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**Food Consumption for the Poor: A Supply or an Income Issue?  
---- Evidence from Less-favored Regions in Rural China**

**(Draft)**

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***Selected Paper prepared for presentation at the Agricultural & Applied Economics Association 2010  
AAEA, CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010***

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# **Food Consumption for the Poor: A Supply or an Income Issue? ---- Evidence from Less-favored Regions in Rural China (Draft)**

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## **Abstract**

The world food crisis has brought about heated discussions on policy responses and actions to achieve future stability and security in food consumption for the poor. While many viewing it as a supply problem and propose to cope with it by increasing self-supply, there are also propositions of viewing it more as an income problem. This paper has taken the experience of China into study. Being the most populous nation in the world and with rural low-income and low food consumption groups still a noticeable portion in the rural area, China has devoted strenuous efforts by utilizing various policy approaches. This paper has estimated empirically the impact of different policy measures, i.e., the predominantly used traditional policy aimed at increasing self-production locally, the “supply” approach, and the pro-market approach of increasing income to purchase more food from market, the “income” approach, on the improvement of food security in disadvantaged regions in rural China. Both Provincial and household data are used in the research, with particular attention paid to regions characterized by low income and low grain production. The results show that with the county’s transition into market system, higher ratio of grain sown area to total cultivate area, as advocated by grain self-sufficiency policy, would hardly lead to improved grain and food consumption for disadvantaged farmers in less-favored regions. On the contrary, it might lead to a worsened food security situation. The increase of income, on the other hand, will help farmers in poor and grain insufficient regions to improve their food security status. It is hoped that the experience from China will help to provide additional evidence for the discussion of policy alternatives for food security for other developing countries.

Keywords: Food consumption, Food production policy; Food security; Less-favored regions; China

JEL Classification: Q18; Q01;

## **1. Introduction**

The world food crisis in 2007-2008 has posed tremendous food security hardships for poor people in developing countries. It also brought about heated discussions about policy responses and actions to achieve future stability and security in food consumption for the poor.

There is a long list of possible contributors to the food crisis and the consequent food insecurity of the poor, including demand growth in emerging economies, biofuel policies, rising energy prices, supply shortfalls, as well as speculation in commodity markets (OECD/FAO,

2008). And one of the most immediate policy actions was the imposition of bans or restrictions on food exports. Countries such as India, Kazakhstan, Vietnam, and China all reduced or eliminated grain exports, with the aim of increasing domestic supply to help achieve food security for the domestic disadvantaged groups. Many of the subsequent policy responses and plans for coping with this problem in the future are also in the same direction: increase the production and supply of grain domestically.

However, there also are other propositions on the issue. Instead of viewing it as a pure supply problem, it has been stated that the crisis should be viewed more as an income problem.

China, as the most populous nation in the world with rural poverty and low-income groups still a noticeable portion of the population, has long been struggling in achieving national food security and food security for the poor. In China, increasing food consumption has long been treated mainly as a supply issue, both for the nation as a whole, and for the less-favored regions where both grain production and farmers' income are in disadvantage. However, the promotion of grain production in these deficit regions exerts mixed effects, as it comes at the cost of substitution for other crops, usually higher-valued than grain, and hence higher income. The documentation of the impact of grain promotion policy on food consumption of farmers in disadvantaged rural regions in China will help foster more informed discussions of the food security impacts of "supply" versus "income".

China has achieved significant improvement in food security for the whole nation in the past decade. However, looking at different groups of people we find that food security status differs substantially. Even with overall surplus in grain supply in the recent years, there are still tens of millions of people lacking the basic food for subsistence. While people in the coastal, rich regions are shifting their concerns of food consumption from staples to animal products, and from mere quantity requirement to nutrition and sanitary requests, those in the rural areas, especially in poor rural areas under unfavorable natural conditions for grain production, are still struggling with inadequate food for subsistence. Improving accessibility to adequate grain and other food of people in these disadvantaged regions is becoming one of the major concerns for policy makers in achieving the goal of national food security.

