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**TRENDS IN CHINA'S REGIONAL GRAIN PRODUCTION
AND THEIR IMPLICATIONS**

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Abstract

The paper examines trends in China's regional grain production during the reform period and their impact on national grain output and interregional grain transfers. It finds that there are significant variations between regions in terms of magnitude and patterns of growth. In general, northern regions experienced a faster growth than southern regions. There is a tendency to shift grain production centres towards the north, resulting in a modification of crop composition in total national output. The share of wheat and maize increased whereas the share of rice decreased. In the meantime, the shift has also led to a change in the prevailing direction of grain flows in interregional transfers. The traditional south-north flow is being replaced by a shift in the opposite direction. An analysis of regional trends in sown areas and yields, however, suggests that for China as a whole, the potential for further increasing grain output is limited under the current level of technology and socio-economic conditions. This, together with the remaining low level of per capita grain output, means a struggle for China to meet its grain demand in the future.

1. Introduction

The issue of grain production and supply has always been an important concern for the Chinese government and people. With China's increasing involvement in the world market, this issue has also drawn more and more international scrutiny. Following Brown's (1994) pessimistic prediction of China's future grain production and the potential threat to the global grain supply, the issue has recently been subject to further discussion.¹

There are a large number of studies of China's grain production both before and since the reforms. Most studies, however, have focused on the nation as a whole. Studies tackling regional disparities in grain production have been relatively few in number. Even fewer studies have linked the impact of uneven regional growth on crop composition, interregional transfers and potential growth of overall national grain output.

China's large size has created considerable variations in natural and socio-economic conditions. These variations have brought about significant disparities in regional grain production. During the economic reform period, the decentralisation of production management and the unbalanced development of the economy in different regions have further reinforced these disparities. The presence of regional variations underlines the complexity of China's grain production. A regional perspective would be helpful in gaining insights into this complexity. Based on this consideration, the present paper is devoted to examining regional trends in grain production and investigating their impact on national grain output and interregional grain transfers. It covers the period between 1978 and 1994, when economic reforms were being implemented in rural China. The implications of regional variations for the future of China's grain production will also be addressed.

During the economic reforms, China's grain output has experienced a relatively rapid growth. Total output rose from 304.77 million tonnes in 1978 to 445.10 million tonnes in 1994, representing an increase of 46.04 percent (SSB, ZTN,

¹ According to Brown, by the year 2030, not only China cannot produce enough food for itself, but the surplus of the rest of the world will not be able to meet China's grain shortfalls.

1995).² Despite this achievement, the pace of the growth has been uneven. The most rapid growth occurred in the early years of the reforms. Since the mid 1980s, growth has been modest. For individual regions, both magnitudes and patterns of growth have varied significantly. The growth in some regions has been greater than that in some others. The time of greatest momentum also varied among regions. For some regions, the growth in the early 1980s was remarkable but has been followed by stagnation ever since. Elsewhere, the growth has been sustained over the whole period. These varying trends have changed the roles of individual regions in national grain production at different stages of the development, and consequently influenced the quantity and direction of grain flows in interregional transfers. The overall performance of national grain production and supply has been determined by the aggregate effect of the varying trends in different regions. The analysis of regional grain production is, therefore, of significance for understanding the mechanism of national growth in the past and predicting China's overall grain production in the future.

The study is organised as follows: Section 2 overviews regional grain production during the reform period. Section 3 examines trends in regional grain production and investigates their effects on the national performance. Section 4 traces changes in grain sown areas and yields in different regions and discusses their implications for the potential growth of national grain output. Changes in per capita grain output in individual regions and their impact on interregional grain transfers are examined in Section 5. Concluding remarks form the final section.

² In 1995, China's total grain output reached 465 million tonnes, an all-time record (Jingji Daily, 1996).

2. An Overview of Regional Grain Production During the Reform Period

According to similarities in natural and social-economic conditions, China can be divided into six agricultural regions.³ Each comprises several provinces.⁴ These regions are: Northeast (Heilongjiang, Jilin and Liaoning), North (Beijing, Tianjin, Hebei, Shandong, Henan and Shanxi), Northwest (Xinjiang, Qinghai, Gansu, Neimenggu, Xizang, Ningxia and Shaanxi), Southwest (Sichuan, Yunnan and Guizhou), Southeast (Jiangsu, Anhui, Shanghai, Zhejiang, Jiangxi, Hubei and Hunan) and South (Guangdong,⁵ Guangxi and Fujian).⁶

Map 1 shows the spatial location of regions and the percentage changes in grain output during the period studied. Although growth was a nationwide trend, the magnitude differed among regions. In the North, Northeast and Northwest regions, the increase exceeded 57 percent, while the growth in the Southwest and Southeast regions was below 36 percent. The South region recorded only 16.6 percent of growth during this period.

The faster growing north and the slower growing south changed the relative weights of these two groups of regions in national grain production. Table 1 gives details of these changes. During the period studied the total increase in national output was 125.3 million tonnes. Of this increase, the three northern regions accounted for 61.5 percent, leaving 38.5 percent to the three southern regions. As a result, the share of the three northern regions in national output increased from 41 percent to 47 percent. Accordingly, the share of the three southern regions declined from 59 percent to about 53 percent.

