REGIONAL DISPARITIES IN CHINA:

THE AGRICULTURAL ASPECT

BY

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in Partial Fulfillment of the Requirements

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ABSTRACT

Regional disparities have existed in China, a vast and heterogeneous country with sharply diversified physical, economic, and social conditions, for hundreds, indeed, thousands of years. These disparities, usually represented by the so-called East-West gaps, have been considerably widened since China's "Reform and Opening up" began to take root in the late 1970s. This phenomenon of increasing regional disparities has brought about many social and economic problems. Appropriate attention should be taken by government to curb and gradually reduce the uneven spatial development, which is the result of the interactions of many factors.

Spatial variations of agriculture are regarded as both the cardinal cause and one of the consequential effects of the general regional disparities. Understanding such variations will positively contribute to the formulation of solutions to the problem of regional disparities. This study provides a quantitative assessment of the differential performance of agricultural production of both grain and red meat during the period between 1980 and 1990. It focuses on change occurring at both the six macro-regions' level and the provincial level by manipulating the classical

shift-and-share approach. The results obtained indicate that although there was no significant change in the basic spatial patterns present in agriculture, each individual region underwent detailed differences in its performance. These variations resulted from the combination of each area's "regional factors" and its agricultural structure.

A good appreciation of these spatial variations in agriculture is a prerequisite for a sound regional policy of agricultural development which should balance the exploitation of regional comparative advantage and the implementation of regional foodgrain self-sufficiency.

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CHAPTER 1. REGIONAL DISPARITIES IN CHINA

1. 1. Setting The Scene

During the past three decades, with the acceptance of economic and social equity as a basic principle to aspire to, equal spatial development has become a clear and pressing objective in many countries. Unfortunately, in many cases the gap between different regions has been steadily increasing instead of being narrowed, the by-product of the process of economic growth. China constitutes a good example of this tendency.

From 1980 to 1992, China's average annual growth rate of GDP at purchase value was 9.1 percent; a rate only exceeded by Botswana (10.1 percent) and South Korea (9.4 percent). During the same period the average annual growth rate of GNP per capita was 7.6 percent; a rate only surpassed by South Korea (8.5 percent) (1). Considering China's size, this growth rate is very impressive. Further, the total GNP of China was $ 506,075 million in 1992, placing it seventh in the world ranking (2). In the Spring of 1993, with the use of a new method of calculating purchasing power parity, the World Bank ranked China second only to the United States, while the International Monetary Fund placed China behind both the United States and Japan (3).

This economic boom has brought about remarkable improvements in the living standards of the Chinese people, including a longer life expectancy, sufficient food supply, much more household income, better housing, more education, access to a wider variety of goods, more leisure time, and especially, less political pressure and more freedom in general.

However, every coin has two sides. Rapid economic growth also created some disturbing side-effects. One of the most disturbing of these side-effects is the increase of social and spatial inequalities. Since 1980, China's spatial patterns have undergone significant change as a result of economic reforms. The existing spatial inequalities, both in terms of urban-rural differences and regional disparities, have widened to a serious extent and caused, and will continue to cause, great social instability and many other problems. Consequently, this problem of widening gaps in regional development has become an important issue not only for academic scholars, but also for policy-makers.

China's economic reforms, the so-called "second revolution", initiated in the late 1970s by the pragmatic leader Deng Xiaoping, have brought about significant changes in every facet of Chinese society as well as remarkable economic growth. Economic reforms embrace two major elements: the intention to liberalise the domestic economy - *DunLeGaoHe* - and the desire to open the economy to the outside world - *DuiWaiKaiFang*. The latter is commonly described as the "open-door policy". In the Chinese context, while "*DuiWaiKaiFang*" refers to the opening up of the domestic economy to the outside world, it does not preclude self- reliance, a long-term policy goal of the country. More precisely, the open-door policy focuses on three aspects: the reform of foreign-trade and exchange regimes, the establishment of a legal and institutional framework for foreign direct investment, and the establishment of Special Economic Zones (SEZs)[1] and other development zones (4).

As an important part of economic modernisation the open-door policy complements and supports the drive towards domestic economic liberalisation. It has led to a change of emphasis in regional development strategy. This change can be summarised in the expression "coastal development strategy". It entails prioritising coastal areas in economic development, especially selected coastal areas, namely, the Special Economic

1. There are five SEZs: Shenzhen, Shantou, and Zhuhai in Guangdong province, Xiamen in Fujian province, and Hainan, itself a province. The basic objective of SEZs was to serve as laboratories for reform and to attract foreign direct investment and technology from abroad by allowing enterprises to operate in a policy environment based much more on market mechanisms than elsewhere in the economy. SEZs have two distinguishing features. First, they have a greater degree of administrative autonomy than other areas. Second, SEZs provided a significantly more attractive incentives' structure than elsewhere in China. See: World Bank, China: Foreign Trade Reform, Washington, D.C., 1994. This book provides a simple and clear explanation of China's different economic zones.

Zones, Open Cities, and other development zones. These were promoted as growth poles by granting them favoured treatment. These growth poles have good locations in terms of economic geography, enjoy a long history of overseas trade, possess good transportation infrastructure together with concentrations of skilled labour, comparative advantages in education and research facilities and some useful harbours.(5)

This coastal development strategy has generated far-reaching geographical impacts. By far the most paramount of them is the reshaping of the spatial patterns of inequality, including the pattern of urban-rural differences and regional disparities. There are quite a few studies addressing China's spatial inequalities. However, all of them focus either on regional income differences or inequality of industrial development. Little attention has been directed to regional disparities in agricultural performance. This thesis will examine the impact of economic reforms on China's regional disparities from the agricultural perspective, using the method of shift-and-share analysis as its cornerstone. Before proceeding further with the analysis of regional disparities in agriculture, it is necessary to review the general situation of China's regional disparities.

1. 2. Regional Disparities As A Concern

1. 2. 1. East-West Disparities

As a continental-size country with a very long settlement history, there are many instances of differences occurring among China's various areas. It is not unusual to find sharp contrasts between areas in terms of economic and social characteristics upon crossing a mountain or a river or even a county border when travelling in China. However, at the macro-level, the most significant gaps exist between eastern coastal provinces and western interior provinces. That is to say, from east to west, the scale of economy and the level of economic and social development are gradually descending. In short, it is the East-West imbalance which constitutes the centrepiece of China's regional disparities.

To avoid confusion, it is necessary to begin by giving definitions of some of the regionalization terms used in China. Traditional China is usually divided into the "Coastal area" and the "Interior area". The former embraces twelve provincial administrative units: all three central municipalities, eight provinces and one autonomous region (Guangxi)[2]. They are, from north to south, Liaoning, Beijing, Tianjin, Hebei, Shandong, Jiangsu, Shanghai, Zhejiang,

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[2] In order to simplify, hereinafter all provincial administrative units are called provinces.

Fujian, Guangdong, Guangxi, and Hainan (Taiwan, Hong Kong and Macao are not included). The remaining eighteen inland provinces (and autonomous regions) comprise the interior area.

In the Seventh Five-Year-Plan, China was officially regionalized into three economic zones: the Eastern zone, the Central zone, and the Western zone. The Eastern zone is equivalent to the coastal area, while the latter two are a further division of the interior area. The Central zone embraces the provinces of Shanxi, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei and Hunan and the Inner Mongolian autonomous region. The Western zone consists of Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai provinces and the Ningxia Hui, Xinjiang Uygur and Tibet autonomous regions. The three zones are very similar to a three-step ladder in terms of economic and social development (refer to Table 1-1 and Figure 1.1). I shall use the three-zonal division to reveal the fundamental nature of regional disparities in China.

One of the most significant characteristics of widening east-west disparities is the increasing gap of production values between east and west. During the period extending from 1982 to 1992, the eastern area developed production activity at a faster rate than the central and western areas. According to Table 1-2, from 1982 to 1992 the eastern area enlarged its gross output value of agriculture and industry (GOVAI) more than six-fold, while its share of national total gross output value of agriculture and industry increased seven percentage points, from 55.17 percent to 62.25 percent; that is, to a level much higher than its population share. By contrast, the shares of national total production value held by the central and western areas decreased by five and two percentage points, respectively, to levels lower than their population proportions.

The difference between individual provinces is more glaring. Shanghai, a coastal municipality, had the highest per capita GOVAI in both 1982 and 1992 (the highest in the history of the PRC). The values in question were 5695 yuan in 1982 and 18691.2 yuan in 1992, respectively. The province with the lowest per capita GOVAI in 1982 was Guizhou, a southwest interior province, which registered 357 yuan. Tibet was the lowest in 1992, with 1162.6 yuan. The ratio of per capita GOVAI of the highest to the lowest was 15.95:1 in 1982. In 1992 the ratio had increased slightly to 16.08:1. In the same year Shanghai's per capita GOVAI was 4.72 times higher than the national average; whereas Tibet's was only 29.36 percent of the national average.

Table 1-1. Three Economic Zones of China Year: 1992

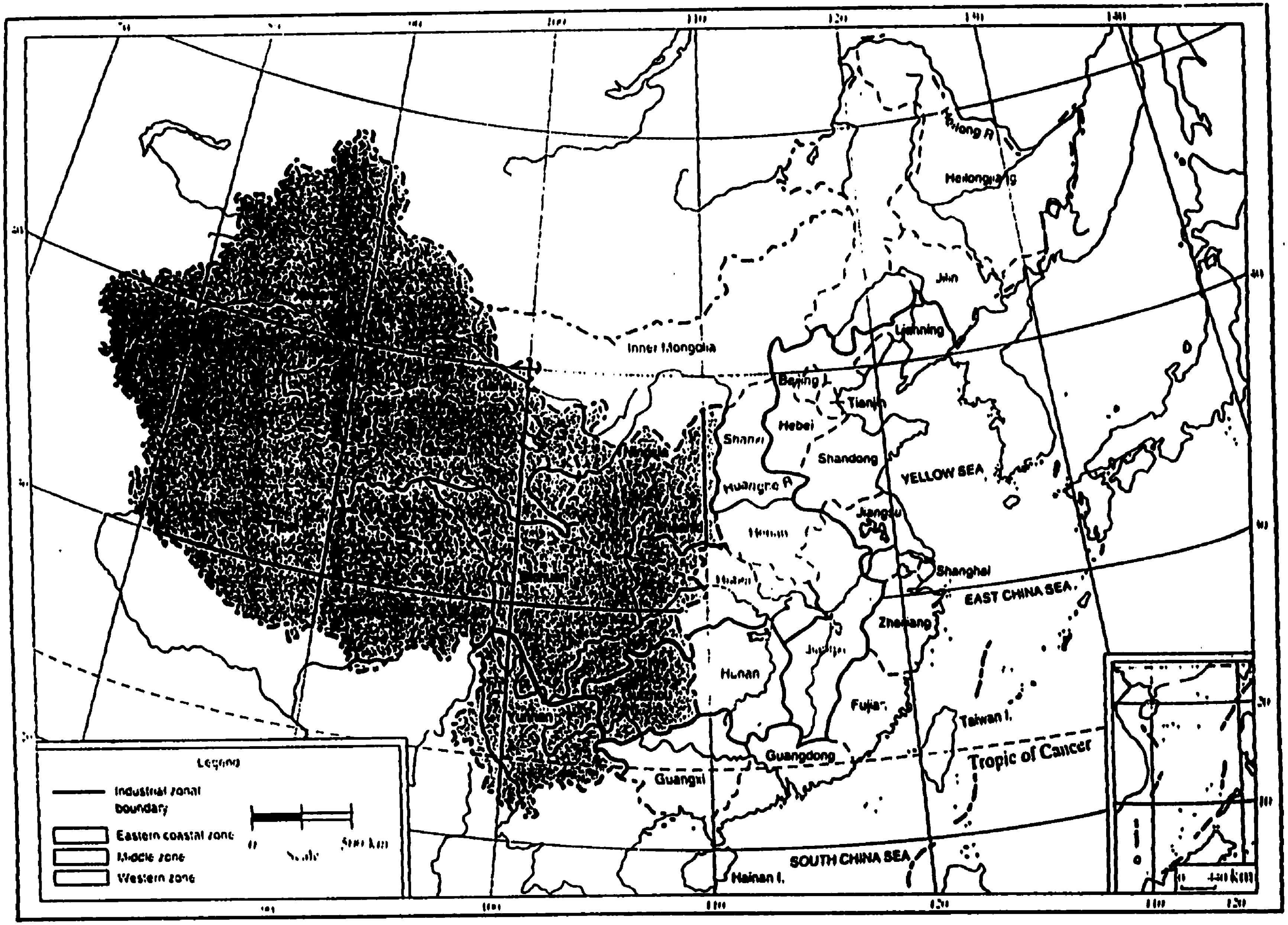
Items	unit	National total	Eastern zone	Central zone	Western zone
Area	%	100	14.0	34.4	51.6
population	%	100	41.28	35.88	22.88
Per capita GOVAI	yuan	3959	5969	2775	2184
Per capita GOVI	yuan	3180	5062	2065	1528
Per capita GNP	yuan	2053	2812	1601	1391

Note: 1. All data are calculated from QUANGUO ZHUYAO SHEHUI JINGJI ZHIBIAO PAIXU NIANJIAN (Yearbook of the Ranking of Major Indicators of Social and Economic Development of China), edited by Comprehensive Department of State Statistical Bureau, China Statistical Press, Beijing, 1993;

2. GOVAI refers to Gross Output Value of Agriculture and Industry

3. GOVI means Gross Output Value of Industry.

Figure 1.1 China's Three Economic Zones



Source: Zhao Songqiao, <u>Geography of China</u>, John Wiley & Sons,Inc., New York, 1994, p.103.

To further demonstrate the widening disparities let us compare two typical provinces: Sichuan and Guangdong. Sichuan is the core province for the Third Front Construction[3], while Guangdong is the major beneficiary of the "open-door policy". In 1982 the GOVAI of Sichuan was 53.46 billion yuan; a value amounting to 6.51 percent of the national total. In the same year Guangdong's GOVAI was 41.50 billion yuan, some 5.06 percent of the national total. After only one decade, in 1991, Shichuan's GOVAI had increased to 211.43 billion yuan (current value), but its share had decreased to 5.81 percent of the national total; while the share of Guangdong, with a GOVAI of 317.89 billion yuan, had increased to 8.73 percent of the national total. In 1986 the per capita GNP of Sichuan was 630 yuan whereas that of Guangdong was 1085 yuan. The ratio of Sichuan to Guangdong thus was 1: 1.72.in 1986. In 1991, the ratio had increased to 1:2.39, with Sichuan's absolute income standing at 1183 yuan and Guangdong's at 2823 yuan.

The pattern of per capita GNP for the three zones displays a similar variation. In general, per capita GNP tends to be higher on the coast than in the interior, and the gap is increasing. In 1992, among the top 10 provinces on the score of per capita GNP, only the last three were interior provinces (Heilongjiang,

[3] The Third Front Construction was a large-scale development scheme initiated by Mao Zedong during 1960's and early 1970's which emphasised shifting heavy and military industries from coastal areas to inland areas. Further explanation may be found in section 5.1 of this chapter.

Xinjiang and Jilin). In 1992 the per capita GNP of Shanghai (the highest) was 7.5 times higher than that of Guizhou (the lowest).

Economic imbalances often lead to corresponding differences in social progress. According to a survey conducted by the State Statistical Bureau, of the combined index of the 1993 social development in 29 provinces (Tibet excluded), the comprehensive ranking of China's social development level declined steadily from east to west[4]. Areas of east China stood at the forefront in various aspects of social development. Among the top 10 places in terms of comprehensive social development, nine were coastal provinces. Only the tenth was a central province, namely, Heilongjiang. Most rankings for the central and western areas are in the lower range. In fact, Western provinces are found among the top 10 only in four categories out of ten (Beijing Review, July 24-30, 1995, p.19).[5]

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[4] The social development combined index brings together data on environment, population, economy, quality of life, employment, health care, culture and sports, education and social security.

[5] The comprehensive ranking, from the highest to the lowest, of China's social development level by province in 1993 revealed: Beijing, Shanghai, Tianjin, Liaoning, Guangdong, Jiangsu, Jilin, Zhejiang, Hainan, Heilongjiang, Shandong, Fujian, Hebei, Shanxi, Hubei, Inner Mongolia, Shaanxi, Hunan, Guangxi, Anhui, Henan, Xinjiang, Ningxia, Sichuan, Qinghai, Yunnan, Gansu and Guizhou (Beijing Review, July 24-30, 1995, p.19).

Regional disparities have always been a cause of concern for large countries. In China there are several reasons which heighten the government's concern for regional disparities. What follows is a brief justification for such concerns.

1. 2. 2. Why Regional Disparities Deserve Attention

The effort undertaken by the Chinese government to overcome regional disparities is an indication in itself of the importance of the issue. Equal development in all areas is an issue which has a bearing on national stability and social justice. Yet there are limits on what can be achieved in overcoming differences between regions. Indeed, some differences reflect acceptable kinds of inequality. For example, other things being equal, farmers in fertile areas are naturally expected to have more net income than those farming in more sterile areas. While differences do exist in the extent to which and the areas in which social intervention by government is considered desirable (6), China, as a socialist country, regards the accomplishment of a certain level of common prosperity for all its people and areas as a basic goal.

Table 1-2 Gross Output Value of Agriculture and Industry

	1992	1982	increase over 1982 %	percentage of national total 1982	1992
	(10 bil. yuan)				
National total production value	461.51	82.07	562.34	100	100
Eastern area	287.28	45.28	634.45	55.17	62.25
Central area	115.98	24.73	468.96	30.13	25.13
Western area	58.25	12.06	483.00	14.69	12.62
Total industrial output value	370.66	55.78	664.50	100	100
Eastern area	243.63	33.34	730.74	59.77	65.73
Central area	86.28	15.40	560.26	27.61	23.28
Western area	40.75	7.04	579.66	12.62	10.99
Total agricultural. output value	90.85	26.29	345.57	100	100
Eastern area	43.65	11.94	365.58	45.42	48.05
Central area	29.70	9.33	318.33	35.49	32.69
Western area	17.50	5.02	348.61	19.09	19.26

Source: 1. Data for 1982 are calculated from Statistical Yearbook of China, 1983 (English edition), compiled by the State Statistical Bureau of China, Economic Information & Agency, Hong Kong, 1983;

2. Data source for 1992 is the same as Table 1-1.

It follows that one of its fundamental socialist ideologies is to eradicate social and spatial inequalities. The equalisation of regional development has been seen as an important hallmark of socialism. National development concentrated in a few areas is considered as a problem that should be corrected by regional policies of even development. The catchphrase "even spatial development" has become a rallying cry for government intervention.

In addition to the pursuit of economic and social equity, three more reasons justify a balanced (spatially even) regional development approach. The first centres on national unity. China is a multi-nationality country with fifty-five recognised "minority nationalities" which together account for 7 percent of the national population. They occur mainly in western areas which have rich natural endowments. Four out of five of China's national autonomous regions are located in the interior area. Perceiving themselves to be depressed, minority nationalities are very sensitive to their status. They fear that they may be left behind in terms of national development. The problem of uneven economic opportunities often comes to the fore as the leading factor accounting for ethnic tension. In the past it was not uncommon for conflict to occur between the Han people and the minorities (and such is the case to this day in Tibet). Therefore, unless the western region experiences a reasonable rate of economic growth, then evident regional disparities between the developed coastal area and the less-developed interior and backward border regions populated by ethnic minorities may generate a series of delicate social problems which could seriously undermine national unity.

The second reason dwells on strategic security. It is believed that highly concentrated industry is vulnerable to war damage. Before the Liberation of 1949 China had experienced four decades of turbulence and war which seriously damaged the coastal industries. The Japanese invasion in particular destroyed most of the country's industrial fabric. For some time after 1949 China feared the threat of foreign invasion. This threat first came from the USA, then later from the former USSR. Such fears lasted until the late 1970's. This made the Chinese government sensitive to the vulnerability of industries concentrated in areas which faced potential foreign attack. To Maoist leaders, it became clear that the interior provinces should be developed to such a level that they might stand alone in the event of external attack or internal turbulence or civil war.

The third focuses on the rationalisation of industry. One of the characteristics of industrial distribution in pre-1949 China was the divorce between the industrial sites and their sources of raw materials (the iron and steel industry was the only partial exception). In Shanghai, for example, where China's processing industries were concentrated, there was no local supply of coal, iron, or oil. Jiangsu had comparatively well-developed agriculture, but was unable to supply Shanghai with sufficient agricultural raw materials for its well-developed processing industries. Shanghai had to import a large quantity of its raw materials, particularly wool and flue-cured tobacco, from more distant areas. Mines were also largely dissociated from the establishments set-up to process their products. In the northeast, many of the products had to be exported in the form of raw materials or semi-finished products, including magnesite, molybdenum ore, paper pulp, and pig iron (7). From the standpoint of the classical theory of location, this separation of industrial centres from their sources of raw materials confirmed the communist description of their being "irrational".

The causes of regional disparities are extremely complex, involving hundreds of physical, political, economic, cultural, and historical variables, as well as a good share of chance or luck (8). However in most cases the varying growth rate of the economic sector dominated by industry is the cardinal and direct cause for uneven spatial development. This cause-effect relationship makes it possible in theory for government to intervene so as to remedy the irrational spatial patterns of development by means of regional development policy. The Chinese government subscribed to this view.

However, it is worth noting that although the Chinese government had many justifications for attempting to correct the irrational distribution of the economy, the regional policy pursued was often not directly addressing spatial inequality per se but was motivated more by military strategy or its notion of economic efficiency, albeit it did sometimes benefit the interior areas. This point will become more clear with a review of regional policy since the Liberation.

The causes for china's east-west uneven development are very complicated, involving a host of factors. However, the physical setting or endowment of natural resources, location of economic activities, heritage of development, and government policy all play a part in shaping east-west gaps. These factors are the subject matter of the following discussion.

1. 3. Variations In Physical Setting

Situated in East Asia, China is encircled by mountains and deserts to the west and north and by the vast expanse of the Pacific Ocean and adjacent seas to the east and southeast. As a result, west China remained in virtual isolation until relatively recently, but east and southeast China was open to maritime transportation. Therefore, east China is more accessible to the outside world than the isolated west of the country.

China is a country with great physical diversity. The natural conditions vary from place to place. The country is divided into three natural realms: Eastern Monsoon China, Northwest Arid China, and the Qinghai-Xizang Frigid Plateau. Eastern Monsoon China occupies about 45 percent of the total land area of China and has a population accounting for 95 percent of the country's total population. The output of industry and agriculture of this natural region amounts to 97 percent of the national total. Strongly influenced by the summer maritime monsoon, this area has humid or subhumid climate. It has the most favourable natural conditions for human activities, and nearly all arable land has been cultivated. Northwest Arid China is the eastern part of the immense Eurasian desert and grassland; it occupies about 30 percent of the total land area of China, but its population accounts for only 4 percent of the country's total population. The influence of the summer maritime monsoon is rather weak, and hence, the climate is. arid or semiarid. Plateau and inland basins of approximately 500 to 1500 m in elevation dominate this area. On the whole, the natural conditions for human activities are barely favourable. The Qinghai-Xizang Frigid Plateau is the highest and largest plateau in the world. It occupies about 25 percent of the total land area of China, but holds less than 1 percent of the country's total population. It has a mean elevation of above 4,000 m with a low temperature. The natural conditions as a whole are decidedly unfavourable to human activities (9).

In terms of landforms, the topography of China is broadly arranged into four great steps.

1) The Qinghai-Xizang Plateau has a mean elevation of above 4,000 m, and, hence, is sometimes called the "roof of the world".
2) From the eastern margin of the Qinghai-Xizang Plateau eastward up to the Da Hinggan - Taihang - Wushan mountains line, is a region composed mainly of plateaux and basins with elevations from 2000 to 1000 m. Numbered among them are the Nei Monggol, Ordos, Loess, Yunnan-Guizhou plateaux and the Tarim, Junggar, and Sichuan basins.

3) From the above-mentioned line eastward to the coast is a zone in which are distributed the largest plains of China with elevation below 200 m—the Northeast China Plain, North China Plain and the middle and lower Changjiang Plain, which are also interspersed with hills generally below 500 m in elevation.

4) The continental shelf has a water depth of generally less than 200 m. There are more than 5000 islands in China's neighbouring seas, many of which are rocky and elevated (10).

Precipitation is unevenly distributed in China. Generally, from southeast China to northwest China, with the distance from the sea increasing, the annual precipitation declines markedly. The 500 millimetre isohyet—running from central Heilongjiang to the Sino-Bhutanese border in the southwest and broadly coinciding with the direction of several major mountain chains—is roughly a dividing line: northwest of it, precipitation is scarce, resulting in chiefly pastoral areas; southeast of it, rainfall is abundant, giving rise to the chief agricultural areas of China.

Owing to the general west-eastward sloping topography, most large rivers in China run eastward. Among them are the Heilongjiang river, Huanghe river, Changjiang river and Zhujiang river. They flow into the Pacific Ocean and are bordered by fertile and broad valley plains which have very good conditions for agriculture. The Changjiang Delta and the Zhujiang Delta are traditionally prosperous areas.

Three natural realms, four great steps of topography, the uneven distribution of water resources, and the differential locations of agricultural land together provide the physical preconditions for the spatial inequality that occurs between east and west areas.

Two further points are worth noting about the physical setting. First, although poor communications and technologies almost entirely prevented their exploitation before 1949, the great hinterland regions do hold enormous natural wealth: there are now known deposits of nearly every kind of useful mineral. There are precious metals, forest, water and energy resources in abundance. The potential for major industrial development in western areas is, in consequence, great (11).

Second, the western regions are the traditional homelands of many of the non-Han minority peoples. All five minority autonomous regions are located in the west. This has complicated the "east-west" issue, since disparities become not only an economic concern but also a political issue with, as has been remarked, strong implications for national integration. Let me note how these disparities have fared through the ages.

1. 4. Legacy Of The Spatial Inequality

China is a country with over 5,000 years of continuous civilisation. In ancient China, the lower Huanghe (Yellow) river basin was the key political and economic area. Indeed, the Huanghe River is called the cradle of Chinese civilisation. From the Sui (AD 589-617) and Tang (AD 618-906) period, South and Southeast China recorded faster development than North China on account of there being in these two regions good conditions for agriculture, rich resources of fish, salt, tea, and silk etc., and thriving sea trades. During the Later Tang and Five Dynasties and Ten Kingdoms (AD 907-959) eras, South China had a relatively peaceful environment, whilst, by contrast, the North suffered seriously from war which forced people to migrate to the South and the Southeast areas. This stimulated the rise of the South at the expense of the North (12). The Lower Changjiang River basin assumed the position of key economic area and was linked to the old key economic area, the lower Huanghe River basin, via the Grand Canal (13).

During the Song dynasty (AD 960-1125), with the political centre relocated in Linan(now Hangzhou) in the southeastern coastal Zhejiang province, the lower Changjiang River basin and Zhujiang (Pearl) River delta experienced an accelerated economic and social progress. The trading ports of Quanzhou, Guangzhou and Minzhou had then some of the most advanced handicraft industries in the world. Sea trading promoted the development of the port cities of Guangzhou, Quanzhou, Shanghai, Ganpu,Wenzhou, Hangzhou and Ningbo.

From Yuan times (AD 1276-1367) to those of the Ming dynasty(AD 1368-1644), the Lower Changjiang River valley remained the key economic area, although Beijing became the national political, economic and cultural centre. Nascent capitalism appeared with the development of urban industries and commerce in coastal cities. Mining, iron-smelting, textile manufacture, paper making and printing, and shipbuilding scored further advances in Southeast China. Several coastal cities continued to prosper through maritime trade, such as Fuzhou, Quanzhou, Guangzhou and Ningbo.

During the early Qing period (AD 1645- 1911), Southeast China remained the national economic base, and inchoate industries steadily developed in prosperous coastal cities. However, the Qing government assumed a negative stance towards commercial development, denying entrepreneurs the right to open mines on their own. It even put a limit on the number of looms a factory could own. Besides, it imposed burdensome taxes, so burdensome in fact that many merchants were forced to close shops as a result of bankruptcy (14).

In addition, the Qing government adopted a "closed-door" policy towards foreign countries, rejecting their material products, technology, and culture. All these moves seriously hampered the development of modern industries at home and led to China gradually falling farther and farther behind the European countries which experienced a rapid development stimulated by the "industrial revolution". Until the Opium Wars China remained an isolated, self-sufficient "Central Kingdom" dominated by agriculture.

China's defeat in the Opium Wars (1839-1842) led to the invasion of the country by European powers who forced the Qing government to open China's ports to foreign business. In 1842, the Treaty of Nanking (Nanjing) opened the ports of Guangzhou, Fuzhou, Xiamen, Ningbo, and Shanghai on the southeast coast to foreign economic activities. The Treaty of Tientsin (Tianjin) in 1858 opened a further 10 ports, eight of which(Tainan, Danshui, Chaozhou, Qiongzhou, Hankou, Jiujiang, Nanjing, and Zhenjiang) were also in the southeast area. These treaty ports grew to be the country's chief economic centres.

In the early twentieth century, Russia and Japan instigated development of industries in northeast China which they occupied. After World War I Japan steadily increased its influence in China, establishing heavy industries in Manchuria (the northeast China). Iron and steel industries were built around the region's coal and iron ore deposits; chemicals and engineering industries were developed for military purposes; and energy industries were established to provide cheap power. There was no heavy industrial base in China other than in this region. The Japanese also developed the textile and mining industries in Qingdao and Tianjin, which, along with Shanghai, had by 1937 become China's largest industrial centres (15).

During the period from 1931 to 1945, heavy industries expanded in the northeast and began to develop in the north, but, by contrast, there was a decline in production in the southeast. In the west, mainly around Chongqing, the Chinese government exploited raw material resources and oversaw the introduction of heavy industry, much of it transferred from the east, which served the needs of the war. Meanwhile, some small industrial centres also developed in interior areas. However, such diffusion was reversed soon after the end of the war. By the end of 1948, coastal areas (excluding Manchuria) accounted for four-fifths of both the total number of factories and the total industrial employment, and were responsible for nine-tenths of the motive power (16).

It is worth pointing out that industry, especially modern industry, took a comparatively small share of the Chinese economy. Industry (including transport) accounted for only 18-20 percent of GDP in 1933, and 23-26 percent in 1952-after three years of rehabilitation (17).

Summarising the above, from 1840 to 1949 modern industries, most of which were initiated by foreign capital, developed only in treaty port-cities on the coastal fringe (e.g. Shanghai, Tianjin and Qingdao) and in the Northern provinces; that is, precisely those areas with the advantage of access to the outside. The rest of the country was virtually devoid of modern industry except mining and cottage industry. Yet, because of its meagre share of the economy, the impact of modern industry on Chinese society was small. Agriculture continued to dominate the country.

For a long time one view was widely accepted by most Chinese scholars. As that view sees it, the incursions by colonial powers were directly responsible for the spatial differentials in China. I shall maintain that, while such intervention contributed decidedly to spatial inequality, it was neither the root nor the sole cause for that condition. The determining factor for the spatial inequality per se is the physical setting of China. Had China not experienced the invasion of outsiders, the spatial inequality would still have prevailed, although the gap might not have become so sharp.

This instance of sharp spatial inequalities was seen by the communist party leaders, who established the People' Republic of China in 1949 after defeating the Guomingdang government, as "irrational" and a product of history. They tried to correct it through regional policy aimed at achieving common prosperity in all areas. The next section will review how the communist government handled this problem.

1. 5. Regional Development Policy Since 1949

China's national strategy for regional development since "Liberation"(the succession of the communists in 1949) may be divided into two phases: the Mao era and the Post-Mao era. Each has sharply contrasting approaches to regional development.

1. 5. 1. Regional Policy in the Mao Era

When the Chinese Communist Party came to power, its leaders regarded the legacy of east-west inequality as one of the fundamental problems confronting economic development. As mentioned before, the communist government advanced good reasons for this; namely, concerns for economic and social equity, national unity, strategic security and rationalisation of industrial distribution. Consequently, it was resolved that great effort must be devoted to overcoming this "irrational" spatial pattern through national development policy.

Rehabilitation and the First Five-Year-Plan Period (1949-57)

Soon after the establishment of the People's Republic of China, the Korean war broke out. The Beijing government felt threatened by the Western powers, and decided to ally itself with the USSR. This meant that China could obtain badly-needed technology and other assistance from the USSR. During the first three years of its ascendancy major efforts were made to restore the social order, repair the war-devastated economy, and restore previous production levels. No immediate large-scale industrialisation program was launched.

The First FYP (1953-1957), relying heavily on Soviet experience and financial and technical assistance, indicated the beginning of large-scale industrialisation. The intent of the First FYP was to establish new industries in the non-coastal provinces. In the words of Li Fuchun, the architect of the First FYP: 'Our present task in urban construction and hence industrialisation is not to develop the large cities on the coast, but to develop medium and small cities in the interior' (18). The major reasons for the inland bias were to place industrial sites close to sources of raw materials and fuel and areas of consumption and to strengthen national defence. The last consideration played a significant role in Chinese regional policy of the 1960s and 1970s. This inland-favoured development approach is sometimes styled the " interior development strategy" in contrast to the Post-Mao era's "coastal development strategy".

In accord with the First FYP, 694 "backbone" industrial projects were advanced for implementation, of which 472 were located in interior provinces. Among the projects in question, 156 were regarded as "key projects" which had direct Soviet technical and financial assistance and were of large scale and were regarded as playing critical roles in the economy. A detailed analysis of these "key projects" will provide a clear understanding of the "interior development strategy".

During the First FYP, 150 of the planned 156 key projects were carried out with a total investment of about 20 billion RenMinBi (RMB) or yuan. The investment for each single project ranged from over 10 million yuan to 6000 million yuan. Table 1-3 shows their geographical distribution based on the then six super-provincial administrative regions[6].

Six provinces each received more than 10 projects. They were in descending order: Shaanxi(mainly military industries), Liaoning, Heilongjiang, Shanxi, Henan, and Jilin. Altogether, 105 projects were built in these six provinces, a number equalling 70 percent of the total of key projects. At the other extreme, twelve provinces were entirely overlooked. They were Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Tianjin, Guangdong, Guangxi, Guizhou, Qinghai, Ningxia and Xizang. These provinces reflected two types of economy: the most relatively developed coastal areas and the most backward remote areas. Among the twelve coastal provinces, eight were denied even a single key project. The other four, however, received 32 projects, or 20 percent of the total (19).

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[6] The super-provincial administrative region which administered several provinces was initiated shortly after "Liberation", but was cancelled in 1954. Its replacement was the economic co-operative region. After 1958 these became little more than a convenience for statistical tabulation.

Table 1-3 Regional Distribution of the Key Projects in the First FYP

Region	Projects	% of the total
Northeast	56	37.3
Northwest	33	22.0
North China	27	18.0
Central China	18	12.0
Southwest	11	7.3
East China	5	3.4

Source: Dadao Lu, ZhongGuo GongYe BuJu De LiLun Yu ShiJian (The Theory and Practice Of China's Industrial Distribution) (in Chinese), Science Press, Beijing, 1990,. p.23.

The investment in the First FYP was destined for activities in metallurgy, machinery, coal, electricity, chemical and other heavy industries. This group shared 89 percent of the total investment.

From the "Great Leap Forward" to the Third FYP (1958 - 1970)

Towards the end of the First FYP, when a review of the non- coastal approach was under way, Mao Zedong suggested that some adjustment should be made. In his famous speech "On the Ten Major Relationships", he argued that the development of the interior would be achieved more effectively by first accelerating the development of the coast which, in turn, would generate a greater accumulation of capital, which then could be devoted to the interior. An extract from his speech catches the essence of his idea.:

"Our old industrial bases are mainly in the coastal regions. If we do not pay attention to industry in the coastal region, this will be to our detriment. On the other hand, if we make full use of the capacity, both in plant and technology, of the coastal industry and develop it properly, then we shall have all the more strength to develop and maintain industry in the interior. It is wrong to adopt a negative attitude towards coastal industry. This will not only hinder the full utilisation of coastal industry, it will also hinder the rapid development of industry in the interior." (20).

Unfortunately, at the time Mao Zedong's view did not prevail, and owing to changes in the political complexion of the supreme leadership, considerable uncertainty characterised the direction of regional policy. Emblematic of that was the Great Leap Forward(GLF), initiated by Mao in late 1957.

The GLF replaced the Second FYP and was diametrically opposed to the First FYP in its principles. It sought low-cost and rapid agricultural development through mass labour mobilisation campaigns and promoted rural, small-scale industrialisation throughout the country. The intention was to create complete industrial systems in each large area and province in the name of self- reliance (21). The interior continued to receive the highest priority in terms of state capital investment.

Things went awry, however, and the program of rapid industrial development overstretched China's resources. A siege mentality developed among the national leadership and relations with the USSR turned sour. National security overrode other considerations, as reflected in the Sanxian (or the Third Front) scheme. Decidedly non-coastal in emphasis, this scheme evolved through the 1960s

In the summer of 1964 Mao advocated an inland-oriented development strategy. In his view, China should be divided into "three great fronts". The first front was the developed coast and border areas vulnerable to seizure by an invasion force; the second was the central plains and other concentrations of population and industry subject to bombing attacks; and the third was the secure base area in the undeveloped, mountainous interior. The third front included all of Sichuan (core province of the third front), Guizhou, Yunnan, Gansu, Ningxia, and Qinghai; a part of Shaanxi; and the western, mountainous parts of Henan, Hubei and Hunan(22). In order to minimise the loss of industrial assets located in the first and second fronts in the event of war, it was maintained that industrial investment should shift to the third line area from the north and northwest, where it had been concentrated during the First FYP. Accordingly, under the terms of the Third FYP, 3.8 billion yuan were allocated to the development of Panzhihua, Jiuquan, and Chongqing; 4.2 billion yuan were set aside for the construction of the Chengdu-Kunming railway and four other lines; while 3 billion went to the construction of provincial third front activities (23).

Regional self-reliance in the production of key minerals and industrial products was further emphasised. In 1970 the national planning conference required that independent economic regions should be established during the Fourth FYP period in order to oversee such regional self-reliance. As part and parcel of this, the interior was to be developed as a comprehensive and strong strategic base with complete industrial sectors. This view stimulated further state investment in the interior areas.

From 1958 to 1975 over half of the state investment went to the interior provinces. The interior's share of state investment in fixed assets during the First FYP (1953-1957) was 55.9 percent. For the Second FYP(1958-1962), its share increased to 59.4 percent, while for the Third FYP (1966-1970), the interior's share peaked at 70.6 percent (24).

The share of total national investment realised by the southwest and northwest regions during this period witnessed a considerable boost. For the First FYP their combined share was only 16.9 percent, but for the Third FYP it reached no less than 35.1 percent.