In the planned economy era, local self-sufficiency has been utilized as the predominate policy tool to address the problem. It was believed that the more grain produced locally, the better accessibility of farmers in those areas to food. Therefore, various administrative measures have also been utilized to expand acreage of grain crops, to the extent of exploitation of marginal land (Wang, 1999). The result of this measure is two folded: grain production has been promoted, but at the price of either substitution for other usually higher-value crops, or over-exploitation of marginal land (Chen and Findlay, 2004). As a result, farmers' income and purchasing power is likely to be reduced and so is their accessibility to food even local grain production increases. More importantly, as poverty and low production are in themselves the result of poor natural resources there, the expansion of grain production usually led to an over exploitation of the scarce resources and serious damages to the fragile environment in those regions. The depletion of the natural resources sometimes lead the regions falling into a vicious circle of poverty—low production—further exploitation, and the long term sustainable food security for those less-favored areas could hardly be achieved.

With China's transition into a market economy, different policy schemes have been taken into consideration, as regional grain trade has gradually been on market operations instead of planned transfers (Wang et al., 2004). If there is enough supply of grain in the market, local grain and food consumption needs could, therefore, be satisfied by purchasing from market through increased income of the farmers. Naturally, a better policy alternative in pursuing local food security for poor farmers should permit and encourage farmers to shift to high-value crops and non-crop produce, in order to maximize resource allocation efficiency and income, instead of force them to produce grains, the least profitable crops (Zhong, 2004; Zhong and Zhu, 2004). This will lead to better economical and environmental sustainability of food security for farmers in those less-favored regions.

However, self-sufficiency has always been deep-rooted in people's mind. Transit toward more market-oriented measures in China is not a smooth journey (Carter et al., 1996; Chen and Findlay, 2004; Zhong, 2004a). Self-sufficiency through mandatory measures is still believed by many people as the most direct and effective approach to address national and regional food security issues, while market mechanism and income generating are regarded in many instances as being indirect and less effective. As a consequence, policy for grain production expansion reappear itself time and again during the transitional period, and is always considered as a ready policy tool whenever food security seems to be a problem. A recent example is in November 2008, the time immediately after the 2007-2008 world food crisis, China issued the nation's first Outline of Mid- and Long-term Plan for National Food Security, in which it is stipulated that the country will seek to stabilize grain sown area, and achieve more than 95% grain self-sufficiency.

It is necessary to obtain a clear understanding of the impact of different approaches on the accessibility of food for people in disadvantageous regions. Self-sufficiency approach such as local grain production expansion, and pro-market approach such as income generating through freer production decisionmaking by the farmers, need to be carefully examined through empirical research work, to facilitate future policy formulation to achieve long-term, sustainable food security for people in less-favored rural regions.

The objective of this paper is to estimate empirically the impact of different policy measures i.e., the predominantly used traditional policy aimed at increasing self-production locally, the "supply" approach, and the pro-market approach of increasing income to purchase more food from market, the "income" approach, on the improvement of food security in disadvantageous regions in rural China, to provide additional evidence for the discussion of policy alternatives for food security improvement that are of concern for many developing countries, especially after the world food crisis. Both Provincial and household data are used in the research, with particular attention paid to regions characterized by low income and low grain production.

The paper is organized as follows. The next section gives a brief discussion of the conceptual framework and model to analyze the impact of various factors on grain and food consumption of farmers in China. Estimation results are presented in section 3. Conclusion and policy implications of the effectiveness of the two different policy alternatives, self supply versus income, on improving grain and food consumption are discussed in the last section.

## 2. Methodology and data

The improvement of food security implies improvement in consumption of both grain and other categories of food. As grain is the main food in China and is the major source of animal feed for other categories of food, such as meat, fish, etc. the core of food security, especially to farmers in disadvantageous regions, is grain security. However, with the rise of income and living standard, the consumption of other categories of food is becoming increasingly important for food security. In our empirical analysis, both grain consumption level and the overall food consumption are used to be dependent variables separately in the regressions to gain a better understanding of the impact of various factors on the improvement of farmers' food security status. Farmers in disadvantageous rural areas are both consumers and producers of grain and mostly other food they consume. Consequently, their grain and other food consumption are affected by income, food price in the market, own production level, and other factors such as cultural and traditions, etc. in different regions. A log-form regression is defined as follows:

$$\ln Y_t = \alpha + \beta \ln R_t + \chi \ln A_t + \delta \ln I_{t-1} + \varepsilon \ln P_t + \eta \ln S_{t-1} + \delta_1 d_p \ln I_{t-1} + \eta_1 d_p \ln S_{t-1} + \phi_k \sum D_j + \varepsilon_t$$

where Y stands for per capita grain consumption, or per capita food expenditure<sup>1</sup>; I stands for per capita net income, and P for price index of grain or food as a whole; S stands for the ratio of grain sown area to total cultivated area; R stands for per capita arable land, A stands for the land grain production ability.  $d_p$  is the area dummy for disadvantageous rural regions, and  $D_j$  is provincial dummy, with j represents province, and t represents the year.

