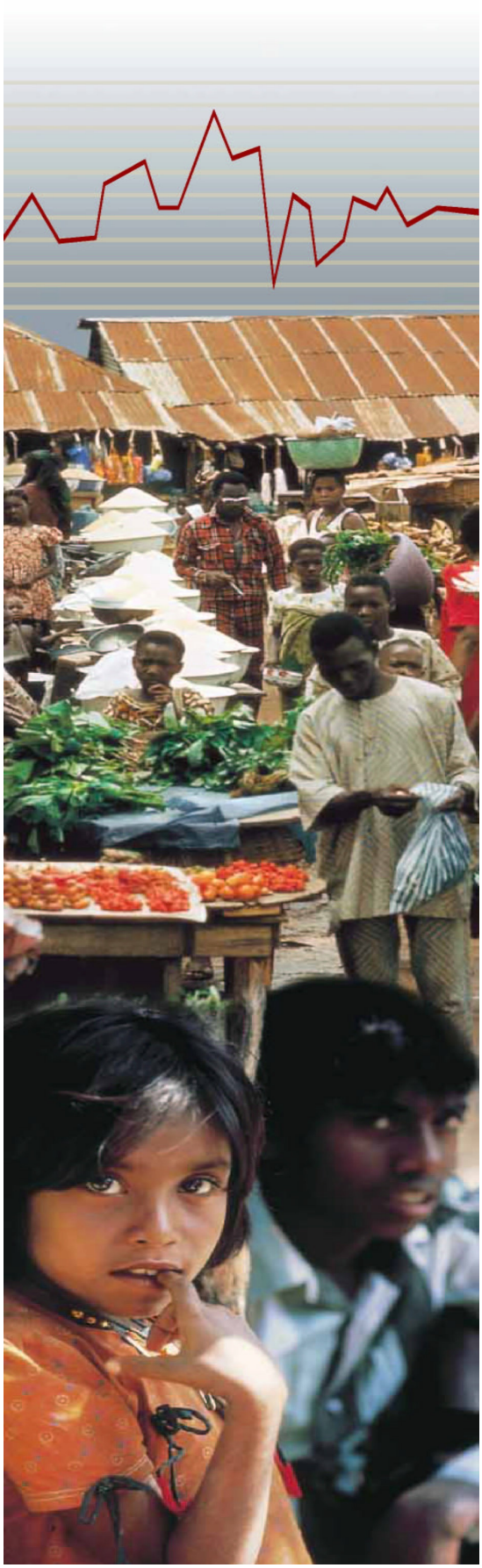

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Measuring Rural Poverty in China: A Case Study Approach

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Abstract

This paper measures rural poverty in Hubei Province and Inner Mongolia in China. The poverty lines we derived by Ravallion's method differ from the official Chinese poverty lines. The official pan-country poverty line underestimates rural poverty in Hubei Province and overestimates rural poverty in Inner Mongolia.

Poverty determinants are estimated by Logit as well as Probit models. The study notes that factors such as living in a mountainous area, lack of better irrigation conditions, a large family size, few fixed assets, few land owned and sole dependence on agriculture as a livelihood source would make a rural household more vulnerable to poverty. On the other hand, a rural household whose members are either better educated or trained laborers would statistically be less poor.

The growth-redistribution decomposition reveals that for all the three FGT indexes in Hubei province, income growth contributed much to the alleviation of poverty, while the redistribution or inequality effects counteracted the growth effects and worsened poverty. The poverty incidence decomposition results reveal that about one third of the growth effects had been counteracted by the redistribution effects. This implies that future anti-poverty programs should pay more attention to solving the inequality problem in China.

Poverty dominance analysis also helps us better understand the poverty situation. It reveals that rural poverty in Inner Mongolia is more severe than that in Hubei, and that poverty incidence in Hubei has lessened from 1997 to 2003, which are the same findings as those drawn from deriving poverty lines.

Key words: Rural Poverty Line, Poverty Determinants, Growth Redistribution Decomposition, Poverty Dominance, China.

JEL classification: I32; D33; C43

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1. Introduction

The most basic issue of any poverty study is the measurement of poverty. This is also true of poverty studies in China. Rapid economic growth in the last quarter century has significantly improved people's living standards. Per capita GDP has increased more than six fold and per capita rural income more than quadrupled. One is therefore led to believe that poverty in China must have declined substantially as a result of rising average income. However, the exact extent of rural poverty is highly debatable, given the varying poverty lines used for measurement.

Currently there are three main benchmarks that measure rural poverty in China. The first one is the standard international poverty line of US$1/day (in 1990 prices) per person, as recommended by the World Bank. The second one is the official poverty line defined by the Chinese government at 637yuan/year (at current 2003 prices) per person. The third one is provided by a number of independent researchers. Table 1 lists a few estimates of poverty incidence for rural China in some selected years.

Table 1 Comparisons of alternative estimates of rural poverty in China (In Yuan/year)

	Poverty line	Number of poor (million)	As % of Rural People	Poverty line (base on 1995)
A. World Bank (2004 for 2000)	$1.08/day	361	38.8	1440
B. Chinese official (2003)	637	30	3.2	530
Chinese official (1995)	530	61	7.1	530
C. Independent researchers				
1. Khan (1999 for 1995)	1157	240	28.6	1157
2. Yao (2004 for 1998)	877	187	20.1	732

Source: World Bank (2004); New Beijing Daily, 2004(for official estimate in 2003); Khan, 1999 (Khan's own estimate and the official estimate for 1995); Yao (2004), Table 9.1.2.

The official estimates are substantially lower than any of all the other estimates, primarily due to its use of a much lower poverty line. The government acknowledged that apart from the 30 million absolute poor in 2003, there were another 60 million low-income rural people (whose net per capita income is above 637yuan/year yet below 882yuan/year) who were highly vulnerable to poverty (New Beijing Daily, 2004). The estimate by the World Bank is substantially higher than both the official and independent estimates because they use an arbitrary international poverty line without considering the actual purchasing power

of US$1/day in rural China. The estimates by Khan (1999) and Yao (2004) are both based on the international poverty line adjusted by the actual purchasing power of US$1/day in rural China. As a result, their estimates are significantly lower than those by the World Bank, but still substantially higher than the official figures.

Purchasing power should also be considered in poverty measurement. However, the estimates in table 1 are subject to a common but important drawback: the estimates use the same poverty line for the whole country. Therefore, poverty incidence must have been underestimated in the rich provinces and overestimated in the poor regions because the prices of food and other daily necessities are usually positively related with per capita incomes.

Literature of poverty measurement has evolved into two closely connected but distinct branches: poverty measures and poverty orderings. The first branch is based on a poverty line, and the other is ranked without a poverty line. In China, there is little research that deals with poverty orderings. Based on the above discussion therefore, there are a few important questions that need to be answered. What is the real poverty situation in rural China? How do the poverty estimates differ across poverty lines? What are the main determinants of rural poverty? How can one decompose the variation in poverty into growth and redistribution components? How can poverty distribution be compared without knowing an exact poverty line? Finally, what are the implications of these to the anti-poverty policy?

The objective of this research is to find answers to these questions through a systematic study using household data from Hubei and Inner Mongolia. The study is presented as follows: Section 1 provides an introduction and a background of the problem, while Section 2 is a review of related literature. Section 3 outlines the study's methodologies, Section 4 presents the results, and Section 5 summarizes the main findings.

2. Literature Review

Up until now, most of the rural poverty studies in China are done using a given poverty line. Using the National Bureau of Statistics (NBS) rural household survey data of

four southern provinces (Guangdong, Guangxi, Yunnan, and Guizhou) from 1985 to1990, Jalan and Ravallion (1998a) assessed the impact of China's poor-area development programs. They found that households in the targeted poor areas have significantly higher rates of consumption growth than one would have expected. Without controlling for spatial externalities, the growth process entailed a sizable underestimation of the welfare gain from the programme. Jalan and Ravallion (1998b, 2000) further investigated the issue of transient poverty in rural China and found it to be considerable: One-half of the mean squared poverty gap and over one-third of the mean poverty gap was accounted for by year-to-year fluctuations in consumption.

Based on the assumption of subsistence intake and income data from NBS, the World Bank (1997) and Yao (2000) conclude that poverty declined sharply from 1978 to 1985 but the incidence of poverty hardly changed and even became sensitive as to how incomes were estimated in the following decade. Riskin (1994), Gustafsson and Li (1998), Riskin and Li (2001), Gusstafsson and Wei (2000) used rural household income survey data from the China Household Income Project carried out by a Sino-US team of social scientists in 1988 and 1995 to confirm the above-mentioned trend of change. However, different authors have come to very different conclusions on the occurrence of poverty in China. The World Bank (1997) says ‘most of China's remaining absolute poverty is now concentrated in a number of resource-poor rural areas, primarily in the northern, northwestern, and southwestern provinces’. In contrast, Riskin (1994) says ‘a new, individualized kind of poverty may be developing within the core regions of agricultural China’. He continues by saying that ‘government anti-poverty efforts are regionally defined. If the findings presented are accurate, most rural poor reside outside officially designated poor regions and anti-poverty measures do not reach most of them’. Riskin’s view is shared by more recent studies with more comprehensive data (Ravallion and Jalan, 1999; Khan and Riskin, 2001; Stiglitz, 2002; Yao, Zhang and Hanmer, 2004).

Rozelle, Park, Benziger, and Ren (1998) employed county-level data to examine the sources and the effectiveness of targeted poverty investments in 43 poor counties of Shaanxi Province during the years 1986 to 1991. According to their results, targeted

investment funds allocated directly to households for agricultural activity have a significant and positive effect on growth, while investments in township and village enterprises or county state-owned enterprises do not have a discernible effect on growth. Investments in agricultural infrastructure do not positively affect growth rates in agricultural output, suggesting that other types of basic investments (e.g. roads and education) should receive higher priority. There is also much research on the effect of anti-poverty programs in China. These include the study by Zhu and Jiang (1995) on the effects of food-for-work programs, and Park and Wang's (2001) assessment of the efficiency of three anti-poverty programs.

Chen and Ravallion (2002) also analyzed income distribution and poverty reduction in China after the country's accession into the WTO. It is concluded in this paper that most of the urban poor would gain from China's entering the WTO, but the rural poor may have to face a sharp decrease in quality of life. Rozelle, Zhang and Huang (2000) studied the reasons for rural poverty rate decrease. They analyzed certain data from Sichuan and Shannxi econometrically and found that most of the changes in rural poverty rate could be explained by economic growth. Tian, Wang and Ke (2003) analyzed the role of agriculture in poverty alleviation. They concluded that insofar as it is the main income source and employment route of the rural poor, the agriculture sector plays an important role in poverty reduction in rural China, yet the role of agricultural growth on urban poverty reduction is indirect and effective. Yue (2005) adopted the data set of the Poverty Monitoring Survey (PMS) to calculate transient poverty and chronic poverty among rural poor, and estimated the causes of transient poverty in China.