Fourth and Fifth FYP Period

In 1972, with President Nixon's visit, Sino-US relation began to improve. China's geopolitics changed. The perceived threat to the eastern coast was lifted. This allowed the government to readdress the development of the coastal areas. At the same time, the Sanxian program was reassessed and gradually scaled down. Industrial investment began to revert to the coast. During the period of the Fourth and Fifth FYPs 47 sets of equipment for industrial complexes were imported. Of these 24 were located in the coastal areas. With the exception of Sichuan and Guizhou, the west was ignored. This-ten year span represents the transition period from the interior-oriented strategy to the coastal development strategy.

Three summarising points are worth noting about regional policy in the Mao era. First, the Sanxian programme, per se, was not intended to narrow regional disparities, but solely to strengthen national defence. The regional development of the interior stemming from it was merely a side-effect of strategic considerations.

Second, three decades of interior development did succeed in narrowing the regional disparities to a certain extent. Modern industry was established in formerly desperately-poor and backward interior areas. The central provinces, such as Heilongjiang, Jilin, Inner Mongolia, Shanxi, Henan, Hubei, and Hunan, were the major beneficiaries. The economies of these provinces were galvanised. Their progress changed the macro economic landscape from a coast-interior dichotomous pattern to an east-central- west three-step gradual ladder structure. Despite this effort, however, results still fell short of expectations. Moreover, much of this growth was gained at the expense of national economic efficiency. From the economic standpoint the Sanxian programme was a great waste of national wealth. Further, the sunk cost of neglecting the coast is incalculable; the price in energy scarcity and transportation bottlenecks is still being paid today.

Third, the regional self-sufficiency policy had been promoted to such a level that it disregarded the basic idea of regional comparative advantage; thus, reinforcing the harmful neglect of economic efficiency. Consequently, this failure compelled Chinese leaders to initiate a new approach for national development after the death of Mao Zedong.

1. 5. 2. Regional Policy in the Post-Mao Era

Two lessons were drawn from the reassessment of the regional policy of the Mao era. First, it was conceded that it would be impossible to eradicate the east-west gap, which was accepted as a product of both Chinese history and geography, within a short time. Resolving regional development gaps would require a process extending over at least several decades. International development experience was cited in support of this view. Therefore "Seeking to build up interior industries within a short time, without developing the old bases of coastal industry, was unrealistic" (25).

Second, it was admitted that Mao's measures to promote egalitarianism and regional self-sufficiency have seriously hurt the improvement of economic efficiency and, hence, have retarded the development of the Chinese economy. In order to increase national economic efficiency it was thought very necessary to fully utilise each region's comparative advantages. Each region has different conditions, therefore it stood to reason that differential development is inevitable in the development process.

With the abandonment of Mao's interior-oriented development strategy, a new regional policy was initiated in the 1980s in parallel with the reforms. The new "coastal development strategy", aiming at economic efficiency, is emphasised to fully utilise the comparative advantages of the coastal area: its geographical accessibility, good infrastructure, relatively more sophisticated technology, skilled workers, and traditional overseas connections. The key point for the new strategy is to let coastal areas "get rich first"; then, in the long term, the effect of growth in the coastal area will gradually trickle down to the interior, thereby closing the regional disparities between these two areas. This policy is in a sense advocated by default, since it is impossible to make all areas become prosperous simultaneously, just as there is no way to let all people become rich at one and the same time. Because the coastal area enjoys a better regional factor endowment, therefore it would be expected to undergo a faster development. This coastal development policy argued that, by granting the coastal area favoured economic policies for both opening to the outside and economic liberalisation, it would spawn growth poles and achieve a fairly quick economic development. The spread-effects or growth spill-over from these poles will gradually diffuse into the interior area and stimulate the "take off' of the latter. However this is a long process, and at the beginning a widening of regional disparities is inevitable. In short, the "coastal development strategy" is an "uneven development strategy" (26).

This uneven development strategy was effectively inaugurated with the establishment of the first four Special Economic Zones (SPZs) of Shenzhen, Zhuhai, Shantou, and Xiamen along the south coast in 1979. As a follow up, in 1984, 14 coastal cities were designated as "open cities" for foreign investment[7]. In 1985, three delta areas, the Pearl River Delta, the South Fujian Delta and the Lower Changjiang River Delta, were opened. In 1988 Hainan Island (formerly part of Guangdong province) was promoted to a province and became the largest SEZ in China. At the beginning of the 1990s some key cities in interior areas were also declared to be "open cities". Within most big cities Economic Development Zones (EDZ) or more commonly, the Economic and Technical Development Zones(ETDZ) were established [8]. The biggest of these is Pudong New Zone at Shanghai. The SEZs, "open cities", ETDZs and some other similar development zones have been granted special administrative and economic powers with the express purpose of allowing them to "take off" before other areas.

The Seventh FYP which divided China into three macro economic zones (see Figure 1-1) clearly and completely demonstrated this differential development policy. Based on this plan the Coastal Eastern Zone will upgrade traditional

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7 Open cities enjoy considerable autonomy in economic decision-making, including, in particular, investment decisions and approvals, and labour, land and price control regulation. However they do not have as many powers as SEZs. Economic and Technical Development Zones are established in open cities to perform more sweeping reforms and attract foreign investment, often of a high-technology nature.

8 The ETDZs were originally restricted to the 14 open coastal cities. Later as the "opening up" process has spread inland, more than 200 ETDZs were established. Enterprises in ETDZs are granted tax deductions and some other privileges that are essentially similar to those in SEZs. ETDZs are intended to reap the economies of scale of infrastructure or external economies. However, no ETDZ has the status of a separate customs area, which is the case SEZs.

technology, restructure its industries, develop knowledge and technology-intensive and high value-added consumer-products' industries and transform itself into an export-orientated economy. The Central Zone will concentrate on producing energy and raw materials, certain machinery and electrical products, and agricultural produce. The Western Zone will emphasise agriculture, forestry, animal husbandry and transport, and selectively develop its energy and mineral resources and certain local processing industries (27).

This coastal development deliberately fostered uneven regional development. Coastal regions have gradually increased their share of central government investment in fixed assets since the late 1970s. In the early 1980s the coastal region as a whole commanded about half of all central government investment, in contrast to the little over 40 percent of central government investment that the coastal region had received over the 1953-80 period (28).

Coast areas also absorbed far more foreign investment than the interior. During the period extending from 1979 to 1990 the coast areas received US $ 12.78 billion of actual foreign direct investment (FDI), which accounted for 93 percent of the national actual FDI value (29). In 1989 Guangdong province absorbed US $ 1.15 billion of actual FDI, while the total actual FDI received by the nine provinces of the western zone was only $ 122 million; that is, just one-tenth of Guangdong's value (30). This bias of FDI was not surprising, since coastal areas score well in terms of economic geography, ties with overseas Chinese, and a generally superior investment environment vis-à-vis other areas. The importance of foreign investment lies not merely in the dollar amount as a capital factor but also in the investment- embodied technology and managerial skills that China wants to acquire (31). Obviously, this bias in favour of the coast would stimulate a differential pattern of regional development.

The coastal region's share of the Gross Output Value of Industry (GOVI) has also increased discernibly during the period from 1981 to 1992. In 1981 its share was 60.49 percent of the national total. In 1992 it had edged upwards to reach 65.73 percent. This trend contrasted sharply with the events of the preceding three decades during which the coast's share of GOVI diminished from 69.4 percent in 1952 to 59.5 percent in 1983 (32).

This widening of regional disparities does not mean that the interior was devoid of fast growth. On the contrary, all regions in China have seen impressive economic growth during the reform period. Regional disparities increased only because the coastal areas recorded an even faster growth. Chinese leaders realised that the coast-interior gap could not be bridged in a short time and they expected a widening of regional disparities in the early period of the reform. In the words of Zhao Ziyang:

" In a country with such a vast territory as ours, uneven economic development in the eastern, central and western regions will exist for a long time. In the past few years, the difference in the level of economic development between some Chinese nationality areas and the coastal zone has been widened. It should be noted that this gap has emerged under circumstances in which national economic construction in nationality areas has experienced huge advances, but the coastal areas have developed at a still faster pace. Our goal is to seek common prosperity for all nationalities, but this cannot be achieved simultaneously" (33).

Nevertheless, in the here and now, this widening of regional disparities has created conflict and friction among the regions and intensified the division between east and west. The "tunnel effect" which had kept the interior quiescent for a decade was fading (34)[9]. Therefore the national government felt compelled to admit that regional disparities were matters of concern in recent years. The Communist Party of China in a recent published document declared that:

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[9] The "tunnel effect", put forward by Albert Hirschman, refers to such a case that if the driver in a jammed tunnel sees the other line moving, he will feel his situation has improved too. However, he cannot wait forever. The waiting period that he is prepared to tolerate is determined by many factors. See dali Yang, Patterns of China's Regional Development Strategy, China Quarterly, June 1990, p. 252.

"Beginning from the Ninth Five-Year Plan period (1996-), it is necessary to pay more attention to supporting development of interior areas, put into practice policies in favour of alleviating the widening tendency of the gap, gradually intensify efforts and work actively towards narrowing the gap" (35).

However, the question of whether the commitment is real or whether it is merely to placate dissent remains open. Should it be the former, the Chinese government must face up to the dilemma of equity versus efficiency in dealing with the issue. Obviously the centre cannot ignore the growing discontent in the interior, especially in the west. But the effective measures for addressing the problem are limited. Maoist redistributive measures can no longer be used because of two reasons. First, the central government has no effective power to forcefully accumulate revenue from coastal provinces for transfer to the west because of the ten-year decentralisation of economic decision-making. Second, it also does not want to hinder the momentum of national economic development by slowing down the growth of the coast. It wishes to make this position clear; namely, "from a strategic point of view, allowing coastal areas to develop first and continue to give play to their advantages is in the interest of the whole, which should be taken into consideration by interior areas" (36). Nevertheless, the government has launched some measures to narrow the regional gap, such as the east-west dialogue which encourages the rich east to aid the poor west. However the effect of such measures is very limited. What the government is hoping for most of all is that the growth in the coastal area will gradually diffuse into the interior through the medium of spread-effects and that this diffusion will not be long delayed.

1. 6. Conclusions

East-west gaps in economic and social development comprise the major issue of regional disparities in China. These spatial inequalities are a natural result of the interactions of many factors, including China's physical geography, patterns of the endowment of regional factors, development history, and government policy. It is impossible to eradicate such a disparity within a short time. During the Mao-era, the Chinese government tried to promote the fast growth of the west, which was devoid of modern economy, in order to achieve an even spatial development by favouring it for state investment over the coastal area. The west, in addition, obtained the greatest amount of state investment during the Sanxian construction period. Interior-orientated policy produced at least two positive results. First, the economic conditions in the interior area were substantially improved. Modern industry spread to all provinces. Second, a sound set of sources of raw materials and markets for the coastal industry was established in the interior area. However, these gains were achieved at the expense of the national economic efficiency. Had the capital resources which were allocated to the interior been invested in the coast, which has a much higher productivity and economic efficiency, the national economy would have registered better development during the Mao-era. It is estimated that of the total 400 billion yuan of fixed assets produced during the period of 1953-1980, only 250 billion yuan were effective (37).

Further, major motivation for the development of the interior, especially the Sanxian programme, was not a deliberate policy designed to alter the east-west imbalance, but a result of defence considerations.

Post-Mao leaders abandoned Maoist interior-orientated policy and adopted a coast-orientated regional policy. This is an uneven development policy which is intended to grant the east priority status in order to make full use of the advantages of the coastal area. This coastal development strategy is based on a self- evident view that it is impossible to make all areas prosperous simultaneously; therefore areas which have comparative advantages should be encouraged to become rich first. The rich area will become the engine of growth and will help the poor area to develop. The growth effect will gradually spread and, thus, the basic goal of common prosperity may be achieved. This is a process extending over several decades. In the beginning, a widening of regional disparities is expected and acceptable as long as the west also experiences fast growth. The signs suggest that this pattern have already become established during the 1980s decade of reform.

Although uneven distribution of industries is the salient feature of east-west inequality, disparities exist in all aspects of the economy, including agriculture. A better and fuller understanding of the whole picture of China's regional disparities is possible only after we have obtained an appreciation of the spatial differentials occurring in each economic sector. There can be no doubt that a detailed analysis of spatial variations of Chinese agriculture will contribute to a better understanding of China's regional disparities. Having reviewed the general picture of China's regional disparities, the next task is to describe the development of Chinese agriculture and its spatial patterns: that is the object of Chapter 2.

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CHAPTER 2: AGRICULTURAL CONTEXT

2. 1. Historical Background

In the preceding chapter I examined the general situations of regional economic disparities in China. This chapter will be devoted to a particular aspect of the Chinese economy: agriculture. The main objectives of the chapter are to present a review of the history of agriculture, its contemporary development, its critical role in the Chinese economy, and its physical regionalization. First, let us review its long and proud history.

2. 1. 1. Ancient Period: from the Neolithic Age to 1840

China is essentially an agrarian country with almost 80 percent of its total population engaged in agriculture. Agricultural activity in China dates back to the early and middle Neolithic period; that is to say, at least to 8,000 or 9,000 years ago. From that time it has undergone a continuous history of over 8,000 years (Table 2-1). Traditionally, it was commonly accepted that the middle and lower reaches of the Huanghe River together constituted the only cradle of China's agriculture and civilisation (1).

Table 2-1 Highlights of Chinese Agricultural History

Approximate Years*	Highlights
5000-2100 (New Stone Age Primitive Society)	Farming villages established in the Wei and Huanghe river valley. Millet, wheat, beans, rice, hemp, cabbage and melon cultivated. Human labour followed by farming implements of stone and wood. Bareland cultivation. mortar and pestle for grinding grain invented.
2100 B 476 B.C. (Slave Socity)	
1600-1100 B.C. (Shang Dynasty)	Bronze farm tools introduced. Chinese characters inscribed on bones or tortoise shells
770-476 B.C. (Spring and Autumn Period)	Use of iron plough drawn by oxen. Description of "Five grains (millet, glutinous millet, soybeans, wheat, rice). Fallow land farming introduced. Water-lifting implements invented.
475 B.C.- 1840 A.D.(Feudal Society)	
475-221 B.C. (Warring States)	Flood control and irrigation well developed. Regionalization of agriculture. Ridge farming and crop rotations introduced. Value of animal manure established. Expansion of winter wheat production. Food-processing equipment and technologies developed.
221-207 B.C. (Qin Dynasty)	Great Wall constructed.
206 B.C.- 220 A.D. (Han Dynasty)	Intensive farming, intercropping, multiple cropping, and bed culture developed. Sowing plough and dragon-bone water lift invented. Expansion of paddy rice production.
581-618 (Sui Dynasty)	Grand Canal constructed.
618-907 (Tang Dynasty)	Plough with a bent beam invented.
1127-1279 (Southern Song Dynasty)	Concept of constant renewal of soil fertility introduced.
1368-1644 (Ming Dynasty)	Corn and sweet potatoes introduced.

1644-1840 (Qing Dynasty)	Multiple cropping extended over all China.

*: The dates given for each highlight may not always coincide with the official dynasty dates.

Source: Yu Toutai, Agricultural History Over Seven Thousand Years in Sylvan Wittwer et al, Feeding A Billion, Michigan State University Press, 1987, p. 20.

However, more and more archaeological findings indicate that early agricultural sites appeared in small patches all over China, although clustered in the middle and lower reaches of the Huanghe River and the Changjiang River. Two great farming systems co-existed from the very beginning: first, dry farmland in Northern China, centred in the middle and lower reaches of the Huanghe River; and secondly, paddy rice farming in southern China, with the middle and lower Changjiang valley and northern southeast coast as its core (2).

During the Western Zhou era (1126-771 B.C.), crop cultivation became the main agricultural sector. The "well-field" farming system[10] was conceived and implemented. Under this system, all land belonged to the king, and all peasants were slaves forced to work collectively in "well-field" land. The

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[10] The well-field farming system was arranged like the Chinese character 'well'". The centre square was the public land, while the surrounding eight pieces of land were privately used by peasants, who also cultivated the public land without compensation(Zhao Songqiao, Geography of China, John Wiley & Sons, Inc., New York, 1994,p.53.)

variety of farm crops increased to include rice, millet, wheat, beans, sorghum, barley, melon, vegetable, mulberry, hemp, and others. Soybean, which was all important for the nutrition and health of the Chinese, was also domesticated about 1100 BC. rrigation, drainage, and fertilisation had been long practised at this time.

During the Spring and Autumn period (771-403 BC), the "well-field" farming system declined, and private land ownership came into existence. When the technology of smelting iron was invented, iron implements were put into use. The custom of using the ox for ploughing had also begun. Consequently, the individual household could carry out its field work to a high standard, and reclamation of large tracts of unused arable lands and construction of large-scale irrigation systems and reservoirs became possible, and this led to the rapid spread of agriculture.

During the Warring States period (403-221 BC), agriculture progressed steadily. Through migration and the settlement of new land, superior agricultural technologies were diffused from the developed area to the undeveloped area. The "peasant-gardener farming system" gradually replaced the primitive shifting cultivation. Private landownership was officially proclaimed and widely adopted. This policy granted the newly-emerged landlord class the ruling power in rural areas. Water conservation projects improved the irrigation of farmland, as well as providing transportation and communication facilities. Emblematic of this is the Dujiang Dam in the Chengdu plain, Sichuan province, which was among the largest irrigation projects constructed by Qin in the third century. It has been operating continuously and benefiting large amounts of farmland ever since. The improvements in irrigation increased the amount of land available to agricultural production and changed the composition of farm crops. The area given over to the cultivation of corn gradually expanded and, during the later Warring States period, the cultivation of winter wheat paved the way for increased production through multiple cropping and crop rotation. Winter wheat, millet, and corn became the main crops of dryland farming (3). The yield per unit of land was impressively high. For example, The average yield of millet reached about 1055 kg/ha during the Warring States period(4).

The spread and development of agriculture led to the formation of agricultural regionalization. Intensive crop cultivation, which constituted the main economic activity, was centred on the densely-populated portion of central China. Animal husbandry for its part was mainly concentrated in the North and Northwest. Fishing was a mainstay in eastern China, while forestry predominated in the mountainous region, particularly in areas south of Changjiang, Huaihe and Tongbai, and around Qinling in the west.

Agricultural production also developed to some degree in the Northern border area (5).

During the Western Han dynasty (206 BC - AD 9) agriculture underwent a rapid development. Crop cultivation covered a vast area, extending from the eastern coastline to the western Gansu corridor, and from the Yanshan in the North to the southern Pearl River valley. Agriculture became the major occupation in the country and a small-scale private land ownership system was widely encouraged. Manual labour was intensively used and so were draft animals. A piece of farmland was carefully treated like a garden. Yield per unit of land was generally on the high side. The primitive fallow system was gradually replaced by a three-year rotating system, in which a plot of farmland was divided into three sections, with each section remaining unused (fallow) once in every three years to regain fertility. Many new crops were introduced from Central Asia, such as grapes, watermelons, and alfalfa. Tea planting assumed a large scale. Animal husbandry and handicraft industries were pursued as sideline enterprises in peasant families. In A.D. 2, China had its first national census, recording a population of 59.6 million and a farmland area of 570 million mu (Table 2-2).

However, a period of war followed which initiated a large-scale migration from the north to the Southern Changjiang area. In the late Western Jin and

South and North dynasties (AD 280 - 589), a second large-scale migration occurred which further shifted the country's economic centre toward the south. South China gradually exceeded Northern China in both economy and population. Paddy rice introduced in the early Northern Song Dynasty and it substantially increased in yields. There was now more than 200 kinds of new rice varieties. Agriculture was also more effective in the North China Plain, where wheat growing and the three-crops-every-two-years system greatly increased production (6).

Industrial crops, such as mulberry and hemp, developed in the south during the Northern and Southern Song dynasties in the twelfth and thirteenth centuries, and tea was produced in sufficient quantities to be exported. At this time, the Changjiang basin was the country's largest agricultural region (7). The introduction of water wheels equipped with wooden chains or bamboo tubes for irrigation further spread the cultivation of paddy rice. The planting of cotton extended southward to Fujian and Guangdong, and important progress was made in the cultivation of sugar cane and tea. Reclamation of farmland, especially in the montane areas and coastal lowlands, also took place on a large scale(8).

The Tang and Song Dynasties (AD 618-1279) coincided with the golden age of ancient Chinese agriculture. Profound technological development revolutionised China's agriculture and by the thirteenth century China had "probably the most sophisticated agriculture in the world"(9).

The devastation of the country during the Yuan Dynasty (1206- 1368) was followed in the fifteenth and sixteenth centuries by measures to revive production. Agriculture not only recovered and developed along the Huanghe River and The Changjiang River, but made considerable progress in Yunnan, Guizhou, Guangdong, and Guangxi provinces in the south. The commercialisation of farming and a rise in the commodity rate of farm produce occurred in the period of the Ming and Qing dynasties(10). During the Ming Dynasty, the total amount of cultivated land was sharply boosted. The centre of commercial rice production moved from the Changjiang Delta (emphasising more economic crops and industries) to its middle reaches in Hunan and Hubei; confirming the old Chinese saying, "*LiangHuShu, TianXiaZhu*", which means" if two Hu(Hunan and Hubei) have a bumper harvest, the whole country will be sufficiently fed". The cultivated area of sugarcane and sugarbeets increased by a sizeable amount. Cotton was widely planted in southern China and spread to the Huanghe River basin, and finally replaced hemp as the basic cloth-making material. Silkworm raising was also popular in southern China, and Hangzhou became very famous for

T[illegible]ble 2-2. [illegible]

Year (A.D.)	
2 (W[illegible]ern Han)	
105 (Ea[illegible]ern Han)	
755 (T[illegible]g)	
1083 (N[illegible]thern S[illegible])	
1381 (M[illegible])	
1562 (M[illegible])	
1753 (Q[illegible])	
1812 (Q[illegible])	
1887 (Q[illegible])	
1949	
1957	
1971	
1980	
1990	

One mu equals 666.[illegible]

Source: [illegible] Song[illegible]

York, 1[illegible] p.58

Table 2-2: Population and Farmland in Chinese History

Year (A.D.)	Population (millions)	Farmland (million mu)*	Farmland per capita (mu)
2 (Western Han)	59.6	576.5	9.7
105 (Eastern Han)	53.3	510.2	9.6
755 (Tang)	52.9	1,120.0	21.2
1083 (Northern Song)	25.0	413.6	16.5
1381 (Ming)	59.9	334.1	5.6
1562 (Ming)	63.7	392.8	6.2
1753 (Qing)	102.8	652.1	6.3
1812 (Qing)	361.7	728.9	2.0
1887 (Qing)	377.6	780.8	2.1
1949	541.4	1,468.2	2.7
1957	646.5	1,677.5	2.6
1971	852.2	1,510.5	1.8
1980	1,031.9	1,539.5	1.5
1990	1,143.3	1,435.1	1.3

One mu equals 666.7 sq.m, or 1/6 acre, or 1/15 hectare.

Source: Zhao Songqiao, Geography of China, John Wiley & Sons, Inc., New York,1994, p.58.

the production of silk. Beginning in the sixteenth century, maize, peanuts, potatoes, and tobacco were introduced from America (11).

During the early Qing dynasty, crop cultivation expanded in the North-east and border region, and farmland laid waste during the long civil war was rapidly reclaimed, reaching 43.47 million ha in 1753 and 52.73 million ha in 1812 (12). Agriculture also developed in the semi-agricultural and semi-stock breeding highlands of Qinghai and Tibet as the population in those areas increased through migration from the interior.

In summary, for the entire ancient period Chinese agriculture was among the most advanced in the world. It was dominated by a small-scale private land ownership system; characterised by intensive use of both manual labour and land through successive cropping, intercropping, and inlaid cropping; and was basically self-sufficient. Farming techniques and implements were both appropriate and ingenious and the output per unit of land ranked at the top of the world. Agricultural regionalization had been grafted onto the landscape at an early date.

2. 1. 2. Modern Period (1840-1949)

China's defeat in the Opium war led to it gradually becoming a semicolonial and semifedual country. Under the influence of foreign powers, there appeared a certain degree of specialisation and commercialisation of agricultural production. Major commercial crops included cotton, tobacco, soya beans, silk, tea, peanuts, sugar-cane, fruits, and vegetables. Rice also began to be produced for trading. However, commercial agriculture was mainly restricted to coastal areas. The national economy remained basically a small peasant economy. Subsistence agriculture continued to dominate the national economy. The appropriation of land for agricultural production continued under the system of feudal land ownership and farming implements and technology remained unchanged. This period saw both a slowdown of expansion of cultivated land and technological stagnation. There were no significant indigenous innovations(13). In all areas grain crops predominated, supplemented by other crops as dictated by natural and economic conditions. However, during this period, a relatively large-scale northwestward shift of the pastoral- farming boundary occurred, and the pioneer settlement in the northeast plain was also significant. The reclamation of frontier areas enlarged the total area of national farmland.

During this period China suffered seriously from foreign invasion and civil war. In particular, the Sino-Japanese War of 1937-45 greatly devastated China's agriculture and the rest of the economy. After the Japanese surrender, civil war once again broke out which culminated in the Communist victory in 1949. The prolonged state of chaos brought China's rural economy to a state of bankruptcy by 1949.

2. 2. Contemporary Development Of Chinese Agriculture (Since 1949)

There are two contrasting phases of contemporary Chinese agriculture. The first extends from 1949 to the late 1970s. The second is the so-called reform period starting in 1978. The former may be called the collectivisation period, the latter can be styled the decollectivization era.

2. 2. 1. Collectivisation Period (1949 - 1979)

When the Chinese Communist Party came to power in 1949 it inherited a war-torn and underdeveloped economy with a population of roughly 540 million. Agricultural productivity was very low and the challenge to secure domestic food supply was keen. The CCP regarded as imperative the institutional change in the countryside; namely, collectivisation was to be the basic tool for liberating China's peasants from centuries of poverty.

The socialist transformation of Chinese agriculture started from land reform, a process that had already begun in the "liberated" areas before 1949. Land reform is not only an economic measure to redistribute land in order to relieve the impoverished peasants and to stimulate agricultural production, but is also a part of the larger political and social revolution to destroy the traditional rural order and the rural elite so that a new socialist order could be constructed and the communist political power consolidated. Through land reform, the property of landlords was confiscated and redistributed among the poor peasants. The rich and middle-income peasants were allowed to retain whatever they had (14). Overall the land reform programme was highly successful, and by 1952, 42 million hectares (106 million acres) of land had been redistributed to 300 million peasants. The share of China's cropland held by the tiny landlord class fell from 29 percent to 2 percent; whereas that held by the poor peasants and hired labourers(who represented 57 percent of the households) increased from 24 percent to 47 percent of the cultivated land (15).

Land reform resulted in a substantial increase in agricultural production. It goes without saying that the previously landless peasants brought to bear a strong economic incentive on their production by acquiring the ownership of land. Rural income was no longer concentrated in the hands of landlords but could be earned directly by the peasants.

In spite of its obvious success, land reform also created some problems that would contribute to a call for the next phase in the socialist transformation. Chief among the problems was the existence of many more small farms created by the land reform process which aggravated land fragmentation. Many ex-tenants also lacked farm tools and they were usually too poor to invest in the small amounts of land they were granted. Further, a new class struggle was emerging; the poor and middle-income peasants were ranged against the emerging class of rich peasants(16).

Land reform was completed in 1952, whereupon China began its ambitious First Five-year Plan which intended to rapidly industrialise the economy. Top investment priority was given to industry, particularly heavy industry. The push for agricultural development primarily came from collectivisation. In Mao Zedong's view, collectivisation was a precondition for agricultural modernisation in China. He reasoned that it would be easier for the collectives to control the peasants' consumption and extract more economic surplus to finance agricultural modernisation. Moreover, he noted that modern agriculture works best on large collective farms. Mao advocated that China's agriculture be collectivised as soon as possible, and certainly before the peasants became accustomed to private ownership of land and aspired to become rich (17).

Under the CCP's drive, the nationwide transition of shifting individual farms into collective farms took place rapidly during the First Five-Year-Plan period. The transformation underwent three stages, each increasingly more collective.

The first stage was dominated by "Mutual Aid Teams (MATs)". The establishment of producer MATs stemmed from the traditional peasant custom of labour exchange during the busy farm season. Although there was no uniform form, MATs usually consisted of about 10 neighbouring households which shared their labour, draft animals and farming implements; but the ownership of these means of production remained unchanged and each of the contributing families took home its own crops. Compensation for such sharing would be settled among members themselves. In the beginning, the MATs were seasonal but later became year-round operations.

MATs solved some minor problems incident to the large number of small poor peasant households. In particular, after a long period of turbulence, the MATs furnished farm tools and draft animals which the poorer peasants had totally lacked. Moreover, the sharing of production resources by income-constrained households helped to check the land reconcentrate on the hands of the rich peasants after the land reform. However, MATs were only the first step of rural collectivisation.

The follow-up of MATs was the system of elementary and advanced Agricultural Producers' Co-operatives (APCs), which occupied the second stage of collectivisation. Elementary APCs were initiated in 1952-1953. They were larger than the Mutual Aid Teams and usually contained about thirty to forty peasant families. Wherever possible, an elementary APC corresponded to an existing hamlet or rural neighbourhood. All of the member's production resources, including land, were pooled and placed under the unified management of co-operative cadres. The pooling of land under centralised management was an important distinction between the MATs and the elementary APCs.

The elementary APCs were basically volunteer organisations. The peasants were free to join and withdraw as they saw fit. This set them apart from advanced APCs which did not allow members to leave once they joined.

Under the elementary APCs fragmentary plots were consolidated, and many boundary lines dividing private holdings were removed, bringing about an increase of acreage for cultivation. Elementary APCs also made it possible to undertake modest projects, such as irrigation ditches, pumping stations, and some mechanised farming, which would have been difficult for individual peasants to undertake. There was also the advantage that instead of each farm household striving for self-sufficiency, the centralised management could allocate each crop to its best suited field. However, elementary APCs were only "semi-socialist" in scope, because the distribution of net income , after taxes and expenses deducted, among the members was proportional to each member's contribution of the property (land and other capital assets). Those who had brought more into the co-operative gained more shares. Partly as a result of dissatisfaction with this situation, and partly because of a wave of contagious enthusiasm for co-operatives, the idea of higher-stage co-operatives, the so-called Advanced Agricultural Producers Co-operatives, soon caught on (18).

Advanced APCs were formed by merging several elementary co-operatives and usually covered 100 to 300 households, the equivalent of a large village. The establishment of advanced APCs involved more than the setting up of co-operatives for the peasants' own sakes. It was a process of transferring land under state control. In the advanced APCs the chief production resources previously owned by individual members were now in the hands of the collective; thus, both the ownership and utilisation of land, draft animals and large farm implements were collective. The distribution of income was solely based on the work performance, rather than on the previous ownership of land or capital goods. By 1957, the collectivisation of China's agriculture was almost complete. Thus, within a span of five years, China's rural population was organised from individual peasants into members of some 752,000 Advanced Agricultural Producers' Co-operatives, and the peasants' farms were changed into collective farms (19).

The third stage of agricultural collectivisation was the people's commune. The commune idea originated in 1958 at the local level. Its initial purpose was to cope with the inadequacy of the advanced APCs in mobilising labour and capital assets to conduct large construction of agricultural infrastructure, such as irrigation projects. Soon after its emergence, and on account of its advantage in mobilising rural resources for large-scale construction, the commune was praised by Mao Zedong and regarded as a good institution for increasing agricultural productivity. Under the encouragement of the CCP, communes spread all over China in short order.

The communes were quite different from the advanced APCs not only in their size but more importantly in their structure and functions. Composed of 4,000 to 5,000 households, the commune was much larger than the advanced APC. In terms of the functions, an advanced APC was still a production unit whose primary task was to maximise farmer income; while a commune was not only a production unit, but also an administrative organ, corresponding to a township. The communes would take over all aspects of political, social, and economic life; they were to provide local social services such as health care and education; and they were also responsible for carrying out all economic activities, including farming, industrial production, commerce, banking, and construction. In short, the commune was a basic economic, social and political entity in the rural areas.

A commune was structured as a three-tier system: production team, production brigade, and commune. This three-tier structure remained unchanged during the whole commune period. The production team, consisting of from 15 to 50 households, was the basic level of collective agriculture. It was an independent accounting unit and carried out most of the farm tasks. Team members were assigned work tasks and earned "*Gongfeng*(work points)" for the work done. These "*Gongfeng*" were the basis for income distribution.

The production brigade served as an organisational link between the commune and the production team. It usually consisted of 15 to 50 production teams. Its primary function was to supervise the teams and to co-ordinate their activities. The production brigade also organised small-scale rural enterprises and capital projects.

The commune , with from several to over a dozen constituent brigades, organised larger rural enterprises and capital projects, and provided commune-wide economic and social services. As the lowest level of government in the countryside, it was responsible for the implementation of government policies. The commune system constituted the basic spatial organisation of the Chinese countryside in the Mao era. It lasted from the late 1950's to the early 1980's and was dismantled in the rural reforms ushered in at that time.

2. 2. 2. Reform Period (since 1979)

There were systematic problems inherent in the commune system. The issue of work incentive was among them. Under the commune system, the remuneration was based on the accumulation of *Gongfeng*(work points) rather than the work efficiency. Farming activities were determined by the commune leaders who received directions and orders from upper officials. Farmers did not have the right to partake in production management. Therefore, they seldom interested themselves in the whole production process. They undertook farming activities in a haphazard fashion, just like a swarm of bees or *Dafulong* in Chinese. Thus, it was very difficult to monitor each member's work performance. Farmers were simply allocated *Gongfeng* on the basis of time. Under such circumstances, the efficient peasants often lost out, because those who did not work well shared the benefits of the efficient peasants. Every team member was obliged to share in production labour and ate in a canteen from a "common pot". There was no proper system of reward and punishment. *Dafulong* and "common pot", the inevitable consequences of egalitarianism, seriously lowered peasants' work incentives, hindered the improvement of work efficiency and of agricultural productivity, and hindered the development of the whole economy.

The pervasive nature of these problems was acknowledged by CCP leaders in 1978. However, the government at that time considered subdivision of collective land into individual household tracts to be in conflict with socialist principles, and thus it explicitly prohibited this practice. Nevertheless, towards the end of 1978, a small number of production teams, first secretly, and later with the support of local authorities, began to try out the system of contracting land, other production resources, and output quotas to individual households. A year later, these teams brought in higher yields than other teams. The central government accepted this practice of Household-Responsibility-System (HRS) and decided to introduce it across all China. By the end of 1983, 98 percent of production teams had adopted HRS (20).

The HRS, called by peasants "the second land revolution", was the key policy of rural decentralisation. It was neither socialist nor capitalist, but a combination of the two. Under the terms of HRS, the individual household made a contract of at least 15 years, which was renewable , with the collective so as to obtain a certain plot of land, livestock and other assets of production. In one sense, it was a distribution of collective assets. In general, this distribution was allocated fairly. The basic means of production, such as land and irrigation facilities, still belonged to the collective. However, the contractor had the right to manage everything independently during the contracted period as long as he met the tax and quota sales obligations to the state. All outputs over the quota were the property of the peasants.

The HRS eliminated the *Dafulong* and "eating from the common pot". A spirit of healthy competition had been introduced, and local-level cadres, who would previously simply give orders, were now obliged to work on their own contracted land. Peasants now were in complete charge and were fully responsible for their own production cycle. They could also freely apply their own labour and manage their means of production. They had regained mastery of the land. In consequence, they were enthusiastic for farming and assiduously attended to improvement. This change greatly unshaded the productive forces. It is undeniable that the HRS not only increased agricultural production, but also recognised the functions and roles of individual households as the basic operational units in farming systems and empowered farmers' political and democratic awareness.

After the adoption of HRS the commune system no longer conformed to the changed conditions. As a result, in 1984, the commune system was totally dismantled. Township government was established as a replacement to perform political administration, while peasants' co-operatives were erected to fulfil economic operations.

The HRS, together with other reform policies, such as reforms in production planning, grain procurement and development of rural enterprises, have served to significantly increase agricultural production, besides producing all-round impacts on Chinese society. Having examined the institutional changes of Chinese agriculture, it is high time to investigate how agriculture is important to the Chinese economy. That is the task of the following section.

2. 3. Role Of Agriculture In Chinese Economy

As remarked at the beginning, China is an old agricultural country with more than 8,000 years of farming history. Despite substantial progress towards industrialisation over the past four decades, and despite rapid diversification of the rural economy during the reform era, agriculture still remains the foundation of the country's economy and has far-reaching significance in Chinese society. Generally, contributions of agriculture to the Chinese economy are significant in the following areas:

1) providing adequate supplies of food and raw materials;
2) acting as a source of savings for investment in non-agricultural activities;
3) constituting a growing source of demand for industrial output;
4) supplying labour for non-agricultural economic activities; and
5) providing foreign exchange for the economy at large[11].

These contributions warrant elaboration, beginning with the vital issue of food and raw materials supply.

[11] For more detailed discussion of the role of agriculture in economic development, see Bruce F. Johnston and John W. Mellor, "The Role of Agriculture in Economic Development", American Economic Review, Vol. 51 (September 1961), pp.566-593.

2. 3. 1. Providing Adequate Supplies of Food and Raw Materials

A Chinese saying maintains that *"people regard food as their heaven"*. Thus adequate food supply is highly valued and is commonly held to be the most important contribution of agriculture. Yet, as a developing country, the object of feeding 22 percent of the world's population on only 7 percent of the earth's arable land is a daunting prospect. Fortunately, China succeeds in this challenge. Since the late 1970's, China has eradicated the age-old problem of famine and the Chinese people have been well fed. Today, very few people deny this great achievement. Based on USDA data, from 1961 to 1988 China's total population increased by 68.79 percent, from 644.7 million to 1088.2 million (excluding Taiwan, Hong Kong and Macao), registering an annual growth rate of 1.96 percent. During the same period, production of cereals, the major food stuff, rose 227.57 percent, from 107 million MT to 350 million MT, with an annual growth rate of 4.48 percent. Comparison of population growth and food growth indicates that during the last three decades the absolute growth and the annual growth rate of cereal production are both greater than their equivalents respecting population growth. In other words, agriculture provided adequate food for the huge base population despite the latter's inexorable rise.

Table 2-3 provides five-year interval growth trends of both population and cereals production. These trends support the above conclusion except for the period of 1961 and 1965 when China had an abnormal situation, struck by both natural and political disasters.

One may argue that the increase of total output of cereals may not necessarily lead to a corresponding growth in the level of per capita food availability, and the cereal production may be insufficient owing to the increase of per capita food consumption. This argument can be refuted by looking at the change of per capita util.-cereals and nutrient availability and self-sufficient ratio of cereals and food.