Per capita income, adjusted by price index, is a representation of the farmer's purchasing power. The higher the income, the stronger should be the ability of the farmers to buy grain and other food from market. The price indices of grain or food show the changing trend of prices over the years and are used in regression for both per capita grain consumption and per capita food expenditure. In a market economy, it is expected that price be negatively related to consumption levels. Farmers own production level is represented in the model in the form of arable land endowment and the ratio of grain-sown area to total cultivate area. The latter is an indicator of grain production policy—either pro local self-sufficiency through “grain dominant” administrative measures, or more market-oriented by allowing farmers' more production decision freedom to shift to other higher-valued crops.

It is worth noting that, although it is seemingly right to include per capita grain output into the group of explanatory variables, with per capita grain consumption as dependent variable, it is not an appropriate variable in our study, as the estimated relationship between production and consumption can not reveal why the production is different among farmer households or among regions, and how to increase the quantity produced. In this study, therefore, the ratio of grain-sown area to total cultivate area is chosen as an explanatory variable to represent the grain self-sufficiency policy in the analysis. We also try the model specification alternative of adding the variable representing land production ability, calculated from the three-year moving average of grain output per sown area. Therefore, we will report regression results from both models.

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<sup>1</sup> Although physical quantity of all categories of food is more preferable, the data is barely available, apart from the aggregation problem. So food expenditure is used as a proxy to represent the overall consumption level of all kinds of food.

Area dummy  $d_p$ , which is defined as provinces (at the provincial level) or villages (at the household level) that are below both the national average of rural per capita net income as well as grain availability, is interacted with income and the ratio of grain-sown area to total cultivate area, respectively, to estimate if there exists significant difference in coefficients for income and grain production policy in disadvantageous regions, in comparison with that of the national average. If so, the effect of local self-sufficiency policy on the food security status in disadvantageous regions would be expected to be negative to a greater extent.

If food consumption of farmers is negatively related with the ratio of grain-sown area to total cultivate area and positively related to farmers' income, the hypothesis would be supported that in the areas where natural resources are poor, self-sufficiency policy would worsen the status of food security in these regions, while measures encouraging more efficient use of resource to increase farmers' income would improve their access to food.

The empirical study is carried out at both provincial and household levels using data from year 1996 to year 2008. The regressions have been run separately for two periods: 2002-2008 and 1996-2001, for the following two reasons. One is the difference in the development of marketization during the past decade in China, especially before and after the country's WTO accession in late 2001; and the other is the nature of the model specification of constant elasticity, which yield more reliable results for shorter time period.

Provincial data are taken from Chinese Statistic Yearbook for the 1996-2008 time period. Beijing, Shanghai and Tianjin are not included as most residents there are urban dwellers in the 3 big cities. Tibet is also excluded for lack of data. The data for Hainan and Chongqing are aggregated to those for Guangdong and Sichuan, respectively, to keep consistency of the data over the years. Disadvantageous regions include Shanxi, Shaaxi, Gansu, Qinghai, Guizhou, Yunnan, Guangxi and Sichuan provinces, which are selected based on the criterion that both the per capita farmer's net income and per capita grain output of the province are below national average for most of the years during the 1986-2008 time period. Household data comes from household survey conducted by Agricultural Research Center of the Ministry of Agriculture during 1996-2008, covering more than four thousand farm households annually in five provinces, namely, Sichuan, Jilin, Zhejiang, Heilongjiang and Anhui, among which 2.1% villages are defined as disadvantageous regions because of their lower than national average per capita net income and grain output.