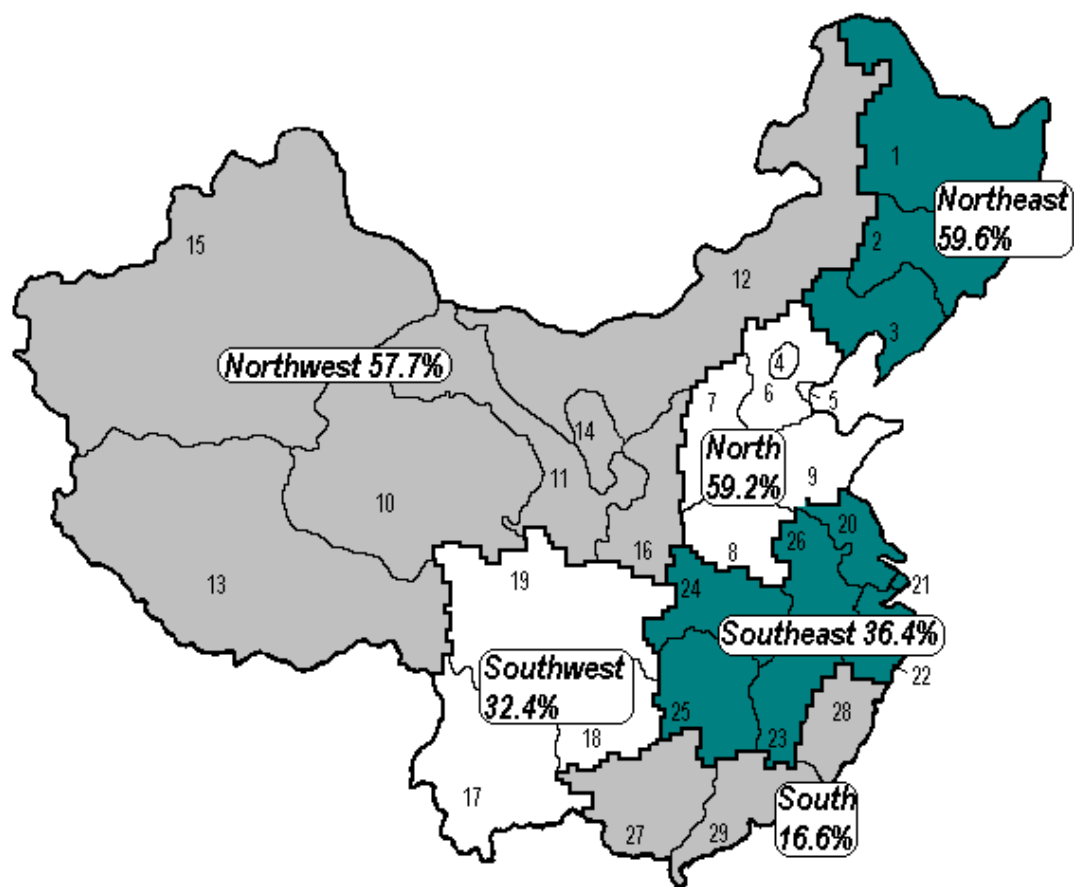
³ The definition of agricultural regions varies in different studies. The six-region definition is the most commonly used one. For further discussion on this issue, see Yang Hong (1994).

⁴ It should be pointed out that natural boundaries of agricultural regions are usually not consistent with provincial boundaries. However, in Chinese statistics, most data are presented on the basis of provinces. For this reason, provincial boundaries are generally used in studies of regional agricultural production.

⁵ Hainan is incorporated into Guangdong province for the sake of data consistency for years 1978 through 1994.

⁶ These six regions are consistent with those defined by Chinese Academy of Agricultural Sciences (1991). The only modification is that Shaanxi province is incorporated into the Northwest region instead of the North region due to its important socio-economic role in the former region.

Map 1 Percentage Changes in Grain Output by Regions, 1978/79-1993/94



- | | | | |
|-----------------|--------------|--------------|---------------|
| 1. Heilongjiang | 2. Jilin | 3. Liaoning | 4. Beijing |
| 5. Tianjin | 6. Hebei | 7. Shanxi | 8. Henan |
| 9. Shandong | 10. Qinghai | 11. Gansu | 12. Neimenggu |
| 13. Xizang | 14. Ningxia | 15. Xinjiang | 16. Shaanxi |
| 17. Yunan | 18. Guizhou | 19. Sichuan | 20. Jiangsu |
| 21. Shanghai | 22. Zhejiang | 23. Jiangxi | 24. Hubei |
| 25. Hunan | 26. Anhui | 27. Guangxi | 28. Fujian |
| 29. Guangdong | | | |

Table 1 Regional Grain Production in the National Profile

Nation	South	South-west	South-east	North-west	North-east	North
Regional shares in total national output (%)						

1978/79	11.0	14.7	33.3	7.6	10.9	22.5
1993/94	9.0	13.6	30.6	8.8	12.8	25.1
Output increases, 78/79-93/94 (mmt)	125.3	4.8	13.8	29.8	15.0	22.2
Regional shares in total national increase (%)	3.8	11.0	23.8	12.0	17.7	31.8

Source: SSB, *ZTN*, 1980-1995.

For respective regions, there are significant variations in terms of production volumes and contributions to national growth.

Of the six regions, the volume of production in the Southeast is the largest. More than 30 percent of national output is produced in this region. However, the slow growth of output has led to a decline in its share in national production. In spite of this decline, the region's contribution to national increase is still substantial due to its large size of production.

The North region is the second largest grain producing area in China. Its output accounts for approximately a quarter of total national output. During the period studied, output in this region experienced a relatively rapid growth. This, together with the large volume of production, contributed greatly to the growth of national output. The region's role in national grain production is raised accordingly.

In comparison to the above two regions, the volume of production in other regions is relatively small. However, it is noted that the shares of the Northeast and Northwest regions in the total national increase are larger than their shares in total output, indicating their enhanced roles in the national profile. In contrast, the opposite situation is evident in the South and Southwest regions.

Overall, uneven regional growth in output has modified their relative roles in national grain production. In terms of the spatial distribution, the faster growing north and the slower growing south illustrated a tendency to shift national grain production centers towards the north.

It is worth pointing out that owing to natural constraints, wheat and maize are concentrated in the northern regions and rice in the southern regions. With the shift of grain production centres, there has been a concurrent change in crop composition in total national grain output. Between 1978 and 1994, the shares of wheat and maize

rose by 4.6 percent and 3.9 percent respectively, whereas the share of rice dropped by 5.4 percent during the same period (SSB, *ZTN*, 1995). This change led to a modification of crop composition in national grain supply. In light of China's involvement in international trade, it would have also influenced types of grain traded in the international market.