Table 2-4 lists the growth of per capita level of food availability. From 1961 to 1986, per capita util.-cereals increased from 165 kg/year to 299 kg/year, an increase of 81.2 percent. Per capita nutrient availability in 1985 greatly exceeded the 1961 level, though this improvement has not been stable over time. In 1961 each person absorbed each day an average 1611 calories of cereals and 40 grams of protein. These intakes expanded to 2611 calories and 62 grams respectively in 1985. With over 2600 calories of food energy available daily per capita, China's average supply is less than 10 percent lower than the Japanese rate, and hence well ahead of India's food availability (2200 Calories per day), and above the all-Asian mean of just below 2500 calories per day. Calculations of average food availability based on China's official consumption statistics result in an even higher intake per day. Further, according to the UNDP during the period of 1988 to 1990 the daily calorie supply in China was 112 percent of requirements (21).

One scholar argued that once the daily food supply surpasses 2600 calories per capita, the considerations of inaccuracy in assessing actual food consumption become relatively unimportant: whatever the actual needs may be (most likely between 2100 and 2300 calories per day),the available food should be adequate to cover them even after subtracting the inevitable retail and household losses. The evidence is clear: China not only feeds itself, but during the 1980s it was doing so with an increasing margin of security and with gradually improving quality of the average diet (22).

Agriculture also makes a great contribution to the Chinese economy by providing extensive variety and large amounts of raw materials for industries. These raw materials can be divided into five categories: grain crops, industrial crops, forestry products, livestock products and aquatic products. China's light industry, especially textiles and forest-products manufacturing, is heavily dependent on these raw materials. Table 2-5 lists the output of selected major agricultural products used for industrial raw materials. Some of them comprise a leading share of the total world production. It is evident that during the 1980's the production of all the selected agricultural raw materials—except the forest products—experienced a great growth in tandem with the diversification of agriculture and the rural economy.

Major reasons for the great achievements in production of food and agricultural raw materials are numerous and will be summarised below:

Table 2-3. Growth of Population and Cereals Production in China

Items	unit	1961	1965	1970	1975	1980	1985	1988
total population	mil.	644.7	715.5	820.4	917.9	983.4	1046.2	1088.2
annu.rate of popu. Growth	% per year	---	2.64	2.77	2.27	1.39	1.25	1.32
production of cereals	mil. MT	107.0	159.1	197.6	241.0	277.2	336.8	350.5
annu.rate of cere. Growth	% per year	---	1.04	4.43	4.06	2.82	3.97	1.34

Source: USDA.

Table 2-4.Average Food Availability and Self-sufficient Ratio in China

Items	1961	1965	1970	1975	1980	1985	1988
per capita util-cereals (kg./year)	165	198	209	231	269	300	---
calorie intake /person/day (calories)	1611	1928	1964	2046	2319	2615	---
protein intake /person/day (gram)	40	48	47	49	55	62	---
self-sufficient ratio of cereals (percent)	99	96	103	104	89	92	94
self-sufficient ratio of food (percent)	--	--	100	101	97	104	--

Source: USDA

1). The upshot of the long-term endeavours of the Chinese government. That government regards agriculture as a guarantee of food security (particularly against the possibility of famine) and as an important guarantee of social stability in both countryside and cities. Food production is invariably accorded high priority in economic activities.

2). Critical are the post-1978 agrarian reform policies, policies which revolved round the replacing of the unproductive commune system with the household responsibility system. The remarkable growth of agricultural production in the first half of the 1980's was mainly ascribed to this reform policy.

3). Also important was the combination of modern technical innovations in farming and highly-valuable traditional technologies of food production which focused on the utilisation of organic manure and intensive farming methods.

4). A massive injection of resources occurred, including the improvement of basic production conditions of agriculture, such as irrigation facilities, farm implements, electrification and the agricultural extension service.

5). Not to be underrated was the implementation of a programme to increase the sown area by intercropping and planting two or more crops on the same piece of land during the cropping year. The sown area increased from 141.3 million hectares in 1952 to 144 million in 1990 (23).

6). The stimulus afforded by the rapidly increasing demand for raw materials brought about by development of light and textile industries after 1978.

7). The tolerance of a certain amount of imports of grains as a supplement to meet the consumption need for grains either as foodstuff or as raw materials.

2. 3. 2. Source of Savings for Non-agricultural Investment

Although there are no direct data available to quantitatively illustrate the financial contribution of agriculture in Chinese economic growth, it is undeniable that it is agriculture that provides substantial amounts of savings to support non-agricultural activities. Based on his thorough examination, Nicholas R. Lardy concluded "enough evidence exists to postulate that the state transferred significant resources out of the agricultural sector " in the 1956-1978 period(24).

Table 2-5: Output of selected major agricultural raw materials in China

	1980	1985	1988	1990
Industrial crops (unit: 1,000 tonnes)				
cotton	2707	4149	4157	4507
oil-bearing	7691	15784	13203	16132
hemp	1436	1927	---	---
sugarcane	22807	51549	49064	57620
beetroots	6305	8919	12810	14526
tobacco	845	2422	2731	2626
silkworm cocoons	326	369	402	---
tea	304	432	545	540
fruit	6793	11639	16661	18744
Forest products (unit: 1,000 cu.m)	30419	29667	25153	---
Livestock products (unit: 1,000 tonnes)				
sheep wool	176	178	222	240
goat hair	12	12	13	---
Aquatic products (unit: 1,000 tonnes)	4497	8236	9553	10610

Source: 1. The State Statistical Bureau of the People's Republic of China, China Rural Statistics, 1988, and 1989.

2.W. Hunter Colby et al, Agricultural Statistics of the People's Republic of China, 1949-1990, United States Department of Agriculture, Statistical Bulletin, No. 844, Washington, D.C., 1992.

Since the establishment of the People's Republic of China in 1949, the government, instigated by the ambition of industrialising China in as short a time as possible and influenced by the Soviet model, has pursued a growth strategy that gave priority to heavy industry over all other sectors. The central objective of development policy has been to accelerate the pace of industrial development. Under this policy agriculture was regarded as an easy-and-ready source of savings for non-agricultural investment as well as a guarantee of food security. For most of the time from 1950 to 1980, heavy-industry investment was achieved at the expense of agriculture and light industry by using Stalinist "forced savings".

There were two forms of capital transfer from the agricultural sector to the non-agricultural sector in China's planned economy. One form was direct or visible transfer which takes the form of state tax and local expenses. Generally, agricultural tax is itself at a modest level. Savings from agricultural tax are not considerable. Local expenses were also modest before 1985. However, since then local expenses have been levied very rigidly under the spur of regional economic competition. Some areas imposed expenses over 10 percent of per capita income (the government regulation is no more than five percent of per capita income). This heavy levy has led to the outbreak of widespread discontent in the countryside.

Another transfer form was indirect or invisible which extracted agricultural surpluses much more significantly. This transfer was operated by using "price scissors"(*JianDao Cha* in Chinese) or the ratio between the prices of agricultural products which are artificially lower priced and the prices of industrial goods (both producer and consumer) which are higher priced. Through "price scissors" the government mobilised a considerable amount of savings for non-agricultural investment[12].

Insufficient agricultural investment may be seen as another way to extract agricultural value. In most of the years since 1949 state budgetary expenditures and investments in agriculture were not equal to the large share of national income contributed by agriculture. Lardly estimated that, during the period of 1953- 1978, total agricultural investment was 598 billion yuan, a sum equivalent to only 12 percent of the total investment (25). Since the mid-1980s, the share of agricultural investment in total investment has even fallen below 10 percent.

After 1980, the "forced savings" mechanism was gradually dismantled at state level. Most agricultural goods were priced at market base. The share of savings from agriculture had declined considerably. Foreign capital became

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12 Bruce L. Reynolds provided a good model to illustrate the mechanism of "price Scissors", though he did not use the term of "price scissors".

an important source for non-agricultural investment. However, owing to the decentralisation of decision- making and increase of regionalism, the expanding local projects have imposed a heavy burden on farmers. The problem of overburdened farmers was so serious that central government issued a series of documents to try to ease the burden for the sake of political stability.

2. 3. 3. Supplying Labour for the Non-agricultural Sector

Since 1960 China has enforced a strict control on rural-urban migration by an elaborate household registration system. This control, combined with an abnormal forced massive urban-rural migration, particularly in the early 1960's and again in the late 1960's until 1977, has curtailed urban population growth. The upshot was a situation which was different from most developing countries. However, even under this circumstance, agriculture still provided a large number of workers for non-agricultural sectors, especially for sectors which are labour-intensive and require no high professional training.

Table 2-6 shows the change in the shares of rural population in total population, of agricultural labour in total labour, and of total labour in total

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See Bruce R. Reynold, China's Economic Policy, 1988, pp 206-212.

population. During the period from 1952 to 1990, the share of rural population in total population and that of agricultural labour in the total work-force revealed consistent declines. This occurred even though the natural growth rate of population in rural areas was greater than that in urban areas mainly on account of a more strict family planning policy for urban residents. The former fell from 87.5 percent in 1952 to 48.2 percent in 1990; the latter from 83.4 percent to 60.16 percent, respectively; whereas the share of total labour in total population had a considerable increase.

This decline can only be explained through the supposition that a large number of rural people became urban residents and the agricultural labour force shifted to non-agricultural sectors during the process of economic growth and urbanisation. If the Chinese government had not strictly controlled rural-urban migration, the shift would have been much greater. The stark point to bear in mind is that the urban sector cannot absorb the immense surplus pool of agricultural labour which has become a serious problem of late.

Table 2-6 Share of Rural Population and Agricultural Labour

items	1952	1960	1970	1980	1985	1990
% of rural popu. in total population.	87.5	80.3	82.6	80.6	63.4	48.3
% of agri. labour in total labour	83.4	65.75	80.77	68.89	62.53	60.16
% of total labour in total population.	36.05	39.09	41.49	42.92	47.48	49.76

Source: W.Hunter Colby et al, Agricultural Statistics of the People's Republic of China, 1949-1990, United States Department of Agriculture, Statistical Bulletin, No. 844, Washington, D.C., 1992.

2. 3. 4. Absorbing Industrial Outputs

The agricultural population accounts for over half of the total population. This huge population itself generates a big market for industrial outputs. Further, during the 1980's, both the purchasing power of peasants and the ratio of purchased commodities of total living expenditures rose sharply. These trends point to exceptionally good prospects for retail sales in rural China despite the fact that the per capita income of rural households remains markedly lower than that of urban residents and that self-produced consumer goods still absorb a big share of the consumption of rural dwellers. In 1987, the total rural retail sales amounted to 335 billion yuan, while the per capita expenditure of rural households was 603.99 yuan. Among the total expenditures, 24.9 percent went to business expenditure, 3.4 percent was spent on purchasing productive fixed assets, and 65.9 percent was dedicated to living expenditure (see Table 2-7). Average per capita income of rural households was 462.55 yuan (compared with 191.33 yuan in 1980). The purchased goods portion of total consumer expenditure accounted for 64.5 percent (compared with 50.4 percent in 1980).

Major industrial goods sold in rural areas include means of agricultural production and basic consumer goods. Durable goods have been steadily increasing their share since the early 1980s.

Table 2-7. Per Capita Total Expenditure Of Rural Households (1987)

Total expenditure	603.99	100.0
household business expenditure	150.59	24.9
tax	8.84	1.5
contribution to collectives according to contract	13.85	2.3
purchasing productive fixed assets	20.52	3.4
living expenditure	398.29	65.9
other non-productive expenditure	----	2.0

Source: The State Statistical Bureau of the People's Republic of China, China Rural Statistics, 1988.

2. 3. 5. A Means of Earning Foreign Exchange

In this respect Chinese agriculture also made considerable contributions to economic development, although its importance as a means of earning foreign exchange has sharply declined in the last decade.

Generally speaking, China's foreign trade was quite conservative before 1980, and especially during the 1960's. The scale of foreign trade was very small in relation to total domestic economic activity. This conservative foreign trade was mainly the result of the autarkic development strategy of the

Maoists, and also in part reflected the large continental nature of China's economy. This conservative foreign trade has been overturned since China opened its economy to the outside and changed its attitude towards foreign trade. Agricultural foreign trade experienced a marked increase, although it did not keep pace with the overall growth of foreign trade. In 1970, for example, agricultural exports accounted for 45 percent of total exports, but in 1985, agricultural exports were only 20 percent of total exports. The share of agricultural imports in total imports underwent an even faster decline. Based on USDA data, the value of total agriculture exports and imports jumped to U.S. $ 6679 million and $ 2644 million in 1986, increases of 291 percent and 192 percent compared with their values in 1975 (Table 2-8).

Before 1980 the aim of agricultural foreign trade was to ensure a net balance in order to finance high priority non-agricultural imports. This explained why there was a net export surplus for most years. Using Surls' calculations for the first half of the 1970s, the agricultural trade surplus financed, on average, about 20 percent of non-agricultural imports (26). However since 1977, except for the period of 1985 to 1989 during which agriculture gained some foreign exchange, the import growth has exceeded export growth, and the agricultural sector has become, and will continue to be in the foreseeable future, a net claimant on scarce foreign exchange. This condition can be attributed to large imports of grains and fertilisers. For instance, the total values of agricultural exports in 1990 and 1992 were U.S.$ 14098.6 million and US.$ 14314.5 million respectively; whereas the values of agricultural imports in 1990 and 1992 were U.S $ 17247.7 million and 18380.7 million respectively. The total balances were -3149.1 and -4066.2 million American dollars respectively (27). The possibility of a sustained increase in exports of major agricultural commodities is very slim.

Table 2-8. Total Value of Agricultural Foreign Trade in China

(unit: million US $)

item	1961	1965	1970	1975	1980	1985	1986	1990	1992
total export	312	770	845	2297	3280	5055	6679	14099	14315
total import	666	782	567	1379	5656	2146	2644	17248	18381
trade balance	-354	-12	278	918	-2376	2909	4035	-3149	-4066

Source: 1990 and 1992 data were from FAO Yearbook, Trade, Vol. 46, 1992; remainder from USDA

There are a number of reasons to account for this. Among them are the relatively low agricultural productivity, large domestic requirement due to the huge population, and rapid improvement of living standards which leave little available for export of most agricultural commodities that are exported, a keen competitive world market, and a relatively low level of grain procurements of the state.

The above elaboration indicated how important agriculture is in the Chinese economy, but it had nothing to say about the geographical pattern of agriculture. The regionalization of agriculture is the task of the next section.

2. 4. Agricultural Regions

The circumstances determining China's agricultural production are the result of the combination of natural conditions, traditional land-use practices, and general economic and technical development levels, with the first element as the chief factor. Different natural conditions shape different agricultural performances. Thus, distinct agricultural regions have developed. There are manifest differences between the east and the west as well as between the north and the south. As described in Chapter 1, China is divided into three natural realms: Eastern monsoon China, Northwest arid China, and the Tibet frigid plateau. These three natural realms differentiate three large agricultural zones: the East monsoon zone, the Northwest continental zone, and the Xizang-Qinghai plateau zone. There are abundant disparities among these three zones in terms of natural conditions, agricultural activities, and development levels. The east monsoon zone has good farming conditions and is dominated by crop cultivation; whereas the Xizang-Qinghai plateau, a sparsely populated area, is generally not suitable for crop cultivation except in some river valleys, and animal husbandry is the main form of agriculture. The Northwest zone is a semi-farming and semi-husbandry area. Its development level is lower than that of the east monsoon zone and higher than that of the Xizang-Qinghai plateau.

Being China's most important agricultural area, the east monsoon zone includes most of the country's cultivated farmland and agricultural population. As a well-developed agricultural area, it provides most of China's grains, cotton and other crucial agricultural products. This zone can be further divided into five agricultural regions: Northeast China; North China; the Middle and lower Changjiang basin; South China; and Southwest China. The Northwest continental zone and the Xizang- Qinghai plateau represent another two agricultural regions (Figure 2-1). These seven agricultural regions reflect different natural conditions, different land-use patterns, and disparity in agricultural activities and development levels. What follows is a brief description of the seven regions.

2. 4. 1. Northeast China

This region is the northernmost area in the eastern part of China and consists of the three provinces of Heilongjiang, Jilin and Liaoning. It covers a total area of 787,900 square kilometres, accounting for 8.21 percent of the total national area; and had a population of 99,333,000 in 1990, or 8.69 percent of the national total. The share of total land is approximately equivalent to its population share. It was called Manchuria until well into the twentieth century, for it was the homeland of the Manchu. Before the twentieth century

Northeast China was little developed. In 1887, this region had only two million ha of farmland, constituting only four percent of China's total farmland at that time. Since then, both farmland and population have dramatically increased. By 1990 the cultivated land amounted to 16.23 million ha, accounting for 16.97 percent of China's total. Soil in this region is dominated by black earths and chernozems which have a high natural fertility and are well suited for cultivation. This region has the best quality land and the second largest acreage of unused arable land. Potentially-reclaimable land is estimated to amount to 10 million hectares. Major crops include spring wheat, maize, sorghum, millet, soybeans, and sugarbeets.

Surrounding the farmland areas of the Northeast plain are the tree-clad mountains: the Da Hinggan ling, the Changbai, and others. These vast mountain forests elevated the Northeast into China's biggest timber base. Forest covers 30 percent of the total land, and the output of timber products accounts for over one-third of the country's total (28).

2. 4. 2. The North China Plain

Located in the north of the eastern part of China, the region includes Hebei, Henan, Shanxi, Shandong, Shaanxi, Beijing and Tianjin. It has a total area of 901,400 square kilometres and a population of 312,230,000 in 1990. Its population share (27.31 percent) is much higher than its share of total area (10.63 percent). This region is endowed with a favourable physical environment and a long history of agricultural civilisation. It was formerly the core region of Chinese agriculture and today still has the largest concentration of cultivated land in China, with a total of 28.46 million ha in 1990, accounting for about 30 percent of the national total. There are only about 2.7 million ha of unused arable land. The potential to enlarge farmland acreage is slim. Although most of the cultivated land has been in use for thousands of years, the farmland is still as productive as ever and, because of careful usage, shows no sign of exhaustion. The cultivation index-the ratio of cultivated land to total land area-is higher than that of any other region of China, reaching over 50 percent (29). The main crops of the region are wheat, maize, cotton, sorghum, and millet, with the first three having the most significance. The production of wheat is 40 percent of the national total, of maize 28 percent, and of cotton 23 percent. This region is also the leading producer of temperate fruits, such as apples, pears, persimmons, and jujuhes (Chinese dates).

This region's dry farmland generally produces three crops in every two years; whereas in irrigated land, the system of two crops per year is popular. Intercropping and inlaid cropping are also commonly practised.

2. 4. 3. The Middle and Lower Changjiang Basin

Lying to the south of the North China plain region and consisting of the six provinces and one municipality of Jiangsu, Anhui, Zhejiang, Jiangxi, Hubei, Hunan, and Shanghai, this region covers 748,000 square kilometres and had a population of 330,364,000 in 1990. Like North China, the population proportion (28.89 percent) is much higher than that of total area (7.80 percent). It has excellent natural conditions and a long history of agricultural development. From the very beginning it has been another centre of Chinese agricultural civilisation.

This is a densely populated area. The per capita farmland is generally less than one mu. In 1990 this region occupied 21.06 percent of national total cultivated land with 20.15 million ha. The plain area, especially in the Han Shui valley and around the Dongting, Boyang, and Tai lakes, is intensively cultivated and irrigated by a well-structured network of canals and rivers. This "watery country" is the most productive grain region as well as the largest commercial grain base in China. By contrast, the hilly land is extensively used and often subject to severe soil erosion (30).

Double cropping is the prevailing farming system. Major crops of the region include rice, winter wheat, maize, cotton, tea, and silkworm cocoons. It produces over half of the country's rice and one-third of the total grain. Of cotton, it produces over 50 percent; of tea, more than two-thirds. Freshwater aquatic products also figure prominently.

2. 4. 4. South China

Embracing Fujian, Guangdong, Guangxi, and Hainan, this region is the southernmost agricultural region of China. It is a tropical and subtropical area with ample water supplies and suitable high temperature. Excluding Taiwan, the area of the region is 569,200 square kilometres, about 5.93 percent of the national total; and the population in 1990 was 141,681,000, accounting for 12.39 percent of the national total. Although its development history is not as long as either North China's or the Changjiang valley's, it developed rapidly after the Opium war. In 1990 there were about 6.8 million ha of farmland, accounting for seven percent of the national total. The pressure of population on land is even greater here than in Central China. In the last decade, loss of farmland resulting from rapid industrialisation and urbanisation has become a keen problem.

Plants grow quite rapidly all year round, giving an evergreen appearance to the vegetation. On the coastal deltas and plains in the east of the region three grain crops per year can be grown, and in some areas even four crops can occur in a year. Rice, sweetpotatoes, sugarcane, and peanuts are the chief crops. The region is also the main producing area for China's tropical and subtropical fruits, such as banana, pineapple, litchi, longan (or dragon eye), orange, and tangerine; and for tropical industrial plants, such as rubber tree, oil palm, coffee, cocoa, etc.(31).

2. 4. 5. Southwest China

This region, composed of Sichuan, Yunnan, and Guizhou, is in the south-western part of eastern China. It is similar to South China, but has lower temperatures, higher elevation and a longer dry season. With a total area of 1,140,000 square kilometres and a total population of 176,582,000 (1990), it accounts for 12 percent of the national total area and 15.44 percent of the national total population.

South of the region lies the Yunnan-Guizhou plateau at an altitude of 1000-2000 m. where agricultural conditions are not very good. Much of the cultivated land is on mountain slopes and is devoted to dryland farming. The cropping index is only 150 percent. "Vertical agriculture", a sustainable pattern of land-use, is a feature of the plateau agriculture. The Sichuan basin is located in the north of the region. It enjoys favourable natural conditions and has had a long history of human development. It is traditionally called "*Tianfu Zhiguo*", which means "the heavenly endowed rich country". However, it faces the severe problem posed by a high population-land ratio.

The region is generally under a double cropping system, with rice, winter wheat, maize, and rape as the major crops. However, rice paddies are dispersed in the mountains and are dependent on rainwater. In winter a large number of the rice paddies are used for the storage of water. This kind of rice paddy is called winter paddy, and it differs from the normal rice paddy in that it is not used to grow a winter crop. It is also called *WangTiantian*, meaning rain-fed field.

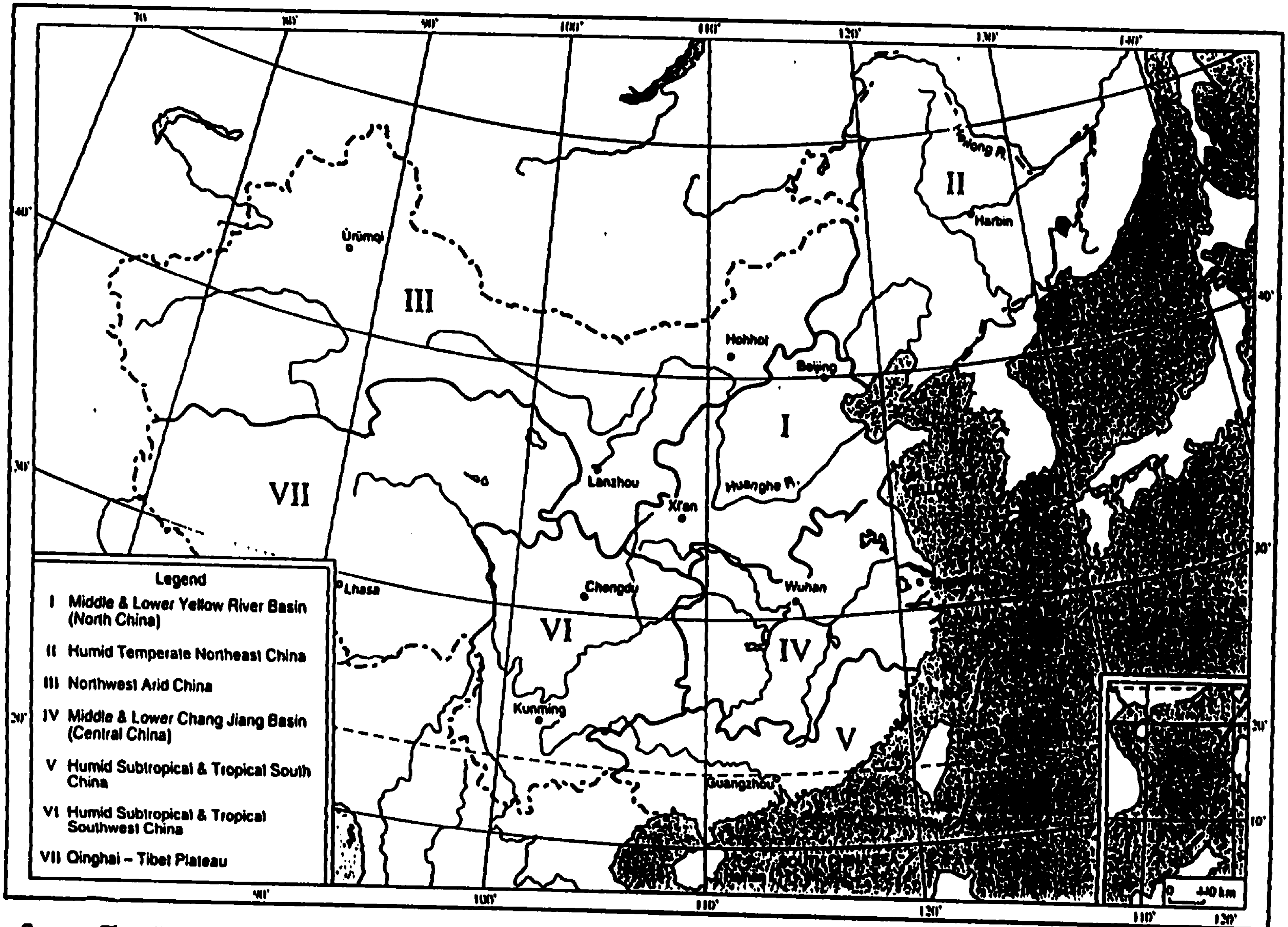
2. 4. 6. Northwest China

This region comprises Inner Mongolia, Gansu, Ningxia, and Xinjiang. It occupies a total area of 3,338,800 square kilometres, accounting for 34.79

percent of the national total. It is the largest of the seven regions. Yet its population ranks it only next to the smallest, with only 63,639,000 people (1990), or only 5.57 percent of the total. It is a vast agricultural region which is sparsely inhabited by ethnic minority peoples whose main agricultural pursuits are animal husbandry on the grassland and crop production in fertile areas supported by irrigation. The vast grassland provides excellent natural pasture land; consequently, animal husbandry is the major agricultural enterprise, and the region is one of China's most important pastoral areas, producing sheep, goats, horses, and cattle.

Because of the dry climate, crop cultivation depends entirely upon irrigation, and farm sizes are determined by the available water resources. After 1949 with the development of irrigation systems and the planting of shelter-tree belts, large-scale reclamation has been conducted. By 1980, farmland in this region totalled 10.8 million ha, accounting for 11 percent of the national total.Yet, cultivated land still occupies only 3.3 percent of the region's stock of land.

Figure 2-1 China's Agricultural Regions



Source: Zhao Songqiao, Geography of China, John Wiley & Sons, Inc., New York. 1994, p78.

There are essentially two farming systems in this region; namely, the irrigated oases farming in the western arid lands and the rain- fed farming in the eastern semiarid area. Under irrigated oases farming at least one crop may be produced per year. In the Tarim Basin and western Hexi Corridor, three crops can be grown in two years. The major crops are wheat, sorghum, maize, and sugar beets. Cotton can also be grown in some oases. As to rain-fed farming, every year can grow one crop, and spring wheat, millet, oats, and Irish potatoes constitute the chief crops. Lack of water resource is the chief constraint for agriculture and desertification is the major environmental problem.

2. 4. 7. The Xizang-Qinghai Plateau

This region consists of Xizang (Tibet) and Qinghai. While, with 1,949,600 square kilometres of total area, it occupies 20 percent of the country's territory, its population was only 6,653,000 (1990), less than one percent of the national total. As the "roof of the world", the Xizang-Qinghai plateau is characterised by high altitude and low temperature. Two-thirds of the region is composed of mountains higher than 4500 metres above sea level where the monthly mean temperature of the hottest month is below 10 C, and there is virtually no frost-free period. A few river valleys in the south and east are below 3000 m, and these comprise the main cropping area.

Though intense solar radiation is a favourable factor for farming, the high altitude and low temperatures serve as major constraints on cultivation, and because of these, most of the region is not suitable for cultivation. Animal husbandry is the main form of agriculture. Major animals are the altitude-tolerant yak, the Tibetan sheep, and the Tibetan goat. Animal products from the region account for 11 percent of the national production, and 29.2 sheep units per year are slaughtered per head of the agricultural population.

Major crops of the region include such cold-resistant crops as highland barley, wheat, peas, potatoes, and rape seeds. Crop cultivation is restricted in the south and southwest river valleys. The Yarlung Zangbo valley dabbled in farming as early as the Tang Dynasty. Since 1957 the cultivated acreage has increased substantially. In 1957 there were only 0.5 million ha of farmland in Qinghai. In 1980 the figure had risen to 0.8 million ha, accounting for 0.8 percent of the national total. In the south-east and east of the region there are a number of forests, which together make up 23 percent of the national timber reserve and the second largest forest area in China (32).

2. 5. Conclusion

In this chapter I recounted the agricultural context germane to this study. Chinese agriculture has a long development history, has undergone complicated institutional change, plays a critical role in the economy and shapes spatial variation in regional well-being. It is the last character that attracts our special attention; for we have only hinted at its importance in this chapter. Yet, before it is possible to pursue a detailed enquiry of the nature of spatial variation in agriculture it is necessary to become acquainted with the appropriate methodology. The next chapter has been set aside for that purpose.

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CHAPTER 3. THE SHIFT-AND-SHARE APPROACH

3. 1. Introduction

In the previous chapter I reviewed the historical development of Chinese agriculture, considering its vital role in the Chinese economy, and the physical regionalization of agricultural regions. This background context was judged vital to facilitate a better understanding of the spatial variations of Chinese agriculture which are the result of the interaction of a number of physical, economic and social factors.

As mentioned at the outset, the main objective of this study is to examine spatial variations in the performance of Chinese agriculture; that is to say, to reveal the regional disparities embodied in Chinese agriculture between the years 1980 and 1990, the critical decade of the reform era. To achieve this object, the shift-and-share approach is selected as the most suitable analytical tool. The shift-and-share technique is recognised as a useful tool of spatial enquiry regardless of context. It quantitatively describes the deviation of a region's performance from the reference area and allocates that deviation between the "structural" and the "regional" factors, factors of great intrinsic interest to economic geographers. To set the scene, this chapter will provide a detailed examination and review of the methodology.

3. 2. The Method Of Shift-And-Share Analysis

3. 2. 1. Evolution of the Method

According to both Dunn and Houston (1.), Daniel Creamer was the pioneer of the technique of shift-and-share analysis. In 1942 Creamer formally originated the shift-and-share analysis method in his article "Shifts of Manufacturing Industries", the fourth chapter of Industrial Location And National Resources, a work undertaken for the U.S. National Planning Resources Planning Board in 1943 (2). However, Creamer" unfortunately did not evolve this tool into a really satisfactory descriptive device and failed to see its analytical possibilities" (3). In the years that followed, the method was creatively applied and further developed by Leser, Fuchs, Dunn, and Perloff (4). These scholars' works established the framework for what has come to be called the classical shift-and-share method. During the 1960s the method was further improved and became a popular tool of regional economic analysis. Nowadays the echnique is fairly well established, although disagreement persists on the algebraic details. In the 1960's and 1970's the technique achieved its greatest popularity. A few prominent examples of its application include those by Ashby, MacKay, Brown, Stillwell, Paris, O'Farrell, Jones and Miller, Randall, Bunce, Martin, and Todd and Brierley (5). Since 1980 application of the technique appears to have lost ground, in part because of its maturity, and partly due to increasing scepticism as to the validity of its conclusions. One notable exception, highlighting the strengths and drawbacks of the technique, is provided by Subramanian (6).

3. 2. 2. Description of the Method

It is an obvious reasoning that if both a region's industrial structure and its economic expansion are in line with that of the reference area containing it, then that region will grow precisely at the same pace as its larger counterpart, the reference area. Should either of these two conditions not be satisfied, the regional economy will grow at a rate different from that of the reference area, and this is often the case. The shift-and-share technique is designed to interpret such variations during a specific period of time by identifying the region's growth factors . It compares one or more local variables with the norms of the reference area. The variables can be any economic and social indicators, such as output, value-added, employment , population, service establishment, and other unit of measurement. For the sake of simplicity, we assume that the reference area is the whole nation, as in most cases we study regional disparities within the national context. Thus the norm of the reference area is the average of the national level. As to regional variables, we shall focus here on employment, by far the most commonly-used indicator, but substitute production data in the actual enquiry of spatial variation in Chinese agriculture.

The shift-and-share method allocates absolute variations in employment among various sources, all established in relative terms. Each source of variation is set relative to a national norm (7). Usually, the first stage in the analysis is to determine the share allocated to individual regions, that is, the regional share.

Regional Share

The regional share is defined as the amount by which total employment in the region would have grown or declined during the period being studied if it grew (or declined) at precisely the same rate as total employment in the nation as a whole (8). This definition implies that the regional share tries to measure the effect of the national growth rate of all industries on regional employment growth, notwithstanding the fact that in most cases the region does not grow at the national growth rate.

For a particular industry i in region j the regional share is:

$$RSij = Eij1\ (En2/En1) - Eij1 \qquad (1)$$

where :

$RSij$ = share of region j for industry i (i= 1,2,...M; j= 1,2,..N).

$Eij1$ = employment in industry i in region j in the base year.

$Eij2$ = end year's employment in industry i in region j.

$En1$ = national employment in all industries at the base year, which is equal to $\sum i \sum j Eij1$.

$En2$ = national employment in all industries at the end year, which is equal to $\sum i \sum j Eij2$.

Equation (1) can be written as:

$$RSij = Eij1(En2/En1-1) = Eij1[(En2-En1)/En1] = Eij1(r..) \qquad (2a)$$

We know that $(En2 - En1) / En1$, namely, r.., is the growth rate of the national employment in all industries during the period studied. It follows, then, that (r..) is an important national norm imposed on the region in shift-and-share analysis.

For all industries in region j, the regional share is :

$$RSj = \sum iEij1(En2 / En1) - \sum iEij1 = \sum iEij1(r..) \qquad (2b)$$

where,

RSj = share of region j

$\Sigma iEij1$ = employment in all industries in region j in the base year

Algebraically, the shift-and-share technique is using the following terms;

Eij = employment in the ith industry in region j.

$\Sigma iEij$ = employment in all industries in region j.

$\Sigma jEij$ = employment in the ith industry in all regions.

$\Sigma i\Sigma jEij$ = employment in all industries in all regions.

The different summations in the computation are shown in Figure 3. 1.

In reality, of course, the individual region's actual change in employment is usually not the same as the national level. This discrepancy necessitates introduction of the shift term. The shift is a composite, containing three elements: total shift, proportionality shift, and differential shift.

Total Shift

The total shift accounts for the rest of the variation occurring during the period under question. It measures the difference between the actual change in employment in a region and the change that would have occurred if it had grown at the aggregate national growth rate. In short, it measures the difference between the actual change and the" supposed change", the regional share. In other words, the total shift "represents a net gain or loss to the region over and above the regional share"(9).

By definition the total shift for a particular industry is:

$$TSij = [Eij2 - Eij1] - [Eij1(En2/En1) - Eij1]$$

$$= Eij2 - Eij1(En2/En1) \qquad (3a)$$

where,

TSij = total shift of region j for industry i.

For all industries in region j the total shift is defined as:

$$TSj = \sum iEij2 - [\sum iEij1(En2/En1)] \qquad (3b)$$

where,

TSj = total shift of region j for all industries.

$\sum iEij2$ = employment in all industries in region j at the end year.

From equation 3, two points of implication may be drawn. On the one hand, if the regional growth rate is equal to the national rate of growth, the regional share would fully account for the growth (decline) in employment during the period under study. On the other hand, the total shift accounts fully for total variation when the national growth rate (but not the regional growth rate) is equal to zero.

One of the features of the shift-and-share analysis is further to divide the total shift into two components, the proportionality shift and the differential shift. It is this feature that grants the shift-and-share technique a spatial flavour.

Proportionality Shift

The proportionality shift, which is also called "industrial mix effect" or "structural component", may be thought of as the extra amount by which employment in the region has grown (or declined) as a result of the region specialising in nationally fast-growing industries (the positive case) or slow-growing and declining industries (negative case).

For a particular industry the proportionality shift is defined as:

$$PSij = Eij1\ [(\sum jEij2 / \sum jEij1) - (En2/En1)] \qquad (4)$$

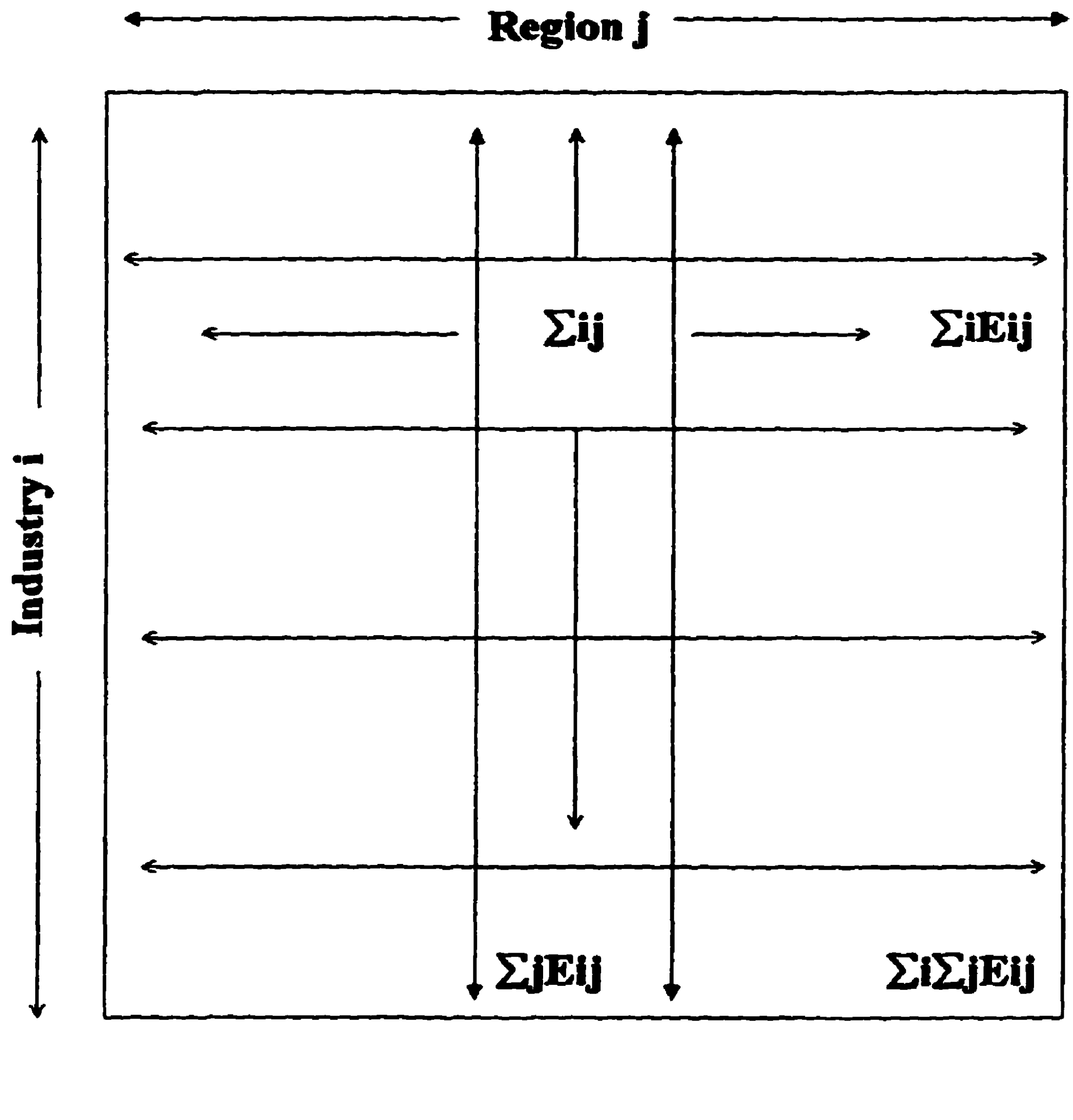
where,

PSij = proportionality shift of region j for industry i,

$\sum$jEij1 = national employment in industry i at the base year,

$\sum$jEij2 = national employment in industry i at the end year.