Available studies on poverty in China provide useful insights for this proposed research, but most of these studies are based on a given poverty line; only few studies have attempted to derive poverty lines using raw data. Chen and Ravallion (1996) derived provincial poverty lines for four southern provinces, but based on unit prices. Khan (1999) derived a rural poverty line based on a survey conducted in 1995, but his calculated poverty line is not relevant and comparable with the current and official poverty line, and he only estimates one single poverty line for the whole country. Both Khan (1999) and Yao (2004) derived rural poverty lines that are based on the international poverty line adjusted by actual purchasing power of US$1/day in rural China.

The above review on existing literature reveals some significant knowledge gaps when trying to understand rural poverty in China. Most of the researches are based on World Bank or official poverty lines, though the official pan-country poverty line may be far too low. There are no region-specific poverty lines based on regional prices. In addition, there are few studies in China that decompose variation in poverty into income change and distribution change as well as compare poverty distributions based on the poverty dominance theory.

3. Methodologies

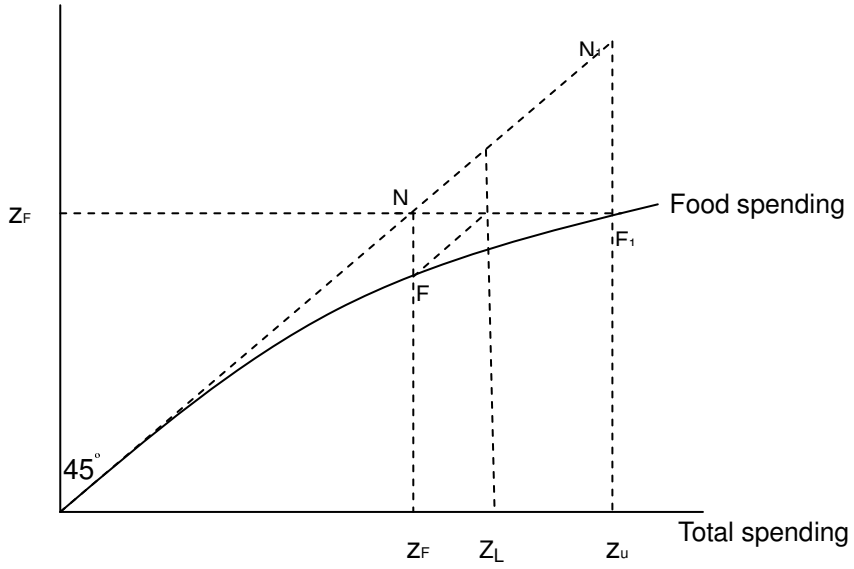
3.1 Deriving the rural poverty line

The first step in this study is to derive the food poverty line, which is defined as the cost to secure a minimum calorie intake for one adult per day. According to international standards, an intake of 2,100 calories per day per person will be used. All the sample households will be ranked according to their mean net incomes and divided into two groups. Following Ravallion (1994), the low-income group will be selected to derive the structure of their food consumption. This is because the consumption pattern of the low-income group is believed to be close to what the poor might choose to follow (Deaton, 1997). The main food items will be treated as the actual food bundle for the low-income group. The respective calorie equivalent for each of the food items can be based on guidelines from the National Nutritional Institute. Once the food bundle is converted into calorie equivalents, it is possible to derive the equivalent physical bundle of food that can produce 2,100 calories. From the price information, the value of this food bundle will be calculated as the food poverty line, denoted by Z_F.

The second step is to set basic non-food consumption. The definition of non-food spending can be made with available data. Assuming that food spending increases with total spending, with a slope less than unity, and decreasing as total spending increases (it being a regression line; see Figure 2), the expected value of food spending at any given value of total spending. Z_F is the food poverty line. Among those households who can afford to reach their nutritional requirement, the lowest level of non-food spending is given by the distance NF, all of which displaces basic food spending. Finally, Z_L can be obtained by

combining Z_F with NF, and this is named the low poverty line (Ravallion, 1994). On the other hand, we have an alternative approach to finding some households whose non-food spending barely reaches the food poverty line; meaning, they can only afford the basic food goods, and do not need to sacrifice some food to obtain non-food items. To these households, the non-food spending is N_1F_1 as in figure 1, and Z_F together with N_1F_1 is Z_U, thus named as high poverty line.

Figure 1: Spending curve in a household



To derive the poverty line, one can follow Ravallion's (1994) approach by running the following regression:

$$s_i = \alpha + \beta \ln(\frac{X_i}{Z_F}) + \gamma \ln(n_i) \qquad (1)$$

Where subscript *i* denotes household, *s* is the share of food expenditure in total expenditure, *X* is total expenditure per capita, and *n* is the number of household members. Once the parameters in equation (1) are estimated, the lower and higher poverty lines can be evaluated by the following formulae (see Ravallion, 1994, for a detailed explanation of lower and higher poverty lines).

The lower line (denoted by Z_L) is: $Z_L = Z_F(2 - \alpha - \gamma \ln(n))$

The higher line (denoted by Z_U) is: $Z_U = Z_F(1+\beta)/(\alpha + \gamma \ln(n) + \beta)$

3.2 Identifying the main determinants of poverty

At the household level, the probability of a household falling into absolute poverty can be estimated using either a Logit model or a Probit model, which estimates this as a function of a set of household-level variables (*Hi*) such as family size and structure, per capita land and capital, education indicators, business types, and a set of village feature variables (*Ci*) such as terrain, irrigation rate, distance to the nearest town, nationality etc.

3.3 Computing for the growth-redistribution decomposition of poverty variation

Although per capita incomes have risen in rural China, income inequality has also increased. The changes in rural poverty can be explained using two main components: income growth and redistribution. The Shapley growth effects and redistribution effects decomposition method discussed by Duclos and Araar (2003) can be used for this purpose. The easiest approach to decomposition is the normalized FGT (Foster, Greer and Thorbecke, 1984) indices $\bar{P}(z;\alpha)=\int_0^1(\frac{g(p;z)}{z})^{\alpha}dp$, where *z* is the poverty line，$\alpha\geq 0$ is an ethical parameter, *p* is the proportion of the population, and *g(z,p)* is the poverty gap. The decomposition can be shown in equation (3), where μ is population mean income, *z* and α is as defined (Duclos and Araar, 2005).

$$\begin{aligned}&\bar{p}_B(z;\alpha)-\bar{p}_A(z;\alpha)\\&=\frac{1}{2}\underbrace{\left((\bar{p}_A(\frac{z\mu_A}{\mu_B};\alpha)-\bar{p}_A(z;\alpha))+(\bar{p}_B(z;\alpha)-\bar{p}_B(\frac{z\mu_B}{\mu_A};\alpha))\right)}_{\text{Shaplay growth effect}}\\&+\frac{1}{2}\underbrace{\left((\bar{p}_B(\frac{z\mu_B}{\mu_A};\alpha)-\bar{p}_A(z;\alpha))+(\bar{p}_B(z;\alpha)-\bar{p}_A(\frac{z\mu_A}{\mu_B};\alpha))\right)}_{\text{Shapley redistribution effect}}\end{aligned}\qquad(3)$$

3.4 Analyzing poverty dominance

Following Duclos and Araar (2003), poverty dominance analysis will be performed to examine whether poverty increases over a particular time period, or whether the poverty situation in one region is worse than in another. Poverty dominance analysis applies stochastic dominance to distributions of households' income.

3.5 Data sources and software

This research uses the rural household surveys in Hubei province and Inner Mongolia. Hubei is a middle income province whose average annual per capita net income

in 2003 (2566 Yuan) is close to the level of China (2622Yuan), while the figure for Inner Mongolia is lower (2268 Yuan). Due to the difficulty of obtaining data, we only can utilize the 1,986 observations of Inner Mongolia for year 2002 and the 3,300 observations of Hubei province for 2002 and 2003. In order to get further insight into poverty variation over time for different regions, Hubei is also divided into developed and less developed regions by the economic geography (See Annex 2 for details). The data are then processed using STATA and DAD software.

4. Rural Poverty in Hubei and Inner Mongolia

4.1 Rural Poverty Measurement

4.1.1 Deriving the rural poverty line

Ravallion's (1994) method is used here to derive the rural poverty lines of Hubei province and Inner Mongolia. In the rural household survey data of Hubei, the index setting of 2003 is more detailed than that of 1997, especially on food purchase and consumption. In this paper, we thus derive the poverty line of 2003, and then adjust it through the CPI of Hubei to attain the poverty line of 1997 and 2002.

Food poverty line

All households in the data are ranked according to average per capita net incomes, and the poorest 30 percent are selected as the sample from which the poverty line is derived, since the consumption pattern of the low-income group is assumed to be close to what the poor might choose to follow.

The next step is to calculate energy intake equivalent for each of the 30 percent low-income households. Then, the low-income group is further divided into three subgroups by the ranges of energy intake equivalent. The first subgroup includes those households with an energy intake of less than 2050 (calories per day per person), the second subgroup includes those with an energy intake of less than 2050 but no more than 2150, while the third subgroup includes those with an energy intake of more than 2150. Since the second subgroup is closest to the 2100 calorie standard, it is thus used here to derive the food poverty line. The distribution of the 30 percent low-income households (H) and population (P) with respect to the three energy intake ranges is given in table 2.

Table2: Primary Energy Intake for the 30 percent Rural Households with the Lowest per Capita Net Income

Year	Region	Number of Sample Households	30% Rural Households with the Lowest Per Capita Net							
			Sub Total		<2050		(2050-2150)		>2150	
			H	P	H	P	H	P	H	P
200	Inner Mongolia	1986	596	2501	23	109	26	107	332	130
2003	Hubei Province	3300	990	4419	29	145	40	186	654	277
	Developed	1890	419	1869	13	642	17	79	269	114
	Less Developed	1410	571	2550	16	815	23	107	385	162

Note: H: number of households, P: number of population

Without special notes, the authors calculate all the tables in this paper.

