



## **Regional Differences and Dynamic Changes in Rural China: the Study of 1996 and 2006 National Agricultural Census**

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## Regional Differences and Dynamic Changes in Rural China: the study of 1996 and 2006 National Agricultural Census

### Abstract

This paper is a further study of rural China based on the study of the first national agricultural census in 1996 (Fanfani and Brasili, 2003). The main emphasis is regionalization of rural China according to the second national agricultural census in 2006, utilizing the same or at least similar indicators applied in the previous analysis. The main data include the households and non-households, employment, education and agricultural production of total 30 indicators for 31 provinces and municipalities. The methodology applied here is principal component analysis and cluster analysis. Hence we compare the two regionalization maps and get a visual perception about the changes in rural China.

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### Introduction: Recent changes in rural China

The agriculture-based reforms greatly promote socioeconomic conditions in China. The liberalization of agriculture, started with the “open doors” policy and “household responsibility system” in 1978 and improved with the following-up reforms in recent years (such as abolishment of agricultural taxation and direct subsidies for grain producers), has changed rural China dramatically. There has been, on one hand, a decrease of the proportion of rural population, and on the other, a tendency of urbanization. However, many consequential aspects along with changes are still less well-known, not only because of the sheer size of China, but also the lack of comprehensive information on the enormously large and varied rural areas, where, even now, more than 50% of the Chinese population still lives.

#### Demographic changes and migration

China’s socioeconomic development comes along with demographic changes. The urban population has grown from 172 million to 665 million from 1978 to 2010, increasing at an average rate of 4.2% a year. Today 49.7% of the Chinese population is living in cities and

towns, compared with just 17.9% thirty years ago<sup>1</sup>. For another, the rural population fell from 790 million (82.1% of the population in 1978) to 674 million (50.3% of the population), whereas still has a relatively higher natural birth rate compared with urban area. The enormous number of immigrant workers should be considered when explicating migration: there is 131 million of labour immigration from rural to urban areas, but most are still rural residents in the “Hukou”<sup>2</sup> system even though they work for long periods in the industry, construction and service sectors in urban areas. If we take a look at the three sectors in China, it is an obvious trend of the transformation from the first sector (agriculture) to the second and third sectors

<sup>1</sup> Quoted from 2010 Gazette published by China National Bureau of Statistics

<sup>2</sup> “Hukou” is used in mainland China for the household registration to control the migration. The rural Hukou, even if migrant in urban areas, cannot take advantages of social security, medical care, school which reserved to urban Hukou. According to the “PRC Regulations of the Registered Permanent Residence”, Hukou is defined as the people registered as permanent residences in the local authority, including registered foreigners and stateless. But it is different with the permanent residence in statistic criteria: usually the latter is larger in developed areas, and vice versa.

(industry and service). The proportion of employment in primary sector declines dramatically from 70.5% in 1978 to 36.7% in 2010, while the proportions of employment in secondary industry and tertiary sectors increase from 17.3% and 12.2% in 1978 to 28.7% and 34.6% in 2010 respectively. On the other hand, the GDP composition has also changed: even though the secondary industry has always been taking the main part in total (all over 40% from 1978 to 2010, 46.8% in 2010), the tertiary sector has increased its part

significantly (from 23.9% in 1978 to 43.1% in 2010), while there is a decrease of agricultural proportion (from the highest 33.4% in 1982 to 10.1% in 2010).

### Urbanization and inequalities

The increase of urban population is a clear indication of urbanization. As in figure 1, it shows that each employed person in secondary industry and tertiary sector create more wealth than primary sector, and the secondary industry occupies the largest part.