Figure 3. 1. The Range of Summation



Based on Stiwell, F.J.B. Regional Growth and Structural Adaptation, <u>Urban Studies</u>, Vol.6, 1969, p.164.

Equation (4) can be written as:

$$PSij = Eij1\ [(\Sigma jEij2 / \Sigma jEij1 - 1) - (En2 / En1 - 1)]$$

$$= Eij1\ [\{(\Sigma jEij2 - \Sigma jEij1) / \Sigma jEij1\} - \{(En2 - En1)/En1\}]$$

$$= Eij1\ (ri. - r..) \qquad (5a)$$

with (ri.), standing for (3jEij2 - 3jEij1) /3jEij1. The national growth rate of industry i, ri., is the second important national norm imposed on the region for shift analysis.

For all industries in the region the proportionality shift is defined as:

$$PSj = \Sigma iEij1[(ri. - r..)] \qquad (5b)$$

where,

PSj = proportionality shift or structural component of region j.

Equation 5 indicates clearly that the proportionality shift will be positive if a region has above average proportions of employment in industries with rapid growth rates at the national level, that is, ri. is greater than r..; whereas it will be negative in the case where a region specialises in nationally static or declining industries, that is, ri. is smaller than r... In other words, the proportionality shift indicates the employment change in region j that has occurred because region j had a higher proportion of industry i which had a rate of growth in the nation different from the rate of growth of all industries of the nation. The outcome of a positive proportionality shift means that the region will grow faster than the rest of the nation, while the occurrence of a negative outcome indicates that the region will grow slower than other regions.

Differential Shift

The differential shift, also known as the "differential growth" or the "regional component", is the amount by which employment in region j would vary if its industries grew at a different rate from their national corresponding norm.

For a particular industry the differential shift is defined as,

$$DSij = Eij1[(Eij2 / Eij1) - (\sum jEij2 / \sum jEij1)] \qquad (6)$$

where,

DSij = differential shift of region j for industry i.

Equation (6) can be written as,

$$DSij = Eij1[\{(Eij2 - Eij1) / Eij1\} - \{(\sum jEij2 - \sum jEij1) / \sum jEij1\}]$$

$$= Eij1(rij - ri.) \qquad (7a)$$

with (rij), standing for (Eij2 - Eij1) / Eij1. The rate of growth of industry i in region j during the period under study, rij, is an important regional parameter for shift-and-share analysis.

For all industries the differential shift is defined as,

$$DSj = \sum iEij\ (rij - ri.) \qquad (7b)$$

From equation (7) we can see that the differential shift can be positive, negative or zero, as is the case with the proportionality shift. If industry i of region j grows faster than the national growth rate of industry i, namely, (rij) is greater than (ri.), the differential shift will be positive for region j. On the contrary, if industry i of region j grows slower than its national counterpart, namely, (rij) is smaller than (ri.), the differential shift will be negative. If the growth rate of industry i of region j is the same as its national corresponding growth rate, namely (rij) = (ri.), the differential shift will be zero.

The total shift (TS) is the sum of the proportionality shift (PS) and the differential shift (DS); namely,

$$TS = PS + DS \tag{8}$$

$$\begin{aligned} PSij+DSij &= Eij1(ri. - r..) + Eij1(rij - ri.) \\ &= Eij1(rij) - Eij1(r..) \\ &= Eij1[(Eij2 - Eij1) / Eij1] - Eij1[(En2-En1) / En1] \\ &= (Eij2 - Eij1) - [Eij1(En2 / En1) - Eij1] \\ &= TSij \end{aligned}$$

The absolute change of employment for industry i in region j during a particular period can be obtained by summing RSij, PSij and DSij,

$$Eij2 - Eij1 = Eij1(r..) + Eij1(ri.- r..) + Eij1(rij-ri.) \tag{9a}$$

The left side can also be written as,

$$Eij2-Eij1 = Eij1\{(Eij2 - Eij1) / Eij1\} = Eij1(rij),$$

thus we get

$$Eij1(rij) = Eij1(r..) + Eij1(ri.-r..) + (Eij1(rij-ri.) \qquad (9b)$$

For all industries in region j the absolute change in employment during the period can be found by summing with respect to i:

$$\Sigma i[Eij1(rij)] = \Sigma i[Eij1(r..)] + \Sigma i[Eij1(ri.- r..)] + \Sigma i[Eij1(rij-ri.)] \qquad (9c)$$

Equation (9) is the classical formula in shift-and-share analysis.

The aggregate rate of growth of region j , signified as (r.j), during the period under question is usually not equal to the national growth rate of all industries. The two national norms, (ri.) and (r..) provide a means to describe mathematically how (r.j)... (r..). In this approach, there are two sources of any discrepancy between (r.j) and (r..):

1. region j had an industrial structure different from that of the nation, so that even if (rij) = (ri.) prevailed in all of its industries, differences between Eij(ri.) and Eij(r..) would not add up to zero when all the industries were considered; and
2. some or all of the industries in region j did not grow in the region at the national rates, i.e., $(rij) \neq (ri.)$.

In other words, through these norms, the formula stipulates the mathematical conditions that must be fulfilled to have (10).

$$(r.j) = (r..)$$

If we move RS in equation (9) to the left side, we can determine whether the region performed like the rest of the country. The difference here is called "net relative change". It is actually the total shift we defined before. The relative change, as indicated by equation (8), is allocated to the industrial composition of the region (proportionality shift effect) , which measures the effect of whether industry i was a slow-growth or a fast-growth industry (this can be defined in terms of employment performance, i.e., whether (ri.) is greater or smaller than (r..), and the effect of regional conditions(differential shift effect). The latter establishes whether industry i performed better or less well in region j than elsewhere in the country. We then have:

$$Eij1(rij-r..) = Eij1(ri.-r..) + Eij1(rij-ri.) \qquad (10a)$$ [13]

and

$$\Sigma i[(Eij1)(rij) - (Eij1)(r..)] = \Sigma i[Eij1(ri.- r..)] + \Sigma i[Eij1(rij-ri.)] \qquad (10b)$$

[13]. This conclusion can be deduced directly from equation 3:

$$\begin{aligned} TSij &= Eij2 - Eij1(En2/En1) = Eij1(Eij2/Eij1 - En2/En1) \\ &= Eij1[\{(Eij2 - Eij1)/Eij1\} - \{(En2 - En1)/En1\}] \\ &= Eij1(rij - r..) \end{aligned}$$

The left-hand side of the equation represents the net relative change (total shift), and the right-hand side corresponds to the variation allocated to industrial composition and to regional conditions.

3. 3. Limitations And Refinement Of The Method

Since its emergence the shift-and-share method has been continuously criticised by scholars for its technical limitations and theoretical disadvantages. Partly this results from research workers being too ready to draw direct policy implications from their quantitative analysis or to equate shift-share with a theory of regional growth. Partly it is due to the serious limitations of the method resulting from its simplicity. Houston even argued that " for both theoretical and empirical reasons it is, frankly, suspect" (11). Yet his objection was countered by many other scholars, such as Ashby and Stilwell (12). In the following discussion, I shall focus on the major limitations of the method and consider the refinements brought forward to overcome these limitations.

3. 3. 1. Technical Limitations

There are three major technical limitations of the shift-share technique; namely, the industrial mix bias, the aggregation bias and the interpenetration bias.

Industrial Mix Bias.

The technique takes no account of changes in the industrial structure in the regions under study during the period under observation. The proportionality shift indicates the gains or losses due to the region specialising in those industries which grew at above or below the corresponding national norm from the point of view of the industrial structure at the beginning of the period. It takes no account of the industrial structure at the end of the period. This is an important defect of the method, because the industrial structure of a region will change during the growth process. A region which had a high proportion of the slow-growing industry may have gradually reduced the proportion of slow-growing industry and acquired a bigger proportion of fast-growing industry at the end of the period. The longer the time period, the bigger the change. Thus the classical shift-share method cannot indicate the impact on regional employment growth of structural modification of industries during the period.

Stillwell (13) provides a remedy for this defect. The key point is to measure the expected shift resulting from the region's industrial structure at the end of the period by reversing the proportionality shift. The reversed proportionality shift (RPS) is defined as:

$$RPS = \sum iEij2[(En1 / En2) - (\sum jEij1 / \sum jEij2)] \qquad (11)$$

The reversed proportionality shift shows the net shift in employment one would have expected in view of the region's final industrial mix. Subtracting proportionality modification shift which indicates the net shift resulting from the difference in initial and final industrial structure. By definition the proportionality modification shift (PMS) is written as:

$$PMS = RPS - PS$$

$$= \sum iEij2[(En1/En2) - (\sum jEij1/\sum jEij2)]$$

$$- \sum iEij1[(\sum jEij2/\sum jEij1) - En2/En1)] \qquad (12)$$

A positive PMS indicates that the region has modified its industrial structure and become more specialised in nationally fast-growing industries. Conversely, a negative PMS shows that the region is tending to specialise in nationally slow-growing industries.

If there is no change of industrial structure during the whole period one may naturally suppose that the PMS will be equal to zero. But Subramanian demonstrated by an empirical example that PMS does not equal zero when there is no change in industrial structure (14). This means that even when there is no change in industrial structure during the period, the result will lead us to believe that the region experienced a structural change. This problem can be simply solved by just one more small step; namely, to compare the initial industrial structure with the final industrial structure to assess whether it changed.

Aggregation Problem

It has been found that the results of the structural shift and the regional shift are not invariant with the level of disaggregation used, whether by sectoral breakdown or spatial boundaries, notwithstanding the fact that the total shift will remain constant. The relative results vary in a nonmonotonic manner according to the level of disaggregation. This means that:

1). with disaggregation, the behaviour of the two components is completely unforeseeable and therefore a mathematical correction of the defect is impossible; and

2). the interpretation of the results arrived at through this method is entirely at the mercy of the level of disaggregation used: different results, and therefore different interpretations, may be arrived at for the same region.

Ashby pointed out that this variation in the results is" shared in principle by any technique which is not indifferent to changes in information" (15). However, the question remains: which level of disaggregation is the most appropriate to use with this technique?. The answer is not the "finer the better". The largest degree of disaggregation, tending towards the equating of firms with industry, tends to reduce the differential component to zero in all cases. On the other hand, when employment is completely aggregated into one sector, the whole net relative change is accounted for strictly by the regional component.

There are several criteria available to classify industries. The determination of the appropriate level of aggregation depends on study purposes and personal experience. "What is appropriate depends more upon the secondary use which is to be made of the shift-share analysis" (16), rather than the nicety of the mathematical analysis.

Interpenetration Problem

This problem is as serious for the analysis as the aggregation bias. This problem essentially consists of the difficulty of distinguishing the industrial mix effect from the regional component. In fact it is very difficult to separate the economic aspects represented by the two components. The two components interact with each other as a matter of course. On the one hand, the industrial structure is partially the product of regional conditions. On the other hand, the industrial structure influences the quality of the local conditions.

From equation (7a): DSij = Eij1(rij - ri.), we can see that the regional component is influenced not only by the differential growth of industry i of region j relative to the national rate of that particular industry, that is (rij) to (ri.), but also by the specialisation of industry i on the total employment of region j, that is Eij.

Estaban-Marquillas illustrated this bias by a simple reasoning (17): Suppose, he said, there were two regions, a and b, with the same amount of regional employment (E.a = E.b) and the same rate of growth in industry i (ria = rib, and consequently ria - ri. = rib - ri.), then their respective regional components [Eia(ria-ri.)] and [Eib(rib-ri.)], will be different if (Eia $\neq$ Eib), or if their industrial structure is different. In attempting to reduce the effect of this bias, he introduced the "allocation effect" into the general formula. The "allocation effect" (AE) is defined as:

$$
\begin{aligned}
AE &= Eij1(rij - ri.) - Eij'1(rij - ri.) \\
&= (Eij1 - Eij'1)(rij - ri.) \qquad (13)
\end{aligned}
$$

where,

Eij'1 = homothetic employment of industry i of region j which corresponds to $\sum iEij1(\sum jEij1/En1)$.

And consequently the total variation is defined as:

$$Eij2 - Eij1 = Eij1(r..) + Eij1(ri. - r..) + Eij'1(rij - ri.) + (Eij1-Eij'1)(rij - ri.) \qquad (14)$$

The "homothetic" employment, Eij'1, is the employment that industry i of region j would have if the proportion of regional employment in industry i were the same as the proportion of national employment in industry i or if the structure of the employment in region j were equal to the national employment. The use of homothetic employment goes some way towards removing the bias which arises as a consequence of the technique allowing for the structural difference at the beginning of the period under study, but does nothing to correct the bias that occurs from the effects of structural changes that are under way

Eij'1(rij - ri.) is the redefined differential shift of industry i of region j which is called by Martin the "corrected regional component" (18). However, Martin proved that to associate rij with Eij1 constitutes a mathematical incongruity which fails to lead to any possible economic interpretation (19). Subramanian provided a detailed mathematical proof for this argument based on Martin's work. (20). Martin provided a solution to the problem of interpenetration in the two components by separating the historical factors from the " current" factors with the use of the homothetic growth (rij') along with the homothetic employment(Eij'). The industrial structure of a region (Eij1 / E.j1), as well as its performance during the period under study (rij), are the result of two groups of factors: the historical factors and the "current" factors. Therefore, it is necessary to distinguish the effects of the two factors. The influence of the industrial factors on the magnitude of the differential shift can be removed by using Eij'. The use of rij' along with Eij' can reduce the indirect effect of the industrial structure on the performance during the current period. These refinements much improved the technique.

The homothetic growth rate is defined as follows:

$$rij' = [(r.j + 1) (ri. + 1) / (r.. + 1)] - 1 \quad (15)$$

Consequently, the redefined differential shift is as follows:

$$DS = Eij'1(rij' - ri.) \quad (16)$$

The difference between classical differential shift in equation (7a) and the redefined differential shift in equation (16) denotes the influence of historical factors on the regional component. That can be defined as:

$$Eij1(rij - ri.) - Eij'1(rij' - ri.) \quad (17)$$

The homothetic elements can also help to separate the historical industrial structure from the current industrial structure and its effects on the proportionality shift. The corrected current proportionality shift is defined as:

$$Eij'1(ri. - r..) \quad (18)$$

Correspondingly, the difference between the proportionality shift and the corrected proportionality shift denotes the influence of current industrial structure on the magnitude of the proportionality shift. That is:

$$Eij1(ri. - r..) - Eij'1(ri. - r..) \qquad (19)$$

It is worth noting that at the aggregate level of all industries of the region, the sum of Eij'1(ri.-r..), is equal to zero (21).

The new formula of "current" net relative change based on the definition of homothetic elements may therefore be defined as:

$$Eij'1(rij' - r..) = Eij'1(rij' - ri.) + Eij'1(ri. - r..) \qquad (20)$$

The right-hand side of the equation embodies the corrected structural and regional components.

The difference between the total net relative change obtained by the general formula, equation (10a), and the "current" net relative change generates the net relative change which is due to factors of a historical nature. The difference is as follows:

$$Eij1(rij-r..) - Eij'1(rij' - r..) = [Eij1(rij - ri.) - Eij'1(rij' - ri.)] + [(Eij1-Eij'1)(ri.-r..)] \qquad (21)$$

At the aggregate level, the historical total shift become zero. That is,

$$\sum Eij1(rij - r..) - \sum Eij'1(rij' - r..) = 0$$

Equation (21) is the redefined shift-share technique which has been used by Martin and Subramanian to study the regional variations of Canadian economy (22).

3. 3. 2. Theoretical Disadvantages

Besides the above-mentioned technical shortcomings, shift-and-share analysis also has some theoretical disadvantages. In what follows, I shall furnish a brief description of the major shortcomings.

Problem Concerning the Assessment of the Change of Industrial Structure

The shift-and-share method does not indicate whether a region has improved its industrial structure in absolute terms. It only shows whether the region has improved its mix relative to the nation.

The shift-share technique implies that the nation as a whole will always" have improved its industrial mix"; i.e., at the end of the period it will have a higher proportion of industries which have grown rapidly during the period (23). However, to say all changes of industrial structure constitute an improvement is open to question. It is highly questionable to make such an assumption. The structural change of the national economy during a given period is not always desirable. For example, the fast growth of chemical industry may not be a good signal from the standpoint of the environment, imposing pollution costs as "externalities" on other industries.. Therefore, the relative "gain" of the region under study during the period may be illusory.

Furthermore the norms of the shift-and-share analysis do not necessarily connote ideals or objectives. A region may accrue more benefits from specialising in nationally static industries for which it has a comparative advantage than by attempting the encouragement of national growth industries in which it is less well suited. Hence, the trend of the region increasing its specialisation in nationally slow-growing or declining industries, which is indicated by the negative proportionality modification shift, does not necessarily imply a bleak future in terms of the growth of the region. In other words, it is perfectly reasonable to envisage the "best" performance for a region being one which does not resemble the national structure and whose industries have a different growth rate, i.e. (rij) is not equal to (ri.), and which specialises in nationally slow-growing industries.

The Uncertainty of the Results

This problem is the result of the disaggregation bias. Owing to the lack of common criteria to determine the appropriate level of aggregation, the results of the regional and structural component cannot be divorced from the researcher's personal bias. Therefore, different people may draw different lessons from the same raw database using the same shift-share method, and this difference is not based on the different interpretations given to the same output data, which is quite common for studies in social sciences, but arises on account of the difference in output data due to arbitrary aggregation.

The Absence of Intersectoral and Interregional Relationships

The pattern of regional change may be greatly influenced by the performance of one or two leading sectors of the economy because of regional linkages and a corresponding regional multiplier effect. Yet shift-and-share analysis treats each industry with identical weights and measures only the direct effects of the economic structure of the region. It is incapable of identifying the indirect impact of the industrial structure on the performance of the industries of the region, and it ignores the effects of intersectoral and interregional relationships. Therefore, the role of local propulsive industries or "key" firms is not directly perceived. Similarly, intermediate market connections with firms outside the region are unknown, although they may play a key role in the performance of the firms of the region (24).

The Problems Related to the Type of Data

There are some problems related to the type of data used by shift-and-share analysis; for example, the employment data which are traditionally and most frequently used in shift-and-share analysis. Measuring regional disparities in terms of employment performance leads to one deficiency; i.e., the fact that variations in productivity between regions and industries, etc., are not explicitly taken into consideration. The employment performances are not necessarily equivalent to output performances. For instance, a high rate of growth in a particular industry might be the result of low productivity, so that a "good" employment performance is not necessarily a "good" performance in terms of output (25).

With these technical provisos in mind, it is now opportune to review the application of the technique.

3. 4. Application Of Shift-and-Share Technique In Regional Analysis

The shift-and-share technique is a useful instrument in regional analysis provided that its limits are expressly recognised. Though it has very little contribution to make to the theory of regional growth, it can be used both as a descriptive device for analysing historical data and as a predictive tool for projecting regional growth.

3. 4. 1. Shift-Share As a Descriptive Device

Conceptually, it is possible to apply the shift-and-share approach to any variable for which we have a matrix of information by region and sector for two separate points in time (26). Employment, output, value-added, population, personal income and even productivity, are all susceptible to analysis. For example, given data on average income by occupation, one could use the shift-and-share technique to measure the apparent contribution of occupational structure to changes in the level of per capita incomes in different regions. Wilkinson and Rainnie (27) proposed to extend the method so as to measure how closely changes in the regional distribution of earnings or unemployment are associated with regional difference in industrial structure. Stilwell (28) discussed in detail the application of variables in terms of (a) employment and (b) population. There are numerous possibilities for the application of the shift-and-share approach. The only limitation is the availability of data on economic or socio-economic variables which take different values in different regions and in different sectors.

The basic procedure and methodology in using shift-and-share as a descriptive device has been mentioned in sections 2 and 3 of this chapter. It is worth noting that the distinction between the composition and differential components of a variable during a given period of time can be made either in terms of a sector-by-sector approach, which indicates the sectoral performance in a given region or set of regions, or in terms of a region-by-region approach, which indicates the regional performance in a given sector. Utilisation of either approach can facilitate "a delightful wedding of the horizontal and vertical dimensions of regional analysis"(29), and, therefore, serve to obtain a comprehensive and better understanding of the performance of the variable in the study area.

There are many cases of the application of the shift-and-share technique as a descriptive device to study the historical trend of a given variable. Martin (30) provided a good example. He studied the regional performance of Canadian industries in terms of employment during the period of 1961-1970. By using the modified shift-and-share approach which has been introduced above, major factors shaping regional disparities in industries, factors including industrial structure, role of historical specialisation in the performance of the region, modification of the industrial structure during the period under study, and the regional conditions, are analysed in an 82-industries breakdown for all five Canadian regions; that is to say, the Atlantic, Quebec, Ontario, the Prairies and British Columbia.

3. 4. 2. Shift-and-Share As A Predicative Tool

There are different ways to use the shift-and-share approach in projecting regional growth. One simple way is to use it together with another simple projection method called the constant-share approach to employ information about the past in order to project the future based on the assumption that the region's growth is closely related to the growth of the nation. This approach derives local projections from projections for the nation and from historical data relating past growth trends for the two regions (31). I shall provide a brief description of the methods in projecting the regional growth of the economic variables, herein still taken to be employment indicators.

Constant-Share Approach

This approach assumes that the local share of the employment of the reference area, say the whole nation, remains constant during the period of the projection; that is, it is assumed that:

$$Eij/Ei. = \text{constant for all time} \tag{22}$$

If equation (22) is true, it must also be true that

$$Eij2 = (1 + ri.t)Eij1 \tag{23}$$

where,

Eij1 = employment in region j in industry i in base year 1

Eij2 = projected employment in region j in industry i in end year 2

ri.t = projected growth rate for industry i in the nation for time period 1 to 2; namely, the national growth rate in industry i during the period of projection.

The constant-share technique itself cannot generate the required ri.t. One can simply assume the continuation of past trends in which the national growth rate for the next m years would be exactly the same as in the last m years. Of course, this is a very crude estimate. Another superior short cut is to resort to forecasts already made by other methods, such as input-output and other approaches.

Shift-Share Approach: Constant Shift

The basic assumption in the constant-share projection approach that the local economy will maintain a constant share of the national employment is rarely correct. In most cases the local employment grows at a rate different from that of the nation. Thus by introducing the shift term, the shift-and-share approach modifies the constant-share projection formula in order to account for differences between local and national growth rates that cause an industry's employment to shift into or out of a region:

$$Eij2 = [1+ri.t + (rijt - ri.t)]\,Eij1 \qquad (24)$$

where,

rijt = projected growth rate in region j for industry i for the period 1 to 2,

rijt-ri.t is the differential shift in growth rate of region j in industry i.

Here the ri.t is identical to the constant-share formula, equation (23). To obtain rijt-ri.t, it is assumed that the differential shift of the growth rate will remain constant; that is, (rijt-ri.t) for the next m years is equal to (rij-ri.) for the past m years for which local and national employment data are available. Thus this technique is commonly called the constant-shift method[14]. The constant shift term (rijt-ri.t) adjusts the constant-share growth rate by the observed difference between the local and national growth rates. If the local employment grew faster than that of the whole nation in the past, the shift term is positive, inflating the combined growth rate and the projected employment. If the local employment grew more slowly than that of the whole nation, the shift term is negative, reducing the combined growth rate and the projected employment (32).

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[14] If we argue that the differential shift is not constant, which is more theoretically justified, then, we have the projected-shift method. But to estimate the change of differential shift is more difficult. There are some models for the projected-shift method. See Donald A. Krueckeberg and Arthur L. Silvers, Urban Planning Analysis: Method and Models, John Wiley & Sons, Inc, 1974,pp418-424. I shall not discuss them because they are not germane to the thrust of my work.

Neither set of projections can be accepted without a careful evaluation of the study area. In some situations, the constant-share projections may be more appropriate; in others, the shift-share projections may be preferred. In many situations, the constant-share projections may be appropriate for some industries and the shift-share projections appropriate for others.

What is presented here is the "classic" shift-and-share projection model. It is based on the precedents set by Greenherg; Emmerson, Ramanathan, and Ramm; Zimmerman; Hellman; and Stevens and Moore (33).

Although there are some limitations in the use of the shift-share technique as a predictive tool, like the constant-share approach, it is still a useful method because it is conceptually and computationally straightforward, requiring nothing more than easily accessible data, and providing fast and reasonably accurate projections. Theoretically more appealing techniques such as regional input-output and econometric forecasting models are difficult to understand, much harder to implement, and generally require data that are difficult or even impossible to obtain.

3. 5. Summary And Conclusion

Shift-and-share analysis is a simple standardisation technique which has been widely used in the analysis of regional growth.

There are three important norms in shift-and-share analysis: the national growth rate of all sectors (r..), the national growth rate of one particular sector (ri.), and the regional growth rate of the sector (rij). With these norms the shift-and-share approach measures and determines the nature of the variations in the regional variables under study by dividing the variable into three components: the regional share component, the proportionality shift (or industrial structure) component and the differential shift (or regional) component. The separation of the variations helps us to understand the different performance in different regions, and hence the regional disparities. Although the shift-and-share approach cannot answer the question of why variations happened in the first place, it provides a good base for further analysis.

The method, in short, is a straightforward, inexpensive, and easy-to-use technique in regional analysis.

The method itself is not a theory of regional growth, but serves as both a descriptive device and a predictive tool. As a descriptive device it provides a base for further analysis by condensing large amounts of information. In a long-term programme of regional studies, it is important in the inventory phase.

To use shift-and-share in forecasting regional growth requires two steps: forecasting the structural component (to project the national growth rate of each sector), and forecasting the differential component (by assuming that the shift is either constant or nonconstant). Stilwell pointed out that when " used in conjunction with regression analysis, it is capable of providing a more operational procedure than regression analysis alone (34). However, in general, the shift-and-share method is not a good forecasting device.

There are some limitations to the shift-and-share approach. The results are not the same at different disaggregation levels and the change is in a nonmonotonic trend. There is likely to be no quick solution to this bias.

Another major limitation is the interpenetration of components which means that the effects of the regional component in two regions are disturbed by the different industrial composition. This bias can be overcome by introducing the conception of homothetic industrial structure.

In spite of the limitations, the shift-and-share approach is not just "a harmless pastime for small boys with calculators" (35), but a useful method in regional analysis. Many of its criticisms are based on a misunderstanding of its purpose and arose out of its erroneous application as a forecasting device. It is especially useful as an inventory instrument in studying regional disparities. The following chapter will demonstrate how it can be used in studying agricultural performance.

End Notes:

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CHAPTER 4. REGIONAL VARIATIONS IN AGRICULTURE AND THE CHANGES ACTING UPON THEM

In the preceding chapter, I presented a detailed outline of the shift-and-share approach. Accordingly, this chapter is intended to apply that methodology for the purpose of examining the spatial variations in Chinese agriculture that occurred during the 1980's, a critical era of Chinese reform and development.

4. 1. Introduction

Rather than examine all facets of Chinese agriculture and the changes underway in them—a huge, scarcely manageable task—this chapter will be selective, choosing representative patterns. In so doing, an appreciation of fundamental changes will be forthcoming, but that appreciation will not be obscured by overwhelming "noise in the system".

4. 1. 1. Indicator Selection

The focus of attention will be placed on cropping and animal husbandry because these two constitute the major activities of agriculture. They outstrip forestry, sideline activities, and fisheries as the principal contributors to agricultural output[15]. From these larger categories two production indicators are selected as benchmarks to reflect the regional variation incidental to Chinese agriculture. The first one is grain production, a chief representative of crop production; the second constitutes meat production, a measure standing for the livestock sector[16]. Both grain and meat are the most important and essential products of Chinese agriculture, besides being vital ingredients of the whole Chinese economy. Their production is critical for China's food security. Grain production can be subdivided into a range of production systems, as follows.

Total grain production:

rice production;

wheat production;

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[15] For example, in 1989, the output of cropping alone amounted for 56.2 percent of the total output of agriculture. The output of animal husband accounted for 27.5 percent. The total of the other three sectors, forestry, sideline, and fishing, took up only 16.3 percent of the total output of agriculture.

[16] There are many indicators that may be chosen for this kind of study. Production index, chosen here, is selected for three reasons: data completeness; general acceptability; and ease of use.

corn production;

soybean production;

sorghum production;

millet production;

other grains production.

Similarly, livestock meat production includes the following major kinds of meats:

pork production;

beef production;

mutton production.

Having stipulated the prime indicators, the next stage is to access data relevant to them.

4. 1. 2. Data Sources

The primary source of data is a statistical bulletin, *Agricultural Statistics of the People's Republic of China, 1949-90*, edited by W. Colby and others, and published by the U.S. Department of Agriculture (USDA) (1).

This bulletin is a relatively complete and reliable database for Chinese agriculture. It uses statistics from a wide variety of sources, primarily Chinese-language sources, from the People's Republic of China (PRC) and is restricted to official data; that is to say, data judged authentic by "people in the know". These data must be compiled in a fashion relevant to regional analysis, a topic to which we now turn.

4. 1. 3. Regional Breakdown

There are two levels of regional breakdown used in this study. The first round, the main concern of the shift-and-share analysis, refers to macro-level regions; that is , those which are basically in accordance with the physical regionalization of agriculture as described in Chapter 2. However, one proviso is in order. On account of the extremely weak economies of Qinghai and Xizang (Tibet), the Qinghai-Xizang region is not comparable as an individual economic region to other agricultural regions. Thus, it is necessary to alter the agricultural regionalization to the extent of putting Qinghai into the Northwest big region and Xizang into the Southwest big region. Consequently, what we get is six agricultural regions; namely, the Northeast, North, Northwest, East & Central, South, and Southwest(Table 4-1). The analysis of regional variation is based on this breakdown.

The second-round regionalization reverts to a provincial-level breakdown, one which is composed of the 31 provincial-level administrative units of mainland China. These are assembled from 22 provinces, five autonomous regions, and four central municipalities (Table 4-1)[17]. While analysis will not neglect this level, most of the inferences will be drawn from the results observed with respect to the big regions.

4. 1. 4. Mathematical Equation

The method of shift-and-share involves quite a few mathematical equations, as discussed in Chapter 3. In order to best serve my purposes of study, "equation (21)" described in the previous Chapter is selected to compute the various shifts, that is

Oij1(rij-r..) - Oij'1(rij' - r..) = [Oij1(rij - ri.) - Oij'1(rij' - ri.)]

[17] Chongqing, formerly a part of Sichuan province, was promoted to the status of central municipality on March 15, 1997, which brings the number of provincial administrative units of mainland China to 31. Due to a lack of data for Chongqing, in this chapter, I still treat Chongqing as a part of Sichuan.

$+ [(Oij1-Oij'1)(ri.-r..)]$

The only difference between the empirical equation and the one presented in Chapter 3 occurs regarding "O". "O" now stands for output value of grain production and meat production, respectively, not employment numbers as used in the original equation (2).

Selection of such an equation for shift-and-share analysis is mainly based on the following considerations.

First, this equation is a complete formula. It contains both the proportionality and differential shifts and to compute them requires the application of the relevant formulas. In other words, this equation covers all basic classical formulas in shift-and-share analysis.

Second, by introducing the "homothetic" term, it is a modified formula which divides total shift into current shift and historical shift. By doing so, the bias of the structural factor is greatly reduced. Therefore, this redefined equation provides a better means for evaluating the agricultural performance on a regional basis.

Preparatory to undertaking the empirical shift-and-share analysis, it is advisable to arrange the data in a manner which allows basic regional patterns to be discerned. That requires a discourse on agricultural specialisation, the object of the next section.

Table 4-1 Agricultural Regions Of China

Regions	Province, Autonomous Region, and Central Municipality	
Northeast	Heilongjiang, Liaoning, Jilin	(3)
North	Shandong, Hebei, Beijing, Tianjin, Henan, Shanxi	(6)
Northwest	Shaanxi, Gansu, Nei Monggol, Ningxia, Xinjiang, Qinghai	(6)
East & Central	Zhejiang, Jiangsu, Shanghai, Anhui, Hubei, Hunan, Jiangxi	(7)
South	Guangdong, Guangxi, Fujian, Hainan	(4)
Southwest	Sichuan, Chongqing, Guizhou, Yunnan, Xizang	(5)

Note: 1. Beijing, Tianjin, Shanghai, and Chongqing are the four Central Municipalities directly under the State Council. They have provincial-level administration power.

2 Nei Monggol, Xinjiang, Ningxia, Guangxi, and Xizang are the five provincial-level autonomous regions.

4. 2. Regional Specialisation Of Agricultural Production

4. 2. 1. Location Quotient

Before undergoing shift-and-share analysis of agricultural production, it is informative to look at the degree of agricultural production specialisation practised by each region. By establishing each region's relative specialisation at the outset, we can hope to acquire a better understanding of the spatial variation in agricultural production as it is manifested across the entire nation.

The location quotients method is selected to reveal the areal specialisation. A location quotient is basically a "ratios of ratios". It compares the ratio of a particular variable in an area, for example output value, in a given sub-sector, say rice production, to the total output at the aggregate level , in our example the total grain production in that area. After accomplishing this ratio it proceeds to calculate a second ratio, say that of rice production in a larger reference area, such as the whole country, to the national total grain production. The first ratio is then weighted by the second. The formula is as follows:

$$Lq = (Oi/O)/(Ri/R)$$

where:

Lq = location quotient of grain crop i of the area

Oi = output of grain crop i in the area;

O = total grain output of the area;

Ri = national output of grain crop i (the reference area);

R = national total grain production

If an area's location quotient in a particular activity, say rice production, is greater than one, then that area is relatively more specialised in rice production than the country, and it often, but not always, implies that the area may be engaged in an "export" activity, that is to say, that the area is satisfying the needs of other areas. On the contrary, a location quotient of less than one implies that the area is less specialised in that activity than other areas of the country, and in consequence may be "importing" goods or services to meet local needs[18].

It is worth noting that there are many factors which may affect the magnitude of the location quotient. For example, if an area's demand exceeds the local production, its location quotient would be less than one, even though it takes a big share of the production undertaken in the reference area as a whole. In contrast, if an area's local consumption of a product is less than what it produces, its location quotient would be greater than one, even though it produces very few such products.

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[18] The location quotient was originally used in the regional employment analysis. Here, we " migrate " it to study a region's exports and imports by using agricultural output data. See Walter Isard, Methods Of Regional Analysis: An Introduction To Regional Science, The Technology Press Of The Massachusetts Institute of Technology, and John Wiley & Sons, Inc, New York, 1960, pp. 123-126.

In spite of its roughness, the location quotient is easily calculated and gives a ready index of the relative specialisation of an area in a particular activity in comparison with the level of activity carried out in the reference area. Moreover, a time-series of location quotients can be computed to monitor changes in specialisation among areas over a specific period of time (3). In this study, I will designate a result "positive" , if the location quotient is greater than one. The inference is that the area has a bigger proportion of the specific sector than would be expected given its overall contribution to the national structure. Consequently, it may export that product. A location quotient smaller than one will be styled "negative", although mathematically it is greater than zero. A "negative" location quotient reveals that the area has a smaller proportion of that specific sector than might be anticipated compared with national structure, and that, as a result, the area may be compelled to import the product in question. What follows is a review of agricultural specialisation derived from the location quotients of grain and meat production calculated for the years 1980 and 1990.

4. 2. 2. Specialisation of Grain Production

In China, most food items are derived from grains. Grain production has a profound significance for the Chinese economy. It remains one of the most important indicators of national economic strength, even though the contribution of grain production to agricultural output values has declined steadily in recent years, and especially during the reform period when non-grain production has experienced marked growth. In general, if grain output is high, market prices will be stable and the following year will see healthy economic growth. If grain output is low, market prices will go up and the whole economy will suffer the following year(4).

Except for a few high-plateau and desert areas, cultivation of grain crops is pursued throughout China. However, each region has evolved its own cropping system. Generally, the Southern regions are based on rice; the North and Northwest, by contrast, are based on wheat; while the Northeast's staple food crop is maize or millet. In Xizang , grain production is very limited, only some kinds of wheat, including barley and oats, are planted. Table 4-2 provides detailed information regarding each province's grain production.

Appendix 4-1 shows the location quotients of grain production in both the six macro-level regions and the 30 provinces for 1980 and 1990, respectively.

What follows is a cropwise description of these location quotient results. I shall conform to a standard pattern: first comes discussion of the 1980 value, then follows discussion of the 1990 value, and finally a comparison of the two is made.

Rice

China has the longest history of rice cultivation in the world, and the country includes one of the regions of origin of cultivated rice. It is not only the largest crop grown in China, but the Chinese rice crop plays a critical role in world rice production. It accounts for more than one-third of total world production.

Being one of the two national staples, rice production is carried out almost everywhere in China, albeit with the South predominating. Among the six macro-level regions, the three northern regions recorded negative location quotients for rice production. To be specific, the Northeast scored 0.27; the North scored 0.13; and the Northwest registered 0.14.