### **3. Results and discussion**

#### ***3.1. Empirical results---provincial level***

The regression results using provincial level panel data for the period of 2002-2008 and 1996-2001 are reported in Table 1. As fixed effects models have been used at the provincial level regression to capture the provincial difference such as culture, tradition, natural endowment and etc; the factor of land availability is assumed to have also been mostly captured and is not reported in the table. Two model alternatives, one "with" and the other "without" land production capability, have been tested for comparison.

The results from regression for per capita food expenditure for the period of 2002-2008, using panel data at provincial level, show that, as expected, the coefficients of farmer's net income is positive and those of the price index of food are negative. At the national level, 1% increase in farmer's income will increase the food expenditure by an average of 0.7%, and there's no significant difference exists between the national average and the disadvantageous regions in the increase of food expenditure from higher net income, judging from the positive yet statistically insignificant coefficient for the interaction variable of disadvantageous area dummy and net income.

**Table 1. Coefficients of Estimated Grain and Food Consumption, provincial level, 2002—2008 and 1996-2001**

	Per capita food expenditure		Per capita grain consumption	
	2002-2008			
	( 1 )	( 2 )	( 1 )	( 2 )
<b>constant</b>	<b>2.370</b> 9.59***	<b>2.557</b> 8.96***	<b>8.837</b> 36.4***	<b>9.260</b> 33.55***
<b>LnI<sub>t-1</sub></b>	<b>0.722</b> 11.03***	<b>0.669</b> 8.67***	<b>-0.311</b> -6.50***	<b>-0.418</b> -7.10***
<b>LnP</b>	<b>-0.310</b> -2.98***	<b>-0.312</b> -3.01***	<b>-0.276</b> -4.87***	<b>-0.303</b> -5.41***
<b>LnS<sub>t-1</sub></b>	<b>0.163</b> 2.13**	<b>0.176</b> 2.29**	<b>0.441</b> 0.59	<b>0.074</b> 1.00
<b>LnA</b>		0.156 1.30		<b>0.350</b> 2.97***
<b>d<sub>p</sub>LnI<sub>t-1</sub></b>	<b>0.104</b> 1.36	<b>0.111</b> 1.46	<b>0.048</b> 0.64	<b>0.060</b> 0.82
<b>d<sub>p</sub>LnS<sub>t-1</sub></b>	<b>-0.662</b> -2.60***	<b>-0.615</b> -2.40**	<b>-0.440</b> -1.73*	<b>-0.357</b> -1.43
<b>R<sup>2</sup></b>	0.729	0.732	0.616	0.638
	1996-2001			
	( 1 )	( 2 )	( 1 )	( 2 )
<b>constant</b>	<b>8.101</b> 4.63***	<b>9.001</b> 4.96***	<b>4.596</b> 5.52***	<b>4.802</b> 5.75***
<b>LnI<sub>t-1</sub></b>	<b>-0.054</b> -0.53	<b>-0.135</b> -1.21	<b>0.030</b> 0.04	<b>-0.050</b> -0.59
<b>LnP</b>	<b>-0.221</b> -0.91	<b>-0.373</b> -1.44	<b>0.181</b> 2.25**	<b>0.145</b> 1.75*
<b>LnS<sub>t-1</sub></b>	<b>-0.834</b> -0.64	<b>-0.093</b> -0.71	<b>0.131</b> 1.09	<b>0.124</b> 1.05
<b>LnA</b>		<b>0.267</b> 1.69*		<b>0.228</b> 1.66*
<b>d<sub>p</sub>LnI<sub>t-1</sub></b>	<b>-0.008</b> -0.06	<b>-0.007</b> -0.06	<b>0.050</b> 0.42	<b>0.057</b> 0.48
<b>d<sub>p</sub>LnS<sub>t-1</sub></b>	<b>0.305</b> 0.95	<b>0.206</b> 0.64	<b>-0.276</b> -0.97	<b>-0.368</b> -1.28
<b>R<sup>2</sup></b>	0.022	0.050	0.120	0.145



Notes: 1. Regional dummy  $d_j$  represents provinces with lower per capita rural income and grain output, namely, Shanxi, Shaanxi, Gansu, Qinghai, Guizhou, Yunnan, Guangxi and Sichuan 2. Numbers in parenthesis are T-value. Significance level of 1%, 5% and 10% are indicated by \*\*\*, \*\*, and \*respectively. Source of data: calculated from Chinese Statistic Yearbook, various years.