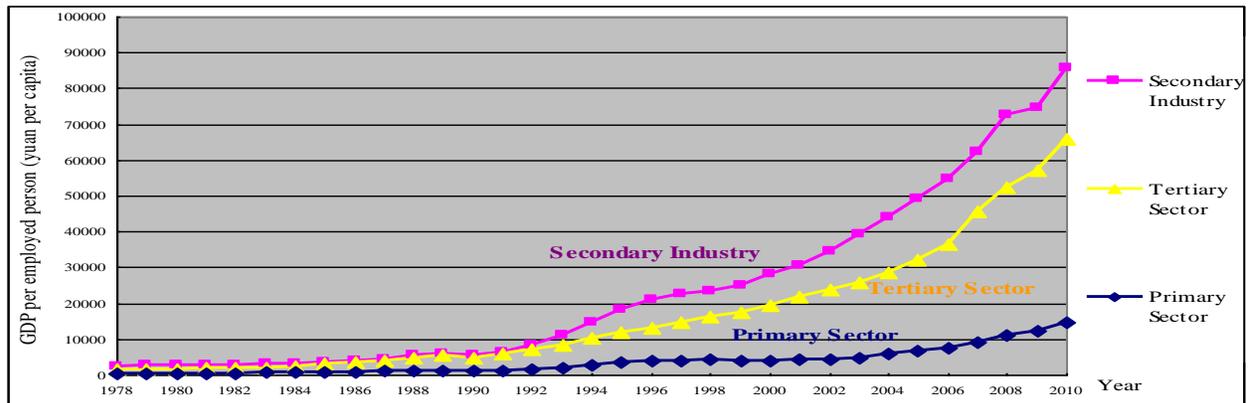


Fig 1: The Distribution of GDP per Employed Person in Three Sectors during 1978-2010

Source: National Statistic Yearbook of China, 2011

If we take a look at another direct indicator of urbanization—the building construction, the floor space of buildings under construction of urban area in 2010 is more than 7, 063 million square meters, whereas rural area is just more than 1,066 million square meters, only 15% of urban; the buildings completed of urban area in 2010 is 1,754 million square meters, whereas rural area is 941 million. Also, the construction area increases fast in urban areas, compared with 2009, the floor space of buildings under construction is 22% and of completed is 7%, whereas there are decreases of both in rural areas, -8% and -11% respectively.

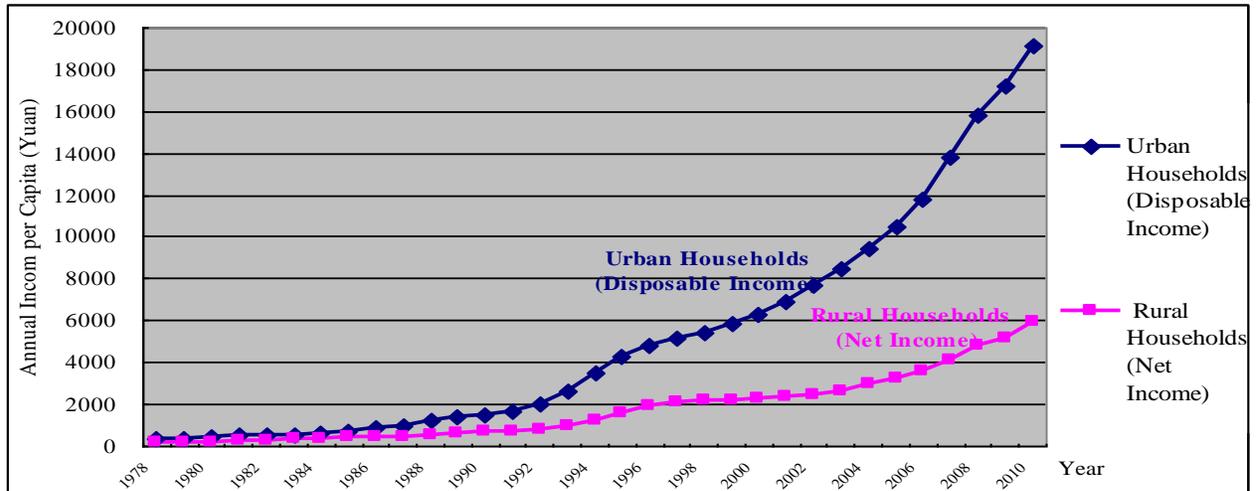
The restructuring in three sectors expand the gap among different regions in different levels, and causes the inequalities not only between costal area and inner land, urban and rural, but also inside them, even at family level. It is complicated to clearly explain why the deep differences existing and how they have increased in the past decades. Normally, we consider geographic factors and urbanization or suburbanization, which could be ascribed to the rural-urban migration, accompanied by double-edged influences. The discrepancies show in many aspects: household income and consumption, basic infrastructures, public education and medication and etc. Take, the Gini

coefficient, as an example, which has been persistently kept around 0.5 in China during the latest years<sup>3</sup>, way higher than the official alert line is 0.4, indicates the large income disparity.

The discrepancies between rural and urban areas show in many aspects: household income and consumption, basic infrastructures, public education and medication, etc. As we can see in figure 2, the annual disposable income evidently signified the disparity between urban and rural areas. The gap of disposable income has been escalating since 1990s. According to the National Yearbook, the annual disposable income per capita of urban households is 19109.44 Yuan in 2010, more than 3 times of the annual net income per capita of rural households, which is 5919.01 Yuan; the ratio has basically been keeping falling down since 1985, whereas 2010 is a breaking point of pullback<sup>4</sup>.