As expected, the location quotients of all three southern regions were greater than 1. Of the three, the South had the highest location quotient of 2.00; the East and Central followed with 1.65; while the Southwest was able to manage only 1.04.

At the provincial level, the location quotients of all the northern provinces were smaller than 1, ranging from the highest, Ningxia's 0.63 (mostly accredited to the famous Hetao plain's irrigation area), to the lowest, Qinghai's 0, a province where no rice production at all was recorded.

All southern provinces, save Xizang, had positive location quotients. Xizang's location quotient was only 0.02 due to very rigid agricultural conditions. Among the positive scores, the two provinces of Hunan and Jiangxi in East and Central, and Guangdong in the South, each had a location quotient greater than 2. It is not surprising that these three provinces are traditional rice "exporting" areas. Jiangxi had the highest degree of specialisation in rice production, with a location quotient of 2.21; Hunan, for its part, achieved 2.10; while Guangdong accomplished 2.07.

In 1990, the underlying pattern of rice production remained basically the same as that of 1980. All northern provinces still had negative location quotients. They embraced Northeast's 0.39, the North's 0.12, and the

Northwest's 0.15. Ningxia, with 0.67, still had the highest location quotient among the northern provinces; and Qinghai still had no rice account at all.

However, significant change had occurred in the Northeast region. Its aggregate location quotient rose 0.12 of a point, from 0.27 in 1980 to 0.39 in 1990. Among its three provinces, Liaoning, with an increase of 0.38 of a point (1990's 0.58 minus 1980's 0.20), had experienced the most remarkable growth. Consistent with this change, it has became a grain-exporting province; a radical departure from its previous status as a grain-importing area. Heilongjiang also increased its location quotient for rice production. Jilin, however, was an exception. Rather than increasing, its level of rice specialisation declined. In 1980 Jilin's location quotient for rice was 0.59; in 1990 the value had dropped to 0.33.

In the southern area all units increased their degree of rice specialisation during the decade under study, both at the macro-region level and at the provincial level. At the macro- region level, the East and Central received an increase from the 1.65 of 1980 to the 1.71 of 1990; the South increased from 2.00 to 2.05; and the Southwest from 1.04 to 1.18.

Wheat

Wheat is the other national staple foodcrop. Its production is also a nation-wide activity. Indeed, wheat has a more extensive cultivated area than rice owing to its less rigid requirements for production.

Generally, wheat production is concentrated in the northern area. With the exception of Liaoning and Jilin, all northern provinces evinced positive location quotients in 1980. The Northwest was particularly specialised in wheat. The location quotient of the region was a sizeable 2.29. Next came the North, with an index of 1.86. The Northeast, by way of contrast, had a negative location quotient, scoring only 0.68.

With a location quotient of 3.5, Qinghai had the highest level of specialisation of wheat production at the provincial level, albeit its absolute amount was very small. Its wheat output accounted for a mere 1.04 percent of the national total. The second highest location quotient was found in Xinjiang, and that registered 3.25.

Dedication to wheat production in Liaoning was very low. That province had the lowest location quotient of any northern province: its score of 0.03 was almost the lowest in the entire country, only Guangxi's trifling 0.01 emerged smaller than it.

Table 4-2 China's Grain Production, 1980 and 1990

unit: 1000 tonnes

	Total Grain		Rice		Wheat		Corn		Soybean	
	1980	1990	1980	1990	1980	1990	1980	1990	1980	1990
Northeast	36045	58537	4225	9730	4165	5596	16380	33361	3345	4618
Heilongjiang	14625	23125	795	3144	3945	5018	5200	10083	2205	3258
Liaoning	12215	14947	1075	3692	55	450	6535	7982	535	427
Jilin	9205	20465	2355	2894	165	128	4645	15296	605	933
North	70645	103580	4025	5074	22270	47117	24310	34109	2230	2641
Shandong	23840	33549	740	906	7660	16614	8255	11109	840	843
Hebei	15225	22769	830	916	3840	9276	6630	8292	295	535
Beijing	1860	2646	295	216	405	1015	890	1309	15	28
Tianjin	1380	1889	310	282	275	620	575	740	30	66
Henan	21485	33037	1780	2700	8905	16399	5330	9605	920	867
Shanxi	6855	9690	70	54	1185	3193	2630	3054	130	302
Northwest	22500	37047	1400	2316	8715	16393	6380	10819	390	904
Shaanxi	7570	10707	755	1004	2300	4637	2750	3338	180	293
Gansu	4925	6907	20	24	2400	3714	890	1162	50	77
Nei Monggol	3965	9730	40	314	825	2617	1390	3931	125	476
Ningxia	1200	1901	330	543	495	775	85	376	15	24
Xinjiang	3885	6662	255	431	2130	3908	1265	2012	20	34
Qinghai	955	1140	0	0	565	742	0	0	0	0
East & Central	103350	142982	74095	103928	12485	20730	2895	5427	1275	1818
Zhejiang	14355	15861	11760	13214	795	872	155	99	120	114
Jiangsu	23575	32308	11755	17085	5080	9298	1230	2302	290	451
Shanghai	1870	2395	1165	1773	205	301	40	67	5	12
Anhui	14540	24572	7730	13401	3405	5980	385	1469	495	554
Hubei	15365	24750	10380	17896	2665	3911	860	1222	115	264
Hunan	21245	26514	19425	24682	245	286	215	245	135	254
Jiangxi	12400	16582	11880	15877	90	82	10	23	115	169
South	38010	43092	33015	37539	490	553	1175	1393	285	385
Guangdong	18085	18969	16230	16777	240	219	65	135	115	139
Guangxi	11905	13631	10070	12008	25	24	1110	1200	100	128
Fujian	8020	8796	6715	7312	225	310	0	33	70	112
Hainan	na	1695	na	1442	na	0	na	25	na	6
Southwest	50005	61005	22500	30745	6030	8967	10160	11710	355	634
Sichuan	34365	42668	15370	21974	4715	7017	5410	7150	205	346
Guizhou	6480	7210	3250	3603	350	718	2115	1773	80	128
Yunnan	8655	10572	3875	5165	785	1068	2630	2778	70	100
Xizang	505	555	5	3	180	164	5	9	0	60
National Total	320555	446243	139260	189332	54155	99356	61300	96819	7880	11000

	sorgum		millet		tuber		other grain	
	1980	1990	1980	1990	1980	1990	1980	1990
Northeast	3570	2897	1830	839	815	1229	1715	1496
Heilongjiang	630	563	1035	331	510	741	305	728
Liaoning	2265	1777	235	300	105	191	1410	319
Jilin	675	557	560	208	200	297	0	449
North	2260	1680	2715	2831	10905	8354	1930	10128
Shandong	315	189	315	456	5555	3640	160	3432
Hebei	890	476	980	1138	1250	1386	510	2136
Beijing	30	19	25	12	25	27	175	47
Tianjin	115	128	20	12	25	20	30	41
Henan	145	101	415	336	3525	2537	465	3029
Shanxi	765	767	960	877	525	744	590	1443
Northwest	595	710	855	865	1590	2110	2575	5040
Shaanxi	140	116	285	185	685	648	475	1134
Gansu	90	111	155	70	440	621	880	1749
Nei Monggol	230	389	395	594	300	613	660	1409
Ningxia	30	6	15	16	65	84	165	161
Xinjiang	105	88	5	0	25	35	80	189
Qinghai	0	0	0	0	75	109	315	398
East & Central	155	108	25	14	6325	6489	6095	10957
Zhejiang	0	0	0	0	780	634	745	1502
Jiangsu	20	14	0	0	1190	1040	4010	3158
Shanghai	0	0	0	0	5	0	450	242
Anhui	100	63	15	0	2125	2595	285	3105
Hubei	20	17	10	13	875	996	440	1427
Hunan	15	12	0	0	1075	844	135	1035
Jiangxi	0	2	0	1	275	380	30	428
South	0	10	10	7	2500	3051	535	3205
Guangdong	0	1	5	1	1365	1631	65	1697
Guangxi	0	2	5	5	170	235	425	264
Fujian	0	7	0	1	965	974	45	1021
Hainan	na	0	na	0	na	211	0	222
Southwest	195	277	10	8	5710	6199	5045	8664
Sichuan	175	258	0	0	4670	4746	3820	5923
Guizhou	10	13	10	8	505	771	160	967
Yunnan	10	6	0	0	535	680	750	1455
Xizang	0	0	0	0	0	2	315	319
National Total	6775	5682	5445	4564	27845	27432	17895	39490

Unlike the situation of rice where the location quotient emerged negative in all the northern provinces, four southern provinces exhibited positive location quotients for wheat production. They are Jiangsu, Anhui, Hubei, and Xizang. The first three are also traditional grain-exporting provinces. Other southern provinces displayed negative location quotients for wheat production. The big East and Central region was forthcoming with 0.72, whereas the Southwest mustered 0.71. The South region scored very poorly with respect to wheat production. The value was only 0.08.

By 1990, the location quotients of wheat in five of the macro-regions had diminished. In detail, the Northeast decreased from 0.68 in 1980 to 0.43 in 1990; the Northwest decreased from 2.29 to 1.99; the East and Central shrank from 0.72 to 0.65; the South from 0.08 to 0.06; while the Southwest reduced from 0.71 to 0.66.

Unlike other macro-regions, the North region had been rendered more specialised in wheat production. Its location quotient increased from 1.86 in 1980 to 2.04 in 1990.

During the period, the following provinces evinced remarkable growth in their location quotients for wheat production: Liaoning, Shandong, Hebei, Beijing. Tianjin, and Shanxi. In contrast, the following provinces had dramatically decreased their specialisation in wheat production: Heilongjiang, Henan, Gansu, Ningxia, Xinjiang, Qinghai, Anhui, Hubei, and Xizang.

Detailed differences notwithstanding, overall change of location quotient implies that specialisation of wheat production has decreased during the period;, in other words, the inclination towards self-sufficiency of wheat in each area increased over the 1980s.

Corn

Corn is the third major grain and is also a widespread crop. Most of its harvest is now fed to livestock, although some of it is directly consumed as food. In 1980, only the two provinces of Qinghai and Fujian had no corn production. However, starting in 1986, Fujian began to plant corn, leaving Qinghai as the only province devoid of corn production. In 1990, Fujian's total output of corn reached 33,000 tonnes.

The Northeast is most specialised in producing corn. In 1980, its location quotient was 2.38; but by 1990 that figure had climbed to 2.62. The Northeast is the only macro-region seeing such an increase. All other regions were wedded to declining location quotients.

The North region's specialisation in corn is second only to that of the Northeast. In 1980, the location quotient was 1.80; in 1990, it dropped to 1.52.

The comparative importance of corn in the Northwest, East and Central', and South regions remained basically the same, although their location quotients recorded slight changes. The Northwest, a positive region, witnessed location quotients which dropped from 1.48 in 1980 to 1.35 in 1990. The East and Central, a negative region, saw its quotients increase from 0.15 in 1980 to 0.17 in 1990. The South, also a negative region, displayed only a 0.01 point difference during the period. Its 1980 score was 0.16 while that for 1990 was 0.15.

Significant change took place in the Southwest. In 1980 it was a positive region with a location quotient of 1.06. In 1990 it had become a corn-importing area, the outcome of a negative location quotient of 0.88.

At the provincial level, most provinces reduced their corn production specialisation. Liaoning, Hebei, Tianjin, Shanxi, Gansu, Ningxia, and Guizhou underwent a marked reduction.

Seven of 30 provinces increased their location quotients for corn production. They were Heilongjiang, Jilin, Henan, Nei Monggol, Jiangsu, Shanghai, and

Guangdong. Of these, Jilin achieved the most remarkable growth. Its location quotient in 1980 was 2.64; after ten years that number had soared to 3.44. Heilongjiang's change range was smaller than Jilin's, but still impressive. Its 1980 location quotient was 1.86; in 1990 the index had increased to 2.01. Change accomplished in the other five provinces was not as significant as that which occurred in the two provinces just mentioned.

Soybean

Soybean is playing an important role in satisfying the daily nutrition needs of the Chinese people. Its production is highly concentrated in the Northeast where all provinces have positive location quotients. In 1980, the Northeast produced 3.345 million tonnes of soybean, an amount which accounted for 42.45 percent of the national total. It had a location quotient of 3.76, much higher than the North's 1.28, the second-highest score. This indicates unequivocally the Northeast's high level of specialisation in soybean production.

In marked contrast, the other four macro-regions recorded negative location quotients, ranging from the Northwest's 0.71 to the Southwest's 0.29.

With the improvement of living standard, daily demand for soybean has steadily grown, and consequently, each area has increased its sown area of soybean. This has led to a reduction in the number of positive location quotients and the growth in the number of negative ones. For example, the Northeast's value dropped to 3.20, while the North's lowered from 1.28 in 1980 to 1.03 in 1990. Bucking the trend, the Northwest increased its score from 0.71 in 1980 to 0.99 in 1990; the East and Central grew from 0.50 to 0.52; the South from 0.31 to 0.36; and the Southwest from 0.29 to 0.42.

Among all provinces, Heilongjiang had the highest specialisation of soybean. In 1980 its location quotient was as high as 6.13. In 1990, its quotient had dropped to 5.71, still an impressively high value and the highest in the country.

Besides Heilongjiang, there were six provinces having positive location quotients. They were Liaoning, Jilin, Shandong, Henan, Nei Monggol, and Anhui.

All other provinces had negative quotients. In 1980 Qinghai and Xizang were the only two provinces which had no soybean production, while Shanghai displayed the lowest quotient of 0.11. In 1990, only Qinghai still refrained from planting soybean, while Hainan now had the lowest quotient, registering 0.14.

It is worth noting that Xizang's quotient dramatically climbed from 0 in 1980 to 4.39 in 1990, the second highest at the latter year. Besides Xizang, three provinces also shifted from negative quotients to positive ones. They were Tianjin, Shanxi, and Shaanxi. However, Anhui, by contrast, dropped from a positive standing of 1.38 in 1980 to the negative rank of 0.91 in 1990.

Sorghum

Sorghum is essentially a northern crop. It is highly concentrated in the northern area, especially in the Northeast. Among three southern regions, the South plants no sorghum at all. The East and Central region and the Southwest, for their part, have very little sorghum production.

In 1980, the Northeast had a location quotient of 4.69, the highest in the country. The North and Northwest also had positive quotients, with scores of 1.51 and 1.25, respectively.

As expected, all southern areas without exception fail to support themselves with sufficient sorghum, and need to "import" the commodity in order to fulfil local demand. The East and Central' s quotient was only 0.07, and that of the Southwest was 0.18. As for the South, it was zero.

During the period extending from 1980 to 1990, sorghum production had decreased both absolutely and relatively. Major reductions occurred in the

Northeast and the North. In 1990, the national output of sorghum was 5,682,000 tonnes, a reduction of 16.13 percent when compared with 1980. Most regions also registered reduced quotients in 1990. The Northeast declined to 3.89 from the 4.69 of 1980; the North slipped to 1.27; the East and Central to 0.06; and the Southwest to 0.02. However, the Northwest had a reverse trend. It increased its quotient to 1.51 in 1990.

Liaoning, Shanxi, Tianjin, Jilin, Nei Monggol, and Heilongjiang are the most specialised areas of sorghum. All of them achieved location quotients over 2. With a quotient of 8.77, Liaoning stands paramount. The second highest was Shanxi, with a score of 5.28.

All southern provinces have negative quotients. All four provinces in the South region, plus Qinghai, Zhejiang, Shanghai, Jiangxi, and Xizang were associated with zero quotients.

In 1990, specialisation of sorghum production was further intensified at the provincial level compared with 1980. Liaoning's quotient increased to 9.33; Shanxi's to 6.21; Tianjin's to 5.32, Nei Mongol's to 3.14.

As to other provinces, except for a few cases such as Ningxia and Jilin, the proportion of sorghum production remained basically the same. Ningxia dramatically dropped its quotient from 1.18 in 1980 to 0.24 in 1990. Equally remarkably, Jilin decreased from 3.47 to 2.14 and Hebei from 2.77 to 1.64.

Millet

Millet is also a northern crop. It is widely sown in all three northern regions whose quotients are all positive and very close. In 1980 the Northeast's quotient was 2.99; the North's was 2.26; and the Northwest's was 2.24. On the contrary, all three southern regions have but moderate interest in the production of millet and, as a result, record very small and close quotients. The East and Central managed only 0.01; the South scarcely better at 0.02; and the Southwest was again 0.01.

In 1990, the pattern of millet production remained the same. Three northern regions still showed positive quotients whereas the southern regions indicated negative ones. However, the northern regions did experience some changes. The Northeast dropped its quotient significantly to 1.40; the North's, by contrast, rose to 2.67; while the Northeast stayed at 2.28. The southern regions displayed the same quotients as in 1980.

Millet production is concentrated in Shanxi, Nei Monggol, Heilongjiang, Jilin, Shaanxi, Gansu, Henan, and Liaoning; all of which have positive location quotients of millet production. Shanxi had the highest quotient, which was as high as 8.24. Nei Monggol came in second, standing at 5.86. the remaining positive quotients ranged from Heilongjiang's 4.17 to Liaoning's 1.13.

All other provinces indicate negative quotients. Indeed, ten provinces had no millet production at all in 1980. They were Qinghai, Zhejiang, Jiangsu, Shanghai, Hunan, Jiangxi, Fujian, Sichuan, Yunnan, and Xizang. Quotients of negative provinces ranged from 0.85 (Tianjin)to 0.02 (Guangdong and Guangxi).

Millet production decreased steadily during the period. Total output fell to 4,564,000 tonnes in 1990, an amount equal to 25.49 percent of the production total for 1980. However, area specialisation has been intensified. The highest provincial location quotient, which was found in Shanxi, rose to 8.85. Nei Monggol remained at 5.86. Hebei's quotient dramatically climbed to 4.89 from its previous 0.79. Shandong also shifted from a negative quotient(0.78) to a positive one(1.33). Liaoning increased from 1.13 to 1.96.

In 1990, two provinces, Xinjiang and Anhui, ceased to produce millet, which brought the total number of " no millet " provinces to 12. Consequently, these two provinces' quotients became zero. Other notable declines were found in Heilongjiang (from 4.17 to 1.39); Jilin (from 3.58 to 0.99); Gansu (from 1.85 to 0.99); and Shaanxi (from 2.22 to 1.69).

Tuber

Unlike sorghum and millet, tuber is a widespread crop. Save for Hainan and Xizang, all provinces were producing potatoes in 1980. In 1990, only Shanghai had no potato production.

Concerning the six macro-regions, one northern region, the North, and one southern region, the Southwest, were forthcoming with positive quotients. That for the North was 1.78, whereas that for the Southwest was 1.31. The other four regions had negative quotients, ranging from the Northwest's 0.81 to the Northeast's 0.26.

In 1990, all regions had bolstered their quotients except the North. One more region had shifted from the negative group to the positive group: the South increased its quotient to 1.15 from 0.76 in 1980. The Southwest and the North changed their comparative positions. With a quotient of 1.65 the Southwest became the most specialised area of potato production. The North had the second-highest quotient, which was 1.31. The remaining three regions also increased their quotients, although they remained on the negative side of the ledger. The Northwest's was 0.93, the East and Central's was 0.74, and the Northeast's was 0.34.

Shandong had the highest level of specialisation in potato production in 1980, and its location quotient was 2.68. In 1990, Shandong 's position was replaced by Sichuan. In the same year, Sichuan had a location quotient of 1.81, and Shandong's quotient(1.76) was only marginally less.

Most provinces showed an increase of location quotients during the period under study. However, a few provinces experienced a reverse trend; for instance, Shandong, Gansu, and Henan.

4. 2. 3. Specialisation of Meat Production

Before the economic reform, the Chinese people had little opportunity to take meat in their daily diet. The author personally experienced such miserable days when each person could hope only for a quota of 500 gm of meat per month. During the 1980s, with the dramatic growth of animal production, eating meat was no longer a luxury but became established in daily diets. People now can eat as much meat as they can afford. Pork, beef and mutton, the so called red meat, are the main components of meat consumption. Together, they constitute over 88 percent of total meat production (Table 4-3). What follows is a description of the regional production patterns associated with the three kinds of meats.

Pork

As the chief meat of China, pork is one of the most important sources of food-energy and is highly valued by the consumers. The Han people, in particular, value this meat. China is ranked first in the production of pork.

As a result of its importance in the daily diet, each area has always tried to satisfy the local demand for pork from local supplies, or, failing that, has attempted to keep imports to a minimum. This explains why no region recorded a quotient greater than 1.2 (Appendix 4-2).

In 1980 five of the six macro-regions had quotients of around 1, which means they were basically self-sufficient in producing pork. Only the Northwest needed to import pork from other regions. Its quotient was 0.68. In 1990 this pattern for the most part remained unchanged. The difference was that the Northeast, the North, and the South slightly decreased their quotients to just under 1. The Southwest climbed from just under 1 (0.99) to 1.11. The Northwest increased its quotient to 0.74. The East and Central also witnessed a small increase, from 1.04 to 1.05.

All areas, including both macro-regions and provinces, had increased pork production during the period under study. Most provinces maintained the same proportion of meat production. However, some changes are worthy of note. Guangdong, initially a self-sufficient province (location quotient was 1.05), became a net importing area of pork at the end year of the period, as indicated by its quotient of 0.90. This occurred despite its pork output growing from 615,000 tonnes to 1,453,000 tonnes, an increase of 136 percent. The change was largely the result of the increase in per capita meat consumption. Similar, though less dramatic, changes also took place in other coastal provinces.

Hunan, Hubei, Guizhou, Jiangxi and Sichuan were traditional providers and they intensified their pork production during the reform era and became the major sources of pork.

Beef

Beef is another major source of food-energy for the Chinese, but it is more popular in northern areas than in the southern parts of the country. Most minorities prefer beef to pork in their daily diet.

Three northern macro-regions accounted for 68.31 percent of national beef production.

During the period from 1980 to 1990, the North significantly augmented beef production. Consequently, its location quotient jumped to 1.87 in the end year from the starting year's 0.44. In terms of beef output, the North also had the biggest growth of beef production in both absolute and relative terms. It produced 455,000 tonnes of beef in 1990, the largest output of all macro-regions, and accounted for 36.23 percent of the national total. Compared with the output of 1980, the North achieved a 1968 percent growth during the period concerned, much higher than either any other region or the country as a whole (366.91 percent).

Equally dramatic change, albeit in the opposite direction, happened in the Northwest and the Southwest. The Northwest dropped its quotient to 3.38 in 1990 from 5.33 in 1980, though the former still topped the list of quotients in 1990. The Southwest had a positive quotient of 1.36 in 1980, but in 1990 it had become a beef-importing area, the upshot of a negative quotient of 0.61.

The other regions all experienced small changes. The quotients for the Northeast and the East and Central increased slightly from 1.20 and 0.34, respectively, in 1980, to 1.40 and 0.40 in 1990. The South, in contrast, decreased mildly, from 0.48 in 1980 to 0.43 in 1990.

Minority-dominated provinces have higher quotients of beef, mainly because they take beef as staple meat. Xizang, Qinghai, Nei Monggol, and Xinjiang ranked the highest four provinces. Their location quotients for the year 1980 were, in descending order, 20.02; 13.18; 8.63; and 7.90. These figures were much higher than other provinces. There were four more provinces having positive quotients in 1980, namely, Heilongjiang (1.93); Jilin (1.45); Gansu (1.6); and Yunnan (1.45).

All other provinces recorded negative quotients for beef production in 1980. Beijing, Tianjin, Ningxia, and Shanghai produced no beef at all in 1980.

In 1990, all provinces in the Northeast and the North improved their quotients for beef. Typical examples were Henan, which increased from 0.59 in 1980 to 3.09 in 1990, Shanxi, which shot upward from 0.52 to 2.01, and Shandong, which rose from 0.44 to 1.82.

The areas containing the highest quotients in 1980 all saw their quotients decline during the period in spite of still ranking the highest in 1990. Xizang dropped to 11.33 in 1990, but was still the top score. Qinghai's quotient fell to 7.7, still sufficient to grant it second place. Xinjiang's quotient declined to 5.55, the third highest, while Nei Monggol, with a quotient of 3.77, occupied the fourth-highest rank instead of its third standing of 1980.

In 1990 only Shanghai had no beef production. Ningxia, Beijing, and Tianjin all were producing beef, a reversal of their 1980 situation. Ningxia even had a positive quotient of 1.67. Beijing and Tianjin were 0.76 and 0.77, respectively. This may have much to do with the rehabilitation of Moslem culture in these areas. Ningxia is a Moslem dominated autonomous region; Beijing and Tianjin also have many Moslems.

Mutton

Like beef, mutton is also favoured by the minority peoples and its production concentrated in their hands. The Northwest was specialised in producing mutton. It held title to the highest quotient in both 1980 and 1990. The corresponding scores were 6.64 and 5.91. The North also had a positive quotient in both 1980 and 1990, which was 1.03 and 1.81.

The remaining four macro-regions recorded negative location quotients for mutton during the period in question. This implied that they must import mutton if they find themselves with much demand. The quotients for 1980 ranged from the Southwest's 0.87 to the South's 0.10, and those for 1990 ranged from the Northeast's 0.46 to the South's 0.08.

Similar to the distribution of beef production, minority-dominated provinces also were forthcoming with the highest location quotients both in 1980 and 1990. In 1980, Xinjiang (14.80), Xizang (13.83), Qinghai (12.75), Nei Monggol (8.73), and Ningxia (5.70) ranked at the top. In 1990 their location quotients were, in descending order, Xinjiang, 14.52; Xizang, 11.81; Qinghai, 9.75; Ningxia, 6.67; and Nei Monggol, 6.55.

Provinces in the Northeast, the East and Central region, and the South all displayed negative quotients in both 1980 and 1990. With the exception of Xizang, provinces in the Southwest also had negative quotients during the period. In the North, there was only one central municipality (Beijing) that registered a negative quotient in 1990, whereas in 1980 there were four provinces which needed to import mutton.

Table 4-3 China's Meat Production

unit: 1000 tonnes

	Total meat		Pork		Beef		Mutton	
	1980	1990	1980	1990	1980	1990	1980	1990
Northeast	1047	1681	1007	1525	28	122	12	34
Heilongjiang	372	460	348	395	16	52	8	13
Liaoning	429	788	423	741	4	34	2	13
Jilin	246	433	236	389	8	36	2	8
North	2217	4918	2111	4089	22	455	84	374
Shandong	902	1870	862	1537	9	176	31	157
Hebei	421	1213	404	1077	4	56	13	80
Beijing	130	204	129	186	0	9	1	9
Tianjin	61	101	60	89	0	4	1	8
Henan	530	1237	494	975	7	182	29	80
Shanxi	174	293	162	225	2	28	10	40
Northwest	832	1814	529	1115	99	281	204	418
Shaanxi	231	445	223	391	2	32	6	22
Gansu	140	375	123	302	5	35	12	38
Nei Monggol	239	501	116	288	46	86	77	127
Ningxia	19	63	15	41	0	5	4	17
Xinjiang	119	278	33	49	21	71	65	158
Qinghai	85	152	20	44	25	52	40	56
East & Central	4298	7947	4200	7654	33	161	65	132
Zhejiang	698	856	688	841	5	5	5	10
Jiangsu	1069	1584	1038	1492	4	19	27	73
Shanghai	165	236	164	233	0	0	1	3
Anhui	518	976	494	848	6	98	18	30
Hubei	554	1375	541	1351	5	13	8	11
Hunan	924	1895	914	1877	5	14	5	4
Jiangxi	370	1025	362	1012	8	12	0	1
South	1320	3152	1301	3065	14	75	5	12
Guangdong	676	1484	668	1453	8	29	0	2
Guangxi	402	906	397	872	3	31	2	3
Fujian	243	641	237	629	3	7	3	5
Hainan	1	121	56(1)	111	na	8	1	2
Southwest	2338	5623	2192	5363	71	162	75	98
Sichuan	1716	4073	1643	3967	36	69	37	37
Guizhou	267	713	255	680	5	24	7	9
Yunnan	308	749	292	711	10	25	6	13
Xizang	47	88	2	5	21	44	24	39
National Total	12055	25135	11341	22811	269	1256	445	1068

Note: (1) is the figure of 1981.

4. 3. Spatial Variations In Grain Production

This section will analyse spatial variations in grain production, crop by crop, during the period stretching from 1980 to 1990. It will do so at the macro-region level using the shift-and-share method. To begin with, however, a brief description of national performance of grain production will be presented.

4. 3. 1. National Grain Production Performance

In China the convention is to divide crops into three categories: "grain" crops, industrial crops or sometimes called cash crops, and other crops.

Rice, wheat and corn are the three main grain (or staple food) crops. In 1980, they accounted for 81.15 percent of total grain output. In 1990, their share had increased to 86.39 percent. Of them, rice is the number one grain crop. In 1980, national rice output was 143,750,000 tonnes, an amount which accounted for 44.93 percent of total grain production. Its share of total grain output had slightly decreased to 42.43 percent in 1990, although rice production in itself increased by 31.37 percent during the 1980-1990 period. The 31.71 percent rate of growth was impressive, but it was still lower than the national growth rate of total grain, which turned out to be 39.47 percent. Therefore, it was not surprising that rice had a negative total shift of -4,901,000 tonnes, which meant that if rice had undergone growth at a rate equalling the national average, there would have been no less than 4,901,000 tonnes of extra rice produced (see Appendix 4-3).

Wheat experienced the largest stimulus during the period under study. In 1980 wheat output was 54,155,000 tonnes; in 1990 it reached 99,356,000 tonnes, an increase of 83.47 percent, or twice the national average growth rate. Its share in national total grain production was 16.93 percent in 1980 and 22.26 percent in 1990. As expected, wheat had a relative gain of 23,822,000 tonnes, the largest positive total shift.

Corn is another grain crop which exhibited a positive shift during the period. The growth rate of corn (56.86 percent) was second only to that of wheat and considerably higher than the national average for grain. Corn's share in total grain also enlarged during the period, from 19.29 percent in 1980 to 21.70 percent in 1990. During the period under question corn achieved a relative gain of 9,281,000 tonnes.

Wheat and corn are the only two food-crops which displayed positive shifts. All other grain crops suffered negative shifts. Soybean, whose growth rate (39.59 percent) was slightly over the national average, had a relative loss of 487,000 tonnes.

Sorghum, millet, and tuber crops all experienced both absolute and relative declines during the period. Sorghum's total output decreased by 16.13 percent, from 6,775,000 tonnes in 1980 to 5,682,000 tonnes in 1990. Its share in total grain declined from 2.12 percent in 1980 to 1.27 percent in 1990, and its total shift was -3,774,000 tonnes.

Millet had a similar history. Total output of millet dropped from 5,445,000 tonnes in 1980 to 4,564,000 tonnes in 1990, a decrease of 16.18 percent. Millet's share in total grain declined from 1.70 percent in 1980 to 1.02 percent in 1990. During the period, it experienced a relative loss of 3,000,000 tonnes.

The output of the tuber crop decreased slightly during the period. In 1980 tuber output stood at 27,845,000 tonnes; after ten years the output had reduced to 27,432,000 tonnes, a decrease of 1.48 percent. Correspondingly, its share in total grain also decreased, from 8.70 percent in 1980 to 6.15 percent in 1990. The total shift attaching to tuber output was -11,405,000 tonnes.

4. 3. 2. A Region By Region Analysis

4. 3. 2. 1. The Northeast

The Northeast was known as Manchuria until the early twentieth century, as it was the home of the Manchu. Since then it has been called the Three Eastern Provinces, or simply as the Northeast. Though suitable for cultivation, this area was little developed until the late nineteenth century. From the 1950s onwards the Chinese government has promoted large-scale cultivation of the land, particularly in Heilongjiang province, which formerly was lying waste in the region, and some 30 percent of the present cultivated area has been brought into cultivation as a result of this activity (5).

The Northeast provided 11.08 percent of China's total grain production in 1980, and 13.12 percent in 1990. During the period under study, grain achieved a growth rate of 65.20 percent, much higher than the national average growth rate of 39.47 percent. This resulted in a positive total shift of 9,114,000 tonnes of grain. In other words, if the region had performed just as the nation in agriculture, it would have produced 9,114,000 fewer tonnes of grain. The good cultivation conditions evident in the region underpinned this admirable performance.

Rice

Based on Appendix 4-3, which provides detailed information for each region's shift, rice had the fastest and greatest growth among all food crops in the Northeast. In 1980, rice accounted for 11.92 percent of the regional output of grains, whereas it commanded 16.62 percent of the regional total in 1990. The region's weighting in national rice output was a mere 3.03 percent in 1980 and a marginally better 5.14 percent in 1990. Rice registered a positive total shift of 3,837,000 tonnes. The relative gain of rice was mainly accredited to the "regional component". The differential shift was 4,165,000 tonnes, while the proportionality shift was -328,000 tonnes. After taking the historical factor into consideration, the corrected differential shift was 3,867,000 tonnes, whereas the current proportionality shift was amended to -1,236,000 tonnes; and the current total shift was 2,631,000 tonnes.

Wheat

Wheat took up 11.75 percent of total regional grain production in 1980. The national counterpart was 16.93 percent. It had a growth rate in the Northeast of 34.33 percent during the period under study, much lower than the national average growth rate of 83.47 percent. This accounted for the appearance of a negative total shift of -214,000 tonnes. It is apparent that the negative shift was mainly caused by "regional factors", for the differential shift was -2,046,000 tonnes.

Corn

Corn, together with rice and wheat, are the three main "grain" (or staple food) crops. Corn alone accounted for 47.42 and 56.99 percent of total regional grain output in 1980 and 1990 respectively, which was higher than the national averages (19.29 percent and 21.70 percent, respectively). During the decade of the 1980s, Northeast corn exhibited a 98.52 percent rate of growth, much bigger than the national growth rate, which was 56.86 percent. This explained why it had a positive shift for both the proportionality (2,921,000 tonnes) and differential (7,001,000 tonnes) components. The Northeast area is good at producing corn and has a higher proportion of corn in its grain structure. This implies that it will be more specialised in corn production. This supposition is confirmed by the analysis of location quotients which presented the Northeast as having the highest quotient among all macro-regions.

Soybean

The Northeast was specialised in producing soybeans as indicated by its highest location quotient. Soybeans occupied 9.44 percent and 7.72 percent of total regional grain in 1980 and 1990 respectively. Both these percentages are higher than the national corresponding figures which were 2.46 percent and 2.47 percent respectively. The Northeast, therefore, retained its standing as a prime soybean supplier throughout the time in question.

Although the Northeast continued as a major soybean producer, it grew slower than the national average in soybean production. Its growth rate was 38.06 percent, whereas the nation experienced a 39.59 percent increase. As a result, the Northeast displayed a negative total shift of 47,000 tonnes. Because of its higher proportion of soybean to total grain, its proportionality shift was positive (4,000 tonnes). However, the slower growth brought about a negative differential shift(-51,000 tonnes). If the historical factor is taken into account, the Northeast displayed a current total shift of 226,000 tonnes and a historical total shift of -273.000 tonnes.

Sorghum

China witnessed a decrease in sorghum production in both absolute and relative terms during the 1980s. The Northeast followed suit. From 1980 to 1990, sorghum output declined from 3,570,000 tonnes to 2,897,000 tonnes, a decrease of 18.85 percent. The national rate of decline was 16.13 percent. Sorghum accounted for 1.07 percent and 4.95 percent of total regional grain output in 1980 and 1990 respectively. At the national level, sorghum output amounted to 2.12 percent and 1.27 percent, respectively, of all grain output.

The Northeast had a relative loss of 2,082,000 tonnes of sorghum, an amount which may be divided into -1,985,000 tonnes of proportionality shift and -97,000 tonnes of differential shift. If the change of grain structure is allowed for, the total relative loss may be reduced to 301,000 tonnes.

Millet

The Northeast is a national base of millet production. Like sorghum, however, millet is a nationally decreasing foodcrop, and the Northeast is no exception to this trend. The Northeast's output of millet was 1,830,000 tonnes in 1980, a volume which accounted for 5.16 percent of the total regional grain. After ten years, production had reduced to 869,000 tonnes, or only 1.48 percent of total regional grain. During the period millet experienced a relative loss of 1,683,000 tonnes, an amount which accounted for 56.07 percent of the national total relative loss (3,000,000 tonnes).

Tuber

Tuber production had noticeably expanded during the period between 1980 and 1990 in the Northeast. The country, in marked contrast, experienced a decrease in production. The Northeast's growth rate of tuber crops was 50.80 percent, sharply different from the national performance of -1.48 percent. As a consequence, the Northeast showed a positive total shift of 92,000 tonnes. This relative gain was chiefly attributed to the "regional factor". The differential shift was 426,000 tonnes. However, it was offset by the "structural factor", to the tune of 334,000 tonnes (that is, a proportionality shift of -334,000 tonnes).

4. 3. 2. 2. The North

Agriculture in this region has a very long history; indeed, most of the cultivated land has been in use for thousands of years. The grain structure of the region is dominated by wheat and tuber crops.

The North produced 70,645,000 tonnes of grain in 1980, which accounted for 22.08 percent of the national total. It maintained this share throughout the following decade. In 1990 the production of total grain accounted for 23.21 percent of the national total. The growth rate of total grain in the region during the period was 46.62 percent, 7 percentage points over the national growth rate. During this period, the North had a relative gain of 5,048,000 tonnes, which arose mainly from the "regional factor". The differential shift thus was 12,253,000 tonnes, whereas the proportionality shift partly countered it with a value of -7,206,000 tonnes.

Rice

In the North rice was not as important as in other regions. In 1980, the output of rice was 4,025,000 tonnes, an amount accounting for 5.70 percent of the regional total grain. In 1990, with 5,074,000 tonnes of production, the share of rice in total grain decreased to 4.90 percent. Rice production itself had increased by 26.06 percent, but that increase was lower than the national norm of 31.71 percent. Therefore, the resultant shift was obviously negative. Rice had a total shift of -540,000 tonnes, which may be further divided into a proportionality shift of -313,000 tonnes and a differential shift of -227,000 tonnes.

Wheat

As mentioned earlier, wheat is the staple food of the North. In 1980, wheat production in the region was 22,270,000 tonnes, a value amounting to 31.52 percent of regional total grain output and 41.12 percent of the national total wheat output. In 1990, wheat production was larger by 111.57 percent, having reached 47,117,000 tonnes. The regional growth rate was higher than the national counterpart. Correspondingly, the share of wheat in regional total grain had increased to 45.49 percent, and its share in national total wheat had also increased, to 47.42 percent. Unsurprisingly, wheat has experienced a big relative gain. Its total shift was 16,056,000 tonnes, of which the proportionality shift accounted for 9,797,000 and the differential shift accounted for 6,259,000. When structural change is considered, the current total shift was 6,384,000 tonnes and the historical total shift was 9,672,000 tonnes.

