

STRUCTURAL CHANGES IN AGRICULTURAL PRODUCTION IN CHINA: THREE NORTHEASTERN PROVINCES

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I. INTRODUCTION

THIS PAPER aims to analyze the changes which have taken place in the agricultural production structure of three northeastern provinces (former Manchuria) of China, in the periods before and after liberation. Analyses are made of the aspects pertaining to output, input, and productivity. The reasons why the three provinces (Heilongjiang, Jilin, and Liaoning) are taken up for analysis are that, firstly, a considerable amount of data of comparatively good quality are available for these provinces for the pre-liberation years¹ and, secondly, the pattern of change in Chinese agriculture characterized by the tendency of an abundance of farmland to a shortage is manifestly observed there with a short period of time.

However, data used in our analysis largely concentrate on the former Manchurian period, which makes it impossible to connect directly the pre- and post-liberation periods on the same level. The author does hope that some day basic statistical materials concerning the farm production structure of this region as well as of China as a whole (down to the county level, if possible) will be made public and that a joint study by Japanese and Chinese researchers will become possible.

There are works by Sun [32] and Chen [4] which quantitatively analyze the changes in the structure of agricultural production (though rather limited to that of grain production) in this part of China, but it seems to the author that their works, especially those by the latter, contain certain problems, and the author will not use, though will make some reference to, their indices of production and productivity.²

In Section II a periodization of the development of agricultural production will be made; Section III will deal with changes in the production structure as seen both from sown area and output of crops, and will try to construct the food

The present paper is mainly based on the author's previous article [20], which was partly rewritten to include some results of an analysis made by the author in his other article [21], and also in making use of Chinese data recently made public.

¹ See, for details, [22, Chap. 4].

² [32] [4]. One question about Chen's indices is that both his data sources and method of estimation are unknown. He worked out indices of output and input for each year since 1914, but judging from the poor availability of agricultural statistics in former Manchuria, especially before 1924, his work could hardly be regarded as very reliable.

grain production index with the 1939 value added weights; Section IV will trace the changes in the input structure as seen from various factors of production, and in Section V an attempt will be made to work out the productivity indices of labor, land, and total factors.

In this paper the main aim is to construct the indices of aggregate output, input, and productivity of the three provinces as a whole. The question of the differences between these provinces is not fully tackled, though it is only referred to when necessary. A more thorough analysis of the causes for the change in various aspects of the production structure is yet to be done by the author in the future.

II. PERIODIZATION

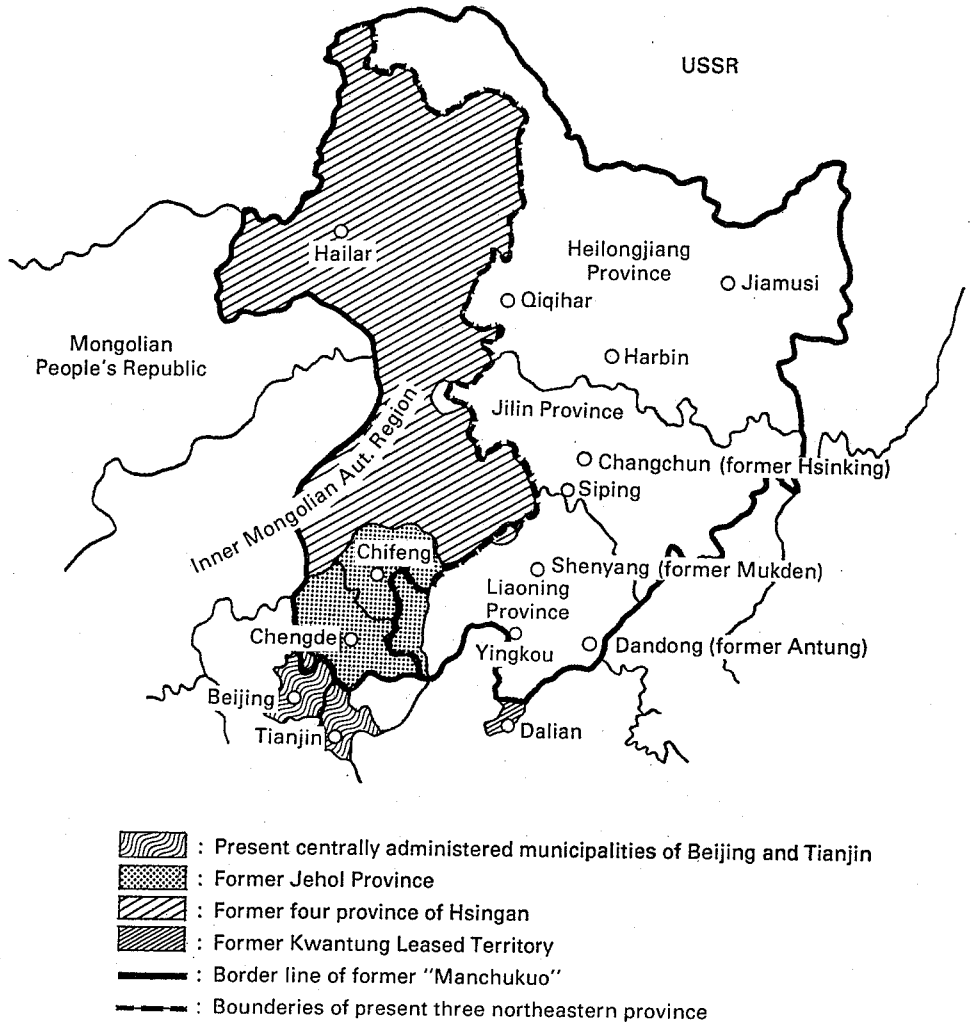
In tracing the development of agricultural production in three northeastern provinces it may be useful to divide the years in question into at least four periods. The period I, the Republican period (1911–31): This period is characterized by the land release and sale by the government followed by a disorderly expansion of land settlement throughout most of former Manchuria. The Chinese involvement in international market relations which had begun at the end of the nineteenth century, with soybeans being the central crop for trading, was furthered during this period. The period II, the Manchukuo period (1932–45): This was the period when the Japanese puppet regime named “Manchukuo” was set up, its agriculture increasingly took on a colonial character in relation to Japan, and state control over farming was tightened. The period III, the period after liberation and covering the First Five-Year Plan (1949–57): Needless to say, this period falls during the years when great institutional changes such as land reform and collectivization took place in rural China and the influence of both international and domestic markets was lessened under the new socialist regime. Finally the period IV, since 1978: In this period the Chinese countryside has again undergone systemic changes and “production responsibility systems” have spread, providing the farmers with more freedom and right as producers than before.