The third step is to make the average consumption for each food item within the second subgroup (whose calorie intake is between 2050 and 2150) as the standard food bundle. The food bundle is composed of corn, beans and leguminous products, vegetables, lipids, meat, milk and its products, egg and its products, aquatic products, sugar, wine and drink, flavouring etc. Though the flavouring cannot be transformed into energy, it is included in the food bundle as a necessary household item. The standard food bundles for Hubei Province (as well as its sub regions) and Inner Mongolia are shown in tables 3 and 4, respectively. The respective energy intake equivalents are given in Appendix Table 1 and Appendix Table 2.

The final step is to derive the food poverty line by valuing the food items in the standard combination using average local prices (unit value) for each food item. The derived food poverty lines are 617 Yuan/year for Hubei Province (2003) and 500 Yuan/year for Inner Mongolia (2002), as shown in tables 3 and 4, respectively.

Table 3: Standard food combination for rural households with 2050~2150 calorie intake in Hubei, 2003 unit: kg, Yuan/kg, Yuan

Food Items	Hubei Province (2003)				Developed Region (2003)					Less Developed Region (2003)			
	Q	P	Q*P		Q1	P1	Q1*P1	Q1*P2		Q2	P2	Q2*P2	Q2*P1
Wheat	0.0402	1.2094	0.0487		0.0250	1.3928	0.0348	0.0288		0.0515	1.1521	0.0593	0.0717
Rice	0.3521	1.0650	0.3750		0.4420	1.2882	0.5694	0.3566		0.2857	0.8067	0.2304	0.3680
Maize	0.0228	1.2628	0.0287		0.0087	1.1823	0.0103	0.0111		0.0332	1.2781	0.0424	0.0393
Other corn	0.0033	1.6492	0.0054		0.0008	1.2875	0.0010	0.0015		0.0051	1.9034	0.0097	0.0066
Potato	0.0122	3.9490	0.0483		0.0110	2.8859	0.0318	0.0702		0.0131	6.3862	0.0839	0.0378
Soy bean	0.0031	3.3459	0.0103		0.0022	3.6401	0.0081	0.0063		0.0037	2.8792	0.0106	0.0135
Other bean	0.0013	2.4615	0.0031		0.0011	2.7157	0.0029	0.0024		0.0014	2.2104	0.0032	0.0038
Vegetable oil	0.0116	6.5389	0.0758		0.0181	6.4404	0.1164	0.1204		0.0078	6.6535	0.0521	0.0502
Tallow	0.0008	7.1583	0.0055		0.0005	8.6427	0.0040	0.0035		0.0010	7.0079	0.0071	0.0086
Greenery	0.1065	1.2437	0.1325		0.0819	1.3783	0.1129	0.0904		0.1247	1.1043	0.1377	0.1719
Cushaw ect	0.0460	1.2161	0.0559		0.0228	1.2460	0.0284	0.0262		0.0631	1.1491	0.0725	0.0786
Root stock	0.0710	1.3536	0.0961		0.0807	1.4794	0.1194	0.0962		0.0639	1.1917	0.0761	0.0945
Night shade	0.0338	1.5053	0.0509		0.0278	1.5763	0.0438	0.0405		0.0382	1.4564	0.0557	0.0602
Garlic & shallot	0.0110	1.6362	0.0180		0.0080	1.8927	0.0152	0.0109		0.0132	1.3673	0.0180	0.0250
Kidney bean	0.0197	1.8358	0.0361		0.0118	1.7197	0.0203	0.0262		0.0255	2.2167	0.0565	0.0439
Water plant	0.0007	1.9374	0.0013		0.0008	1.9317	0.0015	0.0016		0.0005	1.9540	0.0011	0.0010
Mushroom	0.0009	3.6016	0.0031		0.0005	3.0112	0.0015	0.0022		0.0011	4.3636	0.0050	0.0033
Other vegetable	0.0130	1.6750	0.0218		0.0379	1.6803	0.0637	0.0633		0.0048	1.6689	0.0081	0.0081
Pork	0.0456	9.5152	0.4335		0.0300	9.7185	0.2913	0.2804		0.0519	9.3450	0.4855	0.5044
Beef	0.0013	13.0747	0.0171		0.0002	12.6451	0.0029	0.0028		0.0026	14.0475	0.0369	0.0329
Mutton	0.0000	11.2892	0.0002		0.0001	11.2017	0.0013	0.0013		0.0000	11.5179	0.0003	0.0003
Poultry	0.0034	8.7874	0.0301		0.0039	8.9542	0.0350	0.0336		0.0031	8.6083	0.0263	0.0278
Meat product	0.0004	6.5907	0.0027		0.0005	6.6909	0.0032	0.0032		0.0004	6.3466	0.0023	0.0027
Egg product	0.0076	5.9577	0.0454		0.0081	5.8093	0.0470	0.0491		0.0073	6.0562	0.0440	0.0424
Milk product	0.0002	3.2778	0.0005		0.0000	5.0000	0.0000	0.0000		0.0003	2.9333	0.0008	0.0015
Fishery	0.0119	4.1463	0.0492		0.0174	3.9987	0.0696	0.0769		0.0078	4.4216	0.0344	0.0312
Shrimp etc	0.0001	6.3035	0.0009		0.0003	4.4055	0.0015	0.0021		0.0000	7.0704	0.0001	0.0001
Alga	0.0003	3.5289	0.0011		0.0003	3.1199	0.0009	0.0012		0.0003	3.8923	0.0012	0.0009
Other aquatic	0.0002		0.0013		0.0004	4.0000	0.0016	0.0223		0.0000	55.8659	0.0010	0.0001
Sugar	0.0019	3.5272	0.0067		0.0013	3.5096	0.0046	0.0046		0.0023	3.5360	0.0082	0.0081
Distilled spirit	0.0066	4.3353	0.0287		0.0048	4.6454	0.0224	0.0199		0.0079	4.1474	0.0329	0.0367
Beer	0.0073	2.0676	0.0150		0.0055	2.0331	0.0113	0.0115		0.0085	2.0840	0.0178	0.0173
Bean product	0.0033		0.0067		0.0043	1.6977	0.0073	0.0104		0.0026	2.4231	0.0063	0.0044
Flavorings			0.0345				0.0351	0.0351				0.0341	0.0341
Expenditure /yr			***617***				***627***	***552***				***606***	***668***
Food poverty line (ZF)			**617**				**627**					**606**	

Note: Q, P and Q*P stands for quantity, unit value and daily food expenditure respectively.

Table 4: Standard food combination for rural households with 2050~2150 calorie intake in Inner Mongolia, 2002, unit: kg, Yuan/kg, Yuan

Food Items	Inner Mongolia (2002)		
	Quantity	Unit Value	Value
Corn	0.5009	1.2000	0.6011
Vegetable oil	0.0082	5.6637	0.0466
Tallow	0.0043	5.8549	0.0250
Bean and Bean Products	0.0030	2.3965	0.0073
Vegetable	0.1630	0.6181	0.1008
Pork	0.0339	8.4000	0.2850
Beef	0.0003	11.0000	0.0031
Mutton	0.0091	11.2404	0.1022
Poultry	0.0023	9.0262	0.0206
Meat product	0.0002	9.9166	0.0020
Egg product	0.0057	4.5275	0.0259
Milk product	0.0036	5.7927	0.0209
Fishery	0.0021	4.6119	0.0098
Shrimp etc	0.0001	3.9868	0.0002
Alga	0.0001	2.2414	0.0002
Other aquatic	0.0000	3.6134	0.0001
Sugar	0.0043	3.0109	0.0128
Candy	0.0006	5.9036	0.0035
Distilled spirit and wine	0.0140	4.1960	0.0588
Beer	0.0061	2.4674	0.0152
Flavorings			0.0283
Food poverty Line (Z_F)			**500**

Non-food poverty line estimates

In order to get the non-food poverty line parameters, a regression is made according to equation (1), and the results are listed in table 5.

Table5: Parameters of non-food poverty line

	Hubei Province (2003)								Inner Mongolia (2002)	
	Hubei		Developed region		Less developed region					
	Value	T-stat	Value	T-stat	Value	T-stat			Value	T-stat
α	0.6470	23.60***	0.5875	14.75***	0.6782	16.79***			0.8688	27.49***
β	-0.0924	-11.68***	-0.0963	-8.65***	-0.0907	-7.43***			-0.1886	-16.07***
γ	-0.0583	-3.08***	-0.0395	-0.07	-0.0819	-3.02***			0.0621	3.01***
F	89.74		39.92		41.99				132.31	
R^2	0.1539		0.1240		0.1667				0.3086	

Rural Poverty Lines

Based on the derived food poverty line and non-food poverty parameters, the lower and higher rural poverty lines for Hubei Province (2003) and Inner Mongolia (2002) are obtained using Ravallion's method (1994). The results are listed in table 6. The lower line incorporates a minimal allowance for non-food goods (it being the typical non-food spending item of those who can only afford the minimum food requirement), and the higher poverty line gives a more generous allowance.

Using CPI generates the poverty lines of Hubei Province in 1997, while poverty lines of the World Bank are adjusted by purchasing power parity. For reference, the poverty line of World Bank is US$1 per day per person. In China, if we convert the World Bank's poverty line into RMB by nominal exchange rates, the standard would be more than 3000 Yuan/year. This is higher than the average net income of China; this makes the poverty rate so high that it is not feasible as a reference point for this study. Because poverty estimates would change with the nominal exchange rates, it is better to use purchasing power parity instead. Based on the dollar's value in 1995 and GNP adjusted by purchasing power parity， we make the ratio of the two indices of 1997 and 2003 to be purchasing power parity of US$1 to RMB. The results are 4.2994 in 1997, 4.2893 in 2002, and 4.2424 in 2003. Converting the poverty line of World Bank from US$ into RMB, we get 1569 Yuan/year in 1997, 1566 Yuan/year in 2002, and 1548 Yuan/year in 2003.

Table 6: Rural Poverty lines in Hubei and Inner Mongolia Yuan/year

Region and poverty line		1997			2002			2003	
		Z_L	Z_U		Z_L	Z_U		Z_L	Z_U
Hubei Province	Hubei	898	1210		877	1183		889	1198
	Developed region	932	1323		911	1293		922	1310
	Less developed region	885	1201		865	1173		876	1189
Inner Mongolia					519	524			
Chinese official poverty line		640			627			637	
Poverty line of World Bank		1569			1566			1548	

Source: The authors calculate rural poverty lines of Hubei province and Inner Mongolia, while other poverty lines come from the China Rural Poverty Monitoring Report.