However, compared with national average, farmers' food expenditure in disadvantageous regions is negatively more sensitive to the changes in the ratio of grain-sown area to total cultivated area. While 1% increase in the ratio of grain-sown area to total cultivate area will result in a moderate increase of 0.18% in food expenditure for farmers at the national average, it also leads to a considerable decrease of 0.44% ( $0.176-0.615=0.439$ ) in food expenditure for farmers in disadvantageous regions.

For per capita grain consumption for the same time, the results show that the impact of grain-sown area to total cultivated is not statistically significant for the nation in general. There is even sign of negative impact of grain to total sown area on the grain consumption in these regions, manifested from the negative coefficient for interaction variable of disadvantageous regions with grain to total sown area, though with relatively low statistically weak significance. Note that in this grain consumption model, although the price variable shows negative sign as expected and is similar to that in the food expenditure model, the sign of income is negative. In conjunction with the positive sign of the income variable in the food expenditure model, it manifests the fact that with the income rise, people diversify their food consumption from mainly grain to all variety of food.

The regressions for both per capita food expenditure and per capita grain consumption for the period of 1996-2001, on the other hand, yield very weak results, using the same dependent variables as for that in the period of 2002-2008. Except for the variables of grain production ability, which exhibits significant positive sign as expected, most of other variables do not yield significant coefficients. There's also positive sign for grain price in the grain consumption model. It might be due to fact of relatively low income during the period compared with that 2002-2008, which is about 50% higher, resulting in the income constraint from price rise, and the shift of consumption of other kind of food to more grain. However, together with the very low R square of the models, it is reasonable to assume that for the period that market was not performing well, farmers consumption of food were not manifesting their normal responsiveness to factors such as price signal or income that work most in a market mechanism.

The advantage of provincial data lies in the fact that it covers the whole country, and the panel data provides convenience to model specification. However, it also goes hand in hand with the weakness of too much aggregation, while reflecting the overall situation, it also "smooth out" the differences across household within a province. Therefore, we need to complement our analysis with household level data.

### ***3.2. Empirical results--household level***

The estimated results from the regressions utilizing household survey data are listed in Table 2. It could be seen from the table that, for the period of 2002-2008, the area of arable land and the production ability of land yield statistically positive coefficients as expected, and the coefficients for food price, in both food expenditure and grain consumption regressions, exhibit negative sign.