The years between the periods III and IV saw great changes in the agricultural production structure such as the Great Leap Forward. However, since reliable quantitative data are too scarce to cover this period, the author had to give up the idea of treating these years as an independent period.

What makes the matter somewhat complicated is that there were repeated changes in the administrative districts during the four periods.³ Fortunately, however, former Manchuria excluding Jehol Province and the four provinces of Hsingan, as will be seen in Figure 1, roughly corresponds in territory to the

³ For example, during the period of “Manchukuo” considerable changes took place in the administrative districts of “provinces” in 1934, 1937, 1939, and 1941, and after liberation the territory of the Inner Mongolian Autonomous Region was narrowed during the period between 1969 and 1979, and the area of three northeastern provinces was widened as a result.

Fig. 1. Former Manchuria and Present Three Northeastern Provinces



present three northeastern provinces. As regards the territory concerned, what was called "three eastern provinces" in the period I covered an area of 1.04 million km²; former Manchuria in the period II, excluding Jehol Province and the four provinces of Hsingan and including the Kwantung Leased Territory and the South Manchurian Railway Company (hereinafter abbreviated as SMR) zone, was 784,000 km² in area; and three northeastern provinces in the periods III and IV cover an area of about 800,000 km². As great as the territorial difference between the periods I and II may appear, however, it is not very important when considering agriculture, particularly grain production, since the northwestern district of three eastern provinces was much behind in development. Therefore, it is rational enough for the author to make a macro comparison of the four periods in respect to the agricultural production structure in this part of China. Yet the

aforementioned changes in administrative districts naturally make a totally consistent historical comparison impossible.

The period II may be divided into two subperiods, up to 1936 and 1937-42. The former fell in the years just before government control over farm produce began to be tightened as a result of the outbreak of the Sino-Japanese War.

III. CHANGES IN THE OUTPUT STRUCTURE

To begin with, let us take a look at changes in distribution of cropped area (Table I). The concept of "grain" has often changed in China in the recent past, but in this paper the author has adopted what is in use today.⁴ As can be seen from the table, (i) in former Manchuria cropping was characterized by the dominance of soybeans, kaoliang, and millet, which did not change much during the periods I and II; (ii) during the period III, however, the share of soybeans and kaoliang markedly declined while that of rice and wheat rose; (iii) after liberation the share of "others" in grains and commercial crops increased, denoting the diversification in crop production; but (iv) in the period IV the share of corn rose sharply while "others" in grains declined, showing a greater imbalance in crop distribution; and, finally, (v) the changes in cropped area show an almost consistent trend throughout the four periods: the share of kaoliang and soybeans steadily decreased over a period of half a century while that of rice and corn rose.

Now let us examine the changes in the structure of output of grain, in terms of physical weight (see Table II). As will be seen, the shares of rice, corn, and tuber rose after liberation while those of such minor cereals as kaoliang and millet declined, although by the period IV there had been some further changes, with rice production ceasing from expanding and corn increasing enormously. Soybeans, on the other hand, steadily declined both absolutely and relatively. Such a trend could be seen also in each of the three provinces and the difference in the output structure between the provinces did not change much from period to period. The share of corn, for example, rose over the periods III and IV from 24 per cent to 39.7 per cent in Heilongjiang Province, from 26.6 per cent to 59.1 per cent in Jilin Province, and from 26.1 per cent to 52.6 per cent in Liaoning Province, showing the almost same expansion path [21].

How, then, has the agricultural output increased over time in the area concerned? We know two types of price weight indices of grain production worked out by Sun and Chen, the former covering the periods I and II while the latter covers the period I-III. The author, however, has independently worked out a value-added weight index as well as a price weight index of grain production (see Table III). It should be noted that except for 1957 and 1979 yearly data on the production volume of each crop for the periods III and IV were not available. As a result, the author had to see the trend in these periods relying only on Chao's and other physical output indices.

⁴ Tuber is treated as "grain" at the conversion rate of one-fifth in volume; soybeans are also included in grain.

TABLE I
CHANGES IN DISTRIBUTION OF CROPPED AREA

	(1,000 ha)									
	Average of Period I (1924-31)		Average of Earlier Part of Period II (1932-36)		Average of Latter Part of Period II (1937-42)		Period III (1957)		Period IV (1979)	
	Area	%	Area	%	Area	%	Area	%	Area	%
A. Grains:										
1. Rice	196	1.6	217	1.6	389	2.2	820	4.9	842	5.1
2. Wheat	1,156	9.2	1,137	8.4	1,150	6.6	1,023	6.1	2,078	12.6
3. Kaoliang	2,724	21.8	2,794	20.6	3,657	21.1	1,979	11.9	1,241	7.5
4. Millet	2,032	16.2	2,359	17.4	3,218	18.6	2,618	15.7	1,516	9.2
5. Corn	1,028	8.2	1,251	9.2	2,055	11.9	2,876	17.2	4,948	29.9
6. Tuber	(138)	(1.1)	144	1.1	253	1.5	510	3.1	419	2.5
7. Others	921	7.4	1,121	8.3	1,971	11.4	2,064	12.4	515	3.1
8. Soybeans	3,493	27.9	3,638	26.8	3,727	21.5	3,150	18.9	2,750	16.6
B. Commercial crops	(826)	(6.6)	617	4.6	718	4.1	1,603	9.6	962	5.8
C. Others			275	2.0	435	2.5			1,280	7.7
Total	12,514	100.0	13,553	100.0	17,323	100.0	16,700	100.0	16,551	100.0

Note: Estimates were made in the following way. Data on grain, excepting tuber, for the period I were derived from [14], and the corresponding data for the period II from [28, 1942 edition]. The tuber area in the period II is the sum of the area under sweet and Irish potatoes in the Kwantung Leased Territory and that of Irish potatoes in former Manchuria proper, that is, less the area under sweet potatoes there, but this gap is negligible. The area under tuber, commercial crops, and "others" in the period I was estimated on the basis of their respective shares in the earlier part of the period II. The ratio of the area under "special crops" (cotton, tobacco, etc.) in Manchuria proper to the area of ordinary crops and special crops together was 6.5 per cent in 1928, 3.5 per cent in 1929, 2.5 per cent in 1930, and 2.2 per cent in 1931 according to [27] [26, 1929-32 editions]. Data for tuber, commercial crops, and "others" of former Manchuria proper in the earlier part of the period II were derived from the 1935 figures in [30]; the corresponding data for the latter part of the period II were derived from the average of the 1938-42 figures in [28, 1938/39 and 1942 editions]. The "commercial crops" here include perilla, cotton, tobacco, blue hemp, flax and their kind, sugar beet, and peanut; "others" comprise fruit, vegetables, sunflower, etc. The cropped area in the period III was derived by combining relevant data given in [31]. Data for the period IV were derived from [39]. Although the table shows the total cropped area, it must be noted that any exact comparison is not possible between periods, not even between the earlier and latter parts of the period II since Jehol Province and the four provinces of Hsangan were administratively treated differently between these two periods.