<sup>3</sup> To calculate the Gini coefficient, there is a common methodology “Income of Five Groups” (China National Yearbook) created by Hu ZG (2004) and widely applied in China. Based on this method, the Gini coefficient has exceeded 0.5 from 2004, and fell down to 0.47 in 2007, but then bounced back again. In the reports of UNDP (The United Nations Development Program) and World Bank, the Gini coefficient of 2010 in China might even exceed 0.5.

<sup>4</sup> Quoted from the National Statistic Yearbook, the annual disposable income of urban households is 4838.9 Yuan, of rural is 1926.1 Yuan in 1996; and of urban is 739.1 Yuan, of rural is 397.6 Yuan in 1985. The ratio of urban-rural income is 3.33 in 2009 (of urban households is 17174.7 Yuan, of rural households is 5153.2 Yuan).



**Fig 2: Annual Income of Urban Household and Rural Household**

Source: National Statistic Yearbook of China, 2000, 2011

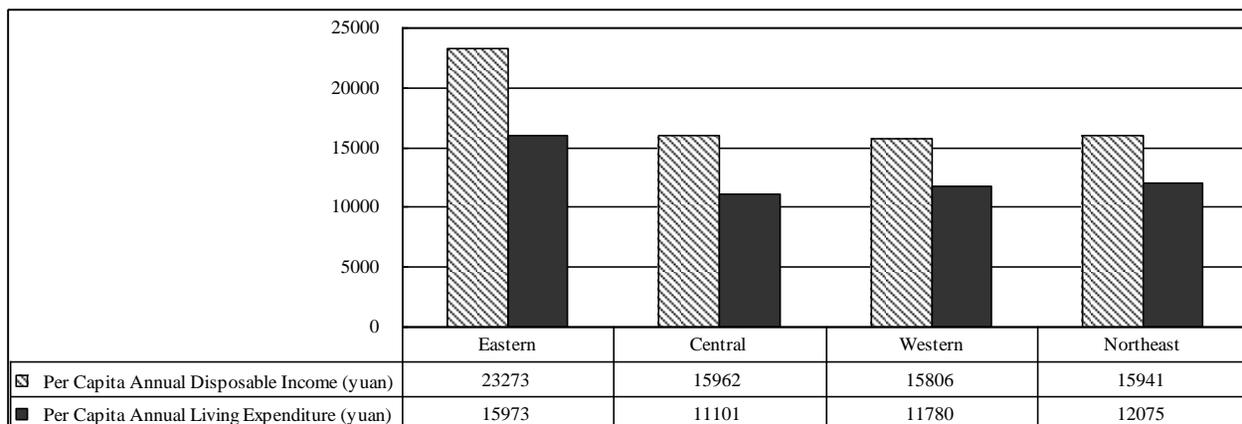
The differences exist not only between urban and rural areas, but also inside themselves. Here we focus on the income and consumption in rural areas. In table 1, we can see a dramatic gap among the five groups classified by the income level: the per capita annual net income of the highest group is 7.5 times of the lowest, and the gap of Engel’s coefficient between them is 14%. If we

focus on the geographic differences among rural areas, as we can see in figure 3, obviously the eastern region takes the highest level of disposable income and living expenditure, while the western region takes the lowest of disposable income and the central region takes of living expenditure. The highest-lowest ratio of income is 1.47, and of expenditure is 1.44.

**Table 1: per Capita Annual Net Income and Engel’s Coefficients of Rural Households (2010)**

Items	Per Capita Annual Net Income (Yuan)	Engel's coefficient (%)
Low Income Households	1870	48.78
Lower & Middle Income	3621	45.49
Middle Income	5222	43.34
Upper Middle Income	7441	40.74
High Income	14050	34.53

Source: National Statistic Yearbook of China, 2011.