4.1.2 Comparing poverty lines

The derived rural poverty lines of Hubei Province are much higher than China's official lines, while those of Inner Mongolia are relatively lower (as shown in Table 6). The poverty line closest to the World Bank poverty line is that of the developed region in Hubei. For example, in 2002 the derived poverty lines for Hubei were 877 Yuan/year (lower line) and 1183Yuan/year (higher line), or 39 percent and 88 percent higher, respectively, than the official line (627 Yuan/year) which is close to the food poverty line for the developed region. On the other hand, the derived poverty lines for Inner Mongolia were 519 Yuan/year (lower line) and 524Yuan/year (higher line), or 17 percent lower than the official line. Given the fact that most of the anti-poverty policies in China were based on poverty monitoring through official lines, there might exist a risk of over-estimating the poverty in Inner Mongolia and under estimating the poverty in Hubei Province. It is also interesting to find that even for a middle-income province such as Hubei, the derived poverty lines are not consistent with the official lines.

The official rural poverty line for 1985 was derived as food poverty line divided by 0.6 in 1986 by the National Bureau of Statistics (NBS). It was based on the expenditure of about 6.7million households and determined as 206 Yuan per person per year. Hereafter, the poverty lines were adjusted year by year through the CPI. The NBS adopted the method proposed by Martin Ravallion (1994) to calculate the non-food component of the poverty line in 1998.

Several factors may account for the difference between the official poverty line and the derived line in our case study. The most basic difference comes from the food consumption structure and food prices. Referring back to table 3 and table 4, one can find that in order to get relatively the same basic 2050 to 2150 calorie energy intake, rural residents in Hubei Province have to spend more money than those in Inner Mongolia. This is a combined outcome of differences in food consumption structure and difference in food prices. Not all the food items in rural Inner Mongolia are priced lower than those in Hubei Province. The same observation also holds true for the comparison between the less developed and the developed region in Hubei.

As shown in table 3, the food expenditure in the developed region is 627 Yuan based on the items' respective prices and 552 Yuan based on prices in the less developed region, a 75-Yuan difference from the regional purchasing power contribution. This implies that the poverty lines derived from a pan-country level food bundle cannot fully reflect the regional poverty situation. In addition, because the structure of the food bundle and food prices also change over time, merely adjusting rural poverty lines at the country- level CPI without fully considering changes in the structure of food consumption and food prices with respect to different regions may lead to wrong poverty estimates.

Another factor also needs to be considered here when we discuss the food price dispersion spatially. Given that China is still on the road towards a market economy and there remains a lack of sufficient transportation infrastructure in its rural areas, not all the regional markets are well integrated. The price changes in one region may thus not keep in step with that of average change at the national level. Therefore, it is not appropriate to apply a single poverty line that is derived by using country level food prices when monitoring poverty dynamics for all the regions. This point is especially important when we come to the discussion on absolute poverty.

4.1.3 Comparing FGTs at different poverty lines

FGT indices are commonly used as poverty indicators. When α=0, FGT denotes the poverty headcount, and is simply the proportion of a population that is in poverty. When α=1, FGT index represents the depth of poverty. When α=2, FGT index represents the severity of poverty. In this section, the normalized FGT is used for comparing different poverty lines. The results are listed in tables 7and 8.

Firstly, it can be noted in the table that rural poverty in Inner Mongolia is severe. Though the derived poverty line is lower, the poverty incidence is higher than that in Hubei in 2002. Based on the lower poverty lines, the poverty incidence is 5.02 percent in Hubei and 7.17 percent in Inner Mongolia, while the poverty gap is 0.0128 in Hubei and 0.0446 in Inner Mongolia, and the squared-poverty gap is 0.005 in Hubei and 0.1039 in Inner Mongolia. Based on China's official poverty line and poverty line of the World Bank, the difference in FGT index between the two provinces is distinctly further.

Secondly, Province-wide measures such as rural poverty level, poverty degree, and poverty depth were all reduced from 1997 to 2003. This implies that rural poverty in Hubei province was alleviated during this period.

Thirdly, all the FGT indices calculated under China's official poverty lines are lower than those under other poverty lines for Hubei Province. It thus seems that the Chinese official poverty line under-estimated the rural poverty in Hubei province. According to the official standard, the poverty incidence was only 2.40 percent in1997 and 2.04 percent in 2003.However, the rural poverty incidence is 7.78 percent in 1997 and 5.07 percent in 2003 under lower poverty line and 17.99 percent in 1997 and 11.6 percent in 2003 under higher poverty line. On the other hand, compared with the FGT indices calculated under the derived poverty lines for Inner Mongolia, the official line over-estimated rural poverty.

Fourthly, all the poverty indices of the developed region are lower than those of the less developed region; hence the poverty in the less developed region is more severe. For example, in 1997 the poverty incidence was 3.45 percent in the developed region under a lower poverty line, but was at 12.41 percent in the less developed region.

Finally, the official poverty line based on changing rates from 1997 to 2003 for Hubei Province shows no significant difference except in terms of poverty headcount and severity of poverty. The poverty headcount of 15 percent is much lower than the estimates under other poverty lines; on the other hand, poverty severity is 45.835, much higher than the estimates under other poverty lines.

Table 7: FGT indices under different poverty lines

		Lower Poverty Line				Higher Poverty Line				Chinese Official Poverty Line				World Bank Poverty Line		
		$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$
1997	Hubei	0.0778	0.0175	0.0066		0.1799	0.0455	0.0177		0.0240	0.0054	0.0024		0.3294	0.0935	0.0386
	Developed Region	0.0345	0.0080	0.0036		0.1133	0.0259	0.0100		0.0073	0.0029	0.0019		0.1968	0.0461	0.0174
	Less developed Region	0.1241	0.0275	0.0098		0.2809	0.0728	0.0280		0.0424	0.0081	0.0029		0.4747	0.1454	0.0618
2002	Hubei	0.0502	0.0128	0.0050		0.1258	0.0309	0.0124		0.0226	0.0038	0.0018		0.2631	0.0690	0.0283
	Developed Region	0.0264	0.0065	0.0025		0.0877	0.0205	0.0078		0.0105	0.0016	0.0009		0.1722	0.0378	0.0141
	Less developed Region	0.0803	0.0208	0.0081		0.1902	0.0496	0.0202		0.0378	0.0067	0.0030		0.3689	0.1066	0.0455
2003	Hubei	0.0507	0.0120	0.0044		0.1160	0.0297	0.0117		0.0204	0.0035	0.0013		0.2238	0.0614	0.0252
	Developed Region	0.0254	0.0053	0.0021		0.0958	0.0198	0.0070		0.0068	0.0017	0.0008		0.1529	0.0360	0.0129
	Less developed Region	0.0845	0.0203	0.0072		0.1756	0.0485	0.0196		0.0375	0.0059	0.0019		0.3132	0.0936	0.0407
2002	Inner Mongolia	0.0717	0.0446	0.1039		0.0720	0.0468	0.1028		0.0937	0.0528	0.0868		0.4521	0.1822	0.1143

Table 8: FGT changing rate from 1997 to 2003 for Hubei province, %

	Lower Poverty Line				Higher Poverty Line				Chinese Official Poverty Line				World Bank Poverty Line		
	$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$
Hubei	-34.83	-31.43	-33.33		-35.52	-34.73	-33.90		-15.00	-35.19	-45.83		-32.06	-34.33	-34.72
Developed Region	-26.38	-33.75	-41.67		-15.45	-23.55	-30.00		-6.85	-41.38	-57.89		-22.31	-21.91	-25.86
Less developed Region	-31.91	-26.18	-26.53		-37.49	-33.38	-30.00		-11.56	-27.16	-34.48		-34.02	-35.63	-34.14

4.2 Main determinants of rural poverty

In this section, we estimate the determinants of rural poverty by Logit Model and Probit Model in order to find out why some households are poor but others are not during the same period. In Hubei province, 2002 and 2003 data are used since the 1997 data has some discrepancies along some statistical items, and the sample size of the model data is 6600. In Inner Mongolia, we use the data of 2002 with a sample number of 1986. The dependent variable is poverty incidence, which is 1 when the household is poor, and 0 if not. All the explanatory variables and other notations are listed in Appendix table 3. The explanatory variables consist of two groups. The first details the village characteristics such as old area (remote areas where the communist party and its military got support from local farmers in 1930s and 1940s), nationality, and terrain, distance to nearest town, and irrigation rate. The second cites the demographic and non-demographic features of rural households such as arable land per capita, physical assets per capita, family size, ratio of old men, ratio of trained labour, education, dependency ratio, and business type.

The Logit and Probit Model estimation results for Hubei Province and Inner Mongolia are given in tables 9 and 10, respectively. These two models show relatively same findings. By comparing the models under different poverty lines, it is interesting to discover that most variables show significant impacts on rural poverty. Locating at a mountainous or minority area, lacking better irrigation conditions, a big family size, few physical capital assets, few land owned, or making a living only on agriculture would make a rural household more susceptible to poverty, while those households whose members are better educated or better trained as labourers would statistically be less likely to fall into poverty. This implies that giving the poor more access to higher-level education and training should be fully taken into consideration in any anti-poverty program.