Now from what are shown in Tables II and III the following observations may be made:

(i) Differences between indices with varied weights are not clear enough. The author's and Sun's price weight indices and the author's value-added weight index have a close similarity to each other.

(ii) Agricultural production in the region continued to increase during the

TABLE II
CHANGES IN THE OUTPUT STRUCTURE

(1,000 tons)

	Period I		Earlier Part of Period II (1932-36)		Latter Part of Period II (1937-42)		Period III (1957)		Period IV (1979)	
	Output	%	Output	%	Output	%	Output	%	Output	%
1. Rice	301	1.8	384	2.5	725	4.3	1,771	9.0	3,860	10.8
2. Wheat	1,237	7.3	906	5.8	845	5.0	1,065	5.4	3,595	10.1
3. Kaoliang	4,631	27.1	3,821	24.6	4,234	25.2	3,476	17.7	3,755	10.6
4. Millet	3,167	18.6	2,779	17.9	2,947	17.6	2,986	15.2	2,260	6.4
5. Corn	1,787	10.5	1,846	11.9	2,672	15.9	4,985	25.3	17,430	49.0
6. Tuber	—	—	204	1.3	290	1.7	802	4.1	980	2.8
7. Others	1,244	7.3	1,571	10.1	1,376	8.2	1,167	5.9	730	2.1
8. Soybeans	4,693	27.5	4,032	26.0	3,703	22.1	3,440	17.5	2,985	8.4
Total	17,060	100.0	15,506	100.0	16,792	100.0	19,692	100.0	35,595	100.0

Note: Unlike Table I, Jehol Province and the four provinces of Hsingan are not included in both parts of the period II so as to make a comparison of the two parts possible. The percentage distribution in the period I is given on the assumption that the tuber output is zero.

period I, but it stagnated in the period II. It even declined in terms of per capita production in the period II.

(iii) Although the author cannot comment in definite terms about the trend in the period III, grain production may well have been stagnant during the period from 1952 through 1957.

(iv) As Table II indicates, the absolute volume of grain production increased over the years from the period II through the period IV, but in terms of the annual per capita production the period II (the earlier part) averaged 458 kg and the period III (1957) averaged 383 kg, and as can be calculated from Table IIIC, the period IV (1980) averaged 398 kg, showing a long-term declining or stagnant trend. This was mainly because the population in the region greatly increased after liberation.

(v) With such a decline or stagnation in the per capita production of food crops, the marketed output ratio also seems to have come down. For example, in Heilongjiang Province the marketed ratio of food grains stood at an average of 46.5 per cent in the period III, but in the period IV (1980) it came down to 33.1 per cent [36].

IV. CHANGES IN THE INPUT STRUCTURE

In this section the author will focus on inputs of agricultural production and trace the movement in labor force, land, capital, and fertilizer. Since available statistics on inputs are still weaker and scantier than those on output, the input indices worked out hereafter are liable to be rough in quality.

TABLE III
GRAINS PRODUCTION INDICES
A. PERIOD I

Year	(1924=100)			
	The Author's Index Weighted by the 1939 Rate of Value Added	Sun's Index Weighted by 1937 Prices	Chen's Index Weighted by 1937-38 Average Prices	Index of Total Population
1924	100.0	100.0	100.0	100.0
1925	118.2	113.6	112.6	102.5
1926	118.8	116.6	115.1	105.0
1927	124.5	124.5	124.0	107.6
1928	127.9	128.1	125.2	112.6
1929	128.6	129.8	122.1	117.3
1930	133.7	135.1	129.6	118.8
1931	133.5	133.6	126.5	120.4

B. PERIOD II

Year	(1939=100)					
	The Author's Index		Sun's Index Weighted by 1937 Prices	Chen's Index Weighted by 1937-38 Average Prices	Index of Total Population (A)	Index of Total Population (B)*
The 1939 Price Weight	The 1939 Value-Added Weight					
1932	91.1	89.7	95.6	85.5	75.9	80.2
1933	98.4	98.2	103.3	88.2	79.3	83.2
1934	75.5	75.2	79.0	70.6	84.4	88.0
1935	93.2	92.8	95.6	87.9	88.0	91.7
1936	98.1	97.9	101.1	93.0	90.9	93.5
1937	103.0	102.2	110.4	87.9	93.6	95.0
1938	106.3	105.9	104.0	100.7	97.8	98.2
1939	100.0	100.0	100.0	100.0	100.0	100.0
1940	101.4	98.5	97.3	102.6	104.2	103.1
1941	95.9	96.6	98.0	104.1	108.5	106.1
1942	89.8	91.3	90.6	92.9	113.7	109.9
1943			96.9	100.2		
1944			101.0	106.4		
1945				90.7		

* Excluding the provinces of Hsingan and Jehol.

C. PERIODS III AND IV

Year	Chen's Index (1949=100)	Wiens's Index (1949=100)	Chao's Index (1949=100)	Official Index (1957=100)	Total Population (1,000)	Index of Total Population (1957=100)
1949	100.0	100.0	100.0			
1950	116.2		100.8			
1951	112.6		102.9			
1952	132.7	137.7	114.4		42,310	82.2
1953	124.2	121.3	105.8			
1954	124.4	123.8	106.6		46,046	89.4
1955	134.8	141.0	121.9			
1956	143.0	136.1	120.9			

TABLE III (Continued)
C. PERIODS III AND IV (Continued)

Year	Chen's Index (1949=100)	Wiens's Index (1949=100)	Chao's Index (1949=100)	Official Index (1957=100)	Total Population (1,000)	Index of Total Population (1957=100)
1957	130.7	127.9	112.5	100.0	51,500	100.0
1979				180.8	87,962	170.8
1980				180.0	89,010	172.8

Note: The author's indices were worked out in the following way: (i) the output index by crop was based on data given in [28, various issues], necessary adjustment having been made so as not to include Jehol Province and the four provinces of Hsingan; (ii) the unit price of each crop was obtained by having an arithmetic mean of various prices in different localities of former Manchuria which were given in [10]; (iii) the unit value added for each crop was obtained by having an arithmetic mean of "values added" in different localities on the basis of [12] and then by having it weighted by production volumes in each locality in 1939.

Wiens's indices were derived from the Thomas-Wiens's estimates of physical output of grains in the three provinces [6, Table 4]. Chao's indices were derived from his estimates of grain output in physical term [2, Appendix Table 14]. The 1957 grain output as estimated by both Wiens and Chao is considerably less than the author's estimate, which may be because they followed a somewhat different definition of grain, for instance, by their exclusion of soybeans.