**Fig. 3: per Capita Annual Expenditures and Incomes of Rural Households (2010)**

Source: National Statistic Yearbook of China, 2011

### **Data source: Snapshot of National Agricultural Census in Rural China**

There have been two times of national agricultural census in rural China carried out by Chinese National Bureau of Statistics: the first one in 1996 (data published in 1997) and the second one in 2006 (data published in 2008). These censuses are aimed at improving the comprehension of socioeconomic conditions in the vast rural China. The data covered rural households and non-households, villages and towns, referring to agricultural production and activities, land use, agricultural labor and employment, rural infrastructure and social services, rural livelihoods, and general conditions of village/town committees, etc. The data compilation of 2006 census is more specific, including four parts: the composite, agriculture, rural residents and rural areas. The permanent residents in rural areas have shrunk from 873.77 million (1996) to 745.76 million (2006), decreased 14.7%; the employments in rural areas have declined from 561.48 million (2006) to 478.52 million (1996), decreased 14.8%, while the employments in the second and third sectors in rural areas have increased 2.9% and 2.0% respectively. The sown land reduces 6.4%, with a decrease of cultivated land for grain (6.8%), while an increase in cotton (23.2%). The infrastructure conditions has been improved dramatically, there are increases in number of villages with electricity (2.7%), telephone (49.9%), TV signals (4.1%), trafficways (8.1%), and purified water (7.1%); number of town and townships with primary schools (22.2%); and number of hospitals (32.1%). In this paper we use the data from the second census (2006) and compare with the result obtained from the first census (1996).

### **Objective and Methodology**

Our main focus will be on mapping rural China by the territorial disparities, and comparing two cluster results obtained from the two national agricultural censuses. We selected 30 original indicators from 2006 national agricultural census, same or similar with the ones that Fanfani and Brasili (2003) applied in their study of rural China based on 1996 national agricultural census<sup>5</sup> (the complete list of the indicators applied in the 1996 and 2006 censuses is reported in annex 1). Principal component analysis is applied to better explain the variability of the indicators among the Chinese

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<sup>5</sup> Some variables are not exactly the same with the ones applied in the study of Fanfani and Brasili for the first census of 1996, because there are some inconsistency of statistical indicators and standards between the two agricultural censuses.

provinces, and 6 principle components are extracted from the initial 30 indicators and applied for clustering. Q-mode cluster analysis is applied to group the 31 provinces and municipalities in the rural areas of China mainland, and a hierarchical method is used since the sample size is not large enough. Our objective is to get a new map that could be compared with the traditional and official administrative division, hence to provide further information for researchers and policy makers.

### **Regionalization of rural China (on 2006 National Agricultural Census)**

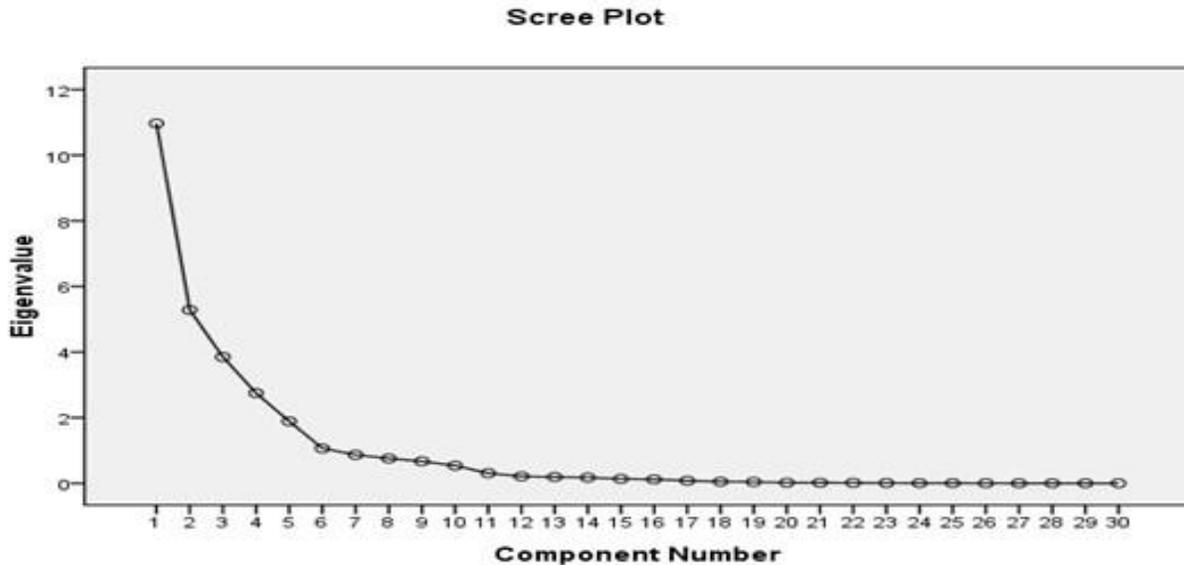
According to the official geographic divisions of China, there are four main groups of provinces in China: Eastern coastal area, Central area, Western area and North-East area. Interestingly, these areas basically rank from developed to undeveloped in socioeconomics as moving from the Eastern to the Western. There is also a more specific and detailed regionalization which divides China into seven zones: Northern, Central, Eastern, Southern, Northeast, Southwest area, and Northwest. Though these official divisions of China mainland are based on the geographical locations, they still have a lot in common in socioeconomic terms.