Table 9.1: Logit estimates of the poverty determinants for Hubei Province, 2002 and 2003

	Lower Poverty Line	Higher Poverty Line	Chinese Official Poverty Line	World Bank Poverty Line
C	-1.7118 (-1.4323)	-0.9772 (-1.2173)	-2.8525 (-1.5998)	1.1272** (2.0636)
Dummy of old revolutionary area	0.2967 (1.3473)	0.1760 (1.1689)	-0.1142 (-0.3268)	0.1832* (1.7470)
Dummy of minority area	0.7034*** (2.1886)	0.8709*** (3.7869)	0.5959 (1.2805)	0.9139*** (5.0663)
Dummy of plain area	-0.0948 (-0.3738)	-0.3421** (-2.1981)	-0.4891 (-1.1985)	-0.2491** (-2.5592)
Dummy of mountainous area	1.0784*** (4.0701)	1.1054*** (6.2444)	1.3123*** (3.4765)	0.6634*** (5.3247)
Log (irrigation rate of village)	-0.1826** (-2.0974)	-0.1367*** (-2.3867)	-0.2887** (-2.1799)	-0.1214*** (-3.1367)
Dummy of below 5 kilometers	-0.0020 (-0.0095)	-0.1409 (-1.0484)	-0.0443 (-0.1448)	-0.1334 (-1.5174)
Dummy of above 20 kilometers	0.2279 (0.6589)	-0.1011 (-0.3691)	-0.6617 (1.2033)	0.2987 (1.5024)
LOG (family size)	2.4704*** (6.6141)	2.4925*** (9.9234)	2.0854*** (3.8537)	2.2435*** (13.2475)
LOG (per capita physical stock)	-0.3036** (-3.3042)	-0.2466*** (-4.0712)	-0.2984** (-2.1776)	-0.2093*** (-5.1809)
LOG (per capita arable land)	-0.7594*** (-4.9026)	-0.7339*** (-6.7701)	-0.5527*** (-2.4765)	-0.8035*** (-10.4812)
Dummy of farming	0.9394*** (4.1487)	0.8334*** (5.4751)	1.4023*** (4.3754)	0.5810*** (5.4595)
Dummy of non-farming& farming	-1.1022*** (-3.6674)	-1.1662*** (-6.0249)	-1.0237** (-2.0490)	-1.1525*** (-9.5332)
Dummy of non-farming	0.1606 (0.1431)	-1.0403 (-0.9581)	-1.7727* (-1.5409)	-1.6604** (-2.0514)
Education duration	-0.0522* (-1.6939)	-0.0644*** (-2.2466)	-0.0657 (-1.0045)	-0.0789*** (-4.1434)
Ratio of the old	1.5789** (2.9566)	1.2916*** (3.4612)	1.2609 (1.6580)	1.5033*** (5.9684)
Ratio of children younger than 6	1.2996 (1.3677)	1.9490*** (3.1564)	12336 (0.8964)	0.8707** (1.9090)
Ratio of trained labor	-0.8726 (-1.2237)	-0.72684* (-1.7296)	-0.9115 (-0.8511)	-0.6211** (-2.1389)
Sample Number	6600	6600	6600	6600
Log Likelihood	-486.10	-1026.98	-252.81	-1893.18
McFadden R^2	0.1931	0.1883	0.1805	0.1868

Note: Z statistics in parentheses. ***:1%significance，**: 5%significance，*:10% significance

Table 9.2: Probit estimates of the poverty determinants for Hubei Province, 2002 and 2003

	Lower Poverty Line	Higher Poverty Line	Chinese Official Poverty Line	World Bank Poverty Line
C	-0.8945 (-1.6772)	-0. 3326 (-0.8510)	-1.2823 (-1.7156)	0.6229* (2.0334)
Dummy of old revolutionary area	0.1346 (1.3417)	0. 0916 (1. 2236)	-0.0124 (-0.0850)	0.1011* (1.6986)
Dummy of minority area	0. 4782*** (3.2136)	0. 5446*** (4.5794)	0. 3319 (1.6061)	0.5375*** (5.1039)
Dummy of plain area	-0. 1167 (-1.1294)	-0. 1747** (-2. 4122)	-0.1970 (-1.2357)	-0.1478** (-2.7564)
Dummy of mountainous area	0.4519*** (3.7835)	1.1054*** (6.2507)	0.5407*** (3.4420)	0.3849*** (5.3518)
Log (irrigation rate of village)	-0.0878*** (-2.2731)	0.0770*** (-2.7473)	-0.1266** (-2.3266)	-0.0584*** (-2.9094)
Dummy of below 5 kilometers	-0.0360 (-0.4017)	-0.0218 (-0.3398)	-0.0250 (-0.1396)	-0.0618 (-1.2636)
Dummy of above 20 kilometers	0. 1146 (0. 6846)	-0. 0019 (-0. 0138)	-0.3229 (-1.3076)	0.1873 (1.5970)
LOG (family size)	1.0563*** (6. 4443)	1.2025*** (9.9607)	0.8225*** (3.6518)	1.2271*** (13.1532)
LOG (per capita physical stock)	-0.1399*** (-3.5238)	-0. 1213*** (-4. 1760)	-0.1435** (-2.4642)	-0.1179*** (-5.2888)
LOG (per capita arable land)	-0. 3285*** (-4.5588)	-0. 3919*** (-7.2913)	-0.2644*** (-2.6630)	-0.4508*** (-10.6119)
Dummy of farming	0. 3962*** (3.9223)	0. 3874*** (5.1341)	0.5998*** (4.2910)	0.3382*** (5.6586)
Dummy of non-farming& farming	-0.5131*** (-4.0629)	-0.5942*** (-6.7010)	-0.4111** (-2.1836)	-0.6376*** (-9.7235)
Dummy of non-farming	0. 0280 (0.0527)	-0.2414 (-0.5545)	-0.6818* (-1.2298)	-0.9128** (-2.1450)
Education duration	-0. 0304* (-1.6006)	-0. 0399*** (-2.8788)	-0.0231 (-0.8496)	-0.0430*** (-4.0405)
Ratio of the old	0.6646** (2.7756)	0.5829*** (3.1420)	0.4860 (1.4440)	0.8338*** (5.7312)
Ratio of children younger than 6	0.5748 (1.3245)	0.8784*** (2.7894)	0.5438 (0.9231)	0.5007** (1.9286)
Ratio of trained labor	-0. 2917 (-0.9924)	-0. 3996* (-1.8669)	-0.2641 (0.6249)	-0.3527** (-2.2090)
Sample Number	6600	6600	6600	6600
Log Likelihood	-528.78	-1063.87	-251.84	-1895.67
McFadden R^2	0.1840	0.1879	0.1836	0.1805

Note: Z statistics in parentheses. ***:1%significance，**: 5%significance，*:10% significance

Table 10.1: Logit estimates of the poverty determinants for Inner Mongolia, 2002

	Lower Poverty Line	Higher Poverty Line	Chinese Official Poverty Line	World Bank Poverty Line
C	-4.0333*** (-6.8365)	-4.337*** (-6.8535)	-4.3199*** (-6.7488)	-0.8957*** (-2.8959)
Dummy of old revolutionary area	1.1190*** (4.6238)	1.1373*** (4.7322)	1.2834*** (4.9618)	0.4452*** (2.7710)
Dummy of plain area	-1.3013*** (-4.6064)	-1.0236*** (-4.6494)	-1.3595*** (-4.4413)	-1.1037*** (-8.3592)
Dummy of mountainous area	0.9585*** (2.5732)	1.3137*** (2.7767)	0.6698* (1.6039)	1.0010*** (5.0217)
Distance to the nearest town	-0.0039 (-0.3256)	-0.0049 (-0.4046)	-0.0012 (-0.0172)	0.0014 (0.2058)
Dummy of minority area	-0.0564 (-0.2342)	-0.0142 (-0.0590)	-0.1590 (-0.6033)	-0.1898 (-1.3232)
Irrigation rate of village	-0.62157*** (-1.8383)	-0.6112* (-1.8134)	-0.6695* (-1.8344)	-1.0374*** (-5.9711)
Family size	0.2422*** (2.8873)	0.2318*** (2.7707)	0.2257*** (2.4681)	0.4513*** (8.6919)
Per capita physical stock	-9.42E-07 (-0.1212)	-8.422E-07 (-0.1084)	-4.41E-06 (-0.5630)	-2.60E-05*** (-5.0609)
Per capita arable land	-0.0165*** (-3.1448)	-0.0163*** (-3.1167)	-0.0167*** (-2.9526)	-0.0181*** (-6.6727)
Dummy of farming	0.5849*** (2.8206)	0.5944*** (2.8697)	0.6753*** (2.9394)	0.1756* (1.6047)
Dummy of non-farming	-0.4747 (-1.0419)	-0.4755 (-1.0430)	-0.3642 (-0.7302)	-0.4975** (-2.5818)
Education duration	-0.4378* (-1.0722)	-0.0426 (-1.0476)	-0.0492 (-1.1146)	-0.1066*** (-4.8265)
Ratio of non-labor in a household	0.2273 (0.5167)	0.2369 (0.5400)	0.4729* (0.9891)	0.3799* (1.5566)
Sample Number	1986	1986	1986	1986
Log Likelihood	-455.13	-456.76	-397.49	-1176.92
McFadden R^2	0.0077	0.0789	0.0834	0.1340

Note: Z statistics in parentheses. ***:1%significance，**: 5%significance，*:10% significance

Table 10.2: Probit estimates of the poverty determinants for Inner Mongolia, 2002

	Lower Poverty Line	Higher Poverty Line	Chinese Official Poverty Line	World Bank Poverty Line
C	-1.7437*** (-6.6182)	-2.1751*** (-7.5044)	-2.3300*** (-7.4447)	-0.5426*** (-2.9202)
Dummy of old revolutionary area	0.5129*** (4.2794)	0.5928*** (4.7148)	0.6584*** (5.0010)	0.26922*** (2.7806)
Dummy of plain area	-0.6132*** (-5.1549)	-0.6475*** (-4.9211)	-0.6771*** (-4.7932)	-0.6728*** (-8.4967)
Dummy of mountainous area	0.4370*** (2.6552)	0.4767*** (2.6903)	0.3460* (1.7720)	0.6015*** (4.9826)
Distance to the nearest town	-0.0022 (-0.4078)	-0.0006 (-0.0965)	-0.0010 (-0.1704)	0.0020 (0.4938)
Dummy of minority area	-0.0793 (-0.6940)	-0.0256 (-0.2117)	-0.0702 (-0.5485)	-0.1124 (-1.2997)
Irrigation rate of village	-0.4081*** (-2.7198)	-0.3029* (-1.8783)	-0.2879* (-1.6914)	-0.6235*** (-6.0626)
Family size	0.1339*** (3.4320)	0.1183*** (2.8351)	0.1072*** (2.4320)	0.2665*** (8.7427)
Per capita physical stock	-2.26E-06 (-0.5956)	-7.18E-07* (-0.1979)	-2.39E-06 (-0.6568)	-1.49E-05*** (-5.1214)
Per capita arable land	-0.0087*** (-3.9381)	-0.0072*** (-3.1301)	-0.0070*** (-2.9161)	-0.0104*** (-6.7685)
Dummy of farming	0.2475*** (2.7169)	0.2618*** (2.6198)	0.3026*** (2.8111)	0.0954* (1.6444)
Dummy of non-farming	-0.2269 (-1.2300)	-0.2417 (-1.1471)	-0.1762 (-0.7853)	-0.2995** (-2.5967)
Education duration	-0.0391* (-2.1045)	-0.0237 (-1.1746)	-0.0257 (-1.2011)	-0.0643*** (-4.8550)
Ratio of non-labor in a household	0.0217 (0.1078)	0.0751 (0.3448)	0.2028 (0.9891)	0.2143* (1.5416)
Sample Number	1986	1986	1986	1986
Log Likelihood	-551.20	-454.26	-396.65	-1177.57
McFadden R^2	0.0800	0.0791	0.0853	0.1335

Note: Z statistics in parentheses. ***:1%significance，**: 5%significance，*:10% significance

4.3 Growth and redistribution decomposition

The poverty changes can be decomposed into growth and redistribution components. Shapley's method was used to study the growth and redistribution effect in Hubei province over the period being studied (1997-2003).