As for total population, that in the period I was derived from the SMR estimates (see the note of Table IV); that in the period II was derived from statistics of the Bureau of Statistics, State Council as well as from [9], although the population of Manchuria proper after 1940 was estimated by the use of the annual average rate of population increase calculated by a log-linear regression of population data covering the earlier years. This processing had to be done because the population as reported in [17] (as of July 1, 1940) as well as in [15] (as of October 1, 1941) widely differed from that given in the pre-1939 data. The population of the provinces of Hsingan and Jehol in 1932 and 1940-42 was estimated by the use of the annual average rate of population increase found by means of a log-linear regression of the 1933-39 data. The total population in the periods III and IV was estimated by the author on the basis of [3, p. 137] [31]; the total population and grain output in the period IV were derived from [37, 1980 and 1981 editions].

A. Labor Force

It seems to be almost impossible to obtain macro figures of the agricultural labor force in stock terms except for population statistics by occupation in the period II. Therefore, the author had first to collect data on the agricultural household population and then check this with available individual data on the labor force.

For the period I even data on the agricultural household population are almost unavailable, so that the author worked it out by multiplying the SMR estimated population of former Manchuria [14] by a certain ratio. For the period II it took a somewhat more complicated procedure to estimate the agricultural household population, excepting Jehol and the four Hsingan provinces for the sake of keeping consistency with the output series (see the note for Table IV). For the periods III and IV the rural population in 1957 and 1980 had to be

TABLE IV
ESTIMATES OF FARM HOUSEHOLD POPULATION

(1,000)									
Period I			Period II			Periods III and IV			
Year	Agricultural Household Population	Index (1924=100)	Year	Agricultural Household Population	Index (1939=100)	Year	Chen's Index (1949=100)	Rural Population	Index (1957=100)
1924	18,070	100.0	1934	22,841	93.3	1949	100.0		
1925	18,514	102.5	1935	23,424	95.7	1950	100.3		
1926	18,973	105.0	1936	23,367	95.4	1951	100.5		
1927	19,446	107.6	1937	24,188	98.8	1952	107.2		
1928	20,353	112.6	1938	24,482	100.0	1953	111.3		
1929	21,198	117.3	1939	24,489	100.0	1954	116.2		
1930	21,471	118.8	1940	25,687	104.9	1955	117.9		
1931	21,752	120.4	1941	26,406	107.8	1956	119.5		
			1942	27,744	113.3	1957	121.7	33,257	100.0
						1979		59,688	179.5
						1980		62,046	186.6

Note: Estimation was made in the following way: For the period I, the SMR estimated population in each year [14, p. 21] was multiplied by 0.726 (the ratio of the agricultural household population to total population in 1934). For the period II, first the total agricultural household population in former Manchuria in 1934-37 was derived from [16], which excluded the four provinces of Hsingan. From the figures thus derived those for Jehol Province were further deducted, assuming that the ratio of the agricultural household population to the total population in the province was 0.9018 (on the basis of data in [28, 1938/39 edition]). To the figures those for the Kwantung Leased Territory and the SMR zone were added. Figures for 1938-42 were derived from data in [28, 1938/39 and 1942 editions] with the necessary territorial adjustment. Therefore, as in Table III, the agricultural household population in the table is not for the whole of former Manchuria; for 1942, for instance, it is 17.8 per cent less. The total population in Jehol Province and the four provinces of Hsingan together increased by 1.9 times for ten years from 1933 through 1942. As for the rural population in the period III (1957), it is the sum of the rural population of three northeastern provinces as given in [31]. For the period IV, the figure for 1979 was derived from [37, 1980 edition] and that for 1980 from [38], however, the rural population in Heilongjiang Province for 1980 was derived by the use of the urban-rural population ratio in 1979.

estimated on the basis of fragmentary data. The results are shown in Table IV. If we calculate the rate of increase in the agricultural household population at compound interest on the basis of the figures in Table IV, its annual rate of increase comes out at 2.68 per cent for the period I, 2.46 per cent for the period II, and 2.60 per cent for the periods III and IV. If errors in estimation are taken into account, it may be reasonable to say that the rate of increase in the farm household population was nearly the same for all periods.

However, these figures above are "agricultural household population" or "rural population," not the agricultural labor force. According to village surveys made during 1935-38, the ratio of the agricultural labor force to the agricultural household population was 37.2 per cent in northern Manchuria and 34.4 per

cent in southern Manchuria, or 36.0 per cent in former Manchuria as a whole. Also, according to the population statistics as of October 1, 1941 [15], the occupied population in agriculture, forestry, and stock-farming constituted 36.1 per cent of the total population and 48.3 per cent of the agricultural population in former Manchuria (excepting the Kwantung Leased Territory). These two data are so different in nature that it is impossible to compare them directly, but it may be safe to say that the ratio of the agricultural labor force to the rural population stood at around 40 per cent during this period. For the period III, on the other hand, only fragmentary data are available: the ratio was 37.6 per cent in Heilongjiang Province in 1957. As for the period IV (1979), the ratio can be found for each province: 23.9 per cent in Heilongjiang, 21.6 per cent in Jilin, and 26.3 per cent in Liaoning, with the average of the region as a whole being 24.2 per cent.⁵ Moreover, the corresponding ratio for 1980 in Liaoning was 28.5 per cent. This may indicate that the ratio declined after liberation, and more so in the period IV. If so, it was possibly because of the rise in the birthrate due to the more equal income distribution after liberation, as well as its effect on average family size.

To add one more remark to Table IV, the figures are data on stock as mentioned above. As far as the author knows, almost the only data available on farm labor hours are the agricultural household surveys made mainly during the period II and the surveys on income distribution in agricultural cooperatives made in the period III (1955 and 1957) [34] [35]. The trouble here is that a comparison of the two periods in farm working hours is not easy since the "working days" as defined in the surveys in the two different periods are not identical with each other. For example, according to a survey taken of twenty agricultural households in Keshan County (of present Heilongjiang Province) made in the period II those who were engaged in agriculture used to spend 218-68 days of labor per head annually [13, p. 19], whereas in the period III the surveys of agricultural cooperatives in three northeastern provinces made in 1955 reported the per capita annual "working days" in agriculture as less than 24 days⁶ and then similar surveys made in 1957 reported the corresponding work days as 185 days for male and 60 days for female [34]. It appears as if the working days per person engaged in agriculture changed widely from period to period. However, when the system of agricultural techniques did not change much, at least not until around 1956, it would be inconceivable that the annual average amount of labor input per person employed in agriculture fluctuated extremely within comparatively so short a period of time. After 1956, though, collectively organized capital construction on farmland during the farmers' slack season became more active than in the early years of the period III, with the resultant increase in the amount of labor input. In fact, until recently in a county of Heilongjiang Province the annual amount of labor input per unit of labor

⁵ Figures for the labor force are derived from [39].