### **Component extraction by PCA**

Here 6 components are extracted according to Guttman-Kaiser's criterion<sup>6</sup>, being able to explain more than 86% of the initial variances. The first 3 components have higher values of variances, explaining nearly 70% together (1<sup>st</sup> is 37%, 2<sup>nd</sup> is 18%, 3<sup>rd</sup> is 15%). Therefore, the first three components are very significant to represent the original indicators.

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<sup>6</sup> Guttman-Kaiser's criterion: considering the components with eigenvalues greater than or equal to 1. A lower level would explain less than the standardized variance (=1). Since some original data are with high skewness, here we applied box-cox transformation to normalized first.



**Fig. 4: The Scree Plot of Principal Components**

The first component (37%) can be characterized as high-qualified labor and non-agriculture, with higher positive values in indicators of labor force in non-agricultural activities and with superior education level, and negative values in indicators of crop planting and illiterate and semi-illiterate labors. The second component (18%) can be characterized as animal husbandry, with positive values in indicators of employment in husbandry in households and all holdings, and number of large animals; and negative values in cultivated land. The third component (13%) can be characterized as arable land utilization, with positive values in indicators of arable land per household and sown area for grain and negative values in employment of non-agricultural activities. The fourth component (9%) can be characterized as mechanization, with positive values in the cultivated area of tractor ploughed, electro-mechanized irrigated and harvest, and number of large/medium and mini tractors per capita. The fifth component (6%) can be characterized as agricultural activities, with positive values in indicators of employment in crop planting and agricultural activities over 6 months. The sixth component (4%) can be characterized as working outside, with a dramatic high positive value in indicator of employment in urban areas, and also higher values in superior education level.

#### **Mapping: regional differences of rural China**

The final cluster result of 31 provinces is four main rural groups, which can be defined as: the east-coastal developed, main rural area, peripheral belt, and mountain area. In figure 5, we can clearly see how the four clusters group together. The clusters of costal developed and peripheral belt are like two belts located

in the east and north part of China, respectively. The inner land starts to converge together and becomes the cluster of main rural area. Tibet and Qinghai, located in mountain area, form the fourth cluster.

The first cluster (Costal Developed) is composed by 7 provinces and municipalities, which all belong to the most developed region in east-coast, and the three municipalities Beijing, Tianjin and Shanghai have the highest GDP per capita in China. This group has been in the head of urbanization and the transformation from agriculture to industry and service, which contribute more to economic growth rather than the primary sector. Also, they can be defined as the core area of high-tech and labor input region. It demonstrated the highest level of engagement in non-agricultural activities in rural areas (61%), which indicates that this cluster is developing an internal system to occupy the surplus rural labors, such as township business. It shows the lowest proportion of persons in agriculture activities (33%): crop planting (35%), animal husbandry (2%), which indicates that agricultural production is no longer the main force of economic growth to rely on in this cluster, and urbanization is speeding up. Also, the percentage of population with superior education level is the largest (16%), and even for the female (10%). The level mechanization of cultivated land is the highest as in tractor ploughed (62%), mechanized irrigation (49%) and harvest (28%). Compared the mean value with other clusters, cluster 1 performs better in high quality labor force, mechanization and employment in non-agricultural, which exactly prove the high developed level and urbanization of this cluster.