Corn

The North harvested 24,310,000 tonnes of corn in 1980, an amount that accounted for 24.41 percent of the regional total grain output (103,580,000 tonnes). In 1990, corn output climbed to 34,109,000 tonnes, which took up 32.93 percent of that year's regional total grain output. The growth rate of corn during the period under study was 41.36 percent, lower than the national correspondent. The total shift of corn was 203,000 tonnes, an outcome which was mainly caused by the regional factor. The differential shift was -4,022,000 tonnes. In contrast, the proportionality shift was positive, recording a value of 4,225,000 tonnes.

Tuber

Tuber crops occupy an important position in this region. In 1980, with an output of 10,905,000 tonnes, they accounted for 15.44 percent of the regional total grain; in 1990 this share had dropped by nearly a half, to 8.07 percent. Both proportions, however, were higher than their national counterparts, which were 8.70 percent and 6.15 percent, respectively. Nevertheless, the negative rate of change for tuber crops in the North (-23.39 percent) was much more pronounced than the national norm (-1.48 percent), which led the region to relatively lose 6,856,000 tonnes of tuber crops during the period. Because the North had a higher proportion of nationally declining tuber production, the "structural component" contributed more to the relative loss than the "regional factor". The proportionality shift was -4,466,000 tonnes, whereas the differential shift was -2,389,000 tonnes.

The North slightly increased its production of soybean and millet during the period under study. The former had a growth rate of 18.43 percent (from 2,230,000 tonnes; output increased to 2,641,000 tonnes); the latter had a growth rate of 4.27 percent (from 2,715,000 tonnes to 2,831,000 tonnes). However, both suffered a relative loss during the period. Soybean production was cut relatively by 469,000 tonnes. Millet lost relatively 956,000 tonnes.

As to sorghum, its production declined both absolutely and relatively during the period extending from 1980 to 1990. The absolute loss was 580,000 tonnes while the relative loss was 1,472,000 tonnes.

4. 3. 2. 3. The Northwest

This region is naturally not conducive to good agriculture. The majority of its cultivated land relies on irrigation. Because of the scarcity of water only a few types of crops are grown. In most cases, wheat occupies more than half of the sown area, and much of this is spring wheat. The next most important crop is corn.

Wheat

Despite the qualifying statement made above, during the period, total grain production in the region experienced a 64.65 percent increase, which was faster than that of the nation. This entitled it to a total relative gain of 5,665,000 tonnes of grain. Wheat was responsible for the lion's share. During the period wheat production gained relatively by 4,238,000 tonnes. This total shift can be further divided into 3,834,000 tonnes of proportionality shift and 404,000 tonnes of differential shift. From 1980 to 1990, the absolute increase in volume of wheat was 7,678,000 tonnes(from 8,715, 000 tonnes in 1980 to 16,393,000 tonnes in 1990), and the rate of growth was 88.10 percent.

Corn

Corn output of the Northwest was 6,380,000 tonnes in 1980, but 10,189,000 tonnes in 1990, an increase of 59.70 percent; that is, 3 percentage points over the national growth rate. Corn constituted 28.36 percent of the regional total grain production in 1980; and this share was reduced only slightly, to 27.50 percent, in 1990. Both proportions were higher than national corn's share in total grain. This explained why the Northwest had a positive total shift of 1,291,000 tonnes for corn. This relative gain was mainly owing to its higher share of total grain. The proportionality shift, accordingly, was 1,109,000 tonnes while the differential shift was only 181,000 tonnes.

Rice

Rice production underwent impressive progress during the period. In 1980 regional rice production was 1,400,000 tonnes; in 1990 it had increased to 2,316,000 tonnes. The growth rate was 65.43 percent, more than double the national growth rate. In 1980 rice accounted for only 6.22 percent of total grain produced by the region. This share was carried over to 1990, when rice accounted for 6.25 percent of total grain production of the Northwest.

Soybean and Sorghum

Unlike other regions, the Northwest slightly decreased its soybean production and increased production of sorghum. Both trends, in consequence, were in the opposite direction to the national pattern. However, the Northwest still contrived negative total shifts for both soybean (-184,000 tonnes) and sorghum (-120,000 tonnes). The relative loss of soybean output was solely because of its absolute decrease; whereas that of sorghum could be fully blamed on the "structural component".

Millet

Throughout the 1980s, millet production was not reduced but kept at the same scale. In 1980, the Northwest had an output of 855,000 tonnes of millet; in 1990 the output was 865,000 tonnes. By comparison, the country shrank its production of millet. During the period , the Northwest lost relatively 328,000 tonnes of millet

Tuber

With 1,590,000 tonnes of output the tuber category was the Northwest's third largest grain crop in 1980, and it contributed 7.07 percent of the region's total grain. In 1990 it changed rank with rice and sat at the fourth place. Its 1990 output was 2,110,000 tonnes, lower than that of rice. The growth rate during the period was 32.70 percent, much higher than the nation's negative rate. The absolute gain could not counteract an overall relative loss for the period. The tuber total shift was -108,000 tonnes; of which the proportionality shift was -651,000 tonnes, whereas the differential shift partly offset it to the extent of 544,000 tonnes.

4. 3. 2. 4. The East and Central Region

The importance of this region in the grain production of China is self-evident when it is considered that it produces 32 percent of the country's total grain by using only 21 percent of the country's cultivated land. The majority of the cultivated area is in rice paddies. More than half of this grows two crops of rice a year, along with winter crops such as wheat, rape, or barley. The remainder of this area grows a crop of rice and then a winter crop in succession.

However, the pace of growth of grain in this region was not as fast as that occurring in the nation. Total grain production increased by 38.35 percent during the period between 1980 and 1990, which was just under the national average. This slowness resulted in a negative total shift of -1,165,000 tonnes, which implies that if this region had performed as well as the nation during the period, it would have produced no less than an extra 1,165,000 tonnes of grain. What follows is a crop by crop description of such relative change.

Rice

Rice is the staple grain crop of the region. In 1980, rice production was 74,095,000 tonnes, or 71.69 percent of the region's total grain output, and 51.54 percent of the national total rice output. In 1990, output of rice climbed to 103,928,000 tonnes; that is 72.69 percent of total grain produced in the region, and fully 54.89 percent of national total rice output. This region's growth rate for rice during the period (40.26 percent) was also higher than the corresponding national rate (31.71 percent). All this conspired to result in a positive total shift of 584,000 tonnes of rice applying to the East and

Central region. Because it contained a higher proportion of rice in its total grain portfolio, and in national terms the rice proportion was declining during the period, the upshot was that the proportionality shift of this region was negative, amounting to 5,754,000 tonnes. However, this negative tendency was more than offset by the positive differential shift, the product of its fast growth rate, which amounted to 6,336,000 tonnes.

Wheat

Wheat is the second largest grain crop in this region. In 1980, wheat production was 12,485,000 tonnes, which accounted for 12.08 percent of the region's total grain, a proportion lower than the national average. In 1990, wheat output reached 20,730,000 tonnes; that is, some 14.50 percent of the region's total grain production, a proportion still lower than the national share of 22.26 percent. The East and Central region increased its wheat production by 66.04 percent , which was lower than the national growth rate of wheat. Consequently, it had a negative differential shift of -2,176,000 tonnes. However, because this region had a higher growth rate of wheat than the national average growth rate of grain, it acquired a positive proportionality shift of 5,492,000 tonnes. On adding the two shift components together, the East and Central region had a positive total shift of 3,317,000 tonnes.

Corn

Corn is steadily improving its position in this region's total grain structure. In 1980, corn output was 2,895,000 tonnes, a volume accounting for 2.80 percent of the region's total grain output. After ten years, it advanced to 5,427,000 tonnes, accounting for 3.80 percent of total grain output of the region. The growth rate of corn was an impressive 87.46 percent, the fastest of all crop rates in the region, and 20 percentage points above the national growth rate of corn. This brought a positive total shift of 1,389,000 tonnes, an amount which was composed of 503,000 tonnes deriving from the proportionality shift and 886,000 tonnes attributable to the differential shift.

Soybean

Soybean also underwent a dramatic increase in the East and Central region during the period. With a 64.92 percent growth rate, the region's soybean production increased from a level of 650,000 tonnes in 1980 to a level of 1,072,000 tonnes in 1990. This increment was well above national growth rates of both total grain and soybeans. Consequently, soybean effected a positive total shift of 165,000 tonnes, a result which was solely accredited to the "regional factor", for this region's share of soybean in regional grain output was well below the national share.

Sorghum and Millet

Sorghum and millet are almost negligible in the region's grain basket, and both were declining during the period from 1980 to 1990. In 1980 output of sorghum and millet registered 155,000 tonnes and 25,000 tonnes, respectively; in 1990 production had declined to 108,000 tonnes and 14,000 tonnes. It was not surprising that both crops experienced relative losses. The total shift of sorghum was -108,000 tonnes, whereas that of millet was -21,000 tonnes.

Tuber

Tuber is the third largest grain crop in the East and Central region, a position which it maintained during the period. In 1980 this region produced 6,325,000 tonnes of tuber crops; in 1990, tuber production turned out to be 6,489,000 tonnes. Tuber had a positive growth rate. In comparison, the national growth rate of tuber crops was negative. Thus tuber in the East and Central region recorded a positive differential shift (258,000 tonnes). However, this positive shift was totally offset by the negative differential shift (2,591,000 tonnes).

4. 3. 2. 5. The South

Being a tropical and subtropical area, the most significant natural features of the region are its high temperature and heavy rainfall, which together favour the growth of tropical plants. This is the main reason why it is designated as a separate region. Agriculture in the region is dominated by rice growing. About 70 percent of the cultivated land is devoted to rice paddies, and rice yield is well above the national average yield.

Traditionally, the South was a grain exporting area, and was playing a pivotal role in rice production. However, significant change had taken place during the period. The region experienced relative losses in all grain crops. From 1980 to 1990, the absolute increase in total grain output was only 13.37 percent, the difference between 38,010,000 tonnes and 43,092,000 tonnes. The growth pace was well below the national average, less than one-third that rate. Consequently, the region lost relatively 9,922,000 tonnes of grain. Both "structural" and "regional" factors were responsible for this loss. The proportionality shift was 3,363,000 tonnes while the differential shift was 6,561,000 tonnes. What follows is a description of these losses.

Rice

As mentioned, rice is dominating grain production in the South. Rice, in consequence, is a prime measure to analyse the development of grain in this region. In 1980, the South produced 33,015,000 tonnes of rice, a volume responsible for 86.86 percent of the total grain output of this region, and 22.97 percent of the national rice production. In 1990, rice output was

37,539,000 tonnes, a volume sufficient to keep the share of rice in the region's total grain output at 87.11 percent, (although its share in national total rice output dropped to 19.83 percent). The growth rate of rice during the period was 13.70 percent, significantly under the national pace. All these events caused the South to lose relatively 8,509,000 tonnes of rice, an amount which accounted for 85.76 percent of the total loss of the region during the period under study. The regional factor was chiefly to blame for this loss. The differential shift was 5,946,000 tonnes, while the proportionality shift was only 2,564,000 tonnes. Taking into account the historical factor, the current total shift was 5,536,000 tonnes whereas the historical shift was 2,973,000 tonnes.

Wheat

This region is not favourable for wheat production. Wheat plays a small role in the grain basket. In 1980 wheat output was 490,000 tonnes, or only 1.29 percent of the region's total grain production. In 1990 it had been augmented to 553,000 tonnes, a 12.86 percent increase, and it was accounting for the same share in the region's total grain production as in 1980. As expected, the region's proportionality shift for wheat was positive, registering 216,000 tonnes. However, because its growth rate of wheat was much inferior to the national growth rate of wheat, its differential shift was negative, namely, -

346,000 tonnes. On combining the two, the total shift registered a negative -130,000 tonnes.

Corn

The South produced 1,175,000 tonnes of corn in 1980, an amount which had risen by 18.55 percent in 1990. Corn accounted for 3.09 percent of the region's total grain output in 1980 and 3.23 percent in 1990. The relative change undergone by corn is very similar to that of wheat: a positive proportionality shift (204,000 tonnes), together with a negative differential shift (450,000 tonnes), is forthcoming with a negative total shift (246,000 tonnes).

Soybean

In 1980 soybean production of the South was 370,000 tonnes; ten years later it had grown to 425,000 tonnes. The regional growth rate of soybean was 14.86 percent, well below the national counterpart. During the period under question, the region lost relatively 91,000 tonnes of soybean, and such loss was solely brought about by the negative differential shift (-91,000 tonnes).

Tuber

Tuber is the second largest grain crop in the South. Its production recorded the fastest growth of all grain crops in the region over the period from 1980 to

1990. In 1980, the South produced 2,500,000 tonnes of tuber crops, which accounted for 6.58 percent of the region's total grain; in 1990 tuber production had advanced to 3,051,000 tonnes, and its share in the region's "grain pie" had increased slightly to 7.08 percent. The growth rate applying to tuber crops was 22.04 percent. This is opposite to the national trend of decline. Therefore, the differential shift of tuber was positive, being 588,000 tonnes. However, the proportionality shift was negative (-1,024,000 tonnes), the corollary of the national decline. The negative proportionality shift outweighed the positive differential shift, and the result was a relative loss of 436,000 tonnes of tuber.

Sorghum and Millet

The South has very little production of sorghum and millet. Their production, in fact, is only nominal. In 1980 the production of sorghum and millet was 5,000 tonnes and 10,000 tonnes, respectively. In 1990 sorghum output was 10,000 tonnes and that of millet was 7,000 tonnes. Sorghum managed a total shift of 3,000 tonnes. This was the only positive total shift in the South, although the paltry showing deprived it of any practical meaning. The total shift of millet was -7,000 tonnes.

4. 3. 2. 6. The Southwest

This region is dominated by mountain and hilly country. Its main grain crops are rice, wheat and corn. Despite the adverse terrain, it occupies an important place in China's grain production.

In 1980 the Southwest harvested 50,005,000 tonnes of grain, which accounted for 15.63 percent of the national total grain output. In the end year of the period under study total grain production of the region reached 61,005,000 tonnes, which accounted for 13.67 percent of the national total grain output. Its share in the national grain basket thus decreased by 2 percentage points. The growth rate of total grain of the region was 22.00 percent , which was lower than the national grain growth rate of 39.47 percent. Consequently, the Southwest had a relative loss of total grain production. Its total shift was -8,739,000 tonnes. This loss was mostly credited to the regional factor. The differential shift was -6,840,000 tonnes, whereas the proportionality shift was -1,900,000 tonnes.

Rice

Rice is the largest grain crop cultivated in the region. In 1980 rice production was 22,500,000 tonnes, an amount which accounted for 45.00 percent of the region's total grain output and 15.65 percent of the national total rice output. In 1990, the region's rice output advanced to 30,745,000 tonnes, which amounted to 50.40 percent of the region's total grain output and 16.24 percent of the national total rice production. The share of rice in the region's total grain output was higher than the national counterpart and, more importantly, the Southwest's growth rate of rice (36.64 percent) was higher than the national growth rate of rice (31.71 percent). So the region showed a relative gain of 1,109,000 tonnes of rice caused by the regional factor. However, because the Southwest's growth rate of rice was lower than the national growth rate of total grain, it relatively lost 1,747,000 tonnes of rice in the proportionality shift. This loss offset the gain from the regional effect with the result that the total shift of rice was -637,000 tonnes.

Wheat

During the period stretching from 1980 to 1990, wheat production in the Southwest increased by 48.71 percent; that is, from 6,030,000 tonnes in 1980 to 8,967,000 tonnes in 1990. The share of wheat in the region's total grain output was 12.06 percent in 1980 and 14.70 percent in 1990. Both fell below the corresponding national proportion. The growth rate of wheat in this region was lower than the national growth rate of wheat but higher than the national growth rate of total grain. Thus, the Southwest displayed a positive proportionality shift (2,653,000 tonnes) and a negative differential shift (-

2,096,000 tonnes). The upshot of adding the two was a relative gain of 557,000 tonnes of wheat.

Corn

Corn is the second largest grain crop produced in the region. In 1980, corn production was 10,160,000 tonnes, accounting for 20.32 percent of the region's total grain output and 16.46 of the national total corn volume. In 1990 output of corn reached 11,710,000 tonnes, or 19.20 percent of the region's "grain pie" and 12.09 percent of the national total corn output. The Southwest's share of corn in the region's total grain was smaller than its national counterpart, and its growth rate of corn (15.26 percent) was much less than a third of the national rate (56.86 percent). Therefore, it registered a negative differential shift of -4,227,000 tonnes, an amount which offset the positive proportionality shift of 1,766,000 tonnes. This granted the region a negative total shift of -2,461,000 tonnes of corn.

Soybean

Soybean was the fastest growing grain crop in the Southwest during the period between 1980 and 1990 because of the increasing demand for soybean products, although its production scale was small. The output of soybean in 1990 was a mere 634,000 tonnes, accounting for only 1.04 percent of the region's total grain and 5.76 of the national total soybean production. The growth rate of soybean was 78.59 percent, much higher than the national growth rates of both soybean and total grain. The fast growth of soybean gave it a positive total shift of 139,000 tonnes which was mainly brought about by the differential shift of 138,000 tonnes.

Sorghum

Sorghum is usually planted by the peasants as an auxiliary grain crop in this region. In 1980 total output of sorghum in the Southwest was 195,000 tonnes. In 1990 it had increased to 277,000 tonnes, although nationally it was a declining grain crop.

The rate of growth of sorghum was 42.05 percent during the period under question, a rate faster than the national rate of growth of total grain. This brought the Southwest a positive differential shift of 113,000 tonnes which outweighed the negative proportionality shift of -108,000 tonnes, and gave a relative gain of 5,000 tonnes to this region.

Millet

Since its production is so trifling, millet has nearly no effect on the region's grain basket. The output was only 10,000 tonnes in 1980, and it further decreased to 8,000 tonnes in 1990. The total shift was -6,000 tonnes.

Tuber

Tuber crops play a substantial role in the region's grain production, and their production grew instead of shrinking, which was the case at the national level. In 1980 the output of tuber crops was 5,710,000 tonnes. A decade later it had increased modestly to 6,199,000 tonnes. The growth rate was 8.56 percent, which was still much lower than the national rate of growth of total grain. So, while the differential shift was positive (574,000 tonnes), the total shift was still negative (-1,765,000 tonnes), because of the larger negative proportionality shift (-2,339,000 tonnes).

Having completed the sweeping review of differences in crop pattern as they are manifested between the big regions, it is necessary to embark on a parallel review that elicits differences in the meat-production pattern.

4. 4. Spatial Variations In Meat Production

4. 4. 1. National Meat Production Performance

In tandem with rising income and improving living standards achieved in the reform era, China's per capita meat consumption has undergone a significant increase. It is the conscious result of the Chinese consumer's ability to diversify his and her diet away from a starchy staple. This changing pattern abides by those experienced by all other societies; that is, except those restricted by religious customs (6). The intake of pork, fish, poultry, beef, mutton, eggs, and dairy products—milk, butter, cheese, yoghurt, and ice cream—all increased. However, because of data inadequacies relating to fish, poultry, and dairy products, I am restricting this examination to pork, beef, and mutton. Fortunately, red meat is a good indicator of the tendency under way in livestock production and related activities.

During the period extending from 1980 to 1990, red meat production exhibited a remarkable progress. The total red meat output, consisting of pork, beef, and mutton, more than doubled. It increased from 12,055,000 tonnes in 1980 to 25,135,000 tonnes in 1990. The national rate of growth of red meat was thus a spectacular 108.50 percent..

Appendix 4-4 shows the relative changes of meat production during the period between 1980 and 1990 at both the national level and the macro-region level. Of the meat types present, pork takes the lion's share. It accounted for no less than 94.08 percent of the total red meat output in 1980, and 90.75 percent in 1990. During the period, China doubled pork production. The pork output was 11,341,000 tonnes in 1980, but by 1990 it had advanced to 22,811,000 tonnes. While the growth rate for pork was very impressive, it nevertheless remained smaller than the national growth rate of total red meat output. Thus, pork evinced a total shift of -839,000 tonnes, an amount which implies that if pork production had progressed at the same pace as the production of total red meat, there would have been an extra 839,000 tonnes of pork for consumers. This relative loss was owing entirely to pork's slower development speed. In other words, the proportionality shift is solely responsible for this relative loss.

During the period under study, beef achieved the fastest growth of the three types of red meat. In 1980, output of beef was only 269,000 tonnes, the least of the three. In 1990, beef assumed second place. Its output had rocketed to 1,256,000 tonnes, a quantity greater than mutton. The growth rate of beef was incredibly high, growing more than three times, by some 366.91 percent. This remarkable absolute increase brought in the biggest relative gain of 699,000 tonnes. The structural factor was the major contributor to the relative gain.

With an output of 445,000 tonnes, mutton held second place in the red meat stakes in 1980. But in 1990 it yielded its position to beef, although it had experienced substantial growth. The output in 1990 was 1,068,000 tonnes, an increase of 140.00 percent over 1980. This growth rate was slower than that of beef, but well above the overall growth of the total red meat output. Therefore, mutton displayed a positive total shift of 140,000 tonnes, and this relative gain was fully attributable to the proportionality shift.

Each region contributed differently to the process of developing red meat, in compliance with its changing pattern of location quotients. A detailed description of these contributions follows below.

4. 4. 2. A Region by Region Analysis

4. 4. 2. 1. The Northeast

The Northeast experienced the slowest progress in boosting red meat production among the six macro-regions. The total red meat production of this region was 1,047,000 tonnes in 1980, and 1,681,000 tonnes in 1990. The corresponding growth rate, then, was only 60.55 percent., well below the national average. As a result, the Northeast recorded a negative total shift of

502,000 tonnes. With a value of -504,000 tonnes for the differential shift, the "regional " factor was the chief culprit.

In accordance with the national trend, the Northeast showed a sound and fast development in beef production. During the period under study, beef output climbed from a meagre 28,000 tonnes in 1980 to 122,000 tonnes in 1990, an increase of 335.71 percent. While much higher than the rate of growth of national red meat, this rate was still smaller than the national growth rate of beef (366.91 percent). As a result, the region was forthcoming with a positive proportionality shift of 72,000 tonnes of beef in conjunction with a differential shift of only -9,000 tonnes. The total shift for beef , in consequence, was 64,000 tonnes.

Mutton output rose steadily during the period. In 1980 it stood at 12,000 tonnes, whereas in 1990 it had been augmented to 34,000 tonnes. The rate of growth was 183.33 percent, which was higher than the national growth rate of both total red meat and mutton. Unsurprisingly, the Northeast displayed a positive total shift which may be further divided into 4,000 tonnes of proportionality shift and 5,000 tonnes of differential shift.

4. 4. 2. 2. The North

Red meat production grew dramatically in the North. In 1980 the total red meat output of the region was 2,217,000 tonnes. After ten years it had climbed to 4,918,000 tonnes, an increase of 121.83 percent, and an increase which was higher than the national counterpart. Thus the region had a positive total shift of 295,000 tonnes which included -72,000 tonnes of proportionality shift and 368,000 tonnes of differential shift.

During the period, pork experienced a 93.70 percent growth in production. Its output increased from 2,111,000 tonnes in 1980 to 4,089,000 tonnes in 1990. However, its 93.70 percent growth rate was still under the national growth rates of both pork production and total red meat. Therefore, the North showed a negative total shift of -312,000 tonnes. Both the "structural" and "regional" factors contributed equally to this relative loss. The proportionality shift was -155,000 tonnes while the differential shift was -157,000 tonnes.

The North exhibited the most remarkable increase in beef production of all the regions. In 1980 its beef production was only 22,000 tonnes whereas in 1990 it registered 455,000 tonnes, a twenty-fold increase. To be more exact, the growth rate of beef was an almost unbelievable 1968.18 percent. This was the fastest growth rate recorded in the country. It granted the North a positive total shift of 409,000 tonnes, most of which came from the differential shift (352,000 tonnes).

This region's mutton production also progressed at a pace faster than the national average growth rates of mutton and of total red meat during the period between 1980 and 1990. Mutton output was 84,000 tonnes in 1980, but 374,000 tonnes in 1990. The total shift of mutton was 199,000 tonnes. The proportionality shift, at 26,000 tonnes, was overshadowed by the differential shift, at 172,000 tonnes.

4. 4. 2. 3. The Northwest

The Northwest, a homeland for many minorities, presented a different picture in the development of red meat production. The total red meat output increased from 832,000 tonnes in 1980 to 1,814,000 tonnes in 1990. The growth rate was 118.03 percent, and, as such, was above the national growth rate of total red meat. The region had a negative differential shift of -202,000 tonnes combined with a positive proportionality shift of 281,000 tonnes. Upon merging the two, the result was 79,000 tonnes of relative gain during the period.

The share of pork in total red meat was 63.58 percent in 1980 and 61.47 percent in 1990. These shares were the smallest of all the regional shares.

Pork production grew at a rate of 110.78 percent, which was higher than the national growth rate of both total red meat and pork. Therefore, the Northwest gained a positive differential shift (51,000 tonnes) and a negative proportionality shift (-39,000 tonnes). The positive outweighed the negative, and the total shift applying to pork was 12,000 tonnes.

This region produced 99,000 tonnes of beef in 1980, which accounted for 11.90 percent of the region's total red meat production. In 1990, an additional 182,000 tonnes of beef were produced, and beef's share in the region's meat basket was increased to 15.49 percent. The growth rate of beef was 183.84 percent, half as much as the national rate, but well above the national growth rate of total meat production. Thus, the Northwest's proportionality shift was positive (256,000 tonnes), and the differential shift was negative (-181,000 tonnes). Because the positive shift was bigger, the total shift was also positive (75,000 tonnes) .

As mentioned earlier, the Northwest is specialised in producing and consuming mutton and is the largest production area for this product. In 1980 mutton output was 204,000 tonnes, an amount which accounted for 24.52 percent of the region's total red meat output, and 45.84 percent of the national total mutton output. However, the growth rate of mutton was only 104.90 percent, a rate lower than both the national growth rate of mutton and the national growth rate of total red meat. As a result, the Northwest displayed a positive proportionality shift of 64,000 tonnes and a negative differential shift of -72,000 tonnes. This effected a relative loss of 7,000 tonnes of mutton during the period in question.

4. 4. 2. 4. The East and Central Region

This region takes first place in red meat production. In 1980, it produced a total of 4,298,000 tonnes of red meat, a volume which accounted for 35.65 percent of the national total output of red meat. In 1990, red meat production in the region increased to 7,947,000 tonnes, rendering the region first place still. However, its share in national total output had decreased to 31.62 percent and, more importantly, its growth rate was only 84.90 percent, well below the national pace. Consequently, the East and Central region had a relative loss of 1,014,000 tonnes of meat, which was the largest relative loss of all regions. This loss was composed of -204,000 tonnes of proportionality shift and -811,000 tonnes of differential shift.

Pork dominated the meat basket. In 1980, pork output was 4,200,000 tonnes, an amount which accounted for a massive 97.72 percent of the region's total red meat production, and 37.03 percent of the national total pork output. In 1990., pork production was bolstered to 7,654,000 tonnes. However, its share in the regional meat basket slightly decreased (from 97.72 percent to 96.31 percent), and its share in the national total meat output declined a touch more, to 33.55 percent. The growth rate of pork was only 82.24 percent, the second lowest of the regional rates (only above the Northeast's). As expected, this region had a negative result in both proportionality (-309,000 tonnes) and differential shifts (-794,000 tonnes). The total shift was -1,103,000 with respect to pork.

Beef takes the last place in the three red meat categories in the East and Central region. In 1980 there were only 33,000 tonnes of beef produced. In 1990, this figure had climbed to 161,000 tonnes, an increase of 387.88 percent, which was above the national growth rates of both beef production and total meat output. Consequently, both the proportionality shift and differential shift of this region were positive. The former was 85,000 tonnes and the latter was 7,000 tonnes. The total shift, for its part, was 92,000 tonnes.

Mutton plays a fairly significant role in satisfying this region's demand for meat. In 1980 mutton output was 65,000 tonnes, and in 1990 it amounted to 132,000 tonnes. The increase, 103.08 percent, was below the national counterpart and also below the national growth rate of total meat output. Thus , this region had a positive proportionality shift (200,000 tonnes) and a negative differential shift (-24,000 tonnes). The total shift for mutton was -4,000 tonnes.

4. 4. 2. 5. The South

Unlike the case in grain production, the South had a positive shift for all red meat. In 1980, total meat production was 1,320,000 tonnes; in 1990 it reached 3,152,000 tonnes, an increase of 138.79 percent. The total shift was 400,000 tonnes.

Meat activity in the South is dominated by pork. In 1980 pork production was 1,301,000 tonnes, and accounted for 98.56 percent of the region's total meat production. In 1990, it had been enlarged to 3,065,000 tonnes, an increase of 135.59 percent. However, its share in the region's total meat portfolio was slightly reduced to 97.24 percent.

Beef has a very small share in this region's meat production. In 1980 the South produced 14,000 tonnes of beef, and in 1990 it supplied 75,000 tonnes. The small volume belied a huge growth rate; namely, 435.71 percent. This rate was not only higher than the national beef production rate, but it was also higher than the national rate of growth of total meat production. Thus, the South had a positive total shift for beef, 46,000 tonnes, which consisted of 36,000 tonnes of proportionality shift and 10,000 tonnes of differential shift.

People in the South eat very little mutton. Its production is scarcely discernible. In 1980 the mutton output was only 5,000 tonnes whereas in 1990 it was 12,000 tonnes. The growth rate coincided with that for national growth. The total shift for mutton was 2,000 tonnes.

4. 4. 2. 6. The Southwest

The Southwest displayed the fastest growth of total red meat production of all six macro-regions. In 1980 total meat output there was 2,338,000 tonnes, an amount which accounted for almost one -fifth of the national total red meat production (19.39 percent); in 1990 it had jumped to 5,623,000 tonnes, and accounted for over one-fifth of the national total (22.37 percent). The growth rate was 140.50 percent, well above the national growth rate of 108.50 percent. The fast absolute growth brought in a relative gain of 748,000 tonnes. The regional factor contributed more than the structural factor to this positive shift, but the historical factor had no effect at all.

The relative gain of total meat in this region was ultimately caused by the rapid growth of pork production. During the period between 1980 and 1990, pork output increased from 2,192,000 tonnes to 5,363,000 tonnes, giving a 144.66 percent growth rate, which was larger than both the national growth rates for pork and for total meat production. In the event, the region had a negative proportionality shift (-161,000 tonnes), combined with a positive differential shift (954,000 tonnes). Because the positive component is larger than the negative, the total shift is also positive. The relative gain was 793,000 tonnes.

Sichuan province dominated this region's pork production. In 1980, Sichuan was responsible for 74.95 percent of the region's total pork output. In 1990, its share had declined, but it still accounted for 68.95 percent of the regional total. There is a Chinese saying: *Chuan Zhu Man Tian Xia.*, which means pigs from Sichuan are seen everywhere in China.

Beef production expanded at a rate of 128.17 percent during the period, a rate which was below the national counterpart. The base year output was 71,000 tonnes while the end year figure was 162,000 tonnes. The total shift was 14,000 tonnes, the result of blending 183,000 tonnes of proportionality shift with -170,000 tonnes of differential shift.

The Southwest had the second largest production of mutton of any big region. Mutton accounted for 3.21 percent of the region's total red meat output in 1980. In 1990 this share had reduced to 1.74 percent. The growth rate of mutton was only 30.67 percent, the lowest of all regional growth rates. Consequently, the Southwest recorded a negative differential shift of -82,000 tonnes. Because mutton production was nationally increasing, the proportionality shift of the region registered positive, amounting to 24,000 tonnes. The total shift turned out to be -58,000 tonnes. The historical factor was a major contributor (-117,000 tonnes) to this outcome.

On that note, the review of regional variations in crop and meat production is completed. All that remains to do now is to summarise the key points brought out in the chapter.

4. 5. Summary

The primary objective of this chapter is to monitor the spatial variations occurring in agriculture during the 1980s, a critical era of Chinese reform and development. Limited by the time and scope of such study, it is impossible to cover all sectors of agriculture in this thesis. Therefore, two output indicators, namely, grain production and red meat production, are selected as the benchmarks of agriculture. The former represents cropping; whereas the latter stands for animal husbandry. Both cropping and animal husbandry are the most essential and important components of agriculture. By studying these two indicators, a basic understanding of regional variations of Chinese agriculture is achieved.

For the purposes of this study, the combination of the location quotient method and the shift-and-share technique is perfect. On the one hand, the application of the location quotient enables us to recognise the areal specialisation of both grain and meat production at both the macro-region level and the provincial level. On the other hand, an analysis of shift-and-share terms of each individual region makes it possible to understand each region's relative performance compared with the national average during the period under study.

From 1980 onward, China's agriculture has undergone a rapid development. All six macro-regions increased their production of both grain and meat dramatically. However, the pace of growth in each region was not the same. Each individual region differed in its performance. What follows is a brief summary of each region's specialisation and performance in grain and meat production.

The Northeast specialises in maize, soybean, sorghum, and millet. It also supports itself with locally produced pork. During the period under question, the Northeast showed an above- average performance. It achieved a positive total shift of 9,114,000 tonnes of grain output and scored a negative total shift of 502,000 tonnes of meat output.

The North is an important agricultural area. It is specialising in producing wheat, corn, soybean, sorghum, millet and tuber. However, its location quotients were not very high, which implied that its specialisation level was not high. The North is also intensifying its beef production. During the period extending from 1980 to 1990, it grew at a faster speed than the national average, and relatively gained 5,048,000 tonnes of grain and 295,000 tonnes of meat.

The Northwest is most specialised in wheat production. It also records positive location quotients for corn, sorghum, and millet. The Northwest is producing more beef and mutton than its local demand warrants. During the 1980s, it displayed a fast development. Its relative gain of total grain and meat are 5,664,000 tonnes and 79,000 tonnes, respectively.

The East and Central region is playing a very important role in grain production. It is mainly specialised in rice and meat production. Yet, during the period under study, its performance was not so good. The total shift of grain of the East and Central region was a negative 1,165,000 tonnes. Its total shift of meat was also negative, -1.014.000 tonnes.

The South is particularly specialised in producing rice. It is barely able to satisfy its demand for pork. Although the South exhibited a positive total shift of meat (400,000 tonnes), it had the poorest progress in grain production. A total relative loss of 9,922,000 tonnes of grain, the largest relative loss among all regions, was registered in its account.

The Southwest is specialised in rice, tuber and pork production. Similar to the South, the Southwest scored a negative total shift of grain (-8,739,000 tonnes) and a positive total shift of meat (748,000 tonnes).

What do these relative performances of individual regions in agriculture imply? What lessons may be drawn from each observation? What recommendations may be made based on the analysis of spatial variations for regional policy? To answer these questions is the task of the next chapter.

End Notes:

1. W.Colby et al, Agricultural Statistics of the People's Republic of China, Statistical Bulletin, No.844, United States Department of Agriculture, Washington, D.C., 1994.
2. See relative equations in Chapter 3.
3. Dennis A. Rondinelli, Applied Methods of Regional Analysis, Westview Press, Boulder and London, 1985, p.90.
4. ShuJie Yao, Agricultural Reforms and Grain Production In China, St. Martin's Press, New York, N.Y. 1994, p89.
5. Xu Guohua and L.J. Peel, The Agriculture of China, Oxford University Press, 1991, p.113.
6. Lester R.Brown, Who Will Feed China? W.W. Norton & Company, New York and London, 1995, p.45.

CHAPTER 5. CONCLUSION: REGIONAL IMPLICATIONS AND AGRICULTURAL POLICY

5. 1. Introduction

In previous chapters I elaborated on China's worsening problem of the widening of regional disparities in both economic and social development (Chapter1); reviewed the historical and contemporary development of Chinese agriculture and the part it plays in the Chinese economy (Chapter 2); presented a regional analysis method of the shift-and-share approach (Chapter 3); and analysed the spatial variations of agricultural performance during the period extending from 1980 to 1990, a critical era of China's economic reforms and opening up (the preceding chapter). Together, this body of work provides a general understanding of the issue of regional disparities in Chinese economic and social development, before addressing the differential performance of agriculture in different regions in particular, and rendering a basic framework to further enquire into the underlining factors of such variations and their relevant implications for regional development of agriculture. The latter is what this concluding chapter intends to address. In other words, the main object of this chapter is to contemplate the relationships between regional disparities of economic and social development and spatial variations of agriculture, to analyse the causes and interpret the regional implications of the spatial variations of agriculture, and to discuss the relevant development policy.

5. 2. The Causes And Implications Of The Spatial Variations

5. 2. 1. National Perspective

As mentioned in Chapter 1, hitherto almost all literature dealing with China's regional disparities has focused on the secondary and tertiary sectors, but especially manufacturing industries. These studies seldom directly address regional disparities from the agricultural standpoint. Though there are voluminous works dwelling on China's agricultural geography, no publication was found to integrate the spatial variations of agriculture into China's general regional disparities. Based on the previous chapters' work, the author strongly believes that there is a close correlation between these two issues. More specifically, it is held that spatial variations in agriculture, brought about by the varying geographical conditions, constitute the fundamental cause of general regional disparities, while the latter in turn would further strongly shape agricultural performance in each individual region. It is the differential performance in agriculture that occasioned an uneven economic and social development.

As discussed in Chapter 1, three factors contribute most to the present general east-west economic and social divisions. They are the physical and economic-geographical setting, heritage of development, and government policy of regional development. All three can be further examined from the agricultural perspective.

The physical and economic conditions for agriculture in the East Monsoon China area are much better than those in the Northwest Arid China and the Qinghai-Xizang Frigid Plateau area. The eastern areas' general physical setting, including climatic conditions, particularly the temperature and precipitation and its seasonal distribution; the topographical pattern; the water resources; soils; and so on, are all better than those of the western areas. So are the economic and social endowments. This forms the physical cause of the east-west divisions.

As human history goes, farming and animal husbandry grew first, then, with a surplus of food supply and labour, came the manufacturing and service sectors. So, it is natural that those areas with good agricultural conditions will bring with them good endowments for the development of the secondary and tertiary sectors, such as more surplus food, labour, and capital, and, consequently, non-agricultural sectors would grown faster and at a larger scale in these areas than those without comparable good agricultural resources. This supposition is borne out in China. For instance, as pointed out in Chapter 1, China's eastern coastal area has better conditions of agriculture than its western interior area; hence, agriculture in the eastern area grew earlier and faster than that in the western area, and so did the secondary and tertiary sectors.

Another case which may arise is that where an area may not have a comparative advantage in agriculture, but it is located in an important 'cross-roads'; in other words, it has good geographical connections, so its agriculture was cultivated earlier than other areas. In such circumstances, it is also likely to generate a better industry and service infrastructure than other areas.