⁶ [35]. Attention should be paid to the fact that these are working days spent for collective work. The number of days will naturally increase if the work on farmers' private plots is to be included.

force (per person) for collective purposes had been set at 320 working days.⁷

B. *Cropped Area*

Changes in the cropped area in three northeastern provinces in different periods are shown in Table V. As noted in the table, a limited availability of data made unavoidable the inconsistency in the type of crops and in the definition of "areas" between periods, but the table will enable one to grasp the changes in the cropped area in the four periods by indices.

As can be seen from the table, in the period I an active expansion of the farmland and the cropped area took place, but in the period II, especially in its latter years, the expansion lost momentum. Since, however, the figures for the period II in the table do not include those for Jehol Province and the four provinces of Hsingan, where the rural population is known to have been increasing, the trend for increase in the farmland and the cropped area in former Manchuria as a whole may not have declined.

In the period III the picture considerably changed, an expansion of the cultivated area through land reclamation was offset by the course of urbanization and industrialization. Kang Chao [2] estimates that the cropped area even decreased in this period. The trend for such decrease continued from the period III into the period IV. As seen from the cultivated area, in Liaoning Province it decreased from 4.75 million ha in 1957 to 3.76 million ha in 1980, in Jilin Province from 4.72 million ha to 4.04 million ha, and only in Heilongjiang Province did it increase from 7.29 million ha to 8.67 million ha. Thus the trend in the periods III and IV seems to indicate that agriculture in three northeastern provinces with the exception of Heilongjiang Province has entered the stage where farmland is scarce.

The multiple cropping index (cropped area/cultivated area \times 100) does not seem to have changed much between the periods before and after liberation. In the period II (1935-40) the average index for former Manchuria excluding Jehol Province and the four Hsingan provinces stood at 96.3, although that for the Kwantung Leased Territory was 138.4, indicating that land was utilized very effectively. In the period III (1957), on the other hand, the corresponding index of 99.6 was a little higher than in the period II (the figure for Liaoning Province was 104), but seen on the whole there was not much change in the picture. In the period IV (1979), three northeastern provinces together averaged 100, showing little change from the previous periods, although in the two provinces of Jilin and Liaoning it was a little higher. In other words, even if there were some important changes in agricultural techniques after liberation as will be stated later, it may be said that so far as the land utilization is concerned, agriculture in this region did not make much progress after liberation, probably constrained by the severe natural conditions.

Here it may be in order to refer to the expansion in the irrigated area, a characteristic fact mainly after liberation. As indicated by the changes in the

⁷ [25, Sept. 29, 1980]. This is the case of a production brigade in Shuangcheng County, Heilongjiang Province.

crop distribution mentioned in the preceding section, the extension of rice growing was remarkable in three northeastern provinces, which was accompanied by an expansion of the irrigated area, especially in the period III. The paddy field area in Liaoning Province increased to 270,000 ha in 1957, a two-fold increase over 1952; in Jilin Province it increased from 132,000 ha in 1955 to a level two times as much in the following year, and in 1958 it increased further to 358,000 ha, which constituted 7.5 per cent of the total cultivated area in the province; and even in Heilongjiang Province it increased to 287,000 ha or 4 per cent of the cultivated area in 1957. In the period IV (1980) in Jilin Province the irrigation ratio, that is the ratio of the irrigated to the total cultivated area, rose to 18.1 per cent against a mere 6.9 per cent in 1957, indicating that considerable efforts were made there for water utilization.⁸ However, as implied by the stagnant share of rice in the cropped area in Table I, the expansion of the paddy field in the region as a whole does not seem to have progressed appreciably since the period III.

C. Capital

Of the agricultural capital which consists of buildings and installations, machines, large farm implements, large animals, and trees, only the large animals (cattle, horses, mules, and donkeys) can be covered by macro data throughout the periods concerned. Table VI reveals the estimated number of such animals for the different periods.

As will be seen from Table VI, the number of large animals increased rapidly during the period I and began to decrease in the earlier years of the period II, and then the number slightly rose again, followed by a gentle upward trend in the period III. The reasons why the number of large animals began to decrease or stagnate in the earlier part of the period II were given as: (i) a decline in the reclaimed land area and the concomitant decrease in demand for draft horses, (ii) restoration of public peace and order and the resultant decline in the need for horses for police purposes, and (iii) growth of the railways network which caused decreased use of draft animals for transport purposes [11, pp. 32-33]. However, these reasons, with the probable exception of the first, would not seem persuasive enough. The decrease in the number of large animals, it seems, was not because of the restoration of public peace and order, but rather because of chaotic situation before and after the "Manchurian Incident." According to an SMR survey horse resources in the three provinces of Heilungkiang, Kirin, and Fengtien together totaled 2.44 million head in 1931, but in June, 1933, when the Manchukuo Ministry of Industry enquired about the number of horses in

⁸ Figures for 1957 are derived from the appendix in [2]. As calculated on the basis of the same data, the irrigation ratio in three northeastern provinces was 1.2 per cent in 1949, 1.6 per cent in 1952, and 6.6 per cent in 1957 against the national average of 13.5 per cent, 17.4 per cent, and 32.2 per cent in respective years, thus indicating that the rate of increase in the irrigation ratio in three northeastern provinces was higher than the average for China as a whole. It should be noted that the denominator in the irrigation ratio is the cultivated land area estimated by Chao.

TABLE VI
ESTIMATED NUMBER OF LARGE ANIMALS

(1,000 head)

Period I			Period II			Periods III and IV		
Year	Number	Index	Year	Number	Index	Year	Number	Index
1924	3,285	100.0	1932	4,513	119.0	1949	4,557	100.0
1925	4,071	123.9	1933	4,247	112.0			
1926	4,413	134.3	1934	3,287	86.7			
1927	4,753	144.7	1935	3,339	88.1	1957	6,162	135.2
1928	5,157	157.0	1936	3,388	89.3			
1929	5,316	161.8	1937	3,635	95.9			
1930	5,343	162.6	1938	3,477	91.7	1979	7,921	173.8
1931	5,347	162.8	1939	3,792	100.0			
			1940	3,844	101.4			
			1941					
			1942					

