

Implication of Grain Policy on Agricultural Restructuring in China

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Abstract

The paper is aimed to analyse the impact of grain policy on the structure and growth of grain sector in China. The study applied econometric analysis to test empirically the impact of grain policy on the structure and growth of grain sector in China. The study revealed that agricultural policy, especially grain policy, has had a great impact on agricultural production in China. In periods of government mandating increase in grain production, policy has diverted resources, especially land, into grain production, which could otherwise have been used to produce higher value crops. This inevitably results in lower growth in agriculture, as well as in farmers' income. Such policy might be justified by the long history of grain shortage in China, as efficiency in resource allocation is outweighed by the goals in the national security in food supply and in social stability.

1 Introduction

China has a long history of self-sufficiency in farm products, and grain self-sufficiency has always been regarded as the key policy objective in agricultural production. However, this policy has gone through a series of changes since 1979, which has exerted significant influence on China's grain production, as well as agricultural growth. As the changes of grain policies have had great impact on grain-sown areas, there are certain periods in which the grain-sown acreage experiences ups and downs when the policy swings. Since grain production is less, if not least, profitable, and accounts for a large percentage of crop production, the changes in grain policy, as

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reflected in sown areas, may directly influence farmers' ability to re-allocate their resources to other more profitable crops and other productions. Therefore, the total value of agricultural products and its growth pattern are likely to associate with grain policy.

It is reasonable to assume that the changes in the grain-sown acreage led by policy swings, may have negative impact on the growth of the total value of the agricultural products. This study will test this hypothesis, and draw some conclusions for the future policy formation.

2 Grain policy, grain production and resource re-allocation

Prior to the 1979 reform, there were mandatory "sown-area plans" in addition to procurement quotas. Farmers had virtually no decision-making rights, because they were forced to follow the acreage plans and deliver grain, cotton, and other produce to the state as specified by the quota. In many cases, they were encouraged, persuaded, or even ordered to make above-quota deliveries to the state, so they could not re-allocate their resources to more profitable production under the planned economy.

Since the reform started in 1979, the quota prices were increased by a big margin, the above-quota premiums were raised even higher, and the types and quantities of the quota were reduced significantly during the first a few years. As a result, the grain production reached the first peak in 1984 in China. This made the Chinese government loosen its control on grain production gradually afterwards, enabling farmers to shift some of their resources to non-grain crops and other sectors. A new grain procurement system, the so-called "contracted purchasing" system was introduced in 1985, and sown areas shifting away from grain production was greatly encouraged at the same time.

Under the new policy, grain-sown areas declined by 3.6% in a year, followed by a reduction of 6.9% in grain production. The significant decline in grain production was taken as a dangerous signal by the government, stimulating tightened control in grain production. The contract for grain purchasing was re-elaborated as a kind of "state

contract”, meaning compulsory, and sown areas were made subject to various administrative measures again.

The grain policy has then swung left and right several times, resulted in changing trends in grain-sown areas, as well as in the changing trends in restructuring of the crop agricultural sector. As the growth of the crop sector depends on sown areas, yields, and crop mix, the policy swings must have had significant impact on the sector. As grain production is least profitable, the net effect is likely to be negative when grain-sown areas are increasing, and vice versa.

From 1986, the policy stressed on increase of grain production after the big decline in 1985, then the policy pressure was reduced as a result of the “difficulties in selling grain” experienced by farmers around 1990. The policy swung again in 1994 after a sharp increase in grain prices spread from the coastal areas to the whole country by the end of 1993. As the price increase was interpreted as the result of grain shortage, the so-called “provincial governor responsibility system” (in grain supply locally) was formally introduced. In practice, such policy is actually a kind of returning to the old system, in which administrative measures were the main tools in achieving grain production goals. The areas sown to grain responded to the policy swings: it increased by 2.3% during the 1986-90 time period, decreased by 3.5% in the 1990-94 time period, and increased again by 3.9% during the 1994-98 time period.

Usually, when the policy puts heavy pressures to increase grain production, it also provides better price incentives, as well as other measures, so the total sown areas and yields tend to increase faster. Therefore, in order to analyze the impact of grain policy on restructuring of the crop sector, we should be able to decompose the growth of the sector, distinguishing contributions from growths in total sown areas, yields, and changes in cropping structure. While grain policy may positively influence total sown areas and yields, it is likely to have negative impact on the potential contribution from restructuring of the sector.

3 Analytical framework

According to Zhong and Zhu², the growth in the total value products in the cropping sector, measured in comparable prices, could be attributed to the growth in total sown areas, the growth in average yields weighted by area sown to each crop, and the improvement of the cropping structure. If farmers were able and allowed to re-allocate their land and other resources to non-grain and more profitable crops, the total value output is likely to increase even if sown areas and yields are maintained at the same levels. This improvement in resource allocation will be reflected by an increase in the value of the “unit product” in the sector. They further estimated and separated contribution made by structural adjustment from those by increases in sown areas and yields.