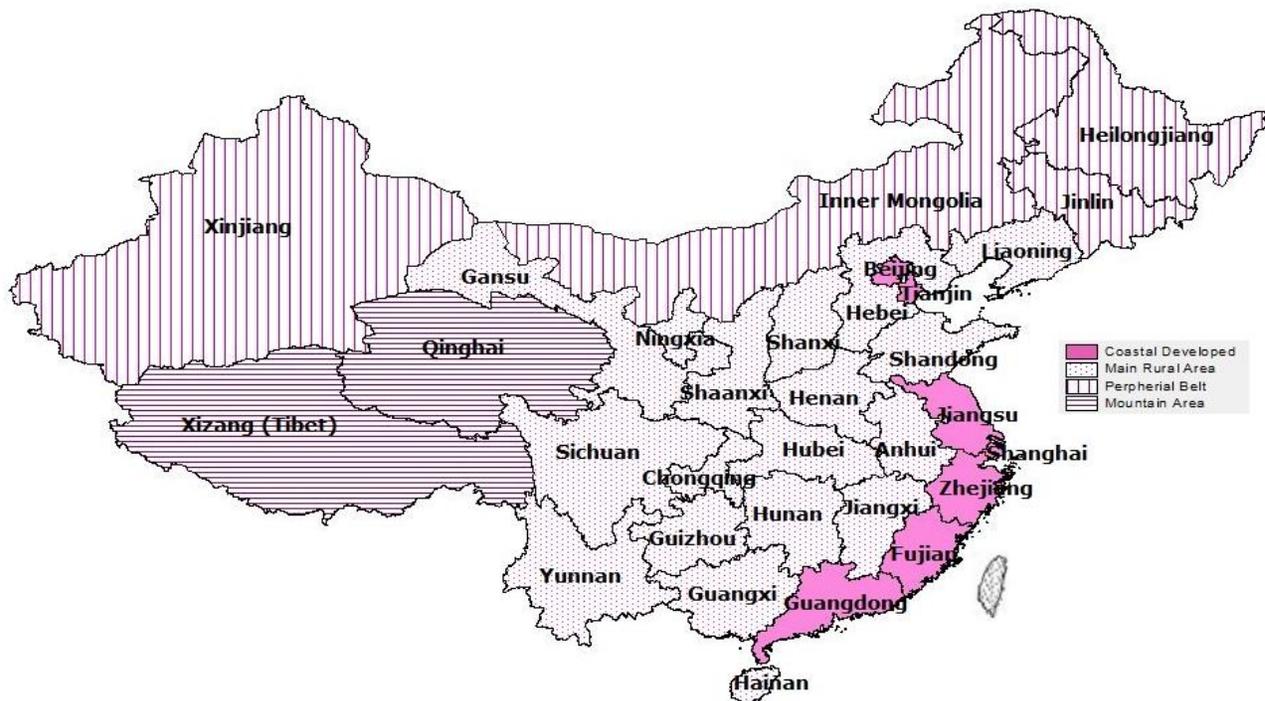


Fig. 5: Mapping: Regional Differences of Rural China (2006)

Cluster	Provinces and Municipalities
1. Coastal Developed	Beijing, Tianjin, Shanghai, Jiangsu, Zhejiang, Fujian, Guangdong
2. Main Rural Area	Hebei, Shanxi, Liaoning, Anhui, Jiangxi, Shandong, Henan, Hubei, Hunan, Chongqing, Sichuan, Shaanxi, Ningxia, Guangxi, Hainan, Guizhou, Yunnan, Gansu
3. Peripheral Belt	Nei Mongol (Inner Mongolia), Jilin, Heilongjiang, Xinjiang
4. Mountain Area	Xizang (Tibet), Qinghai

Note: the processing is based on the Second National Agricultural Census (2006)

The second cluster (Main Rural Area) has the largest group member, 18 provinces and municipalities. Most of them are inland regions; except Liaoning, Hebei and Shandong. This cluster is certainly not developed as the first one, with all its members have just started or been in the process of urbanization, so agriculture still composed as a great percent in the local economic developments. Also, some of them are main export regions of labor force (i. e. Anhui, Henan, Hubei, Hunan, Sichuan, etc.) because of the agricultural labor surplus and shortage of land resources, which could be confirmed by a high level of employments in non-agricultural activities in urban areas (29%). This cluster shares a higher proportion of labor forces in crop planting (76%), also with largest part of employments in cultivated land (95%). The characteristic of labor-intensive agriculture is more obvious in this cluster. If compared with other clusters, this cluster can be described as above-average level in superior education and mechanization, since the mean values are near to

cluster 1. But still, the gap between cluster 2 and cluster 1 are not slight in many aspects.

The third cluster (Peripheral Belt) is composed by 4 provinces and municipalities (Inner Mongolia, Jilin, Heilongjiang, Xinjiang), basically belonging to the north peripheral region. This cluster possesses unique advantages in natural resources, especially the vast arable land, which can be confirmed by the largest average area of sown land per capita (0.5 Ha). It owns the highest ratio in employments in agricultural activities over economic activities (88%), the highest in crop planting (80%) and higher level in sown area for grain (72%). However, the labor mobility is lower, with only 8% of labor force engaged in non-agricultural activities in urban area. Most of the indicators referring to the general conditions are close to but slightly smaller than cluster 2, such as education and mechanization.