Note: Estimation was made in the following way. As for the period I, figures for Manchuria proper excepting the Kwantung Leased Territory for the years 1928-31 were derived from [26]. As data for the years 1924-27 are altogether unavailable, the number of animals in these years was estimated on the assumption that their number per cropped area should be the same as the average corresponding number in the 1928-31 period, and the result turned out roughly to correspond to the figures as given in a passage, "the average number of draft animals per 100 ha in Manchuria as a whole for the 1924-31 period was between thirty-seven and forty head" [11, pp. 31-32]. As for the period II, (i) figures for 1938-42 were derived from [28, various issues], excluding those for Jehol Province and the four Hsingan provinces; (ii) the figure for 1935 is based on [24]; (iii) figures for 1934, 1936, and 1937 were derived by modifying the numbers given in [16], which included those for Jehol Province, with the ratio between the numbers including the province and those not including it for the year of 1935; (iv) figures for 1932 and 1933 were derived on the basis of the above estimated number for 1934 by modifying the 1932 data in [26] and the 1933 data in *Manshū keizai zuhyō* [Manchurian economic chart] by Dalian Chamber of Commerce and Industry (as quoted in [18]). The above estimates for the periods I and II, however, are only for Manchuria proper, so corresponding data for Kwantung Leased Territory were added to them. As for the period III, an estimation was made on the basis of [3], with some adjustment by the author; and as for the period IV (1979), data were derived from [39, p. 121].

135 counties, it received replies from 103 counties, whose reported number of horses totaled only 480 thousand [19, pp. 84-86]. This indicates how many horses were killed, requisitioned, or stolen in those days.

If here large animals are taken for draft animals, they are yet to be examined from the flow aspect, in terms of their working hours. On this aspect only a micro survey is available which deals with the period II. According to the survey, working hours of draft animals roughly corresponded to those in the labor force [22, Chap. 3]. This was probably due to the fact that under the traditional system of agricultural techniques in former Manchuria draft animals were used in close unity with human labor. Therefore, the trend of draft animals as seen from the flow aspect may well have paralleled the corresponding the labor force.

In the period III, large animals rapidly increased in number in four years from 1949 to 1952, after which their number stagnated. In Jilin Province by 1954 it increased by 40.7 per cent over the 1949 level and then declined by 26 per cent by 1957; in Heilongjiang Province from 1949 through 1952 it increased by 44 per cent but by 1957 it declined markedly, except for horses. Such a trend was ascribed to "the failure in dealing with the relation between the raising, working, and reproducing of animals in the early years of the agricultural collectivization" [31, p. 183].

After the period III the number of large animals in China as a whole decreased in 1961 to a level 83 per cent of that in 1957 and after that there began a slow increase. Three northeastern provinces may have followed the same trend. The number of large animals in the region has reached by 1979 a level 28.5 per cent higher than in 1957 [39], a rate of recovery considerably higher than the national average.

Of agricultural capital other than large animals, let us briefly take a look at farm machinery and large farm implements. In the days of former Manchuria farming was mainly based on draft animals, with matching large farm implements, such as the *lizhan* ("Chinese plow"), the *huaipa* ("furrow-making implement"), etc. Such modern farm machines as tractors, seeders, reapers, threshers, plows, etc. were only used by some of the Russian émigré farmers in the Sanho district and also by some colonists—Japanese and Korean farmers. Only treadle threshers were coming into use among Chinese farmers.⁹ According to a record, as of June 1935, the number of tractors totaled only 198 in all Manchuria and the number of tractors sold in north Manchuria between 1922 and 1938 made a total of only 588. Nevertheless, it should not be overlooked that even in those former-Manchurian years the rapid mechanization had already started, as indicated by the fact that the volume of farm machinery imported, though small in absolute terms, was growing fairly fast, so that its index stood at 3,915 in 1938 taking 1933 as 100.¹⁰

The mechanization of agriculture progressed rapidly after liberation. In this the state farms played the leading role. In Heilongjiang Province, there were 36 ordinary state farms, 36 farms under the Ministry of Public Security, 13 farms of the colonial troops, 12 farms specializing in fruit growing, vegetable growing, bee culture, etc., and 28 tractor stations in 1957. The number of tractors in the province totaled 3,167 and the area under mechanized cultivation reached 221,000 ha, or 3 per cent of the total cultivated area in the province. By 1980 the province had as many tractors as 56,000. In particular, its 114 large state farms had 4,900 large and medium tractors and 2,800 combines [25, November 23, 1980]. Thus a great part of the farm and non-farm work came to be mechanized on these state farms, while in the people's communes also 50 per cent of such work as plowing, seeding, and cultivating was said to be mechanized [25, October 23, 1980]. In 1979 the ratio of the machine-cultivated

⁹ A pertinent description of how farm machines and implements were introduced and spread in former Manchuria is given in [18, pp. 806–9].

¹⁰ The figures are all from [24, pp. 271–77].

area to the total cultivated area reached 69.4 per cent in Heilongjiang Province, 38.4 per cent in Jilin Province, and 46.5 per cent in Liaoning Province, or an average for the three provinces of 56.6 per cent [39]. Against the national average of the corresponding ratio of 42.4 per cent, one may well see how high the level of agricultural mechanization in the region is.

D. Fertilizer

Of current inputs in agriculture, only fertilizer can be covered by macro data, though scattered. In the days of former Manchuria, newly reclaimed land was given no fertilizer for some time, and then as the fertility of soil clearly declined, there began the application of self-supplied *tufen* ("soil manure"), a fermented mixture of dung and soil while crop rotation including legumes was introduced.

As to the volume of *tufen* produced in former Manchuria there were some calculations made on the basis of the number of animals. According to one such calculation, which was made on the basis of livestock feed and reckoning with the extent of utilization of the manure in various localities excepting the four Hsingan provinces, the annual output of the *tufen* manure amounted to around 57.5 million tons (50 million tons if Jehol Province is excluded).¹¹ If we divide the figure by the corresponding cultivated area, the output per hectare comes out at about 3.6 tons (3.3 tons if we exclude Jehol Province). According to a survey of individual villages, the volume of *tufen* applied varied widely as between north and south Manchuria: While in a south-Manchurian village the manure was applied in amounts of between 40 and 70 tons per hectare annually, in north-Manchurian villages farmers applied only between 5 and 10 tons of the manure per hectare, not annually, but every three years [1, p. 23]. Such a difference reflected the fact that the rate of decrease in the soil fertility varied greatly between north and south Manchuria. Now, it was often pointed out that *tufen* was an inferior manure as it lacked fertilizer components. Tsuge [33], for instance, on the basis of the analyses made by the Gongzhuling agricultural experiment station of *tufen* components in various localities of former Manchuria, pointed out: "*Tufen* in our country [Manchukuo] is poor in fertilizer components, comprising 0.35 per cent of a total nitrogen content, 0.50 per cent of phosphoric acid and potash, and 0.03 per cent of ammonia nitrogen. Also as tests show, average fertilizer response of *tufen* is only about 20 per cent of that of ammonium sulphate. Thus, as seen both from fertilizer components and response, *tufen* is of low value as fertilizer" [33, p. 51]. Therefore, the above-mentioned *tufen* output of 3.6 ton per hectare was tantamount to only 13 kg per hectare in terms of total nitrogen, or 2.5 kg per hectare in terms of ammonium sulphate.