The same logic could be used to analyse the impact of grain policy on the structural adjustment in China’s agriculture, especially in the crop sector. When the crop structure changes in response to market signal and in pursuing higher return, the value of the “unit product” is likely to increase, as more resources are allocated to more profitable non-grain crops, or to high-value but relatively low-yield grain varieties. If the crop structure is forced to change in order to boost grain production, the value of the “unit product” tends to decline, or increase at much slow rates.

In this study, we first estimate contributions of total areas, yields and crop structure to the overall growth in the crop sector in the above 3 periods: 1986-90, 1990-94, and 1994-98. Then, we try to find out whether the contribution of the structural adjustment to the growth is negatively related with grain policy as reflected by the change in grain-sown areas. In order to minimise potential impact of other factors on structural adjustment, 6 provinces in the mid- and low-reach of the Changjiang (Yangtze River) are chosen in our analysis. As the natural resources, production technology, as well as existing crop structure are more or less similar in the 6 provinces, their responses to the

² Zhong Funing and Zhu Jing, “Jiegou Tiaozheng Zai Woguo Nongye Zengzhang Zhong De Zuoyong [The Role of Structural Adjustment in China’s Agricultural Growth]”, *Zhongguo Nongcun Jingji [Chinese Rural Economy]*, forthcoming.

policy are likely to show the same trend. Hence, the relationship between the structural change and grain policy could be analysed with fewer disturbances. Finally, some conclusions will be drawn from the analysis.

Following the approach used by Carter and Zhong (1991) in measuring regional comparative advantage in Chinese agriculture, a rank correlation test and a linear regression analysis will be used in this study.

4 Empirical Analysis

As described above, the growth in the value of “unit product” could be calculated from subtracting the growths in total sown areas and weighted average yields from the growth in total value output in the crop sector. This variable could be used as an indicator of the contribution of structural improvement to the overall growth in the sector. The growth rates of the value of “unit product” can be calculated as follows:

$$G_{\text{output}} = G_{\text{area}} * G_{\text{yield}} * G_{\text{value}} \quad (1)$$

and

$$G_{\text{value}} = G_{\text{output}} / (G_{\text{area}} * G_{\text{yield}}) \quad (2)$$

where G_{output} = growth in total value output in the crop sector;

G_{area} = growth in total sown areas;

G_{yield} = growth in weighted yields; and

G_{value} = growth in the value of “unit product”.

The growth patterns of the value of “unit product” are calculated for the 6 provinces, as well as the national average, during the 3 time periods mentioned above. Those figures are listed in Table 1, along with the growth patterns of grain-sown areas.

Table 1 Contribution of Structural Adjustment and Grain-Sown Areas

Regions	Growth in the value of “unit product”			Growth in grain-sown areas		
	1986-90	1990-94	1994-98	1986-90	1990-94	1994-98
Zhejiang	0.8666	1.2047	1.1149	1.0235	0.8393	1.0213
Anhui	0.7903	1.0670	1.0770	1.0321	0.9413	1.0190
Jiangsu	0.8795	1.2711	1.1943	0.9798	0.9035	1.0344
Jiangxi	0.7036	1.1276	1.0852	1.0196	0.9800	0.9961
Hubei	0.7323	1.0875	1.0337	1.0212	0.9135	0.9873
Hunan	0.8256	1.0864	1.0850	1.0298	0.9428	0.9995
National	1.0415	1.1123	1.0736	1.0228	0.9650	1.0387

Source: Calculated from the Editorial Board of China Agricultural Yearbook, (various issues), *Zhongguo Nongye Nianjian* [China Agricultural Yearbook], Nongye Chubanshi, Beijing.

From the results shown in Table 1, we could find a clear trend that growth of the “unit product” values is negatively related with that of grain-sown areas. To further test the hypothesis of negative correlation between grain-sown area growth and the contribution of crop restructuring to agricultural growth, the following two methods are used. The first method is the rank correlation test and the second uses linear regression.

The Spearman rank correlation coefficient r' is defined as follows:

$$r' = 1 - \frac{6 * D * D}{n * (n * n - 1)} \quad (3)$$

Where D is the difference between the two corresponding ranks, and n is the number of observations.

The rank correlation coefficient is a measurement of the relationship between two variables, based on the observations' ranks rather than on their numerical values. The value of r' varies between -1 to 1. A value of 1 means perfect positive correlation, -1, perfect negative correlation, and 0, no correlation at all. The rank correlation statistic has some advantages over the linear correlation coefficient because it involves less restrictive assumptions on the data.