3. Growth Patterns of Regional Grain Production and Their Impact on The Trend in National Output

Over the years of the reforms, the pace of output growth has proceeded unevenly at both national and regional levels. Table 2 shows this unevenness.

For the nation as a whole, between 1978 and 1994 total output increased by about 46 percent. This is, however, mainly attributed to the remarkable growth in the early 1980s. Between 1978 and 1984, total output increased by 34.1 percent. Output plunged in 1985 and then stagnated for the rest of the decade. In 1990, output jumped to a higher level and has been relatively stable at this level in recent years.

The national trend is, nevertheless, the combined result of varying trends in respective regions. To show the regional patterns and their impact on national performance more clearly, Figure 1 presents them in graphic forms.

Table 2 Growth Indices of Regional Grain Output, 1978-1994

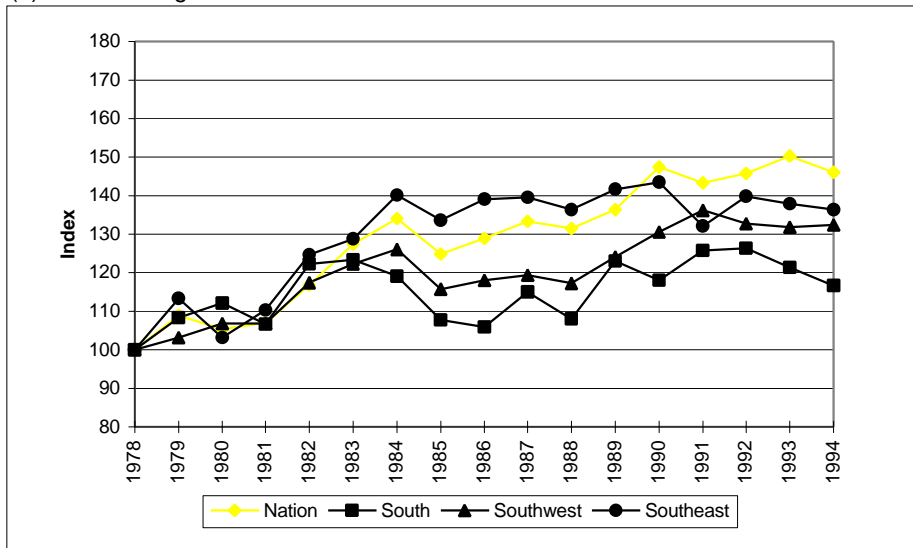
	Nation	South	South-west	South-east	North-east	North-west	North
1978	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1979	108.91	108.40	103.11	113.32	102.98	105.01	107.97
1980	105.37	112.16	106.83	103.11	102.53	96.39	101.73
1981	107.04	106.67	106.83	110.24	96.42	98.04	103.89
1982	116.75	122.28	117.45	124.67	95.53	108.46	107.66
1983	127.39	123.39	122.28	128.81	130.54	116.88	124.16
1984	134.14	119.10	126.09	140.17	139.39	123.98	129.95
1985	124.86	107.69	115.70	133.62	105.07	120.61	129.55
1986	128.94	105.86	117.97	139.11	127.19	121.13	127.69
1987	133.29	115.02	119.33	139.52	135.69	125.79	134.91
1988	131.51	108.05	117.20	136.38	137.48	136.45	131.92
1989	136.40	123.01	124.15	141.68	116.05	141.60	142.61
1990	147.41	118.09	130.54	143.44	173.16	158.13	152.24

1991	143.36	125.74	136.16	132.12	161.89	155.22	149.99
1992	145.78	126.41	132.71	139.84	167.09	159.99	147.21
1993	150.34	121.31	131.77	137.89	173.24	174.56	164.98
1994	146.04	116.62	132.37	136.43	159.62	157.66	159.20

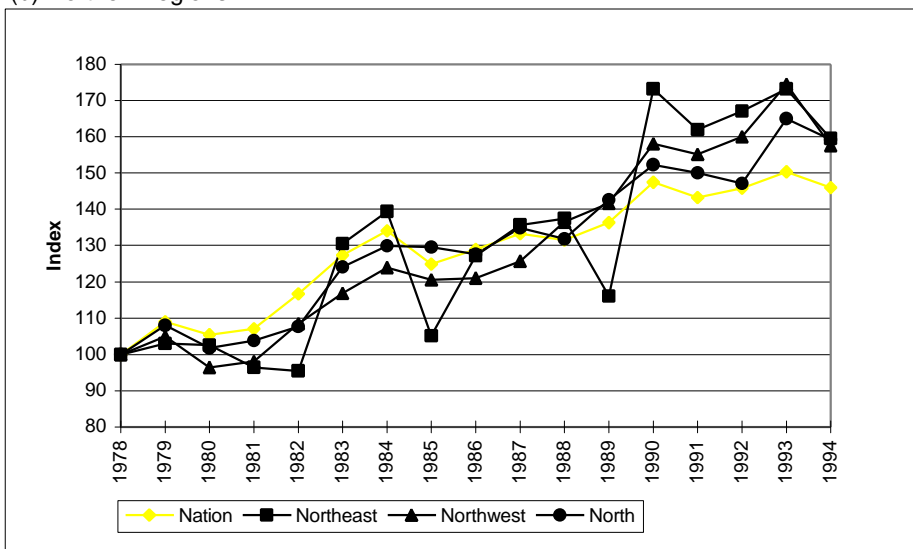
Source: Data for 1978-1991 are from USDA, for 1992-1994 are from SSB, *ZTN*, 1993-1995.

Figure 1 Trends in Grain Output by Regions, 1978-1994

(a) Southern regions



(b) Northern regions



Source: Same as Table 2.

Of the three southern regions, the growth patterns in the South and Southwest regions were similar - both grew slowly but smoothly. In the Southeast region, the growth in the early 1980s was significant, but this was followed by stagnation in the late 1980s and decline in the 1990s. As a result, average growth rate for the period as a whole was modest. Taking the national trend as a reference, in the early 1980s the growth in the three southern regions was all above that of the national average. Entering into the 1990s, their growth was invariably below the national average.