The year 1997 is regarded as the reference period, since Shapley's decomposition approach is based on the precondition that the two periods being referenced should have the same poverty lines: the poverty line thus used in the decomposition is that for 1997 (marked as z_97). By the ratio of the poverty lines of these two years, the deflated net incomes of 2003 can thus be derived as dy_03=y_03*(z_97/z_03). Performing the Shapley decomposition at the poverty line of 1997 (z_97) is denoted as (y_97, dy_03, z_97).

In order to reveal the impact of growth and redistribution effects on poverty headcount, poverty deficit, and poverty depth, three FGT indices were decomposed. As noted previously, the FGT index of Hubei province and its regions became smaller during the period of 1997 to 2003; hence the total effect is negative. In order to make the effects comparable, the total effects are normalized as 100. The decomposition results are shown in table 11.

Table 11: Growth-redistribution decomposition of poverty variation from 1997 to 2003 in Hubei

Poverty Lines		$\alpha=0$	$\alpha=1$	$\alpha=2$
Lower Line	Total Effects	-0.0270	-0.0056	-0.0022
	Growth Effects	-0.0376	-0.0099	-0.0038
	Redistribution Effects	0.0106	0.0043	0.0016
Higher Line	Total Effects	-0.0639	-0.0158	-0.0060
	Growth Effects	**-0.0812**	-0.0230	-0.0095
	Redistribution Effects	0.0173	0.0072	0.0035
Official Line	Total Effects	-0.0036	-0.0019	-0.0011
	Growth Effects	-0.0128	-0.0034	-0.0012
	Redistribution Effects	0.0092	0.0015	0.0001
World Bank Line	Total Effects	-0.1057	-0.0320	-0.0134
	Growth Effects	-0.1405	-0.0438	-0.0193
	Redistribution Effects	0.0348	0.0118	0.0059

For all the three FGT indexes in Hubei province, income growth was largely utilized for poverty alleviation, while the redistribution or inequality effects counteracted the poverty reduction efforts. The poverty incidence decomposition results reveal that about one third of the growth effects had been counteracted by the

redistribution effects. This implies that future anti-poverty programs should pay more attention on solving the inequality problem in China.

It is also interesting to find that the poverty severity (α=2) decomposition results for the developed region of Hubei Province under both the lower poverty line and the official Chinese poverty line appear to have same tendency for growth effects and redistribution effects (Table 12). This implies that among the households with incomes lower than either poverty line, the redistribution or inequality status improves from 1997 to 2003 in this developed region.

Table 12: Growth-redistribution decomposition of poverty variation from 1997 to 2003 in the developed and less developed regions of Hubei.

Poverty Lines		Developed Region				Less developed Region		
		$\alpha=0$	$\alpha=1$	$\alpha=2$		$\alpha=0$	$\alpha=1$	$\alpha=2$
Lower Line	Total Effects	-0.0090	-0.0028	-0.00144		-0.0396	-0.0072	-0.0026
	Growth Effects	-0.0213	-0.0045	-0.00147		-0.0585	-0.0164	-0.0066
	Redistribution Effects	0.0123	0.0017	-0.00003		0.0189	0.0092	0.0040
Higher Line	Total Effects	-0.0175	-0.0062	-0.0030		-0.1053	-0.0244	-0.0085
	Growth Effects	-0.0617	-0.0154	-0.0056		-0.1108	-0.0352	-0.0154
	Redistribution Effects	0.0442	0.0092	0.0026		0.0055	0.0108	0.0069
Official Line	Total Effects	-0.0004	-0.0012	-0.0011		-0.0049	-0.0022	-0.0010
	Growth Effects	-0.0031	-0.0009	-0.0004		-0.0248	-0.0065	-0.0021
	Redistribution Effects	0.0027	-0.0003	-0.0007		0.0199	0.0043	0.0011
World Bank Line	Total Effects	-0.0439	-0.0100	-0.0046		-0.1615	-0.0519	-0.0211
	Growth Effects	-0.1097	-0.0269	-0.0102		-0.1691	-0.0618	-0.0294
	Redistribution Effects	0.0658	0.0169	0.0056		0.0076	0.0099	0.0083

4.4 Poverty dominance

Over the years, the literature on poverty measurement has evolved into two closely connected but distinct branches: summary poverty measures, and partial poverty orderings (Zheng, 2000). Potentially different results could be obtained by the choice of a different poverty line/measure, so few sweeping conclusions can be drawn if poverty trends differ substantially when different poverty measures are applied, or when the position of the poverty line is changed. To address the gap, poverty orderings is a useful branch to obtain unanimous agreement among some measures on poverty comparison. In this section, poverty dominance analysis is used to do the poverty comparison between regions and over time.

4.4.1 Poverty dominance over time

As shown in figure 2 for Hubei Province, at any poverty line, the first-order poverty dominance curve in 1997 is higher than that in 2003.This reveals that rural poverty has been reduced during the period from 1997 to 2003. This is also true for the developed region in Hubei Province (Figure 3).

Figure 2: First-order poverty dominance curves in 1997 and 2003

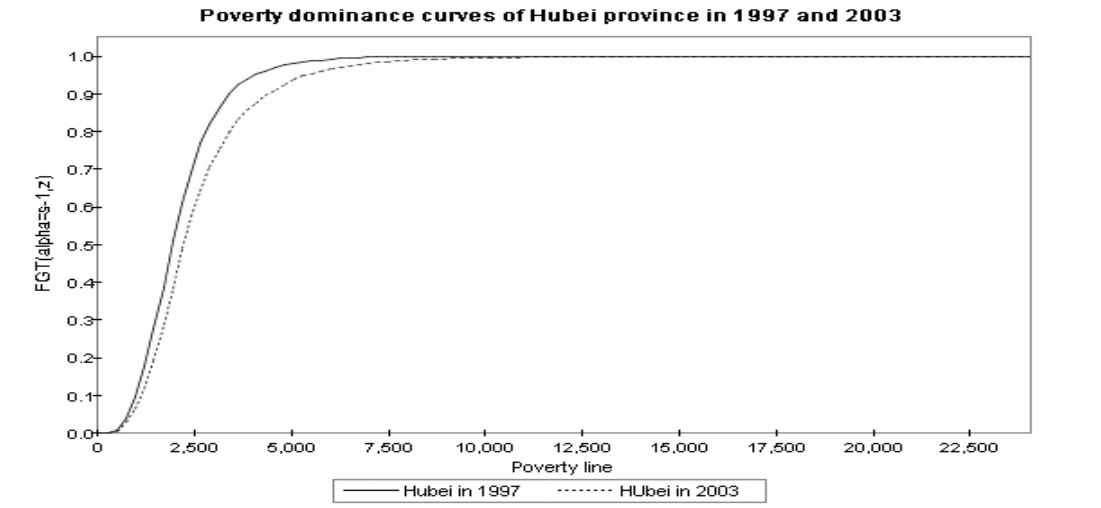
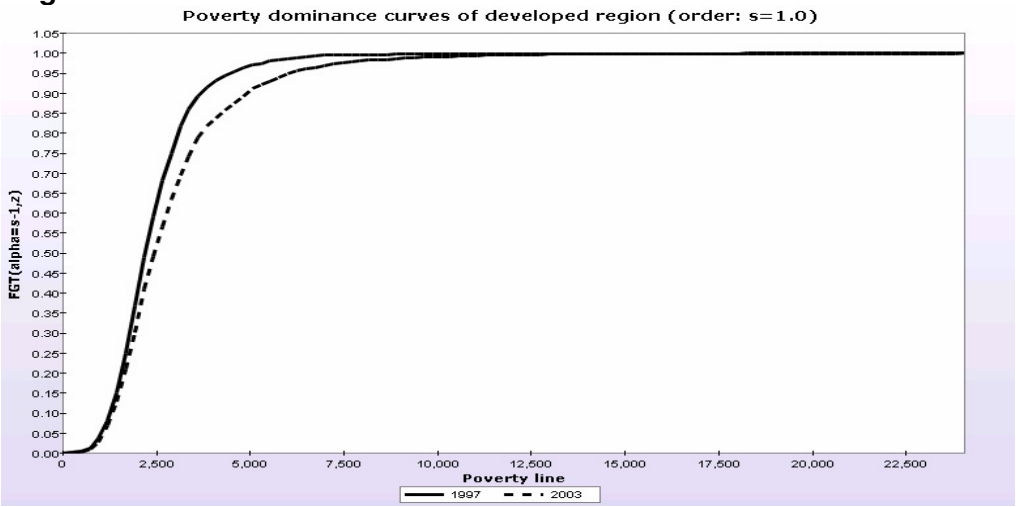


Figure 3: First-order poverty dominance curves in 1997 and 2003, Developed Region.



In contrast, the first-order dominance does not hold for the less developed region in Hubei Province. As shown in figure 4 to 6, the first-order dominance curves intersect at 111.39, 343.75, 345.75 and 8499.13(Yuan/year), the second-order dominance curves intersect at171.25 (Yuan/year), and the third-order dominance curve intersect at 220.57 (Yuan/year). This evidence implies that we cannot robustly conclude whether rural poverty in the less developed region has been reduced during the period from 1997 to 2003. However, to certain extent, this uncertainty reminds us that the poverty situation of the rural households with per capita net income lower than

500 Yuan/year remains unchanged, and that these households did not gain much from the economic growth that marked the period from 1997 to 2003.