**Table 2. Coefficients of Estimated Grain and Food Consumption household level, 2002-2008 and 1996-2001**

	Per capita food expenditure		Per capita grain consumption	
	2002-2008			
	( 1 )	( 2 )	( 1 )	( 2 )
<b>constant</b>	<b>0.293</b> <i>18.76***</i>	<b>0.027</b> <i>0.79</i>	<b>4.022</b> <i>254.8***</i>	<b>3.880</b> <i>119.5***</i>
<b>LnR</b>	<b>0.124</b> <i>32.83***</i>	<b>0.136</b> <i>33.98***</i>	<b>0.310</b> <i>86.23***</i>	<b>0.316</b> <i>83.31***</i>
<b>LnA</b>		<b>0.468</b> <i>8.93***</i>		<b>0.025</b> <i>5.03***</i>
<b>LnI</b>	<b>0.472</b> <i>111.9***</i>	<b>0.461</b> <i>104.7***</i>	<b>0.206</b> <i>51.85***</i>	<b>0.200</b> <i>48.43***</i>
<b>LnP</b>	<b>-1.137</b> <i>-19.42***</i>	<b>-1.157</b> <i>-19.76***</i>	<b>-1.46</b> <i>-55.85***</i>	<b>-1.47</b> <i>-56.10***</i>
<b>LnS</b>	<b>-0.077</b> <i>-9.96***</i>	<b>-0.079</b> <i>-10.14***</i>	<b>0.091</b> <i>12.47***</i>	<b>0.091</b> <i>12.50***</i>
<b>d<sub>p</sub>lnI</b>	<b>-0.144</b> <i>-12.88***</i>	<b>-0.137</b> <i>-12.19***</i>	<b>-0.03</b> <i>-2.88***</i>	<b>-0.026</b> <i>-2.48**</i>
<b>d<sub>p</sub>LnS</b>	<b>-0.523</b> <i>-11.73***</i>	<b>-0.523</b> <i>-11.63***</i>	<b>-0.254</b> <i>-6.08***</i>	<b>-0.253</b> <i>-5.98***</i>
<b>Adj-R<sup>2</sup></b>	0.451	0.452	0.433	0.433
	1996-2001			
	( 1 )	( 2 )	( 1 )	( 2 )
<b>constant</b>	<b>0.956</b> <i>71.86***</i>	<b>0.997</b> <i>25.88***</i>	<b>5.346</b> <i>465.6***</i>	<b>4.765</b> <i>145.19***</i>
<b>LnR</b>	<b>0.061</b> <i>14.81***</i>	<b>0.056</b> <i>12.99***</i>	<b>0.147</b> <i>41.72***</i>	<b>0.164</b> <i>45.03***</i>
<b>LnA</b>		<b>-0.01</b> <i>-1.68**</i>		<b>0.102</b> <i>18.79***</i>
<b>LnI</b>	<b>0.298</b> <i>74.07***</i>	<b>0.308</b> <i>72.53***</i>	<b>0.066</b> <i>19.26***</i>	<b>0.050</b> <i>13.87***</i>
<b>LnP</b>	<b>0.178</b> <i>2.55**</i>	<b>0.186</b> <i>2.66***</i>	<b>0.220</b> <i>9.63***</i>	<b>0.217</b> <i>9.57***</i>
<b>LnS</b>	<b>-0.08</b> <i>-8.56***</i>	<b>-0.077</b> <i>-8.21***</i>	<b>0.111</b> <i>13.95***</i>	<b>0.103</b> <i>12.86***</i>
<b>d<sub>p</sub>lnI</b>	<b>-0.394</b> <i>-19.15***</i>	<b>-0.394</b> <i>-19.14***</i>	<b>0.081</b> <i>4.62***</i>	<b>0.106</b> <i>6.09***</i>
<b>d<sub>p</sub>LnS</b>	<b>-2.485</b> <i>-0.72</i>	<b>-2.42</b> <i>-0.70</i>	<b>1.848</b> <i>0.63</i>	<b>1.828</b> <i>0.63</i>
<b>Adj-R<sup>2</sup></b>	0.394	0.396	0.124	0.137

Note: 1. Data cover five provinces: Sichuan, Jilin, Zhejiang, Heilongjiang and Anhui. Villages with per capita income and grain output lower than national average are defined as disadvantaged regions . 2. Numbers in parenthesis are T-value. Significance level of 1%, 5% and 10% are indicated by \*\*\*, \*\*, and \*respectively. 3. Coefficients for provincial dummy are not listed for simplicity.

Source: Calculated from Household Survey data by Agricultural Research Center of the Ministry of Agriculture.

Similar to the results from the provincial data, the variable of income in the regression of per capita food consumption yield significantly positive effect on farmers' food consumption expenditure. A 1% increase in income will lead to an expansion of farmers' per capita consumption on food for farmers on average by 0.46%, and farmers in less-favored regions by 0.32% ( $0.46\% - 0.14\% = 0.32\%$ ). The increase in the ratio of grain-sown area to total cultivate area in less-favored areas exerts similar stronger negative impact on food consumption levels than the sample average, 0.52 percent point more. Unlike that in the provincial level regression, the coefficient of grain area ratio for all the household on average is also statistically negative, the same as the other household at large, though to a much small extent (0.08%).

The positive income effect could also be found in the results in the per capita grain consumption regressions for the same period, with the elasticity of 0.2% for the households on average and 0.17% for households in less-favored regions. Similar to the results at the provincial level, but with much stronger statistical significance, the coefficients of grain sown area ratio are positive and yet for the sample households on average, but are negative and strong for farmers in less-favored regions, indicating that while the increase of grain sown area ratio may help to improve grain consumption for farmers on average, although only with a mild improvement, it does not, for farmers in less-favored regions. On the contrary, 1% increase of grain sown area ratio will decrease their grain consumption by 0.16% ( $-0.25 + 0.09 = -0.16$ ).