Overall, Chinese agriculture has not received what it deserved in terms of capital input since 1949. On the contrary, the CCP government put too much capital into industry at the expense of agriculture. Among the limited capital investments for agriculture, most of it went to the eastern area in the hope that it would generate more capital return and products in order to support non-agricultural sectors. This imblanced investment further exacerbated the gaps existing between eastern agriculture and western agriculture.

The interaction among these three factors, combined with other factors, first established the basic reality of east-west disparities in agriculture, and then affirmed the disparities in the secondary and tertiary sectors. The imbalanced distribution of industry and services then produced differential progress in nearly every aspect of economic and social development; resulting in what we call general regional disparities. General regional disparities, in turn, further shape the spatial variations of agriculture.

However, it is worth noting that some areas, after successfully experiencing an economic take-off which was heavily reliant on their comparative advantages in agriculture, may no longer be interested in developing agriculture, primarily because of the lower comparative profit of agriculture compared with the secondary and tertiary sectors. Areas of this kind will shift economic focus to industry and/or tertiary sectors. Less capital investment will go to agriculture. For these areas it is more profitable to import agricultural goods rather than to produce them locally. Such areas will then lose their comparative advantages for agriculture. The South region, particularly Guangdong province, is a good example. These occurrences offer a good opportunity for undeveloped areas to catch up.

For each individual region, this kind of change B either switching away from agriculture or playing 'catch-up' with it—seems economically rational, but from the national point of stand, it will aggravate the transportation bottlenecks and regional gaps, and potentially impair national food security. However, for the moment, let us remain with regional options

5. 2. 2. Regional Perspective

5. 2. 2. 1. The Northeast

Although the Northeast region, located in the northern part of the natural realm of Eastern Monsoon China, has very good potential for agricultural development in terms of the best quality of land and the second largest acreage of unused arable land, it failed to make the best use of this potential. Nevertheless, Heilongjiang province has became one of the most important bases of commercial food grains and economic crops in the country. During the period from 1960 to 1980, the major focus of economic development was placed on industry, particularly heavy industry. There are two historical reasons for this situation. First, the Northeast was long occupied by the Japanese, who established a certain scale of military-related industries and resources mining. Second, the Northeast was one of the biggest beneficiaries during the first two Five-year-plan periods. Many former USSR- supported industrial projects were located in this area. Because of these two reasons, the Northeast has long been the national industrial base, strongly featured in mineral mining and heavy industry. Meanwhile it has to import a large amount of agricultural goods, particularly rice and meat. Liaoning, in fact, has been a net grain and meat import province for a long time.

Since the early 1980s, the Northeast belatedly began to realise the importance of agriculture in its economy and its great advantages in agriculture, and put a great effort into developing cultivation and animal husbandry. The result was impressive. It produced 13.12 percent of the nation's total grain in 1990, which was more than its population share (8.69 percent). More importantly, the Northeast achieved a growth rate of 65.20 percent in grain production during the period from 1980 to 1990, much higher than the corresponding national average growth rate of 39.47 percent. This produced a positive total shift of 9,114,000 tonnes of grain. In detail, rice and corn contributed the most to this positive shift. From a provincial perspective, Heilongjiang made the biggest contribution. It had a total shift of 2,727,000 tonnes of grain production; whereas that of Liaoning was -2,090,000 tonnes..

However, regarding the red meat production, the Northeast did not perform as well as in grain production. Its national share of red meat was only 6.69 percent, lower than its population proportion. Although, it had a growth rate of 60.55 percent in meat production during the period under study, this was lower to the tune of about 40 percent than the national growth rate. Consequently, it had a negative total shift of 502,000 tonnes in red meat production. This negative shift was fully caused by the "regional" factors. Traditionally, peasants in the Northeast were not accustomed to, or interested in, raising pigs in their houses, as were those in the southern area. Major animal husbandry is in the form of a combination of seminomadism and fixed pastoralism.. This may explain in part the Northeast's disappointing progress in red meat production.

5. 2. 2. 2. The North

The North was traditionally the core of Chinese agriculture and today it still has the largest concentration of cultivated land. This region suffers from a high population pressure on land. Its population share (27.31 percent) is much higher than its share of total area (10.63 percent). Most arable land in the North region has been cultivated for thousands of years and there is only a slim possibility for enlargement of farmland acreage. Because of this severe population pressure, agriculture has always been accorded prime importance in order to meet the unrelenting demand for food.

There is no big change anticipated for agriculture. The North maintained its national share of grain production during the period extending from 1980 to 1990. In 1980, it produced 22.08 percent of the national total grain output; in 1990 this share was 23.21 percent. The growth rate of total grain during the period was 46.62 percent, 7 percentage points above the national norm, which brought it a relative gain of 5,048,000 tonnes of grain. This gain is mostly because of its effort to maintain the current scale of grain production.

The North region did even better in meat production than in grain production. During the period under study the growth rate of red meat production was 121.83 percent, much higher than the national counterpart of 108.50 percent. This faster growth rate gave it a positive total shift of 295,000 tonnes. This relative gain was credited to the 368,000 tonnes associated with the differential shift.

The North's increase in pork production was slower than the national pace, so the relative gain was owing to expansion in beef and mutton. Beef played the critical role in achieving a faster growth of total red meat production. From 1980 to 1990, total beef production increased by twenty times, from 22,000 tonnes to 455,000 tonnes, or an incredible growth rate of 1968.18 percent, which was the fastest growth rate in the country. It is this incredible growth that granted the North a positive total shift of 409,000 tonnes. The North has a large stock of cattle, horses, mules, donkeys, and sheep, but it has no water buffalo. It is good policy to keep domestic-feeding cattle as well as pigs and chickens in this region.

5. 2. 2. 3. The Northwest

The Northwest is an arid area. Around half of the region has less than 100 mm of annual rainfall. Generally, cropping is impossible without irrigation under such circumstances. This is why only a small fraction of land is cultivated and most of the cultivated land is irrigated. Rain-fed cropping is only possible on a few alluvial fans or plains to be found at the foot of various high mountains, and the yields here may be only a fraction of those obtained from the irrigated land. Wheat is the major grain-crop of the region. Corn takes the second place. The two account for 67.08 percent of the total grain.

For a long time , the Northwest was unable to produce the food it needed. It had to import a large amount of food. However, during the period under study, the Northwest launched a large-scale programme of basic construction of agricultural facilities; improved the existing, and built many new irrigation facilities; and claimed a considerable area of new farmland. As a result, the Northwest achieved an above-average performance in grain production. Its rates of growth of both total grain and wheat were greater than the corresponding national averages. The total shifts of total grain and wheat were 5,664,000 and 4,238,000 tonnes, respectively. The increase of wheat production was the major contributor for the positive performance of total grain production of the region. The most significant change is that it now is basically able to feed itself.

Xinjiang had the largest contribution to make in agricultural development among all provinces in the Northwest. It has become an important base of China's commercial grains, featured in wheat products (1).

Dominated by ethnic minorities, people who usually prefer beef or mutton to pork either due to religious reason or cultural tradition, the Northwest has a different meat consumption structure. Compared with other regions, pork, with 61.47 percent of the total red meat in 1990, took the smallest share among all regions, though it was still the chief meat consumed, and the growth rate of pork was higher than the national average.

Beef , a commonly-liked meat by most ethnic minorities, steadily increased its share in the region's total red meat. The Northwest had a positive 75,000 tonnes of total shift of beef, mainly because of the structural factor. However, its growth rate was much lower than the corresponding national counterpart. This is probably because: first, the Northwest already had a considerable scale of cattle raising before 1980 (Mongols, the Kazak, the Kirgiz, the Tajik, and the Yugur, etc., are good at livestock grazing) , so it is very difficult to achieve an acceleration in its growth; and second, the minorities' peasants record lower levels of production compared with those of the Han people.

The Northwest is specialising in both production and consumption of mutton, the most favoured meat of many local ethnic minorities. The Northwest alone produced nearly half of the national total of mutton. However its growth rate, while attaining 104.90 percent, was under both the national growth rate of mutton and the national growth rate of total red meat, which brought it a negative total shift of -72,000 tonnes of mutton. Reasons for this state of affairs echoed those for beef.

5. 2. 2. 4. The East and Central China Region

This region, another densely populated area, is one of China's economic and political cores. It has been the national centre of Chinese agriculture for a very long time. This region has the highest level of agricultural production. With only 21 percent of the country's cultivated land, it produces 32 percent of the country's total grain.

However, it is precisely its relative maturity that contributed much to its relatively poor performance of grain production. During the period under question the growth rate of grain production in this region was lower than the national average. The total shift was -1,165,000 tonnes of grain. The neglect and loss of farmland caused by rapid industrialisation were other important factors in this tardy performance.

In terms of output, the East takes first place among all six regions in red meat production. However, in a similar fashion to grain production, this region did poorly in producing red meat. Its growth rate (84.90 percent) was much under the national average. With a value of - 1,014,000 tonnes, it was not surprising that the East had the largest relative loss of red meat production.

5. 2. 2. 5. The South

Blessed with tropical and subtropical agricultural conditions, the South had been a grain export region for a long time. It was the major production base of rice which is the staple grain crop of the region. Just like the East, the South had a high level of agricultural productivity. However, since 1980, the pace of agricultural development has been much lower than other regions. The growth rate of total grain production during the period between 1980 and 1990 was only 13.37 percent, less than one-third the national norm. Consequently, it had a relative loss of grain of 9,922,000 tonnes, which was the largest relative loss. Such poor performance was caused by two factors. First, the South had a higher proportion of rice while rice was a relatively national slow-growth sector. Second, the region was rapidly undergoing industrialisation, so agriculture was comparatively neglected.

The South had a better accomplishment in producing red meat. With a positive total shift of 400,000 tonnes, this region was barely able to achieve self-sufficiency in meat production. Peasants in this region have a propensity to domestically raise hogs. With the existing good conditions of production, it is not very difficult to maintain a balance in the growth of meat supply and demand.

5. 2. 2. 6. The Southwest Region

Although the general conditions of agriculture in the Southwest region are not as good as those in the eastern and the southern areas, this region plays an important role in national agriculture. Sichuan, which produced around two-thirds of this region's total grain, has long been a 'big province of agriculture'. The Sichuan basin has the best natural conditions, is the most densely populated, possesses the highest level of agricultural production, and the highest living standards of the region. Both the grains and pork produced here are important at the national level. This is why Sichuan deserves its reputation as the 'Land of Abundance'.

However, during the period under study, the Southwest fell behind the pace of national growth. Its share in the national grain basket declined, and the growth rate of total grain production was much lower than the national average. Unsurprisingly, it had a relative loss of total grain production. The total shift was -8,739,000 tonnes. Such losses were caused mainly by the regional factors. The insufficient investment of agricultural capital, the huge number of the impoverished population, and the poor transportation infrastructure, are all contributors to the below-average performance.

By contrast, the Southwest achieved the best performance of all six regions in respect of meat production. The growth rate of total meat in the region was much higher than the national average, which led to a positive total shift of meat of 748,000 tonnes. This positive shift for the most part came from pork. The Southwest, particularly Sichuan, is famous for domestic-fed pork production. The growth rate of pork was greater than that of the national average. Because nationally, pork was a relatively slow-growing sector, so the Southwest had a negative proportionality shift (-161,000 tonnes), and a positive differential shift (954,000 tonnes). In the end it had a relative gain of 793,000 tonnes of pork. Sichuan has become a very important national production base of pork.

Both beef and mutton registered a relative loss. Their growth rates were slower than the national norm, even though nationally the two were fast-growing sectors. While the absolute consumed amount of beef and mutton increased, the share of beef and mutton in meat consumption declined. The share of beef fell from 3.04 percent in 1980 to 2.88 percent in 1990; that of mutton, from 2.21 percent to 1.74 percent.

It is now appropriate to move from a recapitulation of regional strengths and weaknesses in agricultural production to an assessment of the policy measures most suited to the agricultural well-being of the regions at issue. That is the object of the next section.

5. 3. Regional Policy Of Agricultural Development

5. 3. 1. National Policy Perspectives

China is a huge country with diversified natural and social conditions. It is such diversity that creates the natural spatial variation inherent in the agricultural pattern and development level. The latter is the ultimate cause of China's regional disparities. This diversified set of agricultural conditions requires a regional development policy for agriculture. This policy should rest on two basic principles. The first principle is to initiate regional policy consistent with the different natural conditions, economic features and different development levels of each region and to develop it in an integrated manner. In so doing, local comparative advantages will be identified and reinforced. In short, the policy prescribes *Yin Di Zhi Yi,* which means that its intent is to suit measures to local conditions.

The second principle is to maintain a balance between economic efficiency and social equity. This implies that the regional policy should not only tap the regional comparative advantages in order to provide a better economic return, but that the regional policy should also address regional disparities, and put more effort and economic resources into economically disadvantages areas in order to maintain a relatively balanced regional development.

With these two principles in mind, a brief outline of regional policy bearing on agriculture is presented.

5. 3. 2. Regional Specification

The Northeast Region: with the rich agricultural resources and better development conditions, this region should become the national production base for both grain and meat. Heilongjiang and Jilin will be the commercial grain and meat producers. It is recommended to increase the paddy area; cultivate high yield varieties of wheat; raise yields of corn; and prosecute measures for adding acreages of new farmland.

The North Region: because of the heavy population pressure and limits on the stock of resources, the top priority is to keep the pace of growth in agriculture pegged to the rapid development of the secondary and tertiary sectors. Shandong and Henan have good opportunities to supply quantities of commercial grains and meat. Measures should be taken to secure the farmland; to improve basic infrastructure of agriculture; and to pay particular attention to the large area of low and medium-low farmland in the Huang-Huai-Hai plain.

The Northwest region: its margin of self-sufficiency in food supply is still very narrow. Because of its fragile conditions, the temptation is to rely on imported grain. Thus, the first priority is to secure its self-sufficiency in food supply at the regional level; after this it may export some agricultural products, such as wheat, cotton and fruits. There is ample room to increase both farmland and per unit grain yield. Water is the key constraint for agriculture. In fact, this region has a great potential to develop irrigation-agriculture, and is regarded as the important national production base of commercial grains for the 21st century.

The East and Central Region: with a concentration of many traditional agricultural bases, and a good endowment of natural and social resources, and being the largest production area in China for many food crops (rice, winter wheat, etc.) and many cash crops, and having well-developed domestic animal husbandry, this region should still function as one of the most important national core areas of agriculture. It should consolidate self-sufficiency in grain and meat. Hunan, Hubei, Anhui, and Jiangxi will continue to be the commercial grain suppliers. However, this region faces severe problems of population pressure. The farmland per capita is less than 1 *mu* (0.07 ha.); an amount under the national average, not to mention the world average. The amount of potential arable land is also very limited. Sustainable agriculture here mainly depends on application of new agricultural technology.

The South Region: though traditionally the national grain base, with the rapid advance of industrialisation and urbanisation during the 1980s, this region has great difficulty in maintaining its former status. If the region can achieve self-sufficiency, that will be an honourable achievement, and this should be the priority. In addition, Guangdong and Fujian, which have close ties with Hong Kong and Taiwan, can also develop some export-oriented producing bases for agricultural, livestock and fishery products. The Zhu Jiang Delta, famous for its mulberry dike-paddy field-fish pond ecosystem, will continue to play a key role in providing agricultural products for the region.

The Southwest China: this area is generally under a double-cropping system, with rice and corn as the chief crops. Compared with the East and Central region and the South China region, both farming and fishing are less developed. There is plenty of scope for raising the output of much medium-and-lower yield farmland. The Sichuan basin has good endowment for agriculture and is a national agricultural production base, but now faces severe population pressure. Thus the future development of agriculture there depends very much on the input of technology and investment. The Yunnan-

Guizhou plateau is a less- developed mountainous area, but has good potential to develop 'vertical agriculture'. This region should not have much difficulty in producing enough foodgrain and meat stuff for itself, and even for inter-regional trading.

With this brief review of prescriptions, the next object is to focus on regional dimensions of grain production.

5. 3. 3. Regional Policy of Grain Production

China's current regional policy of food production maintains that each province should pursue self-sufficiency in food supply; in other words, each province should basically rely upon itself to secure food supply. It is more commonly expressed as each provincial governor being responsible for filling his/her provincial rice bag. Controversy attaches to this policy. The main argument is that such a policy is effected at the expense of regional specialisation in agriculture, which may have the result of preventing a better economic pay-off for each individual area. This policy requires those areas which have lower cost in producing crops other than grains to produce a certain amount of grains at a higher production cost, and further, because the selling price of grain is usually lower than other crops, condemns the producers to less-than-potential economic returns.

The opinion of the author is that the current policy is justifiable for four reasons, allowing that less-than-desirable side-effects may arise. First, because foodgrain is the vital and key product in the Chinese economy, it is not possible to overstate its importance. Thus, ensuring that each area has enough food is always the top priority of the Chinese government. However, with the decentralisation started at the beginning of the economic reform, the provincial government has more power than ever before, and the central government no longer has the power and ability it used to have to distribute grains between provinces without incurring heavy economic cost. This impairs the prospects of those provinces which have marginal levels of self-sufficiency in grain production. This is the most insistent reason why the central government requires that each province should strive to produce what it needs.

Second, regional specialisation will result in an enormous growth in regional trading of agricultural products. This trading will impose huge demands on transportation. Already in China the current transportation infrastructure falls far behind the demand and has been a bottleneck of economic development. The transportation shortfall is especially pronounced in bulk transportation of commodities, such as grain and fertiliser. Specialising in grain production will have the inevitable result of a great rise in long-distance grain and fertiliser transportation, which will seriously worsen the already jammed interregional network. This explains in part why the central government persists in its desire for regional self-sufficiency in grain. This leaning will continue for the foreseeable future. Only after the transportation infrastructure has been subject to substantial improvement will it be possible to lean significantly towards regional specialisation in grain production.

Third, at the current stage of China's economic transition, should the goal of regional self-sufficiency in food production be abandoned, then, the so-called inter-provincial 'grain war' is a distinct possibility, particularly in poor harvest years. The rich provinces can purchase grains from poor provinces with a higher price, which will result in food shortages for the poor provinces.

Fourth, because of the lower returns attendant on grain production, some areas, particularly in the east coastal provinces, have reduced the sown area of grain. This decline in the sown area of grain encourages two outcomes: the producer is tempted either to yield to non-agricultural landuse or to shift to other agricultural uses. While some of the loss is inevitable during the industrialisation process and the readjustment of agricultural structure, much of the transfer is solely because of short-term economic gain. One typical example is the fashion of establishing economic development zones. Many areas have inadequate investment environment, but local authorities still went ahead and established many so-called economic development zones, resulting in a waste of good farmland. Maintaining a policy of foodgrain self-sufficiency helps to curb this kind of waste.

The above four justifications explain why the Chinese central government adhered to a provincial self-sufficiency policy in food production and supply. However, one point should be stressed. On balance, it is not realistic to expect that every province can feed itself. First of all, all the municipalities except Chongqing[19] are unable to feed themselves. They are basically urban areas. There is no conceivable way for them to achieve such a target, though they administer some rural areas.

Second, some non-urban provinces are also unable to feed themselves. Included in this category are two kinds of provinces. One kind consists of those provinces which have good agricultural conditions, and hitherto were able to produce more than enough grains, but now, with rapid industrialisation and urbanisation, must turn to importing grains from other provinces or abroad. Guangdong is representative of such provinces. Another kind is

[19] Previously, there were the three municipalities of Beijing, Tianjin, and Shanghai. A new Municipality has been established, that is Chongqing, formerly a part of Sichuan province.

composed of those provinces which have poor agricultural conditions and traditionally are not able to feed themselves, such as Qinghai, Gansu, Xizang, etc.. For these provinces, it is extremely difficult, if not impossible, to realise self-sufficiency. They must rely on the outside to satisfy their food needs.

Although it seems impossible for all provinces to feed themselves, it is not beyond the bounds of possibility to achieve self-sufficiency for grain production and supply at the macro-region level. Since the Northwest, which has the worst conditions among all six macro-regions, has been basically able to feed itself, so should all other regions.

As discussed above, the policy of provincial self-sufficiency is not appropriate for some provinces, even though the majority of provinces should be able to achieve it. For the exceptions, their food security can be assured through the central government's allocation or via provincial food trading. So a large amount of long-distance transportation of grain still must be allowed for. Besides this, the inter-provincial and inter-regional structural food trading will also generate a huge demand for long-distance transportation facilities. How transportation interrelates with food production and distribution is a major subject, deserving further study. At this juncture, it is appropriate that attention is switched to the issue of East-West divisions in China.

5. 3. 4. Addressing East-west Gaps from the Agricultural Perspective

East-West disparities has been substantially increased since the early 1980s. This issue, which is an inevitable consequence of the economic take-off period, has created many social and economic problems, and is a serious concern for both scholars and policy-makers. There are many ways to address this issue. From the agricultural viewpoint, the author holds that promoting agriculture in the West constitutes the precondition for curbing the growth in east-west gaps. Because, as I discussed before, spatial uneven development in agriculture is the fundamental cause of the general regional disparities, so it is logical to address regional disparities first from the agricultural aspect. Only when the western agriculture closes its gap with that of the east, will there be any prospect of significant convergence in the disparities.

Emphasising agricultural development has critical importance for the Chinese economy. As I discussed in Chapter 2, agriculture plays a critical role in the Chinese economy, with eastern agriculture playing a more active role than that of the western area. However, this pattern is changing. First, because its economic returns are lower than those of the secondary and tertiary sectors, agriculture is being neglected in the eastern coastal area, which has better general conditions in developing agriculture than the western area. Thus, the region with a comparative advantage in agriculture is gradually shifting its orientation to other branches of the economy.

Second, eastern agriculture is facing more and more constraints than ever before—from physical and resources constraints, mostly in the form of decreasing acreages of farmland, to institutional constrains—thus, its potential for growth is smaller than the western. In consequence, western agriculture can take over the dominant role previously played by eastern agriculture. Developing agriculture in the western area will not only maintain agriculture's role in the national economy in all aspects, as discussed in Chapter 2 (production contribution, market contribution, factor contribution, and foreign exchange contribution), but also will accelerate the growth of that region. To illustrate the latter point, let us take market contribution as an example. Agriculture effects backward and consumption linkages to the rest of economy. The backward linkage refers to the demand by agriculture for different inputs, such as fertilisers, chemical insecticides, machinery, electricity, transportation, and rural infrastructure. Apparently, developing agriculture will stimulate growth of these agriculture-related industrial sectors. Further, because of China's limited resources of farmland, the sustainable growth of agriculture is relying more and more on the increasing use of industrial products, such as fertilisers, insecticides, farm machinery and equipment, electricity, services, transportation, and many others.

The consumption linkage means the multiplier effect of farmers' consumption on the rest of the economy. The purchasing power of farmers is contingent on the growth rate of agriculture. As farmers' income grows, they will be more able to buy consumer goods which are produced by both the agricultural sector itself and the non-agricultural sectors, such as housing, clothing, and electronic products. This indirect effect should not be understated.

Because China is still an agrarian society and 80 percent of the total population is living in the countryside, the rural community is inevitably a dominant market for many domestically produced consumer goods. As rural incomes increase, farmers are spending a higher proportion of incremental expenditure on manufactured products. Therefore the rural sector produces a big market for traditional durable goods, such as TV sets, bicycles, watches, and other domestic electrical appliance which have limited market prospects in urban areas(2).

The Chinese government has taken certain measures to promote the growth of agriculture as well as the general economic and social progress in the western area. Measures directly promoting agriculture include, but are not limited to:

*. increasing capital investment to the western area in the forms of interest-subsidised loans and special funds on agricultural projects, such as the so-called ShanXi project(a large agricultural construction project in the area consisting of Dingxi and Hexi prefectures of Gansu province and Xihaigu Prefecture of Ningxia Autonomous Region);

*. rendering technical guidance and all necessary agro-use materials to poverty-stricken areas;

*. promoting rural and township enterprises;

*. encouraging east-west co-operation in all aspects of agriculture; and

*. more importantly, granting policy privileges, which are as attractive as, if not more favourable, than those in the eastern area.

In recent years, the Chinese government has began to seriously address the east-west gaps. Several steps have been taken to promote the growth of the western areas. Two significant recent developments deserve airing here. The first issue is the completion of the Nanning-Kunming railway (3). The Nanning-Kunming railway extends from Nanning, the capital of Guangxi

Zhuang Autonomous region, in the east, via Hongguo in Guizhou in the north, to Kunming, the capital of Yunnan province, in the west. The total length is 898.7 kilometres. It is a first-grade electrified railway with a designed transport capacity of 10 million tonnes per year in the first instance, and over 20 million tonnes in due course. The Nanning-Kunming railway provides a shortcut to seaports for the Southwest area and a main line of communication to the east area. It is intended to improve the transportation infrastructure in the area covering west Guangxi, south Guizhou, and east Yunnan. This region, mostly occupying the Yunnan-Guizhou Plateau, the least developed part of Eastern Monsoon China, despite having rich deposits of minerals, is a poverty-stricken area, containing many minority peoples. The railway is intended to accelerate economic growth, promote social progress and ethnic unity, and shrink east-west disparities. In all respects, this railway should benefit the poverty-stricken area.

The second notable development is the establishment of the central municipality of Chongqing (4). Chongqing, the largest metropolis in the western area, was originally a part of Sichuan province. It is the industrial and transportation hub of Southwest China, and the economic core of the upper reaches of the Changjiang river. The new Chongqing includes the former Chongqing city, Wanxian City, Fuling City, and Qianjiang prefecture. The total area of New Chongqing is 82,000 km^2, and the total population is 30.02 million. Promoting Chongqing to the fourth provincial-level central municipality has three objects:

First, to co-ordinate the resettlement of over one million immigrants generated by the Three Gorges Project. Most of the affected areas of the Three Gorges Project are now under the administration of Chongqing. Thus, Chongqing has the power and is responsible for the well-being of the forced immigrants.

Second, to strengthen the effectiveness of Chongqing as the largest growth pole in the upper reaches area of the Changjiang river in order to spur and stimulate the economic growth of the surrounding area, most of which is countryside. The main challenge for this object is how to revive state-owned enterprises which are the mainstay of Chongqing's economy. There are a large number of state-owned enterprises concentrated in Chongqing. The Chinese government hopes Chongqing may find means of overcoming the lethargy displayed by enterprises of this kind.

Third, to experiment with ways in which a large rural area can be integrated with a large metropolis. In other words, to establish how a large city with a big administrative area may guide and promote rural industrialisation and social progress.

The Chinese government expects Chongqing to become the largest growth pole in the western area. However, whether this plan will be realised remains to be seen.

5. 4. Summary And Conclusions

China is a vast and heterogeneous country with very diversified physical, economic, and social conditions. Sharp contrasts exist among its regions. These contrasts are best represented by the so-called east-west gaps. The east-west gaps have been considerably widened since economic reforms began to take root. Although all areas have achieved very impressive development outcomes, the pace of growth in the eastern coastal area is far higher than that of the western area. The resultant increase in east-west disparities has been noticed by both scholars and policy-makers. The Chinese central government has begun to address this issue by initiating a series of measures, including improving railway, road, communication, and other basic infrastructure; constructing some key bases of industry and agriculture; accelerating the development of resource-based industries in the west; promoting east-west co-operation; transferring some industries, such as textiles, sugar refining, etc., from the east to the west, and so on. The objective of the Chinese government is to first contain east-west disparities and then moderate them.

The differential performance of agriculture is the cardinal cause of regional disparities. If agriculture in the west were to improve dramatically, it would be possi0ble to achieve an all-round economic and social development in the west, and, therefore, curb the east-west gaps. Further, agriculture should not be treated as only a source of inputs for non-agricultural sectors, it also plays a positive role as an engine of regional development.

During the period extending from 1980 to1990, the basic spatial pattern of agriculture did not change significantly. However, each region registered different degrees of agricultural development. This difference was manifested in the spatial variations in agriculture. In most cases the regional factor proved the main cause of differential performance; although varied agricultural conditions also played a role in shaping spatial variations.

From the national viewpoint, one of the key issues of agricultural development is how to balance the exploitation of regional comparative advantage and the implementation of regional foodgrain self-sufficiency. The author maintains that at the national level long-term foodgrain self-sufficiency is very necessary primarily for four justifications: to secure domestic food security; to safeguard domestic grain production and rural employment; to exploit the comparative advantage of China's grain production; and to save foreign exchange. However, at the regional level, emphasising foodgrain self-sufficiency will create a conflict with the goal of achieving regional comparative advantages. Regional foodgrain self-sufficiency is a policy inherited from the Mao-era, and its perpetuation is justifiable only for a transition period. To require each province or autonomous region to achieve foodgrain self-sufficiency is unrealistic, but to attain national foodgrain self-sufficiency is both realisable and desirable.

After China's national transportation infrastructure has been substantially improved, and the new economic system has been fully established, this self-sufficiency policy can be adjusted. However, because of China's large size and heterogeneous geographical conditions, there is always a need to strike a balance between agricultural specialisation and grain production. In other words, the conflict between efficiency and equity will always exist. This is why government intervention is always necessary in a large-size country, even one that adopts many of the trappings of the free market system.

End Notes:

1. People's Daily (Overseas Edition), March 28,1995.
2. Shujie Yao, Agricultural Reforms and Grain Production in China, St.Martin's Press, New York, 1994
3. People's Daily (Overseas Edition), March 19, 1997
4. The National People's Congress approved establishment of the Central Municipality of Chongqing on March 14, 1997. See People's Daily (Overseas Edition), March 15, 1997.

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Appendix 4-1: Location Quotients of Grain Production 1980 and 1990

unit 1000 tonnes

Area	Total grain 1980	grain 1990	total rice 1980	rice 1990	total wheat 1980	wheat 1990	total corn 1980	corn 1990	total soybean 1980	soybean 1990
Northeast	36045	58537	4225	9730	4165	5596	16380	33361	3345	4618
Heilongjiang	14625	23125	795	3144	3945	5018	5200	10083	2205	3258
Liaoning	12215	14947	1075	3692	55	450	6535	7982	535	427
Jilin	9205	20465	2355	2894	165	128	4645	15296	605	933
North	70645	103580	4025	5074	22270	47117	24310	34109	2230	2641
Shandong	23840	33549	740	906	7660	16614	8255	11109	840	843
Hebei	15225	22769	830	916	3840	9276	6630	8292	295	535
Beijing	1860	2646	295	216	405	1015	890	1309	15	28
Tianjin	1380	1889	310	282	275	620	575	740	30	66
Henan	21485	33037	1780	2700	8905	16399	5330	9605	920	867
Shanxi	6855	9690	70	54	1185	3193	2630	3054	130	302
Northwest	22500	37047	1400	2316	8715	16393	6380	10819	390	904
Shaanxi	7570	10707	755	1004	2300	4637	2750	3338	180	293
Gansu	4925	6907	20	24	2400	3714	890	1162	50	77
Nei Monggol	3965	9730	40	314	825	2617	1390	3931	125	476
Ningxia	1200	1901	330	543	495	775	85	376	15	24
Xinjiang	3885	6662	255	431	2130	3908	1265	2012	20	34
Qinghai	955	1140	0	0	565	742	0	0	0	0
East & Centra	103350	142982	74095	103928	12485	20730	2895	5427	1275	1818
Zhejiang	14355	15861	11760	13214	795	872	155	99	120	114
Jiangsu	23575	32308	11755	17085	5080	9298	1230	2302	290	451
Shanghai	1870	2395	1165	1773	205	301	40	67	5	12
Anhui	14540	24572	7730	13401	3405	5980	385	1469	495	554
Hubei	15365	24750	10380	17896	2665	3911	860	1222	115	264
Hunan	21245	26514	19425	24682	245	286	215	245	135	254
Jiangxi	12400	16582	11880	15877	90	82	10	23	115	169
South	38010	43092	33015	37539	490	553	1175	1393	285	385
Guangdong	18085	18969	16230	16777	240	219	65	135	115	139
Guangxi	11905	13631	10070	12008	25	24	1110	1200	100	128
Fujian	8020	8796	6715	7312	225	310	0	33	70	112
Hainan	na	1695	na	1442	na	0	na	25	na	6
Southwest	50005	61005	22500	30745	6030	8967	10160	11710	355	634
Sichuan	34365	42668	15370	21974	4715	7017	5410	7150	205	346
Guizhou	6480	7210	3250	3603	350	718	2115	1773	80	128
Yunnan	8655	10572	3875	5165	785	1068	2630	2778	70	100
Xizang	505	555	5	3	180	164	5	9	0	60
National Total	320555	446243	139260	189332	54155	99356	61300	96819	7880	11000

(to be continued)

Appendix 4-1

Area	total	sorgum	total	millet	total	tuber	total other	grain
	1980	1990	1980	1990	1980	1990	1980	1990
Northeast	3570	2897	1830	839	815	1229	1715	1496
Heilongjiang	630	563	1035	331	510	741	305	728
Liaoning	2265	1777	235	300	105	191	1410	319
Jilin	675	557	560	208	200	297	0	449
North	2260	1680	2715	2831	10905	8354	1930	10128
Shandong	315	189	315	456	5555	3640	160	3432
Hebei	890	476	980	1138	1250	1386	510	2136
Beijing	30	19	25	12	25	27	175	47
Tianjin	115	128	20	12	25	20	30	41
Henan	145	101	415	336	3525	2537	465	3029
Shanxi	765	767	960	877	525	744	590	1443
Northwest	595	710	855	865	1590	2110	2575	5040
Shaanxi	140	116	285	185	685	648	475	1134
Gansu	90	111	155	70	440	621	880	1749
Nei Monggol	230	389	395	594	300	613	660	1409
Ningxia	30	6	15	16	65	84	165	161
Xinjiang	105	88	5	0	25	35	80	189
Qinghai	0	0	0	0	75	109	315	398
East & Central	155	108	25	14	6325	6489	6095	10957
Zhejiang	0	0	0	0	780	634	745	1562
Jiangsu	20	14	0	0	1190	1040	4010	3158
Shanghai	0	0	0	0	5	0	450	242
Anhui	100	63	15	0	2125	2595	285	3105
Hubei	20	17	10	13	875	996	440	1427
Hunan	15	12	0	0	1075	844	135	1035
Jiangxi	0	2	0	1	275	380	30	428
South	0	10	10	7	2500	3051	535	3205
Guangdong	0	1	5	1	1365	1631	65	1697
Guangxi	0	2	5	5	170	235	425	264
Fujian	0	7	0	1	965	974	45	1021
Hainan	na	0	na	0	na	211	0	222
Southwest	195	277	10	8	5710	6199	5045	8664
Sichuan	175	258	0	0	4670	4746	3820	5923
Guizhou	10	13	10	8	505	771	160	967
Yunnan	10	6	0	0	535	680	750	1455
Xizang	0	0	0	0	0	2	315	319
National Total	6775	5682	5445	4564	27845	27432	17895	39490

(continued)

Appendix 4-1

Area	ratio of rice to total grain 1980	ratio of wheat to total grain 1980	ratio of corn to total grain 1980	ratio of soybean to total grain 1980	ratio of sorghum to total grain 1980	ratio of millet to total grain 1980
Northeast	0.117214593	0.115550007	0.45443196	0.092800666	0.099042863	0.050769872
Heilongjiang	0.054358974	0.26974359	0.355555556	0.150769231	0.043076923	0.070769231
Liaoning	0.088006549	0.004502661	0.534997953	0.043798608	0.185427753	0.019238641
Jilin	0.255839218	0.017925041	0.504617056	0.065725149	0.073329712	0.060836502
North	0.056975016	0.315238163	0.344114942	0.031566262	0.031990941	0.038431595
Shandong	0.031040268	0.321308725	0.346266779	0.035234899	0.013213087	0.013213087
Hebei	0.054515599	0.252216749	0.43546798	0.019376026	0.058456486	0.064367816
Beijing	0.158602151	0.217741935	0.478494624	0.008064516	0.016129032	0.01344086
Tianjin	0.224637681	0.199275362	0.416666667	0.02173913	0.083333333	0.014492754
Henan	0.082848499	0.414475215	0.248080056	0.042820572	0.006748895	0.019315802
Shanxi	0.010211524	0.172866521	0.383661561	0.01896426	0.111597374	0.140043764
Northwest	0.062222222	0.387333333	0.283555556	0.017333333	0.026444444	0.038
Shaanxi	0.099735799	0.303830911	0.36327609	0.023778071	0.018494055	0.037648613
Gansu	0.004060914	0.487309645	0.18071066	0.010152284	0.018274112	0.031472081
Nei Monggol	0.010088272	0.208070618	0.350567465	0.031525851	0.058004566	0.09962169
Ningxia	0.275	0.4125	0.070833333	0.0125	0.025	0.0125
Xinjiang	0.065637066	0.548262548	0.325611326	0.005148005	0.027027027	0.001287001
Qinghai	0	0.591623037	0	0	0	0
East & Centra	0.716932753	0.120803096	0.028011611	0.01233672	0.001499758	0.000241896
Zhejiang	0.81922675	0.0553814	0.010797631	0.008359457	0	0
Jiangsu	0.498621421	0.215482503	0.052173913	0.012301166	0.000848356	0
Shanghai	0.622994652	0.109625668	0.021390374	0.002673797	0	0
Anhui	0.531636864	0.234181568	0.02647868	0.034044017	0.006877579	0.001031637
Hubei	0.675561341	0.173446144	0.055971363	0.007484543	0.00130166	0.00065083
Hunan	0.914332784	0.011532125	0.010120028	0.006354436	0.000706048	0
Jiangxi	0.958064516	0.007258065	0.000806452	0.009274194	0	0
South	0.868587214	0.012891344	0.030912918	0.007498027	0	0.000263089
Guangdong	0.897428808	0.013270666	0.003594139	0.006358861	0	0.000276472
Guangxi	0.845863083	0.002099958	0.093238135	0.008399832	0	0.000419992
Fujian	0.837281796	0.028054863	0	0.00872828	0	0
Hainan	na	na	na	na	na	na
Southwest	0.449955004	0.120587941	0.203179682	0.00709929	0.00389961	0.00019998
Sichuan	0.447257384	0.13720355	0.157427615	0.005965372	0.005092391	0
Guizhou	0.50154321	0.054012346	0.326388889	0.012345679	0.00154321	0.00154321
Yunnan	0.447718082	0.090699018	0.303870595	0.008087822	0.001155402	0
Xizang	0.00990099	0.356435644	0.00990099	0	0	0
National Total	0.434434028	0.168941367	0.191230834	0.024582365	0.021135219	0.016986165

(continued)