The fourth cluster (Mountain Area) contains just 2 members (Tibet and Qinghai), which is the least in the four clusters, yet these two regions occupy nearly 20% of the territory land<sup>7</sup>. This cluster is somewhat isolated from other regions, not only because its remote location, but also for its particular socioeconomic background and developing patterns. It shows the lowest level in education and mechanization. The population ratio of agricultural households to non-agricultural households is the highest (66%). Its main agricultural sector is animal husbandry, with the largest proportion of labor distribution (28%) and number of large animals per 100 persons (0.2).

### **Comparison study of rural China: the 1996 and 2006 National Agricultural Census**

#### **Introduction of cluster results in the 1996 National Agricultural Census**

In the study of the first national agricultural census in rural China (R. Fanfani, C. Brasili, 2001), four clusters are obtained through five principal components as in figure 6: Cluster of urban area includes 4 provinces and municipalities (Beijing, Jiangsu, Shanghai, Tianjin); Principal agricultural area includes the highest number of provinces (16), all located in the East-Southern and Middle and South part of China; Peripheral area includes 9 provinces from the Northern part of China and also from South (Yunnan and Guizhou); Mountain area is composed by only 2 provinces (Qinghai and Tibet) but they have a very large area, mainly mountainous.

#### **The comparison of cluster results between 1996 and 2006 National Agricultural Census**

The main results of the PCA and cluster analysis are represented in the maps (figure 5 and figure 6), where we can get a visual image about the changes in the two clustering results of 1996 and 2006. Here we also should pay attention that the differences, in some degree, might also be caused by the inconsistency of the indicators applied in principal component analysis. Also, there are 31 samples in the second map, whereas 30 in the first. (Chongqing<sup>8</sup> is added in.)

The cluster of coastal developed, which represented the most developed group, is clearly expanded during the decade 1996 to 2006. Three provinces (Zhejiang, Fujian, and Guangdong) are added in the 2006 research,

indicating the expansion of urbanization and economic growth in coastal provinces. It has already developed as a belt locating in the east coast, compared with just the several isolated spots in the 1996 census.

The changes in the clusters of main rural area and peripheral area are more complicated to explain. Five provinces (Gansu, Ningxia, Henan, Yunnan and Guizhou) moves from peripheral cluster of 1996 to main rural area of 2006. As far as we concerned, it could be interpreted as an expanding of the relevance of agriculture in the inner region of rural China. The cluster of main rural area shows more rural characteristics in socioeconomic conditions, whereas the cluster of peripheral area shares a traditional history and unique advantage in agricultural resources, its cultivated land per capita (0.5 Ha) is more than four times of the green cluster (0.12 Ha). Also, the cluster of main rural area mainly are the labor exporting areas, and labor-intensive in agricultural production. Both of them have lower developing level than the cluster of coastal developed, and this situation still remains in the result of 2006 census.

The cluster of mountain area remains the same, composed by Tibet and Qinghai, but clearly there are changes in the indicators. The proportion of persons engaged in agricultural activities increase from 80% (1996) to 86% (2006). It still remains its characteristic of animal husbandry, the employment in this sector even increased from 25% (1996) to 28% (2006). The education level improved, such as the proportion of illiterate and semi-illiterate decreased from 61% (1996) to 38% (2006), even though it is still the highest among the four clusters.

### **Conclusion**

Above all, we can conclude that the new zoning based on our analysis of clustering rural China is significantly different from the traditional and official geographic classifications. The study of 1996 and 2006 national agricultural census in rural China not only demonstrate the improvements of rural China in the last ten years, but also reflect the necessities of targeted policies and projects to develop rural areas, hence to narrow down the social-economic inequalities existing within the rural and especially between rural and urban areas. These differences and the disparities in socioeconomic conditions cause many problems other than economic inequality, such as migration, aging of rural population and gender unbalance, and also social instability and cohesion. What would be necessary is some financial and policy support from the central government in order to improve living basic facilities, to enhance rural local development, intensive production and

<sup>7</sup> Tibet is around 1.2 million square km, occupies 12.5%; Qinghai is 0.7 million square km, occupies 7.5%.

<sup>8</sup> Chongqing is designated as a single municipality in June, 1997 from Sichuan province, so the information is not included in the first census.