Figure 4: First-order poverty dominance curves in 1997 and 2003, Less Developed Region

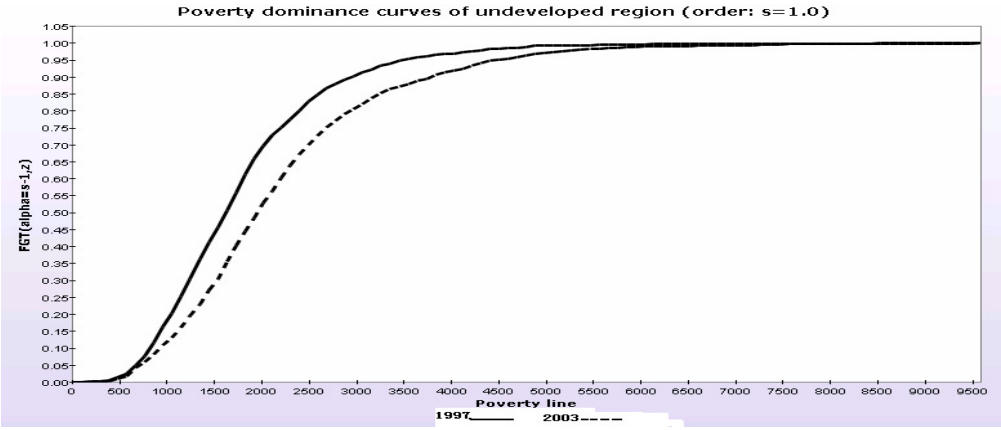


Figure 5: Second-order poverty dominance curves in 1997 and 2003, Less Developed Region

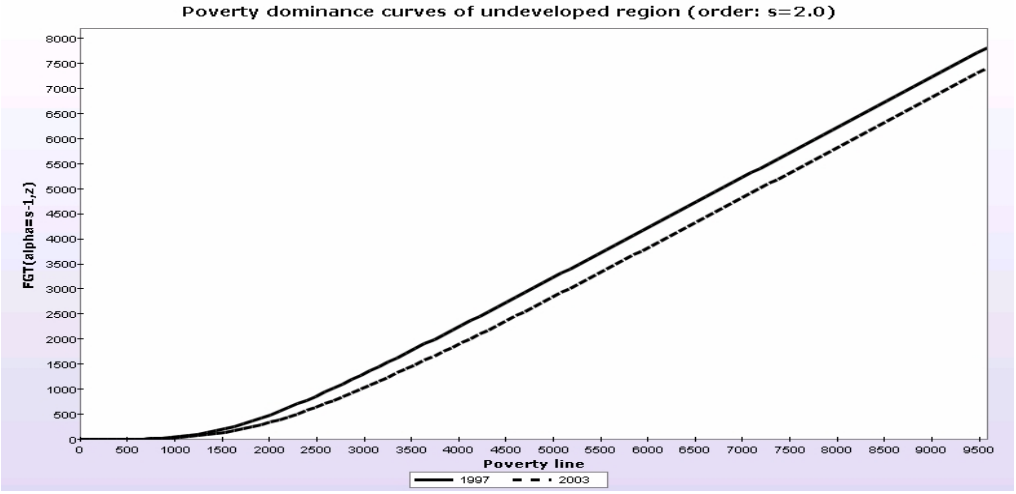
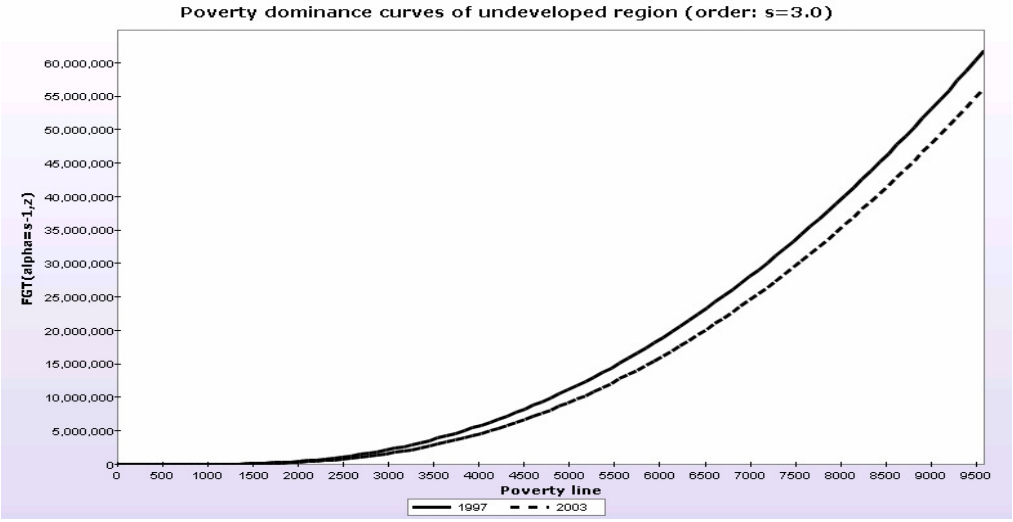


Figure 6: Third-order poverty dominance curves in 1997 and 2003, Less Developed Region



4.4.2 Poverty dominance between regions

The results of poverty dominance analysis for Hubei and Inner Mongolia are shown in figures 7 and 8. The first-order dominance curves intersect at 4781.93, 8799.57, 9263.34 and 9444.23(Yuan/year), but the second-order dominance curves do not intersect at all. This implies that second-order income distribution for Hubei Province dominates that of Inner Mongolia in 2002, and rural poverty for Inner Mongolia is more severe than that of Hubei, which are the same findings as earlier noted.

Figure 7: First-order poverty dominance curves of Hubei and Inner Mongolia, 2002

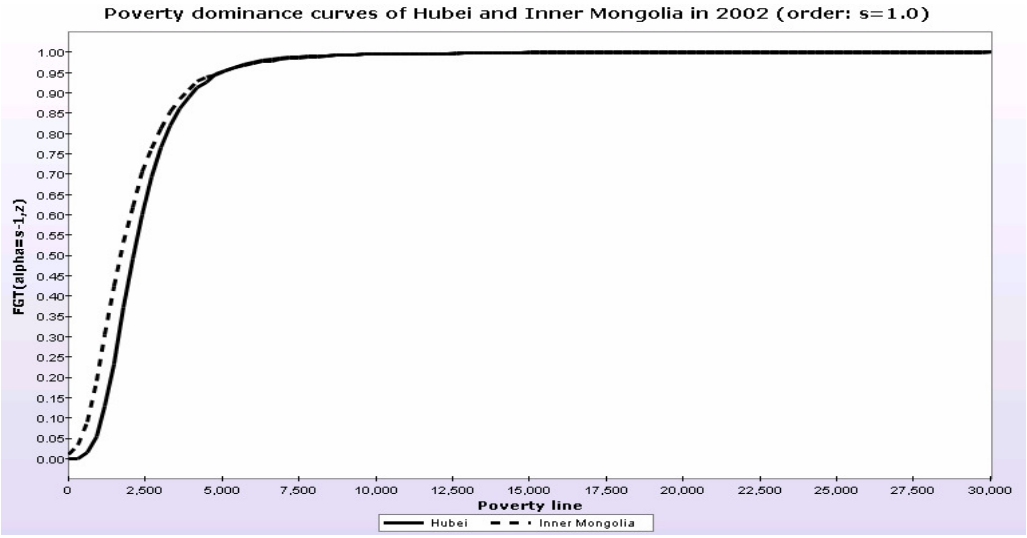


Figure 8: Second-order poverty dominance curves of Hubei and Inner Mongolia, 2002

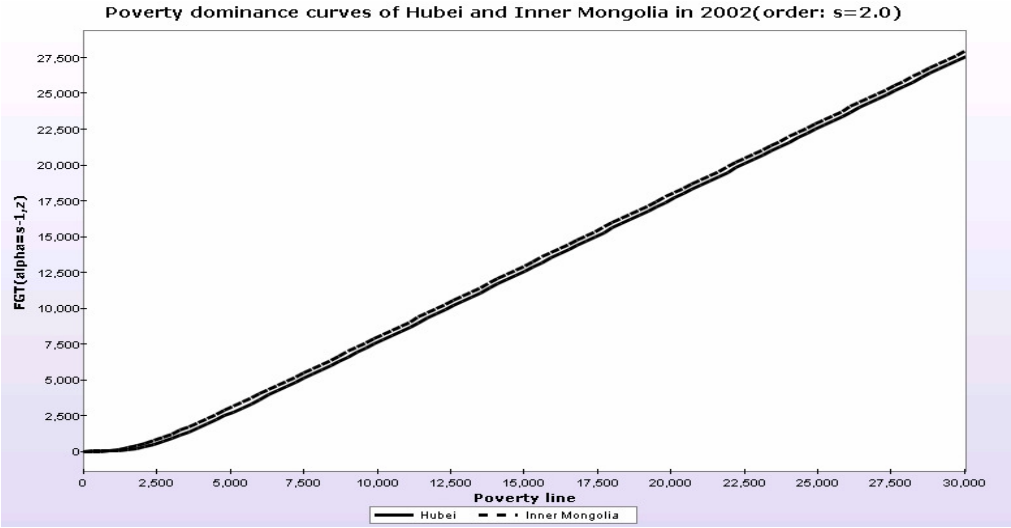


Table 13 gives us more information on the poverty difference over time and between regions. The poverty difference is calculated at the poverty line of 1000

Yuan/year (which is the default poverty line of the DAD software). One can draw the same conclusions here.

Table 13: Poverty difference

	Poverty difference	Standard deviation
The same region at different period		
Hubei between 1997 and 2003	0.0372	0.0077
Developed region between 1997 and 2003	0.0095	0.0071
Undeveloped region between 1997 and 2003	0.0613	0.0140
Different regions in the same period		
Inner Mongolia and Hubei in 2002	0.1555	0.0122

In summary, poverty dominance analysis helps us understand the poverty situation in certain localities without restrictions in setting poverty lines. Our case study reveals that rural poverty in Inner Mongolia is more severe than that in Hubei, and the poverty phenomenon in Hubei has been reduced during the period of 1997 to 2003.

5. Conclusions and discussion

The most basic issue in any poverty study is the manner by which poverty is measured. Our case study assessed rural poverty in Hubei province for 1997, 2002 and 2003 and rural poverty in Inner Mongolia for 2002, using the data set of NBS's rural household survey. The poverty lines we derived using Ravallion's method differ from the Chinese government's official poverty lines. The official pan-country poverty line underestimates rural poverty in Hubei Province and overestimates rural poverty in Inner Mongolia.

Based on the derived poverty lines, poverty determinants are estimated by Logit model and Probit model. It reveals that most variables show significant impacts on rural poverty under different poverty lines. Locating at a mountainous area, lack of better irrigation conditions, a large family size, few fixed assets, few land owned or making a living exclusively on agriculture would make a rural household more prone to being poor. Obversely, a rural household with members that have stayed in school longer, or who are better trained at labour would less likely become poor. This implies that getting the poor more access to higher-level education and training should be fully taken into consideration in any anti-poverty program.

The growth-redistribution decomposition reveals that for all the three FGT indexes in Hubei province, income growth contributed much to poverty alleviation, while the redistribution or inequality effects counteracted the growth effects and heightened poverty. The poverty incidence decomposition results reveal that about

one third of the growth effects had been counteracted by the redistribution effects. This implies that future anti-poverty programs should pay more attention to solving the inequality problem in China.