These growth patterns made the southern regions the major contributors to the national growth in the early 1980s and their contributions have been only modest in the 1990s.

In comparison with the southern regions, the growth in the three northern regions was generally faster and more sustainable. With reference to national production, the growth in all the northern regions was slow in the early 1980s. In the late 1980s, however, their growth sped up and after 1990, the growth surpassed the national average. This has made the northern regions the major contributors to the national growth in recent years.

It is noted, however, that in the Northeast region, alongside the rapid growth in output, fluctuations are also significant. For example, output increased by more than 30 percent in 1983, whereas in 1985 it dropped by 30 percent. The jump in 1990 was remarkable, 50 percent above the previous year. Since this region is the major maize producing areas in China, the sharp fluctuations would particularly affect the stability of maize supply at the national level.

Sharp fluctuations in the Northeast region may partly be attributed to the instability of weather conditions in the region. Using the figure for areas affected by natural disasters as a proxy for weather conditions, the Northeast region year to year figures for the proportion of areas affected by natural disasters in total crop sown areas fluctuated quite considerably compared with other regions.⁷ Given the limitation of human ability to overcome the effect of severe natural disasters, sharp fluctuations in this region will remain. This may imply a long-term instability in the national maize supply.

4. Regional Trends in Yields and Sown Areas and Their Implications for the Further Growth of National Output

⁷ In Chinese statistics, natural disasters refer to floods, droughts, frosts, freezing, typhoons and hailstorms. Areas affected by natural disasters refer to the areas where the output reduced by more than 30 percent compared with the normal year due to disasters. The excessive fluctuations in weather conditions in the Northeast region can be reflected by its high value of coefficient of variation for proportions of areas affected by natural disasters in total crop sown areas over the years. During the period 1980 to 1994, the values of coefficient of

4.1 Trends in Grain Yields and Sown Areas Across Regions

In China, the scarcity of arable land has determined that increasing yields is the major means for increasing output. This is particularly the case during the reform period, when the nation's sown areas of grain have been decreasing constantly. Again, there are variations among regions in terms of trends in sown areas and yields during this period.

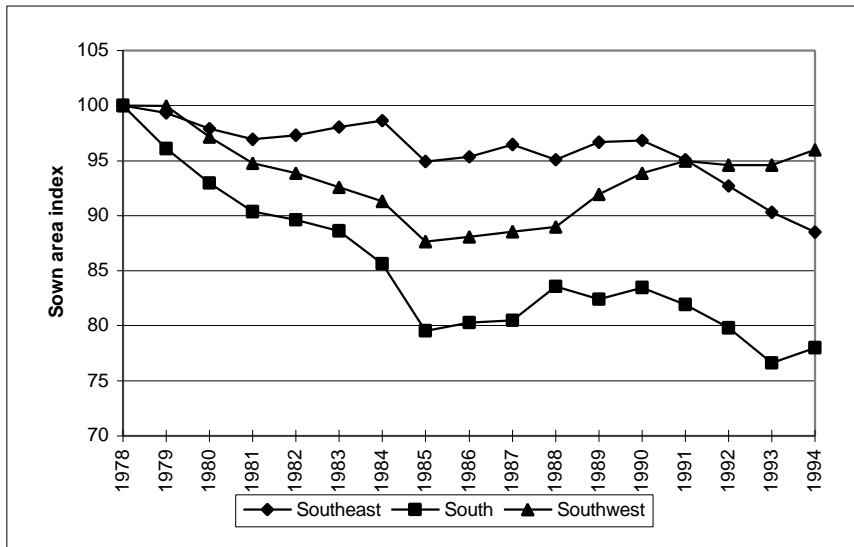
Figure 2 shows that the decrease in grain sown areas was the general trend in all the regions during the period studied. However, the magnitude of the decrease varied. The South region experienced a drastic decrease, whereas in the Northeast region, the decrease was only evident in some years in the mid 1980s and in the later years sown areas recovered. Other regions registered somewhat smaller decreases than that in the South region.

Regional trends in yields are illustrated in Figure 3. During the period studied, the magnitude of the increase tended to be greater in the northern regions than that in the southern regions. It is noteworthy that this difference emerged mainly in the 1990s. This is consistent with output performance in these two regional groups at the time, highlighting the crucial role of yields in supporting the growth of grain output.

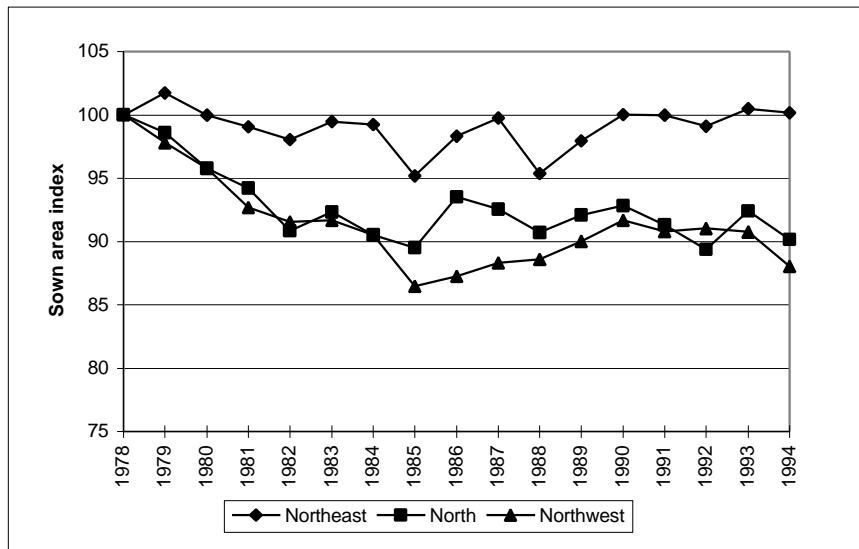
Figure 2 Trends in Grain Sown Areas by Regions, 1978-1994

variation for the proportions are 0.589, 0.234, 0.320, 0.341, 0.318 and 0.328 for the Northeast, North, Northwest, South, Southeast and Southwest respectively.