Like that at the provincial level, the regressions using household data for both per capita food expenditure and per capita grain consumption for the period of 1996-2001, yield mixed results. Compared with the results of the 2002-2008 period, the major differences in the results of the 1996-2001 period lie in the positive coefficient of price index, and the insignificance of the interaction term between disadvantageous region dummy and the ratio of grain sown area to total cultivated land. Unlike the results of the provincial level of the same period, the household regressions still show significant positive income effect on both food expenditure and grain consumption, in regardless of households in general or in disadvantageous regions, although with slight difference in extent.

#### **4. Conclusions and policy implications**

The results from both provincial and household regression for the period of 2002-2008 show that, while higher ratio of grain sown area might have a slight positive impact of grain consumption for rural farmers in average, it turns out to have significant negative impact on both grain and food consumption for farmers in less-favored regions. According to the household regression results, 1% increase in the grain area ratio would lead to 0.6% decrease of food consumption and 0.16% grain consumption for farmers in less-favored regions. For the results at provincial level, 1% increase in the grain area ratio would lead to 0.44% decrease of food consumption for those farmers.

On the other hand, the factor of income yield significant positive impact on food consumption for all rural farmers, regardless of whether being disadvantageous. According to the household regression results of the same period, 1% increase in farmers' net income would lead to 0.46% and 0.33% higher food consumption for farmers on average and those in less-favored regions, respectively, and the provincial regression finds the positive income effect up to 0.67%

for all groups. While the provincial regressions exhibit decreasing grain consumption with the rise of income for the whole country, household data however, support the positive impact of income on grain consumption, for both household on average and for those in less-favored regions, to the extent of 0.2-0.3%.

The above results from regressions using both provincial data and household survey data for the period 2002-2008 support the hypothesis that, higher ratio of grain sown area to total cultivate area, as advocated by grain self-sufficiency policy, will hardly lead to improved grain and food consumption for disadvantageous farmers in less-favored regions. On the contrary, it might lead to a worsened food security situation. The increase of income, on the other hand, will help farmers in poor and grain insufficient regions to improve their food security status.

From the comparison of the results between the period of 2002-2008 and that of 1996-2001 we find that, the messages conveyed in the latter are more ambiguous. In the period that market was not performing well to the extent that facilitated farmers for adequate trading, the variables such as price and income were not responding in the right sign or significance as expected.

The following conclusions could be drawn from the results of the above regressions: the food consumption level of farmers' are closely and positively related to their income and purchasing power, and the expansion of the grain-sown area ratio would negatively affect the farmers' grain consumption and expenditure on food, especially so in the less-favored regions; Compared with direct grain consumption, food consumption is more positively sensitive to the change in income and to the grain self-sufficiency policy, especially so in the less-favored regions.

The first conclusion implies that, the grain self-sufficiency policy, which had been carried out in China for quite a long time, has already exhibited substantial negative impact at the regional level in terms of achieving food security. In regions poor in natural resources and vulnerable in environment, the self-sufficiency policy has not been able to achieve its purpose of ensuring a long-term, sustainable production growth. On the contrary, it has led to a decreased consumption of grain and food for farmers in these areas and hindered the improvement of their food security. In fact, even for China as a whole, the excessive emphasis on grain production would negatively affect farmers' income and therefore their food security, as grain production is relatively less profitable for farmers.

The second conclusion implies that food security will manifest itself more in the form of a diversified food consumption in the future for farmers. With continuous economic development and increase in income, demand for food other than grain in these regions will certainly increase at an accelerate pace. Regressions in this paper show that the increase in income will have much greater impact on farmers' expenditure on food than direct grain consumption. Food security in the future would also be more focus on the growth of consumption as well as nutritious standard of different category of food than the quantity of grain.

In conclusion, in China, a more desirable policy alternative to improve food consumption for low income farmers in the less-favored regions is to carry out an income generating approach, rather than pursuing the regional self-sufficiency policy. It is increasingly true with the country's

market-oriented reform. An effective and functional market mechanism for agricultural products will not only help to facilitate inter-regional trade and farmers' food accessibility, but also their cropping adjustment and realization of higher economic return through improved resource allocation. This will provide some reference for developing countries also with high concern for food security.

### **Acknowledgement**

The authors are grateful to the support from Natural Science Foundation of China (Project No. 70873061), NCET program of the Ministry of Education (NECT-07-0443) and the support by the Fundamental Research Funds for the Central Universities (KYJ200901).

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