In former Manchuria there was also other self-supplied manure, such as stable manure, dried night soil, bean cake, etc., but most of this was used for vegetables and other garden products, and the volume could not be compared to *tufen*.

Chemical fertilizer was beginning to be used, particularly in south Manchuria. However, as shown in Table VII, most of the ammonium sulphate, whose production in Manchuria was rapidly on the increase after 1934, was exported to

¹¹ [8]. The method of estimation is not known.

TABLE VII
 PRODUCTION AND CONSUMPTION OF AMMONIUM
 SULPHATE IN FORMER MANCHURIA

Year	Production	Consumption
1934	57,792	1,020
1935	172,786	3,146
1936	181,737	10,662
1937	214,402	18,878
1938	193,215	21,138
1939	154,770	34,200
1940	221,366	70,000*

Source: [24, pp. 249-50].

* Allotted volume.

Japan, Korea, Taiwan, and North China, leaving a very insignificant amount, for domestic consumption. In 1940 the consumption of ammonium sulphate per cultivated and was only 3.7 kg per hectare.

However, the picture widely changed after liberation. In the first place the fertilized area was extended: it reached 60 per cent of the estimated cropped area in 1957.¹² Even in Heilongjiang Province, where the newly reclaimed land area expanded, so that in the days of traditional farming techniques crop cultivation in many cases used to be made without fertilizer, it increased by 107 per cent during the period from 1952 through 1957 while the cultivated area expanded by 12.5 per cent. Secondly, chemical fertilizer increased in application. In 1957 in Heilongjiang Province the area under chemical fertilizer already covered 97,000 ha, or 1.4 per cent of the total cropped area in the province; in 1980 in Jilin Province the volume of chemical fertilizer applied totaled 303,000 tons, or 75 kg per hectare of the cultivated land [38]. Thirdly, the total supply of manure and fertilizer per hectare of cultivated land increased. In Liaoning Province, for instance, the total supply of fertilizer per hectare stood at 27.5 tons in 1957, denoting a 37.5 per cent increase over the 1952 level [31].

V. TREND OF PRODUCTIVITY

The preceding two sections examined the output and input trends of agriculture (grain production) in three northeastern province before and after liberation. In this section, on the basis of the estimate thus obtained, analyses will be made of the patterns of (a) labor productivity, (b) land productivity, and (c) total factor productivity in different period.

A. Labor Productivity

The index of agricultural labor productivity can be obtained by dividing the grain production index by the index of the agricultural household (or rural) population, as shown in Table VIII. From this table one may see that agri-

¹² Estimated on the basis of data in [31]. The ratio of the fertilized to the cultivated area in Jilin Province was assumed at 60 per cent.

TABLE VIII
INDICES OF AGRICULTURAL LABOR PRODUCTIVITY

Period I		Period II		Period III		Period IV	
Year	The Author's Index (1924=100)	Year	The Author's Index (1939=100)	Year	Chen's Index (1949=100)	Year	Official Productivity Index of Grain Production (1957=100)
1924	100.0	1934	80.6	1949	100.0	1957	100.0
1925	115.3	1935	97.0	1950	115.9		
1926	113.1	1936	102.6	1951	112.0	1979	100.7
1927	115.7	1937	103.4	1952	123.8	1980	96.5
1928	113.6	1938	105.9	1953	111.6		
1929	109.6	1939	100.0	1954	107.1		
1930	112.5	1940	93.9	1955	114.3		
1931	110.9	1941	89.6	1956	119.7		
		1942	80.6	1957	107.4		

Note: Figures for the period I were derived by dividing the production index estimated by the author in Table III A by the agricultural household population index for the corresponding period in Table IV; the period II figures were derived likewise by dividing the author's index in Table III B by the index in Table IV; and those for the periods III and IV were derived by dividing the official index in Table III C by the corresponding index in Table IV.

cultural labor productivity rose in the earlier years of each period and then declined or stagnated in the later years, although the index for the period IV is of a different nature from the indices for the preceding periods. An amazing fact here is that labor productivity in food production hardly seems to have improved since 1957 until recently notwithstanding the increased mechanization and chemical fertilization. Needless to say, this labor productivity is defined on the assumption that the agricultural labor force grew at the same rate as did the rural population. Since, as stated earlier, the agricultural labor force seems to have declined in its ratio to the rural population after liberation, labor productivity in the true sense of the term may not have declined as much as indicated by Table VIII. Yet, at least in the provinces of Heilongjiang and Jilin, there has been little indication of agricultural labor productivity having increased as compared with the pre-liberation level [21]. In Heilongjiang Province the food output per head of the agricultural labor force decreased from 2,249 kg in 1949 to 2,142 kg in 1977 [5]. Moreover, if we take the labor force in flow terms, the working hours per head of the labor force are likely to have increased as discussed earlier, which all the more underlines the decline in agricultural labor productivity.

B. *Land Productivity*

The index of land productivity can be worked out in the same way as in the labor productivity index. As will be seen clearly from Table IX, land productivity showed a declining trend during the periods I and II, but in the period III it began to rise gradually and in period IV it rose rather sharply.

The chronic decline in land productivity before liberation was just the pheno-

TABLE IX
LAND PRODUCTIVITY INDICES

Period I		Period II		Period III		Period IV		
Year	Index (1924=100)	Year	Index (1939=100)	Year	Chen's Index (1949=100)	Chao's Index (1949=100)	Year	Official Index for Grains (1957=100)
1924	100.0	1935	112.4	1949	100.0	100.0	1957	100.0
1925	95.4	1936	114.5	1950	113.3	103.5		
1926	88.5	1937	115.9	1951	105.8	107.4	1979	183.4
1927	86.0	1938	112.4	1952	121.0	122.1	1980	182.6
1928	81.4	1939	100.0	1953	112.2	112.2		
1929	81.9	1940	101.1	1954	111.2	112.7		
1930	82.5	1941	95.8	1955	119.2	127.5		
1931	79.5	1942	89.3	1956	124.6	127.4		
				1957	112.8	123.6		

menon that had begun to be loudly discussed as a problem of "declining land fertility" since around the middle of the 1930s. Land productivity as shown in Table IX is calculated on the basis of the total value added in food output, but if we examine it in terms of yield per unit area of land for each of the food crops, it showed a uniform declining trend after its peak level in the early years of the period I. For example, the index of the average yield per cropped area, with 1924 as 100, was 73.2 for soybeans in 1937, 66.5 for kaoliang, 62.7 for millet, and an average of 73.2 for ordinary crops. Such a declining trend was more marked in more developed south Manchuria, while in north Manchuria such a decline was hardly noticeable throughout the years in question.