(a) Southern regions



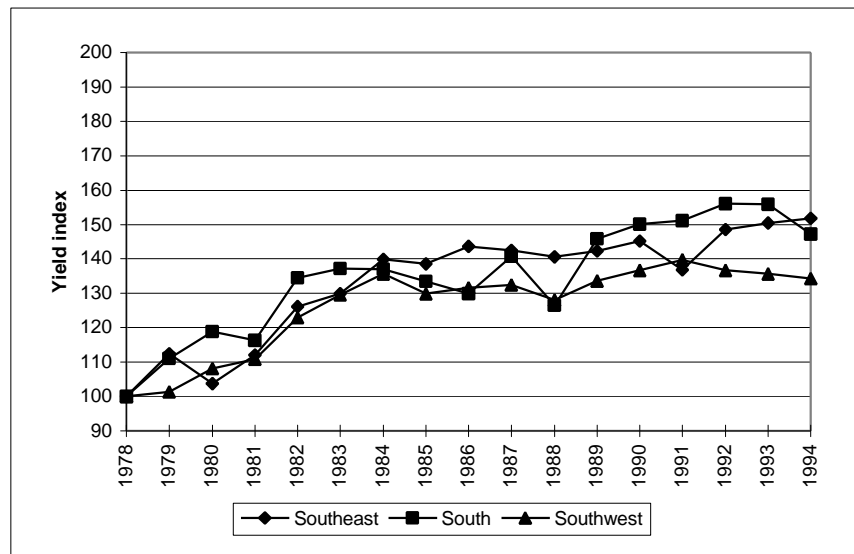
(b) Northern regions



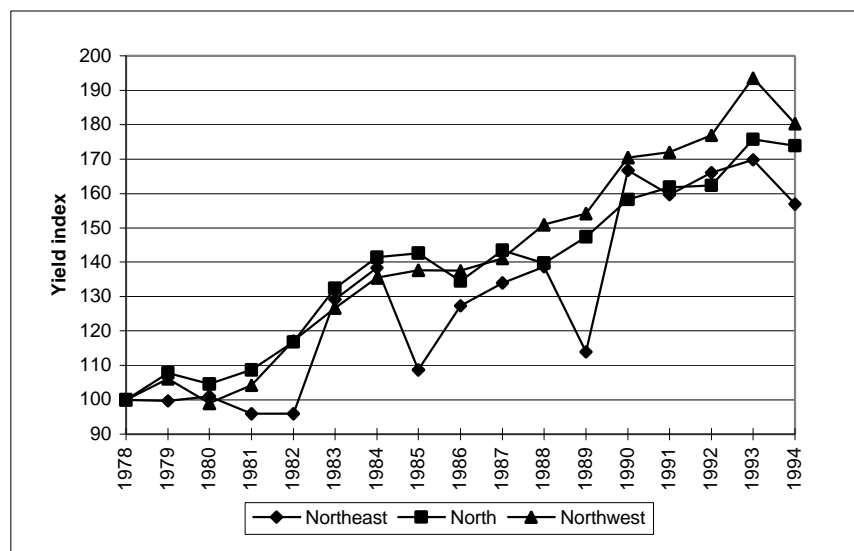
Source: Same as Table 2.

Figure 3 Trends in Grain Yields by Regions, 1978-1994

(a) Southern regions



(b) Northern regions



Source: Same as Table 2.

4.2 Regional Trends and the Further Development of National Grain Production

Regional trends in yields and sown areas provide useful information for examining potential growth of national grain output. Because of the scarcity of arable land resources and taking into consideration the experience during the past years of the reforms, grain sown areas are unlikely to increase in any regions in the future.⁸

⁸ Lin and Shen (1994) argued that such a declining trend is irreversible also because it is a natural adjustment to the process of economic growth.

Instead, the decline is expected to be long-term. Therefore, yields will remain the key factor in determining the future growth of output.

Figure 3, however, shows that in the southern regions stagnation of yields has been a trend evident since the mid 1980s. This trend is likely to continue under the current technology and socio-economic conditions, since few incentives are presented for commercial grain production.

For the northern regions, the increase in yields was relatively rapid in the 1980s. However, as shown in Figure 3, entering into the 1990s the pace has tended to slow down. This is particularly so in the North region, where the yields have actually stagnated. If this trend continues, the overall growth of national grain production will be retarded.

Will slow growth in yields be the trend in the northern regions for the rest of the 1990s and the years beyond? The answer is likely to be affirmative after exploring several factors that are overshadowing the potential increase in yields in the northern regions.

First of all, the lack of support of new technologies has been the general situation for grain production in the 1990s. For rice and wheat, there has no significant technological breakthrough since the 1980s (Lin, 1991). Given the fact that rice yield in China is among the highest in the world, the potential for further increase would have become more difficult. For maize production, the introduction of the plastic film cover technique and hybrid maize varieties in the 1980s brought about a rapid growth in the maize yield in the later years of that decade. In the North and Northeast regions, where maize production is concentrated, this led to a swift increase in average yields (Yang Hong, 1995).⁹ Since the 1990s, however, no further technological breakthrough has taken place. The pace of the increase in maize yield has slowed down.

It should be pointed out that the lack of technological progress in grain production is closely related to the rural institutional reforms and the reduction of agricultural research resources since the 1980s. The implementation of the Household Responsibility System, to a large extent, weakened the function of collectives in

⁹It is reported that the effect of the plastic film cover technique has been dramatic in the areas where the spring temperature is low. For example, an experiment in Shanxi province showed

supporting agricultural infrastructure construction and maintenance, tasks difficult for individual households to fulfil (Watson, 1989). The ageing of agricultural infrastructure and the lack of construction funds have become serious problems facing agricultural production. For individual farmers, although the increasingly scarce (and hence more expensive) land resources encouraged a search for technical alternatives that can save land, few effective technological measures are available for farmers.