This study also proves that, without the need for setting poverty lines, using poverty dominance analysis helps to better understand the poverty situation in any locality. Our case study reveals that rural poverty in Inner Mongolia is more severe than that in Hubei, and that the poverty in Hubei has actually been reduced during the period from 1997 to 2003, the same findings as those drawn from deriving poverty lines.

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Appendix

Table 1 : Standard food combination and energy intake equivalences for rural households with 2050 to2150 calorie intake in Hubei Province, unit: Calorie/Kg, Kg, and Calorie

Food Items	Coefficients (Calorie/kg)	Hubei Province (2003)		Developed Region (2003)		Less Developed Region (2003)	
		Quantity (Kg)	Equivalents (Calorie)	Quantity (Kg)	Equivalents (Calorie)	Quantity (Kg)	Equivalents (Calorie)
Wheat	3620.70	0.0402	145.6936	0.0250	90.4076	0.0515	186.5122
Rice	2756.16	0.3521	970.3539	0.4420	1218.2839	0.2857	787.3027
Maize	3901.44	0.0228	88.7866	0.0087	33.8256	0.0332	129.3654
Other corn	2030.00	0.0033	6.6381	0.0008	1.5840	0.0051	10.3696
Potato	958.04	0.0122	11.7197	0.0110	10.5489	0.0131	12.5842
Soybean	5983.62	0.0031	18.3325	0.0022	13.3845	0.0037	21.9856
Other bean	3327.54	0.0013	4.2446	0.0011	3.5312	0.0014	4.7713
Vegetable oil	17081.00	0.0116	208.0868	0.0181	308.7434	0.0078	133.7702
Tallow	17961.00	0.0008	13.9026	0.0005	8.2533	0.0010	18.0737
Greenery	279.40	0.1065	19.6044	0.0819	22.8907	0.1247	34.8472
Cushaw ect	184.00	0.0460	15.1776	0.0228	4.1870	0.0631	11.6110
Rootstock	330.19	0.0710	17.5635	0.0807	26.6448	0.0639	21.0838
Nightshade	247.35	0.0338	18.6653	0.0278	6.8668	0.0382	9.4560
Garlic& shallot	552.50	0.0110	18.3481	0.0080	4.4415	0.0132	7.2728
Kidney bean	1670.00	0.0197	7.6225	0.0118	19.7493	0.0255	42.5678
Water plant	387.20	0.0007	1.3139	0.0008	0.3088	0.0005	0.2122
Mushroom	2009.00	0.0009	0.2241	0.0005	1.0207	0.0011	2.2891
Other vegetable	257.20	0.0130	132.6670	0.0379	9.7497	0.0048	1.2424
Pork	7027.20	0.0456	312.9859	0.0300	210.6186	0.0519	562.9857
Beef	5321.28	0.0013	9.8087	0.0002	1.1995	0.0026	13.9657
Mutton	6109.32	1.47E-05	0.0495	0.0000	0.0000	2.56E-05	0.1564
Poultry	3360.72	0.0034	8.9769	0.0039	13.1468	0.0031	10.2831
Meat product	2623.50	0.0004	1.0874	0.0005	1.2419	0.0004	0.9337
Egg product	2679.60	0.0076	23.8404	0.0081	21.6849	0.0073	19.4684
Milk product	3130.00	0.0002	0.2434	0.0000	0.0000	0.0003	0.8655
Fishery	1530.24	0.0119	15.6124	0.0174	26.6459	0.0078	11.9151
Shrimp etc	1314.72	0.0001	0.0815	0.0003	0.4559	0.0000	0.0000
Alga	553.15	0.0003	0.2162	0.0003	0.1640	0.0003	0.1678
Other aquatic	719.44	0.0002	0.6831	0.0004	0.2745	1.79E-05	0.0129
Sugar	3964.00	0.0019	6.2534	0.0013	5.2514	0.0023	9.1805
Distilled spirit	3300.00	0.0066	2.6803	0.0048	15.9421	0.0079	26.1938
Beer	405.00	0.0073	5.3708	0.0055	2.2431	0.0085	3.4605
Bean product	1497.60	0.0033	4.9589	0.0043	6.4869	0.0026	3.8308
Daily Energy Intake			**2091.7938**		**2089.7773**		**2098.7371**

Table 2: Standard food combination and energy intake equivalences for rural households with 2050 to 2150 Calorie intake in Inner Mongolia, 2002, unit: Calorie/Kg, Kg, and Calorie

Food Items	Coefficients (Calorie/kg)	Inner Mongolia (2002)	
		Quantity (Kg)	Equivalents (Calorie)
Wheat	3620.70	0.2108	763.1700
Rice	2756.16	0.0534	147.2822
Maize	3901.44	0.0383	149.3446
Other corn	2030.00	0.0447	42.8058
Potato	958.04	0.1476	299.6531
Soybean	5983.62	0.0056	33.5530
Other bean	3327.54	0.0005	1.7040
Vegetable oil	17081.00	0.0082	140.3918
Tallow	17961.00	0.0043	76.8016
Cushaw ect	184.00	0.0040	0.7444
Rootstock	330.19	0.0292	9.6466
Nightshade	247.35	0.0276	6.8274
Cabbage	208.10	0.0692	14.4026
Greenery	279.40	0.0116	3.2408
Other fresh vegetables	257.20	0.0210	5.3936
Dried Vegetables	2684.10	0.0003	0.8247
Vegetable Products	2634.50	0.0001	0.2024
Pork	7027.20	0.0339	238.4084
Beef	5321.28	0.0003	1.4988
Mutton	6109.32	0.0091	55.5322
Poultry	3360.72	0.0023	7.6585
Meat product	2623.50	0.0002	0.5374
Egg product	2679.60	0.0057	15.3002
Milk product	3130.00	0.0036	11.3002
Fishery	1530.24	0.0021	3.2521
Shrimp etc	1314.72	0.0001	0.0673
Alga	553.15	0.0001	0.0425
Other aquatic	719.44	0.0000	0.0184
Sugar	3964.00	0.0043	16.8486
Distilled spirit	3300.00	0.0139	45.8814
Beer	405.00	0.0112	4.5524
Wine	739.00	0.0003	0.2081
Drinks	330.00	0.0101	3.3461
Candy	4006.80	0.0006	5.0271
Bean product	1497.60	0.0030	4.5632

Table3: Explanatory variables, and their expected signs

Name of Variables	Expected Sign	Way of creating variables and explanation
Dummy of old revolutionary area	?	It is 1 if the village locates at an old revolutionary area and 0 otherwise.
Dummy of minority area	?	It is 1 if the village locates at a minority area and 0 otherwise.
Dummy of plain area	–	It is 1 if the village locates at a plain area and 0 otherwise.
Dummy of mountainous area	+	It is 1 if the village locates at a mountainous area and 0 otherwise.
Log (irrigation rate of village)	–	The ratio of irrigation area to the total arable land in the village (%).
Dummy of below 5 kilometers	–	It is 1 if the distance from the village to the nearest town is no more than 5 Km and 0 otherwise.
Dummy of above 20 kilometers	+	It is 1 if the distance from the village to the nearest town is more than 20 Km and 0 otherwise.
LOG (family size)	+	Family size that represents the number of household and has always been considered as a cause of poverty. Its estimates should be positive.
LOG (per capita physical stock)	–	Physical capital stock of the household.(Yuan)
LOG (per capita arable land)	–	Cultivated land per capita of household. (Mu.) 1 Mu=1/16 Ha.
Dummy of farming	+	It is 1 if the household only does farming and 0 otherwise.
Dummy of farming & non-farming	?	It is 1 if farming is the main income source for the household that also does non-farming business and 0 otherwise.
Dummy of non-farming& farming	–	It is 1 if non-farming business is the main income source for the household that also does farming and 0 otherwise.
Dummy of non-farming	–	It is 1 if the household only does non-farming business and 0 otherwise.
Education duration	–	Education years of the member who got the highest level of education in the family.
Ratio of the old	+	The ratio of the number of the old more than 60 year's old to the size of the family. (%)
Ratio of children younger than 6	+	The ratio of the number of children younger than 6 year's old to the size of the family. (%)
Ratio of trained labor	–	The ratio of the number of trained labors to the total number of labors in the household. (%)
Ratio of non-labor in a household	+	The ratio of the non-labor to the size of the family. A family with less labor should be easy to fall into poverty, sign of this variable should be positive.(%)

Annex 1: Poverty dominance analysis

Poverty dominance analysis is an application of stochastic dominance to distributions of households' income. Stochastic dominance has much application in economics; however, it is also useful in income distribution and poverty analysis.

Comparison of two poverty distributions, denoted by A and B can be expressed below:

$$\Delta P(Z) = P_A(Z) - P_B(Z) = \int_0^1 [\pi(Q_A(p);Z) - \pi(Q_B(p);Z)]dp = \int_0^z \pi(y;Z)\Delta f(y)dy \quad (9)$$

where P(z) denotes poverty indexes, *Q(p)* denotes the quantile at percentile *p*, *z* an artificially defined poverty line, *p* population distribution, *y* per capita income (or consumption), $\pi(Q(p),z)$ the contribution of an individual to overall poverty, $\pi(y;z)$ income poverty density function, and $\Delta f(y)$ the difference in the densities of income (Duclos and Araar, 2003, p118). To check whether the above difference in poverty indices is positive will involves the use of stochastic dominance curves. The dominance curve of order 1 is simply the headcount index of poverty for different poverty lines. The higher order curves are iteratively defined as

$$D^S(Z) = \int_0^s D^{S-1}(y)dy \qquad (10)$$

An important character of poverty ordering is s-order stochastic dominance, which implies (s+1)-order stochastic, but not vice versa. And in principle, it is possible to examine higher orders of dominance comparison but in practice it is rare to go beyond the third order. If the first-order poverty dominance curves of the two distributions have crossing(s), we should use the second-order poverty dominance should be used. If the second-order poverty dominance curves of the two distributions have crossing(s), one should proceed to the third-order poverty dominance.

Annex 2.The division of regions in Hubei Province

According to administrative regional divisions, Hubei is made up of twelve cities and one self-governing state. In the rural household survey, the developed region (the red region in Figure 1) covers Wuhan, Xiaogan, Jingmen, Jingzhou and Yichang, while the less developed region (the multicolour region in Figure 1) covers Huangshi, Huanggang, Xiangfan, Xianning,Yunyang and Enshi.

Figure 1: Map of Hubei province and its regional divisions