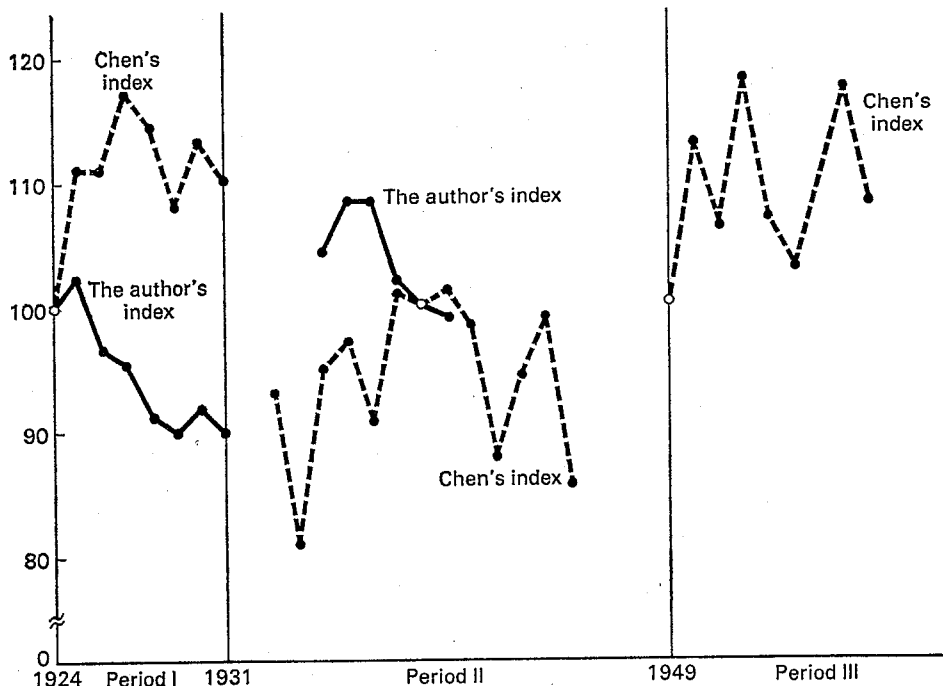
The causes of the decline in the land fertility were not simple. Arakawa [1], who held that the old social and economic structure in Manchuria did aggravate the falling land fertility, pointed out the following four causes: (i) too short a period of tenancy contract, (ii) too much concentration on grain production and neglect in the growing of fodder crops and green manure, (iii) too small a number of livestock raised, and (iv) inexpediency of fertilization under traditional farming techniques. Thus the causes were not only social and economic, as in (i) and (ii), but technical, as in (iii) and (iv), which, in fact, resembled the problems faced by agriculture in Hokkaido in the years following the end of the Meiji era in Japan.¹³

After the period III, and especially in the period IV, land productivity increased, which may largely be ascribed to increased fertilization, particularly to an increased supply of chemical fertilizer. In other words, in these periods there came to be formed such a technological system, as well as an institutional and organizational mechanism, that made it possible to secure self-supplied manure and chemical fertilizer.

Land productivity as measured in terms of the grain output increased at the highest rate in Liaoning Province, where the productivity index with 1939 as 100 grew to 141.5 in 1957 and to 329.6 by 1980, while in Heilongjiang Province

¹³ See [7, p. 235 ff.].

Fig. 2. Shifts in Total Factor Productivity in Former Manchurian Agriculture



Sources: [20] for the author's indices and [4] for the Chen's indices.

Note: Base years for the periods I, II, and III are 1924, 1939, and 1949, respectively.

where development has still been of an extensive character it was lower than in the other provinces with 122.7 in 1957 and 185.9 in 1980 [21].

C. Total Factor Productivity

The total factor productivity index, which is the ratio of an aggregate output index to an aggregate input index, can be found for the periods I and II in the following way: First an aggregate input index is obtained by summing up the indices of the labor force, cropped area, and large animals, which are available in a time series (see Tables IV, V, and VI), with their respective weights of 0.391, 0.397, and 0.212; then the grain production index with value-added weight in Table III is divided by the above aggregate input index.¹⁴ Its movement is shown in Figure 2.

From Figure 2 it may be summed up that the productivity index showed a trend toward a decline in the period I and did not show any sign of rising in the period II. In other words, agriculture in former Manchuria had to be conducted on the whole inefficiently, or more correctly, under very unfavorable conditions. With regard to the periods after liberation, the author had to give up his attempt to work out productivity indices as data are not sufficiently

¹⁴ Based on the average value added for each factor of production that can be derived from [12].

available. But judging from scattered information for each province, the movement of Chen's index and the author's own analysis of productivity pattern in China as a whole,¹⁵ collective farming in the region does not seem to be efficient. After liberation, especially in the period IV, non-land input, particularly current inputs such as chemical fertilizer have grown at a higher rate than the physical output.

VI. CONCLUSIONS

From the foregoing analyses we may now sum up the structural changes in agriculture in three northeastern provinces over a period of more than half a century up to the present, although it must be noted that the conclusions here are tentative because of the restricted availability as well as the insufficient quality of data used for the analyses.

(1) It seems that the changes, be they in the aspect of output or in that of input, form one continuous historical process that has not been interrupted by liberation. Certainly, as the shifts in land productivity indicate, technological changes of any noticeable scale took place as late as in the period IV. At the same time, however, that some continuous changes had taken place before the period III should not be overlooked.

(2) While the Northeastern agriculture before liberation was characterized by the abundant land with an expansion of the cultivated land area, it gradually lost its extensive character after liberation as the population increased rapidly and industrialization and urbanization progressed. It is now being changed into intensive farming. A typical manifestation of this is the continued increase in the fertilized area and fertilizer applied per hectare of land. Thus, the man-land ratio in three northeastern provinces, except for the peripheral areas of Heilongjiang Province, has been rising in recent years, especially as compared with that in the pre-liberation years.

(3) However, there are few indications that the regional differences between three northeastern provinces in the development of agriculture have been narrowed after liberation. Although efforts may have been made toward equalizing the provinces in the agricultural production structure, they appear to have as yet failed to produce the desired result since, in particular, agriculture is definitely more affected by natural and geographical conditions than is any other industry.

¹⁵ As for indices of agricultural production in China for the 1952-79 period estimated by the author, see [23].

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