Since the 1980s, the government investment for agricultural research has gradually reduced. For example, in 1980, about 130 million yuan was invested by the government for this purpose, whereas in 1994, the figure reduced to 103 million yuan in real term (SSB, 1995). This has undermined the basis of agricultural research for new technologies. Meanwhile, the poor remuneration system has meant that few incentives have been provided for agricultural scientists, such as plant breeders, to undertake to research. Although market demand for grain has been increasing continuously, limited private resources have been attracted to agricultural research due to the absence of effective enforcement of patent and licensing laws in China. Since all the above constraints are unlikely to be removed in a short run, the pace of technological progress will remain slow. This will limit the potential for further increases in grain yields all over the country, including the northern regions.

Secondly, there has been an increasing concern with water shortage in the northern regions. Apart from the relatively scarce and volatile precipitation and the long term constraints on grain production in northern China, there has also been a tendency of a decrease in overall water supply in some areas. This situation is particularly severe in the North region. It has been reported that in the North China Plain (where the North region is situated), the level of ground water has been declining since the 1970s (He Xiwu, 1991). Meanwhile, in recent years, the discharge of many rivers in the northern regions has been declining (Cheng Tianwen, 1991). During the dry season, some rivers are often completely dried up. According to the official news on Chinese Central Television, in 1995 the lower reach of the Yellow River was totally dry for 3-4 months, causing a water crisis in the surrounding areas. Since the level of yields in the northern regions is heavily reliant on the availability of water, the reduction of water supply means a threat to their grain production. Given

that maize yield increased by 25-30 percent by applying this technique (Huang Peirui, et al,

the substantial role of the North region in national production, the effect of a water shortage is even more critical.

Thirdly, with the development of the rural economy in the northern regions, their comparative advantage in grain production may decline. Concern has been widely expressed that high opportunity costs of grain production are one of the major factors constraining farmers' investment to this sector (Yu and Buckwell, 1991). Under the current economic policies and marketing conditions, the opportunity costs of grain production in the developed areas are usually higher than in the less developed areas (Deng Yiming, et al, 1992). Therefore, a shift of grain production from the developed areas to the less developed areas is expected. The relatively faster growth of grain output in the northern regions and the slower growth in the southern regions during the period studied may partly reflect this shift. However, with the development of the rural economy in the northern regions, the opportunity costs of grain production will also rise. Farmers will shift resources to other more profitable sectors. This situation may have already occurred in the North region where the rural economy has been developing rapidly whereas grain yields have been stagnant in recent years.

Given the above concerns, it may be argued that the slow increase in yields has been a trend and is likely to remain in the near future in the northern regions. Unless some major changes in policies and/or technologies happen, the further growth of national output will be limited.

5. Changes in Per Capita Grain Output and Their Impact on Interregional Grain Transfers

Regional variations in grain production generated needs for interregional transfers. However, the extent to which a region can export or needs to import is strongly influenced by the level of per capita grain output and the balance between output and consumption. Based on official statistics, the current average annual grain consumption is estimated to be around 370-380 kg/per capita at the national level.¹⁰

1990).

¹⁰ In 1992, the average direct grain consumption was 235.91 kg/per capita. The average meat consumption was 22.58 kg/per capita (including pork, beef, mutton and poultry) and eggs,

Noting that income levels are different among regions, the level of grain consumption would vary. The figure is higher in the developed areas as people consume more meat and other grain based manufactured food. In the less developed areas, the figure is lower because of an opposite dietary structure (Harry Wu and Yanrui Wu, 1995). Despite the existence of regional variations, the level of 370-380 kg/per capita may still be a useful yardstick for examining the direction and magnitude of interregional grain transfers.

5.1 Changes in Per Capita Grain Output During the Reform Period

Table 3 shows the per capita grain output and changes during the period studied. The figure for the national average is 377 kg/per capita, which is close to the figure for average consumption estimated above. The match of these two figures implies that China may have just achieved a bare grain self-sufficiency. This can be corroborated by the fact that in recent years China's net international grain trade was balanced with only a small amount of exports (SSB, *ZTN*, 1994 and 1995).

Despite the achievement of grain self-sufficiency, the overall increase in per capita output was rather small. Taking the nation as a whole, during the period studied per capita grain output increased only from 328.6 kg to 377.2 kg, representing an increase of 14.8 percent compared with the 46 percent of the increase in total output. This is disappointing, given the fact that the growth rate of total national output during this period was the highest in the history of the People's Republic. As China is unlikely to maintain the same growth rate as achieved in the previous years of the reforms, one would not expect a significant improvement in per capita grain output in the foreseeable future. In light of population growth, this vision is even more unrealistic.

Table 3 Changes in Per Capita Grain Output by Regions,
1978/79 and 1993/94

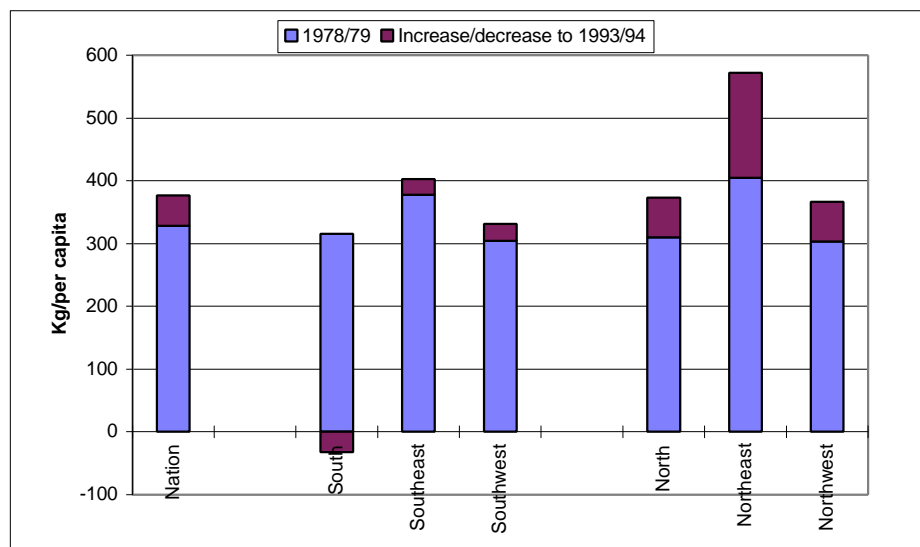
(kg/capita)

7.75 kg/per capita (SSB, 1994). Based on a commonly used conversion rate of 4.5 to 1 between grain and animal products, the quantity of per capita meat and eggs consumption is equivalent to 136.48 kg of grain. This amounts per capital total grain consumption to about 372.39 kg. The figure, however, may be slightly higher taking into consideration the consumption for manufactured food, alcohol, and other grain related products.