**Annex 1. Indicators of Agricultural and Socioeconomic Conditions in Rural China**

	Indicators in 2006 Census	Indicators in 1996 Census
1-same	Persons in agricultural households / persons in non-agricultural households	
2-similar	RH: % of persons aged 10-24	RH: % of persons aged 7-25
3-similar	RH: % of persons aged 35-59	RH: % of persons aged 36-61
4-similar	RH: % of labor in crop planting	RH: % persons aged>7 in crop planting
5-similar	RH: % of labor in animal husbandry	RH: % persons aged>7 in husbandry
6-similar	RH: % of labor in non-agri in rural	RH: % of aged>7 in non-agri in rural
7-similar	RH: % of labor in non-agri in urban	RH: % of aged>7 in non-agri in rural
8-similar	RH: % of labor in eco-act. in hometown	RH: % aged>7 in eco-act. in hometown
9-same	AH: persons engaged in economic activities, female/male	
10-same	AH: persons engaged in non-agriculture / persons engaged in agriculture	
11-same	RH: % of persons illiterate and semi-illiterate	
12-same	RH: % of persons with educational level of primary school and middle school	
13-same	RH: % of persons with superior educational level	
14-same	RH: % of male with superior educational level	
15-same	RH: % of female with superior educational level	
16-same	RH: male/female with superior educational level	
17-same	RH: % of persons engaged in agricultural activities 6 months and over	
18-same	AH: Hectare/number of persons in rural households	
19-similar	AH: % employment in crop planting	% agricultural land for cultivated
20-similar	AH: % employment in forestry	% agricultural land for woodland
21-similar	AH: % employment in husbandry	% agricultural land for herbage grassland
22-similar	AH: % employment in fishery	% agricultural land for fishery
23-same	AH: % distribution of sown area for grain	
24-same	AH: % among cultivated land tractor ploughed	
25-same	AH: % among cultivated land electro-machine irrigated area	
26-same	AH: % among cultivated land machine harvested area	
27-same	AH: number of large animals for 100 persons engaged in agricultural activities	
28-same	Large and medium tractors / persons engaged in agricultural activities	
29-same	Mini tractors / persons engaged in agricultural activities	
30-same	AH: persons engaged in agriculture / persons engaged in economic activities	

Note: RU is rural households, AH is all holdings. The inconsistency of indicators is because of the different statistic measures applied in the two censuses and the divergences are controllable.

Annex 2. The Mean and Variance of 4 Clusters

Indicators	cluster 1		cluster 2		cluster 3		cluster 4	
	mean	St.dev	mean	St.dev	mean	St.dev	mean	St.dev
1	10.63	6.39	34.49	16.03	15.92	1.9	65.88	38.11
2	0.22	0.05	0.25	0.03	0.25	0.05	0.3	0.03
3	0.41	0.04	0.37	0.04	0.39	0.07	0.28	0.03
4	0.35	0.15	0.76	0.08	0.8	0.02	0.63	0.05
5	0.02	0.01	0.03	0.02	0.07	0.02	0.25	0.05
6	0.61	0.16	0.2	0.08	0.12	0.01	0.12	0.09
7	0.25	0.11	0.29	0.13	0.08	0.03	0.18	0.11
8	0.6	0.03	0.63	0.03	0.69	0.03	0.59	0
9	0.87	0.11	0.96	0.06	0.89	0.02	1.01	0.04
10	2.83	2.45	0.27	0.14	0.14	0.01	0.16	0.11
11	0.04	0.02	0.08	0.05	0.05	0.02	0.38	0.11
12	0.8	0.05	0.82	0.05	0.87	0.04	0.56	0.08
13	0.16	0.05	0.1	0.02	0.09	0.02	0.05	0.03
14	0.14	0.04	0.08	0.02	0.07	0.01	0.04	0.03
15	0.1	0.06	0.04	0.01	0.05	0.01	0.02	0.01
16	1.74	0.34	2.21	0.57	1.73	0.29	1.84	0.05
17	0.38	0.18	0.6	0.21	0.43	0.34	0.6	0.28
18	0.05	0.02	0.12	0.06	0.49	0.18	0.14	0.01
19	0.87	0.07	0.95	0.03	0.92	0.02	0.72	0.02
20	0.03	0.05	0.01	0.01	0	0	0	0
21	0.05	0.03	0.04	0.03	0.08	0.02	0.28	0.02
22	0.03	0.02	0.01	0.01	0	0	0	0
23	0.58	0.11	0.69	0.08	0.72	0.25	0.66	0.11
24	0.62	0.27	0.4	0.29	0.78	0.15	0.31	0.21
25	0.49	0.3	0.24	0.22	0.21	0.12	0.03	0.02
26	0.28	0.19	0.16	0.15	0.23	0.17	0.15	0.1
27	0.02	0.01	0.02	0.01	0.05	0.03	0.17	0.05
28	0	0	0	0	0.02	0.01	0	0
29	0.04	0.05	0.06	0.06	0.13	0.03	0.12	0.07
30	0.33	0.15	0.8	0.08	0.88	0.01	0.86	0.08

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