Appendix 4-1

Area	ratio of tuber to total grain 1980	ratio of other grain to total grain 1980	location rice 1980	wheat 1980	corn 1980	quotients soybean 1980
Northeast	0.022610626	0.047579415	0.26980988	0.68396515	2.37635297	3.77509105
Heilongjiang	0.034871795	0.020854701	0.12512596	1.59666986	1.85930034	6.13322725
Liaoning	0.008595989	0.115431846	0.20257748	0.02665221	2079765528	1.78170849
Jilin	0.021727322	0	0.58890234	0.10610214	2.638785	2.67367072
North	0.154363366	0.027319697	0.13114768	1.86596195	1.79947414	1.28410274
Shandong	0.233011745	0.006711409	0.0714499	1.9018949	1.81072671	1.4333405
Hebei	0.082101806	0.033497537	0.12548649	1.49292475	2.27718497	0.78820839
Beijing	0.01344086	0.094086022	0.36507764	1.28886098	2.50218343	0.32806104
Tianjin	0.018115942	0.02173913	0.51708123	1.17955339	2017886759	0.88433845
Henan	0.164067954	0.021643007	0.19070444	2.45336724	1.29728062	1.74192241
Shanxi	0.076586433	0.086068563	0.02350535	1.02323382	2.00627458	0.7714579
Northwest	0.070666667	0.11444444	0.14322594	2.29270864	1.48279202	0.70511252
Shaanxi	0.090488771	0.062747688	0.2295764	1.79843999	1.8996732	0.96728168
Gansu	0.089340102	0.178680203	0.0093476	2.88448976	0.94498704	0.41299054
Nei Monggol	0.075662043	0.166456494	0.2322164	1.23161438	1.83321621	1.28245802
Ningxia	0.054166667	0.1375	0.6330075	2.44167551	0.37040749	0.50849461
Xinjiang	0.006435006	0.020592021	0.15108638	3.24528301	1.70271352	0.20941863
Qinghai	0.078534031	0.329842932	0	3.50194299	0	0
East & Centra	0.061199806	0.058974359	1.65026841	0.7150593	0.14648062	0.50185244
Zhejiang	0.054336468	0.051898293	1.88573338	0.32781432	0.05646386	0.34005909
Jiangsu	0.0504772	0.17009544	1.14774946	1.27548691	0.27283212	0.50040615
Shanghai	0.002673797	0.240641711	1.43403742	0.64889772	0.1118563	0.1087689
Anhui	0.146148556	0.0196011	1.22374591	1.38617067	0.13846449	1.3848959
Hubei	0.056947608	0.028636512	1.55503781	1.02666473	0.29269006	0.30446797
Hunan	0.050600141	0.006354436	2.10465278	0.06826111	0.05292048	0.25849573
Jiangxi	0.022177419	0.002419355	2.20531647	0.04296203	0.00421716	0.37727019
South	0.065772165	0.014075243	1.99935354	0.07630662	0.16165237	0.3050165
Guangdong	0.075476915	0.003594139	2.06574244	0.07855191	0.01879477	0.25867572
Guangxi	0.014279714	0.035699286	1.9470461	0.0124301	0.48756852	0.34170154
Fujian	0.12032419	0.005610973	1.92729331	0.16606272	0	0.35505858
Hainan	na	na	0	0	0	0
Southwest	0.114188581	0.100889911	1.03572689	0.71378575	1.0624839	0.28879606
Sichuan	0.135894078	0.11115961	1.02951738	0.81213709	0.82323343	0.24266875
Guizhou	0.077932099	0.024691358	1.15447497	0.3197106	1.70677961	0.5022169
Yunnan	0.06181398	0.086655113	1.03057784	0.53688684	1.5890251	0.32900864
Xizang	0	0.623762376	0.02279055	2.10981863	0.05177507	0
National Total	0.086864969	0.055825053	1	1	1	1

(continued)

Appe ndix 4-1

Area	location sorghum 1980	millet 1980	tuber 1980	quotients other grain 1980	ratio of rice to total grain 1990	ratio of wheat to total grain 1990	ratio of corn to total grain 1990
Northeast	4.68815276	2.9888955	0.26029625	0.85229501	0.16621966	0.095597656	0.569913046
Heilongjiang	2.03815839	4.16628664	0.40144831	0.38357243	0.13595676	0.216994595	0.436021622
Liaoning	8.77340122	1.13260653	0.09895806	2.06774269	0.24700609	0.030106376	0.534020205
Jilin	3.46955068	3.58153257	0.25012755	0	0.14141217	0.006254581	0.747422429
North	1.51363188	2.26252338	1.7770497	0.48938058	0.04898629	0.454885113	0.329301023
Shandong	0.62516918	0.7778735	2.68245933	0.12022218	0.02700528	0.495215953	0.331127604
Hebei	2.76583305	3.78942613	0.9451659	0.60004487	0.04023014	0.407396021	0.364179367
Beijing	0.76313534	0.79128282	0.1547328	1.68537271	0.08163265	0.383597884	0.494708995
Tianjin	3.94286593	0.8532093	0.20855291	0.38941531	0.14928534	0.328215987	0.391741662
Henan	0.31931984	1.13714909	1.88877009	0.38769344	0.08172655	0.496382843	0.290734631
Shanxi	5.28016181	8.24457827	0.88167226	1054175514	0.00557276	0.329514964	0.315170279
Northwest	1.25120279	2.23711478	0.81352319	2.05005526	0.06251518	0.44249197	0.029203444
Shaanxi	0.87503497	2.21642812	1.04171766	1.12400588	0.09377043	0.433081162	0.311758663
Gansu	0.86462847	1.85280679	1.02849403	3.2007171	0.00347474	0.537715361	0.168235124
Nei Monggol	2.74459268	5.8648725	0.87103057	2.98175253	0.03227133	0.268961973	0.404008222
Ningxia	1.18285978	0.73589302	0.6235732	2.46305183	0.28563914	0.407690168	0.197790637
Xinjiang	1.27876733	0.07576762	0.07408057	0.36886701	0.06469529	0.586610627	0.302011408
Qinghai	0	0	0.90409325	5.90851082	0	0.650877193	0
East & Central	0.07096014	0.01424079	0.70453956	1.05641384	0.72686072	0.144983285	0.037955827
Zhejiang	0	0	0.62552798	0.92965954	0.83311267	0.054977618	0.006241725
Jiangsu	0.04013946	0	0.58109962	3.04693735	0.52881639	0.287792497	0.071251702
Shanghai	0	0	0.03078107	4.31064005	0.74029228	0.125678497	0.027974948
Anhui	0.32540847	0.06073395	1.68247981	0.35111655	0.54537685	0.243366433	0.059783493
Hubei	0.06158723	0.03831529	0.65558774	0.51296882	0.72307071	0.158020202	0.049373737
Hunan	0.03340625	0	0.58251493	0.11382768	0.93090443	0.010786754	0.009240401
Jiangxi	0	0	0.25530913	0.04333816	0.95748402	0.004945121	0.001387046
South	0	0.01548841	0.7571771	0.2521313	0.87113617	0.012833008	0.032326186
Guangdong	0	0.01627632	0.86889935	0.06438218	0.88444304	0.11545153	0.007116875
Guangxi	0	0.02472551	0.1643898	0.63948503	0.88093317	0.001760693	0.088034627
Fujian	0	0	1.38518659	0.10050994	0.83128695	0.035243292	0.003751705
Hainan	0	0	0	0	0.85073746	0	0.014749263
Southwest	0.18450767	0.01177311	1.31455273	1.80725149	0.50397508	0.146987952	0.191951479
Sichuan	0.24094336	0	1.56442903	1.99121368	0.51499953	0.164455798	0.167572888
Guizhou	0.07301604	0.09085099	0.89716372	0.44229887	0.49972261	0.099583911	0.24590846
Yunnan	0.05466712	0	0.71161	1.55226206	0.48855467	0.101021566	0.26276958
Xizang	0	0	0	11.1735205	0.00540541	0.295495495	0.016216216
National Total	1	1	1	1	0.42428005	0.033364999	0.216964748

(continued)

Appendix 4-1

Area	ratio of soybean to total grain 1990	ratio of sorghum to total grain 1990	ratio of millet to total grain 1990	ratio of tuber to total grain 1990	ratio of other grain total grain 1990
Northeast	0.078890275	0.049490066	0.014332815	0.020995268	0.025556486
Heilongjiang	0.140886486	0.024345946	0.014313514	0.032043243	0.031481081
Liaoning	0.028567608	0.118886733	0.020070917	0.012778484	0.021342075
Jilin	0.045590032	0.0272172	0.010163694	0.014512582	0.021939897
North	0.0254972	0.016219347	0.027331531	0.080652636	0.097779494
Shandong	0.025127426	0.005633551	0.013592059	0.108498018	0.102298131
Hebei	0.02349686	0.020905617	0.049980236	0.060872239	0.093811762
Beijing	0.010582011	0.00718065	0.004535147	0.010204082	0.017762661
Tianjin	0.034939121	0.06776072	0.006352567	0.010587612	0.021704606
Henan	0.026243303	0.003057178	0.010170415	0.076792687	0.09168508
Shanxi	0.031166151	0.079153767	0.090505676	0.76780186	0.148916409
Northwest	0.024401436	0.019164845	0.023348729	0.056954679	0.136043404
Shaanxi	0.027365275	0.010834034	0.017278416	0.060521154	0.10591202
Gansu	0.011148111	0.016070653	0.010134646	0.069908788	0.25322137
Nei Monggol	0.048920863	0.039979445	0.061048304	0.063001028	0.144809866
Ningxia	0.012624934	0.003156234	0.008416623	0.04418727	0.084692267
Xinjiang	0.005103573	0.013209246	0	0.005253678	0.028369559
Qinghai	0	0	0	0.095614035	0.349122807
East & Central	0.012714887	0.00075534	0.000009791	0.045383335	0.076632024
Zhejiang	0.007187441	0	0	0.039972259	0.09848055
Jiangsu	0.013959391	0.000433329	0	0.03219017	0.097746688
Shanghai	0.005010438	0	0	0	0.101043841
Anhui	0.022545987	0.002563894	0	0.105608009	0.12636334
Hubei	0.010666667	0.000686869	0.000525253	0.040242424	0.057656566
Hunan	0.009579845	0.000452591	0	0.03186224	0.039035981
Jiangxi	0.010191774	0.000120613	0.000006031	0.022916415	0.02581112
South	0.008934373	0.000232062	0.000162443	0.070802005	0.074375754
Guangdong	0.007327745	0.000005272	0.000008272	0.085982392	0.089461753
Guangxi	0.00939036	0.000146724	0.000366811	0.017240114	0.019367618
Fujian	0.01273306	0.000795816	0.000113688	0.110732151	0.116075489
Hainan	0.003539823	0	0	0.124483776	0.130973451
Southwest	0.010392591	0.004540611	0.000131137	0.101614622	0.142021146
Sichuan	0.008109122	0.006046686	0	0.111230899	0.138815975
Guizhou	0.017753121	0.001803051	0.00110957	0.106934813	0.134119279
Yunnan	0.009458948	0.000567537	0	0.064320848	0.137627696
Xizang	0.108108108	0	0	0.003603604	0.574774775
National Total	0.024650247	0.012732973	0.010227611	0.061473233	0.088494385

(continued)

Appendix 4-1

location quotients

Area	wheat 1990	corn 1990	soybean 1990	sorghum 1990	millet 1990	tuber 1990
Northeast	0.42936295	2.62675412	3.2003848	3.88676444	1.40138441	0.34153512
Heilongjiang	0.97459961	2.0096427	5.71541894	1.91203942	1.3994972	0.52125521
Liaoning	0.1352184	2.46132245	1.15891764	9.33691877	1.9624247	0.2078707
Jilin	0.02809154	3.44490262	1.84947569	2.13753696	0.99375052	0.2360797
North	2.04305022	1.5177628	1.03435883	1.2738068	2.67232789	1.31199599
Shandong	2.22419031	1.52618159	1.01935798	0.44243799	1.32895735	1.76496358
Hebei	1.82975988	1.67851861	0.95320993	1.64184889	4.88879461	0.99022347
Beijing	1.72287401	2.28013537	0.4292862	0.56394136	0.44342195	0.16599227
Tianjin	1.47413429	1.80555443	1.41739439	5.32167317	0.62111936	0.17223126
Henan	2.22943123	1.34000861	1.06462639	0.24009934	0.99440765	1.24920527
Shanxi	1.47996846	1.45263358	1.26433423	6.2164404	8.84915082	1.24900191
Northwest	1.98738822	1.3459995	0.98990636	1.50513512	2.28291028	0.92649559
Shaanxi	1.94512.95	1.43690929	1.11014204	0.85086444	1.68938917	0.9845123
Gansu	2.41507021	0.77540303	0.45225148	1.2621289	0.99091035	1.46256807
Nei Monggol	1.20800352	1.86209154	1.98459935	3.13983588	5.96896985	1.024853
Ningxia	1.83103609	0.91162568	0.51216259	0.24787876	0.82293142	0.71880504
Xinjiang	2.63467618	1.39198377	0.20703941	1.03740475	0	0.08546285
Qinghai	2.92332009	0	0	0	0	1.55537671
East & Central	0.6511713	0.17494006	0.51581176	0.05932156	0.00957354	0.73826172
Zhejiang	0.24692396	0.02876838	0.29157684	0	0	0.65023844
Jiangsu	1.29257808	0.32840221	0.56629822	0.03403205	0	0.5236453
Shanghai	0.56446666	0.12893776	0.20326119	0	0	0
Anhui	1.09304488	0.27554473	0.91463536	0.20135862	0	1.71795111
Hubei	0.70972472	0.22756571	0.43272048	0.05394409	0.05135632	0.65463328
Hunan	0.04844713	0.04258941	0.38863078	0.03554481	0	0.51782276
Jiangxi	0.02221029	0.00639296	0.41345526	0.00947247	0.00589643	0.37278689
South	0.057838759	0.1489928	0.36244558	0.01822525	0.0158828	1.15175339
Guangdong	0.05185337	0.03280199	0.29726864	0.00414024	0.00515444	1.39869644
Guangxi	0.00790789	0.40575544	0.38094386	0.01152318	0.03586477	0.28044912
Fujian	0.15829011	0.01729177	0.51654901	0.06250043	0.0111158	1.80130677
Hainan	0	0.06798	0.14360193	0	0	2.02500779
Southwest	0.66017497	0.88471275	0.4216019	0.35660262	0.01282184	1.65298971
Sichuan	0.73862926	0.77235076	0.32896716	0.47488408	0	1.80942002
Guizhou	0.44726663	1.13340284	0.72020053	0.1416049	0.1084877	1.73953455
Yunnan	0.45372365	1.21111647	0.38372631	0.04457222	0	1.04632283
Xizang	1.32717497	0.07474125	4.38568059	0	0	0.05862069
National Total	1	1	1	1	1	1

(continued)

Appendix 4-2: Location Quotients of Meat Production 1980 and 1990

unit: 1000 tonnes

Area	Total meat		total pork		total beef		total mutton		ratio of pork to total meat
	1980	1990	1980	1990	1980	1990	1980	1990	1980
Northeast	1047	1681	1007	1525	28	122	12	34	0.9617956
Heilongjiang	372	460	348	395	16	52	8	13	0.9354839
Liaoning	429	788	423	741	4	34	2	13	0.986014
Jilin	246	433	236	389	8	36	2	8	0.9593496
North	2217	4918	2111	4089	22	455	84	374	0.9521876
Shandong	902	1870	862	1537	9	176	31	157	0.9556541
Hebei	421	1213	404	1077	4	56	13	80	0.95962
Beijing	130	204	129	186	0	9	1	9	0.9923077
Tianjin	61	101	60	89	0	4	1	8	0.9836066
Henan	530	1237	494	975	7	182	29	80	0.9320755
Shanxi	174	293	162	225	2	28	10	40	0.9310345
Northwest	832	1814	529	1115	99	281	204	418	0.6358173
Shaanxi	231	445	223	391	2	32	6	22	0.965368
Gansu	140	375	123	302	5	35	12	38	0.8785714
Nei Monggol	239	501	116	288	46	86	77	127	0.4853556
Ningxia	19	63	15	41	0	5	4	17	0.7894737
Xinjiang	119	278	33	49	21	71	65	158	0.2773109
Qinghai	85	152	20	44	25	52	40	56	0.2352941
East & Centra	4298	7947	4200	7654	33	161	65	132	0.9771987
Zhejiang	698	856	688	841	5	5	5	10	0.9856734
Jiangsu	1069	1584	1038	1492	4	19	27	73	0.9710009
Shanghai	165	236	164	233	0	0	1	3	0.9939394
Anhui	518	976	494	848	6	98	18	30	0.953668
Hubei	554	1375	541	1351	5	13	8	11	0.9765343
Hunan	924	1895	914	1877	5	14	5	4	0.9891775
Jiangxi	370	1025	362	1012	8	12	0	1	0.9783784
South	1320	3152	1301	3065	14	75	5	12	0.9856061
Guangdong	676	1484	668	1453	8	29	0	2	0.9881657
Guangxi	402	906	397	872	3	31	2	3	0.9875622
Fujian	243	641	237	629	3	7	3	5	0.9753086
Hainan	1	121	56(1)	111	na	8	1	2	0
Southwest	2338	5623	2192	5363	71	162	75	98	0.9375535
Sichuan	1716	4073	1643	3967	36	69	37	37	0.9574592
Guizhou	267	713	255	680	5	24	7	9	0.9550562
Yunnan	308	749	292	711	10	25	6	13	0.9480519
Xizang	47	88	2	5	21	44	24	39	0.0425532
National Total	12055	25135	11341	22811	269	1256	445	1068	0.9407715

(to be continued)

Appendix 4-2

Area	ratio of beef to total mea 1980	ratio of mutton to total meat 1980	location pork 1980	beef 1980	quotient mutton 1980	ratio of pork to total meat 1990	ratio of beef to total meat 1990
Northeast	0.026743	0.0114613	1.0223478	1.1984676	0.3104858	0.9071981	0.0725758
Heilongji	0.043011	0.0215054	0.9943795	1.9274893	0.5825782	0.8586957	0.1130435
Liaoning	0.009324	0.004662	1.0480909	0.4178473	0.1262932	0.9403553	0.0431472
Jilin	0.03252	0.0081301	1.0197478	1.45737	0.220243	0.8983834	0.0831409
North	0.009923	0.037889	1.0121349	0.4447049	1.0264098	0.8314355	0.0925173
Shandon	0.009978	0.0343681	1.0158196	0.4471476	0.9310272	0.8219251	0.0941176
Hebei	0.009501	0.0308789	1.0200351	0.4257874	0.8365048	0.8878813	0.0461665
Beijing	0	0.0076923	1.0547808	0	0.2083838	0.9117647	0.0441176
Tianjin	0	0.0163934	1.0455319	0	0.4440965	0.8811881	0.039604
Henan	0.013208	0.054717	0.9907565	0.5918847	1.4822769	0.7881973	0.1471302
Shanxi	0.011494	0.0574713	0.98965	0.5151049	1.5568901	0.7679181	0.0955631
Northwest	0.11899	0.2451923	0.6758467	5.3324501	6.6422321	0.6146637	0.1549063
Shaanxi	0.008658	0.025974	1.026145	0.3880011	0.7036334	0.8786517	0.0719101
Gansu	0.035714	0.0857143	0.933884	1.6005045	2.3219904	0.8053333	0.0933333
Nei Mong	0.192469	0.3221757	0.5159124	8.625313	8.7277044	0.5748503	0.1716567
Ningxia	0	0.2105263	0.8391769	0	5.7031342	0.6507937	0.0793651
Xinjiang	0.176471	0.5462185	0.2947697	7.9083752	14.796997	0.176259	0.2553957
Qinghai	0.294118	0.4705882	0.2501076	13.180625	12.748182	0.2894737	0.3421053
East & Ce	0.007678	0.0151233	1.0387206	0.3440824	0.4096889	0.9631307	0.0202592
Zhejiang	0.007163	0.0071633	1.0477288	0.3210181	0.1940536	0.9824766	0.0058411
Jiangsu	0.003742	0.0252572	1.0321326	0.1676862	0.6842161	0.9419192	0.0119949
Shanghai	0	0.0060606	1.0565152	0	0.1641811	0.9872881	0
Anhui	0.011583	0.034749	1.0137084	0.5190825	0.9413474	0.8688525	0.1004098
Hubei	0.009025	0.0144404	1.0380144	0.4044596	0.3911897	0.9825455	0.0094545
Hunan	0.005411	0.0054113	1.0514535	0.2425007	0.1465903	0.9905013	0.0073879
Jiangxi	0.021622	0	1.0399745	0.9689541	0	0.9873171	0.0117073
South	0.010606	0.0037879	1.0476573	0.4753013	0.1026132	0.9723985	0.0237944
Guangdo	0.011834	0	1.050378	0.5303447	0	0.9791105	0.0195418
Guangxi	0.007463	0.0049751	1.0497365	0.3344338	0.1347756	0.9624724	0.0342163
Fujian	0.012346	0.0123457	1.0367115	0.5532608	0.3344431	0.9812793	0.0109204
Hainan	0	1	0	0	27.089888	0.9173554	0.0661157
Southwest	0.030368	0.0320787	0.9965794	1.360908	0.8690084	0.9537613	0.0288102
Sichuan	0.020979	0.0215618	1.0177384	0.9401565	0.584106	0.973975	0.0169408
Guizhou	0.018727	0.0262172	1.015184	0.8392159	0.7102218	0.9537167	0.0336606
Yunnan	0.032468	0.0194805	1.0077388	1.4550041	0.5277251	0.9492657	0.0333778
Xizang	0.446809	0.5106383	0.0452322	20.023333	13.833134	0.0568182	0.5
National	0.022314	0.0369141	1	1	1	0.9075393	0.0499702

(continued)

Appendix 4-2

Area	ratio of mutton to total meat 1990	location pork 1990	beef 1990	quotient mutton 1990
Northeast	0.0202261	0.999624	1.4523837	0.476013
Heilongjiang	0.0282609	0.9461801	2.2622196	0.6651095
Liaoning	0.0164975	1.0361594	0.8634595	0.3882619
Jilin	0.0184758	0.9899113	1.6638105	0.4348202
North	0.0760472	0.9161428	1.8514506	1.7897432
Shandong	0.0839572	0.9056634	1.883477	1.9759033
Hebei	0.0659522	0.9783392	0.9238819	1.5521612
Beijing	0.0441176	1.0046559	0.8828798	1.0382931
Tianjin	0.0792079	0.9709642	0.7925522	1.8641302
Henan	0.0646726	0.8684993	2.9443602	1.5220465
Shanxi	0.1365188	0.8461541	1.9124041	3.2129207
Northwest	0.23043	0.6772861	3.0999757	5.4230878
Shaanxi	0.0494382	0.9681693	1.439061	1.1635105
Gansu	0.1013333	0.8873812	1.8677813	2.3848439
Nei Monggol	0.253493	0.6334164	3.4351838	5.9658679
Ningxia	0.2698413	0.7170969	1.5882494	6.3506183
Xinjiang	0.5683453	0.1942164	5.1109638	13.375805
Qinghai	0.3684211	0.3189655	6.8461909	8.6706584
East & Central	0.01661	1.0612551	0.4054263	0.3909114
Zhejiang	0.0116822	1.082572	0.1168922	0.2749374
Jiangsu	0.0460859	1.0378826	0.2400422	1.0846143
Shanghai	0.0127119	1.0878737	0	0.2991692
Anhui	0.0307377	0.9573717	2.0093959	0.7234009
Hubei	0.008	1.0826478	0.1892038	0.1882772
Hunan	0.0021108	1.0914143	0.1478455	0.0496773
Jiangxi	0.0009756	1.0879056	0.2342862	0.0229606
South	0.0038071	1.0714671	0.4761725	0.0895989
Guangdong	0.0013477	1.0788629	0.391069	0.0317178
Guangxi	0.0033113	1.0605297	0.6847353	0.0779293
Fujian	0.0078003	1.0812526	0.2185392	0.1835776
Hainan	0.0165289	1.0108162	1.3231036	0.3890024
Southwest	0.0174284	1.0509312	0.5765489	0.4101716
Sichuan	0.0090842	1.0732042	0.3390189	0.2137937
Guizhou	0.0126227	1.050882	0.6736138	0.2970712
Yunnan	0.0173565	1.0459775	0.6679554	0.4084785
Xizang	0.4431818	0.0626069	10.005971	10.430126
National Total	0.0424906	1	1	1

(continued)

Appendix 4-3: Shift of Grain Production, 1980-1990

unit: 1000 tonnes

Area/crop	1980	1990	growth rate	rij	ri. & r..	Total shift	Prop. shift	Diff. shift	Homothetic production	rij'
Northeast										
total grain	35435	58537	65.20%	65.20%	-	9114	806	8308	35435	
Rice	4225	9730	130.30%	130.30%	-	3837	-328	4165	15921	56.00%
wheat	4165	5595	34.33%	34.33%	-	-214	1832	-2046	5998	117.30%
corn	16805	33361	98.52%	98.52%	-	9922	2921	7001	6836	85.78%
soybean	3345	4618	38.06%	38.06%	-	-47	4	-51	873	65.34%
sorghum	3570	2897	-18.85%	-18.85%	-	-2082	-1985	-97	750	-0.67%
millet	1830	869	-52.51%	-52.51%	-	-1683	-1018	-665	603	-0.72%
tuber	815	1229	50.80%	50.80%	-	92	-334	426	3084	16.68%
other grains	680	238	-65.00%	-65.00%	-	-710	-286	-425	1370	15.45%
North										
total grain	70645	103580	46.62%	46.62%	-	5048	-7206	12253	70645	
rice	4025	5074	26.06%	26.06%	-	-540	-313	-227	31741	38.46%
wheat	22270	47117	111.57%	111.57%	-	16056	9797	6259	11958	92.87%
corn	2630	3054	16.12%	16.12%	-	-614	457	-1071	13629	64.89%
soybean	2230	2641	18.43%	18.43%	-	-469	3	-472	1740	46.75%
sorghum	2260	1680	-25.66%	-25.66%	-	-1472	-1257	-215	1496	-11.84%
millet	2715	2831	4.27%	4.27%	-	-956	-1511	555	1202	-11.89%
tuber	10905	8354	-23.39%	-23.39%	-	-6856	-4466	-2389	6148	3.56%
other grains	23610	32829	39.05%	39.05%	-	-101	-9916	9814	2731	2.47%
Northwest										
total grain	22500	37047	64.65%	64.65%	-	5665	2295	3370	22500	
rice	1400	2316	65.43%	65.43%	-	363	-109	472	10109	55.49%
wheat	8715	16393	88.10%	88.10%	-	4238	3834	404	3808	116.59%
corn	6380	10189	59.70%	59.70%	-	1291	1109	181	4341	85.17%
soybean	390	360	-7.69%	-7.69%	-	-184	0	-184	554	64.79%
sorghum	595	710	19.33%	19.33%	-	-120	-331	211	476	-0.99%
millet	855	865	1.17%	1.17%	-	-328	-476	148	383	-1.05%
tuber	1590	2110	32.70%	32.70%	-	-108	-651	544	1958	16.30%
other grains	2575	4104	59.38%	59.38%	-	513	-1081	1594	870	15.07%

(to be continued)

Appendix 4-3

Area/crop	1980	1990	growth rate	rij	ri. & r..	Total shift	Prop. shift	Diff. shift	Homothetic production	rij'
East & Central										
total grain	103350	142982	38.35%	38.35%	-	-1165	-5271	4103	103350	
rice	74095	103928	40.26%	40.26%	-	584	-5754	6336	46435	30.64%
wheat	12485	20730	66.04%	66.04%	-	3317	5492	-2176	17493	81.98%
corn	2895	5427	87.46%	87.46%	-	1389	503	886	19939	55.59%
soybean	650	1072	64.92%	64.92%	-	165	1	165	2545	38.47%
sorghum	155	108	-30.32%	-30.32%	-	-108	-86	-22	2188	-16.81%
millet	25	14	-44.00%	-44.00%	-	-21	-14	-7	1759	-16.86%
tuber	6325	6489	2.59%	2.59%	-	-2333	-2591	258	8995	-2.28%
other grains	6720	5214	-22.41%	-22.41%	-	-4159	-2822	-1337	3996	-3.31%
South										
total grain	38010	43092	13.37%	13.37%	-	-9922	-3363	-6561	38010	
rice	33015	37539	13.70%	13.70%	-	-8509	-2564	-5946	17078	7.06%
wheat	490	553	12.86%	12.86%	-	-130	216	-346	6434	49.13%
corn	1175	1393	18.55%	18.55%	-	-246	204	-450	7333	27.50%
soybean	370	425	14.86%	14.86%	-	-91	0	-91	936	13.47%
sorghum	5	10	100.00%	100.00%	-	3	-3	6	805	-31.83%
millet	10	7	-30.00%	-30.00%	-	-7	-6	-1	647	-31.87%
tuber	2500	3051	22.04%	22.04%	-	-436	-1024	588	3308	-19.92%
other grains	445	114	-74.38%	-74.38%	-	-507	-187	-320	1470	-20.77%
Southwest										
total grain	50005	61005	22.00%	22.00%	-	-8739	-1900	-6840	50005	
rice	22500	30745	36.64%	36.64%	-	-637	-1747	1109	22467	15.21%
wheat	6030	8967	48.71%	48.71%	-	557	2653	-2096	8464	60.48%
corn	10160	11710	15.26%	15.26%	-	-2461	1766	-4227	9647	37.20%
soybean	355	634	78.59%	78.59%	-	139	0	138	1232	22.10%
sorghum	195	277	42.05%	42.05%	-	5	-108	113	1059	-26.64%
millet	10	8	-20.00%	-20.00%	-	-6	-6	0	851	-26.68%
tuber	5710	6199	8.56%	8.56%	-	-1765	-2339	574	4352	-13.83%
other grains	5045	2465	-51.14%	-51.14%	-	-4572	-2119	-2453	1933	-14.74%

(continued)

Appendix 4-3

Area/crop	1980	1990	growth rate of the	rij	ri. & r..	Total shift	Prop. shift	Diff. shift	Homothetic production	rij'
The national	total						-14638	14633		
total grain	319945	446243	39.47%	r..=	39.47%	0	-14638	14633	244759	
rice	143750	189332	31.71%	r1.=	31.71%	-4901	-10815	5909	64586	31.71%
wheat	54155	99356	83.47%	r2.=	83.47%	23822	23823	-1	9166	83.47%
corn	61725	96819	56.86%	r3.=	56.86%	9281	6960	2321	11908	56.86%
soybean	7880	11000	39.59%	r4.=	39.59%	-487	9	-496	1006	39.59%
sorghum	6775	5682	-16.13%	r5.=	-16.13%	-3774	-3770	-4	5825	-16.13%
millet	5445	4564	-16.18%	r6.=	-16.18%	-3000	-3030	30	4376	-16.18%
tuber	27845	27432	-1.48%	r7.=	-1.48%	-11405	-11405	0	142396	-1.48%
other grains	12370	12058	-2.52%	r8.=	-2.52%	-9536	-16410	6875	5495	-2.52%

(continued)

Appendix 4-3

Area/crop	Current Prop.shift	Historical prop.shift	Corrected diff. shift	Historical diff. shift	Current total shift	Historical total shift
Northeast						
total grain	0	806	9114	-806	9114	0
Rice	-1236	908	3867	298	2631	1207
wheat	2639	-806	2029	-4076	4668	-4882
corn	1188	1733	1977	5024	3166	6757
soybean	1	3	225	-276	226	-273
sorghum	-417	-1568	116	-213	-301	-1781
millet	-336	-683	93	-758	-242	-1441
tuber	-1263	929	560	-134	-703	795
other grains	-575	290	246	-671	-329	-381
North						
total grain	0	-7206	5048	7205	5048	0
rice	-2465	2152	2142	-2369	-323	-217
wheat	5260	4537	1124	5135	6384	9672
corn	2369	-1912	1095	-2167	3464	-4078
soybean	2	1	124	-596	127	-596
sorghum	-832	-425	64	-280	-768	-705
millet	-669	-842	52	504	-617	-338
tuber	-2518	-1948	310	-2700	-2208	-4648
other grains	-1147	-8768	136	9678	-1011	910
Northwest						
total grain	0	2295	5665	-2295	5665	0
rice	-785	676	2404	-1932	1619	-1255
wheat	1675	2158	1261	-857	2937	1301
corn	754	354	1229	-1048	1984	-693
soybean	1	0	140	-324	140	-324
sorghum	-265	-66	72	139	-193	73
millet	-213	-263	58	90	-155	-172
tuber	-802	151	348	195	-454	346
other grains	-365	-716	153	1441	-212	725

(continued)

Appendix 4-3

Area/crop	Current Prop.shift	Historical prop.shift	Corrected diff. shift	Historical diff. shift	Current total shift	Historical total shift
East & Central						
total grain	0	-5271	-1165	5268	-1165	0
rice	-3606	-2148	-494	6830	-4100	4684
wheat	7696	-2203	-259	-1916	7436	-4120
corn	3465	-2962	-253	1139	3213	-1823
soybean	3	-2	-29	193	-26	191
sorghum	-1217	1131	-15	-7	-1232	1124
millet	-979	965	-12	5	-991	970
tuber	-3684	1093	-72	329	-3756	1423
other grains	-1678	-1144	-31	-1305	-1710	-2449
South						
total grain	0	-3363	-9922	3362	-9922	0
rice	-1326	-1238	-4210	-1736	-5536	-2973
wheat	2830	-2615	-2209	1863	621	-751
corn	1275	-1070	-2153	1703	-878	632
soybean	1	-1	-245	153	-243	152
sorghum	-448	445	-126	132	-574	577
millet	-360	354	-101	100	-462	455
tuber	-1355	331	-610	1198	-1965	1529
other grains	-617	430	-268	-52	-885	379
Southwest						
total grain	0	-1900	-8739	1899	-8739	0
rice	-1745	-3	-3708	4817	-5453	4816
wheat	3723	-1071	-1946	-150	1778	-1221
corn	1677	89	-1896	-2330	-219	-2241
soybean	1	-1	-215	354	-214	353
sorghum	-589	480	-111	225	-700	705
millet	-474	468	-89	89	-563	557
tuber	-1782	-556	-537	1111	-2320	555
other grains	-812	-1307	-236	-2217	-1048	-3523

(continued)

Area/crop	Current Prop.shift	Historical prop.shift	Corrected diff. shift	Historical diff. shift	Current total shift	Historical total shift
The national						
total grain	0	-14638	31401	-16768	31401	0
rice	-11163	349	20480	-14570	9317	-14217
wheat	23823	0	7651	-7652	31474	-7652
corn	10728	-3768	6770	-4449	17499	-8217
soybean	9	-1	398	-895	408	-895
sorghum	-3767	-3	-940	936	-4707	933
millet	-3030	0	-708	738	-3738	738
tuber	-11405	0	-2112	2112	-13517	2112
other grains	-5195	-11215	-139	7013	-5334	-4202

(continued)

APPENDIX 4-4 SHIFT FOR MEAT PRODUCTION

unit 1000 ton

Area/meat	1980	1990	growth rate	rij	ri. & r.. (%)	Total shift	Prpo. shift	Diff. shift	Homoth produc (Aij'1
Northeast						-502			
total meat	1047	1681	60.55%	60.55%		-502	2	-504	1047
pork	1007	1525	51.44%	51.44%		-575	-74	-500	985
beef	28	122	335.71%	335.71%		64	72	-9	23
mutton	12	34	183.33%	183.33%		9	4	5	39
North									
total meat	2217	4918	121.83%	121.83%		295	-72	368	2217
pork	2111	4089	93.70%	93.70%		-312	-155	-157	2086
beef	22	455	1968.18%	1968.18%		409	57	352	49
mutton	84	374	345.24%	345.24%		199	26	172	82
Northwest									
total meat	832	1814	118.03%	118.03%		79	281	-202	832
pork	529	1115	110.78%	110.78%		12	-39	51	783
beef	99	281	183.84%	183.84%		75	256	-181	19
mutton	204	418	104.90%	104.90%		-7	64	-72	31
East									
total meat	4298	7947	84.90%	84.90%		-1014	-204	-811	4298
pork	4200	7654	82.24%	82.24%		-1103	-309	-794	4043
beef	33	161	387.88%	387.88%		92	85	7	96
mutton	65	132	103.08%	103.08%		-4	20	-24	159
South									
total meat	1320	3152	138.79%	138.79%		400	-58	458	1320
pork	1301	3065	135.59%	135.59%		352	-96	448	1242
beef	14	75	435.71%	435.71%		46	36	10	29
mutton	5	12	140.00%	140.00%		2	2	0	49
Southwest									
total meat	2338	5623	140.50%	140.50%		748	46	703	2338
pork	2192	5363	144.66%	144.66%		793	-161	954	2200
beef	71	162	128.17%	128.17%		14	183	-170	52
mutton	75	98	30.67%	30.67%		-58	24	-82	86
National	total						-5	11	
total meat	12055	25135	108.50%	r..=	108.50%	6	-5	11	10692
pork	11341	22811	101.14%	r1.=	101.14%	-833	-835	2	10669
beef	269	1256	366.91%	r2.=	366.91%	699	690	9	6
mutton	445	1068	140.00%	r3.=	140.C0%	140	140	0	16

(to be continued)

tic Area/meat	rij'	Current Prop.shift	Histori prop.sh	Corrected diff. shift	Historical diff. shift	Current total shift	Hist. To. Sh
Northeast							
total meat		0	2	-502	-2	-502	0
pork	54.88%	-73	-2	-456	-45	-528	-46
beef	259.54%	60	12	-25	16	35	28
mutton	84.81%	12	-8	-21	27	-9	18
North							
total meat		0	-72	295	510	295	0
pork	114.00%	-154	-2	268	-425	115	-427
beef	396.76%	128	-71	15	338	143	267
mutton	155.34%	26	1	13	160	38	161
Northwest							
total meat		0	281	79	-281	79	0
pork	110.33%	-58	19	72	-21	14	-2
beef	388.25%	48	208	4	-185	52	23
mutton	150.97%	10	55	3	-75	13	-20
East							
total meat		0	-204	-1014	204	-1014	0
pork	78.37%	-298	-12	-921	127	-1218	115
beef	314.06%	248	-163	-51	58	197	-105
mutton	112.83%	50	-29	-43	19	7	-10
South							
total meat		0	-58	400	58	400	0
pork	130.35%	-91	-4	363	85	271	81
beef	434.73%	76	-40	20	-10	96	-50
mutton	174.86%	15	-14	17	-17	32	-31
Southwest							
total meat		0	46	748	-46	748	0
pork	132.01%	-162	1	679	275	517	276
beef	438.58%	135	49	37	-207	172	-158
mutton	176.84%	27	-4	32	-114	59	-117
National							
total meat		0	-5			0	6
pork	101.14%	-835	0	0	2	-835	2
beef	366.91%	695	-5	0		695	4
mutton	140.00%	140	0	0		140	0

(continued)