	1978/79	1993/94	Changes	%
Nation	328.63	377.21	48.58	14.78
South	315.38	282.88	-32.50	-10.04
Southeast	377.70	402.71	25.02	6.62
Southwest	304.63	331.11	26.49	
North	309.78	372.73	62.95	20.32
Northeast	404.65	572.39	167.74	41.45
Northwest	303.74	366.54	62.79	

Source: SSB, ZTN, 1979, 1980, 1994 and 1995.

Figure 4 Changes in Per Capita Grain Output by Regions



Source: Table 4.

Regional variations can, however, be distinguished. Figure 4 gives a graphic view of per capita grain output in different regions. A general impression is that the

level in the northern regions is higher than that in the southern regions. It is also noted that this is mainly due to the relatively greater increase in the former regions than in the latter regions during the reform period.

The original level of per capita grain output was low in the South and Southwest regions. During the period studied, the level in the former region decreased by 32.5 kg/per capita and in the latter region it increased only modestly. As for the Southeast region, the original level of per capita output was relatively high. This is consistent with its traditional role as a granary in China. However, the slow growth in this region during the period studied has reduced the margin of per capita grain output above the national average.

In the northern regions, per capita grain output experienced a relatively fast growth. In the North and Northwest regions, the original level of per capita output was similar to the South and Southwest regions. Owing to the relatively rapid growth during the reform period, the current level in these two regions has exceeded their southern counterparts and has been close to the national average. In the Northeast region, the original level of per capita grain output was high and the growth during the period studied was remarkable. Its current level is hence substantially higher than in other regions.

5.2 Regional Variations in Per Capita Grain Output and Their Impact on Interregional Grain Net Transfers

Interregional grain transfers can occur for variety exchange and/or balancing grain supply and demand between surplus or deficit regions. The latter is the net volume transferred among regions. Because China is only barely self-sufficient in grain, regional net transfers are substantial in determining the overall grain situation. The following analysis hence focuses on grain net transfers among regions. The interregional variety exchange is not considered due to a lack of historical data.¹¹

Bearing in mind the average level of grain consumption of 370kg-380kg/per capita, the regions above this level are expected to have a potential for exporting grain and the regions below would need to import. Table 3 shows that of the six regions, only two regions, Northeast and Southeast, have a per capita grain output level above

this threshold. These regions are expected to be the suppliers in interregional grain transfers.

In the North and Northwest regions, the current level of per capita output is around the threshold, implying a grain self-sufficiency in these regions. The quantity of net transfers would be small, though variety exchanges with other regions may still be significant.

Both the original level and the current level of per capita grain output in the South and Southwest regions are much lower than that of the national average. They would, therefore, be the major importers in interregional grain transfers.

The above expectation of the roles of respective regions in interregional grain transfers can be verified by examining the quantity of state grain transfers over the years. It should be pointed out that in China, there are two systems for grain transfers: the state system and the market system. With the progressive decentralisation of administrative controls, the proportion transferred through the state system is declining and through the market channels is expanding. In spite of these opposing trends, the role of the state in interregional grain transfers remains crucially important. Given China's lack of market integration for grain transactions (Cheng and Wu, 1994), grain transferred through the state channels is particularly necessary in balancing the nationwide supply. As for the grain transferred through the market channels, little data are recorded in Chinese official statistics. Nevertheless, there seems no reason to doubt that the prevailing direction of grain transfers through the market channels is consistent with that in the state system. It is expected that grain flows in the state system also reflect the situation of market transfers.

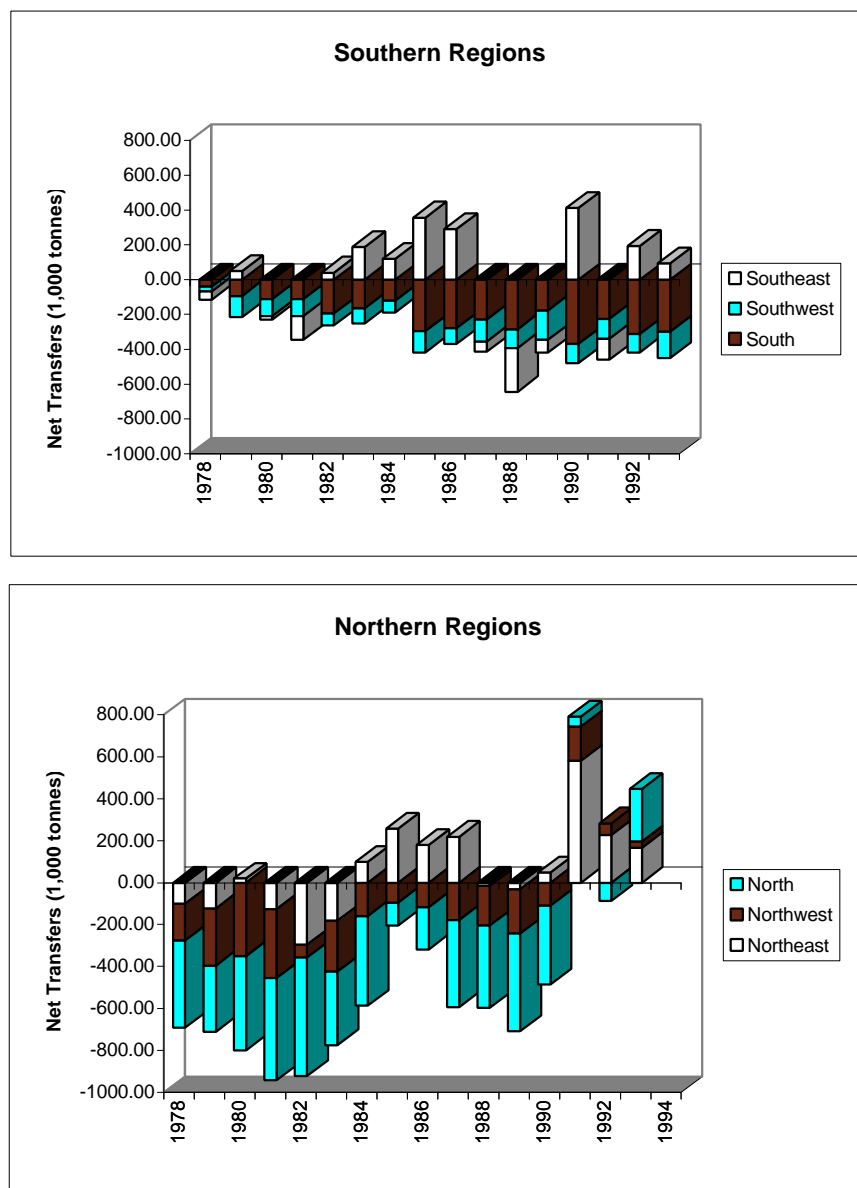
Figure 5 illustrates the quantity of the state grain net transfers among regions. A region's net transfers are defined as the balance between the in-flow and the out-flow. The in-flow refers to grain transferred into the region from outside, including from overseas. Similarly, the out-flow refers to grain transferred out from the region to other regions and/or to overseas.