The ranks of the growths in both “unit product” value and grain-sown areas are calculated for each region in the 3 time periods. The results are listed in Table 2.

Applying the data in Table 2 results in the rank correlation coefficients between the growths of the “unit product” value and grain-sown area listed in Table 3.

Table 2 Ranks of Growths in “Unit Product” Value and Grain-Sown Areas

Regions	Growth in the value of “unit product”			Growth in grain-sown areas		
	1986-90	1990-94	1994-98	1986-90	1990-94	1994-98
Zhejiang	3	1	2	2	3	1
Anhui	3	2	1	1	3	2
Jiangsu	3	1	2	2	3	1
Jiangxi	3	1	2	1	3	2
Hubei	3	1	2	1	3	2
Hunan	3	1	2	1	3	2
National	3	1	2	2	3	1

Source: Calculated from figures in Table 1.

Table 3 Rank Correlation Coefficients

Region	Zhejiang	Anhui	Jiangsu	Jiangxi	Hubei	Hunan	National	Overall
r'	-0.5	-0.5	-0.5	-1	-1	-1	-0.5	-0.72

Source: Author’s calculation.

All the coefficients have negative signs as expected. As the critical value of r' for 21 observations (six provinces and national) is 0.37 at a significance level of 0.05, the coefficient of -0.72 is statistically significant. In 3 of the provinces, the value of r' is as higher as -1, meaning perfect negative correlation between the two variables. Thus, the hypothesis is supported by the test.

A further test of the impact of grain sown area change on the contribution of crop restructuring to the agricultural growth is based on pooled cross-sectional and time-series linear regression:

$$R_{ij} = a_0 + \sum_{i=1}^6 a_i D_i + b A_{ij} + e_{ij} \quad (4)$$

where: R_{ij} is the estimated growth rate of “unit product” value in the i^{th} province and the j^{th} period;

A_{ij} is the growth rate of grain-sown area in the i^{th} province and the j^{th} period;

D_i is a dummy variable, which equals one for the i^{th} province and zero for the other provinces.

Applying the 1986-1998 data in Table 1, the OLS results are as follows:

$$R_{ij} = 2.78 - 0.22D_1 - 0.1D_2 - 0.12D_3 - 0.15D_4 - 0.18D_5 - 0.11D_6 - 1.69A_{ij}$$

(4.24) (-.18) (-.8) (-.97) (-1.24) (-1.5) (-.98) (-2.62)

$$F=1.44 \quad R^2=0.44$$

(Note: the figures in parentheses are t-ratios.)

Although the values of F-statistics and R^2 are not high, the estimated coefficient associated with the grain-sown area is significant at the 5% level and this is of interest. This statistical result shows the numerical relationship between the grain area growth rate and the contribution of crop restructuring to agricultural growth. It can be interpreted that, on average, if the growth rate of grain sown area increased by 1%, the contribution of crop restructuring to agricultural growth would decrease by 1.69% in that province during this time period. The insignificant coefficients of the dummy variables indicate that the intercept of the function does not vary from province to province.

Therefore, it may be concluded that if a province increases its grain-sown area less, or more preferably, decreases its grain-sown area, the overall average value of unit crop output would be increased at a higher rate. This implies that the structural adjustment in the crop sector may contribute significantly to agricultural growth, if this adjustment is not intervened by grain policies.

5 Conclusions and Implications

Agricultural policy, especially grain policy, has had a great impact on agricultural production in China. Under the planned economy, most agricultural resources, especially land, were mobilised to increase grain production. After the reform started, the pressures of the grain-focused policy have experienced swings during various time periods. The evolution of the grain policy is clearly influenced by the demand-supply situation in the domestic grain market, as well as by the general process in the overall reform of the whole economy.

However, the swings in the grain policy not only influence grain supply, but also have significant impact on the structure of the crop sector and its contribution to the overall growth in the sector. In periods of government mandating increase in grain production, policy has diverted resources, especially land, into grain production, which could otherwise have been used to produce higher value crops. This inevitably results in lower growth in agriculture, as well as in farmers' income. Such policy might be justified by the long history of grain shortage in China, as efficiency in resource allocation is outweighed by the goals in the national security in food supply and in social stability.

After consecutive bumper harvests in the mid-1990s, and due to many other factors, China is now facing over-supply and the grain market prices have dropped sharply since the end of 1996. Under the new situation, which is likely to continue for some time, the grain-focused policy seems to have lost its grounds, and could be relaxed to achieve improvement in resource allocation, as well as in farmers' income.

The Chinese government has responded to the real-world situation with advocating "strategic adjustment in agricultural production structure". The findings of this study strongly support this new direction in policy arena, and wish to convince the policy makers, along with similar studies, to move towards this direction firmly and continuously.

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