The quantity of regional net transfers shown in Figure 5 is consistent with the expectation. The South and Southwest regions have been the major grain importers. The amount transferred into these regions increased steadily over the years. This is

¹¹ In Chinese official statistics, data for interregional transfers by crops are only available for

particularly so in the South region. The Southeast region is dominated by grain out-flows, while the quantity transferred has varied from year to year. In the mid 1980s, the region provided a large grain outflow. Between 1987 and 1989, it once became a recipient of state grain transfers. After 1990, the out-flow was predominant. However, the quantity transferred out from this region has tended to decline.

Figure 5 The State Grain Net Transfers by Regions, 1978-1993



Source: Data for 1978-1989 are provided by the Commission for Integrated Survey of Natural Resources. Data for 1990-1992 are calculated based on the value of provincial trade provided in Almanac of China's Commerce, ZSN, 1991-1993 and the state average grain purchase price in those years. Data for 1993 are from the Ministry of Domestic Trade of China, ZGMN, 1994.

The situation in the northern regions is different from the southern regions. Before 1990, the North region was a major importer, but the quantity decreased gradually. Entering into the 1990s, the in-flow dropped dramatically and in some years, the region even had a net out-flow. The trend in the Northwest region was similar to the North region. In the Northeast region, the out-flow became predominant in the mid 1980s and the quantity further increased in the 1990s.

Fluctuations in the quantity of transfers in the Southeast and Northeast regions are noticeable. For the latter region, the fluctuations may partly be explained by its volatile output. The reason for the fluctuations in the former region does not seem straightforward. It may be partly related to its small margin of per capita output above the average consumption. A minor fluctuation in output would result in a significant impact on the region's ability to export. Whatever the reasons for the fluctuations, they have caused instability in domestic grain supply. This instability would have, in turn, influenced China's performance in the international grain market.

The above examination demonstrates a close relationship between the level of per capita grain output and grain transfers among regions. Since the uneven growth during the reform period has changed the relative levels of respective regions in terms of per capita grain output, the quantity and direction of grain flows in interregional transfers have also been modified. The significantly high level of per capita output in the Northeast region in comparison with a very low level in the South and Southwest regions results in a transfer of grain from the former to the latter. As the North and Northwest regions managed a grain self-sufficiency in total quantity, the net in-flows to these regions has been small. The prevailing direction of grain transfers is therefore dominated by the flow from the Northeast region to the South and Southwest regions. This is opposite to the traditional flow of "moving southern grain to the north", indicating a reversal of grain flows in interregional transfers. However, it is noteworthy that this reversal is not only due to the rising role of the Northeast region, but also the result of improvement in grain self-sufficiency in the North and Northwest regions, which has reduced grain in-flows into the northern regions.

6. Concluding Remarks

This study investigated the trends in regional grain production during the reform period and their impact on the performance of national grain production and interregional grain transfers.

It found that although the increase in grain output was a trend experienced nationwide, the pace of the growth varied among regions. The northern regions tended to have faster growth than the southern regions. There is a tendency to shift grain production centres towards the north.

During the period studied, the momentum of growth occurred at different times for respective regions. This altered the major contributors to national growth over the years. In general, the contribution of the southern regions was relatively large in the early 1980s, whereas the northern regions have provided the bulk of national growth since the mid 1980s. The study, however, argues that with the rising role of the Northeast region in national production, the fluctuations in its output are expected to increase the instability of overall grain supply in China.

The growth measured in per capita output terms was much smaller than that measured in total output terms. The modest increase in per capita output during the reform period, together with the currently low level of national average figure, suggests a long-term tightness in China's grain supply. For respective regions, however, the level of per capita output varied significantly. The relatively rapid growth in the northern regions brought about a greater improvement in per capita grain output. In the southern regions, the opposite tendency was in evidence. The uneven regional growth has changed the prevailing direction of grain flows in interregional transfers. The traditional south-north flows are being reversed.

The examination of trends in grain yields and sown areas suggests that stagnation in output in the southern regions is likely to continue under current technology and socio-economic conditions. Further growth of national output will rely primarily on an increase in yields in the northern regions. However, some factors detrimental to the further growth in the northern regions are also looming. The lack of

new technologies will limit potential growth in yields. This, together with the increasingly serious water shortage and the possible deterioration of economic conditions for grain production in these regions, will slow further growth of yields. This may suggest that for China as a whole, the future of overall grain production is not optimistic.

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