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GROWTH RATES OF TAIWAN AGRICULTURE 1911—1972

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GROWTH RATES OF TAIWAN AGRICULTURE 1911–1972

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FOREWORD

Economic growth is generally considered in terms of rising real income per person. Defined in this way, economic growth can be achieved through advancement of production techniques to make it possible to produce a greater output with the input of a given quantity of resources. Thus, the changes in productivity may be said as the result of technological improvement.

For the measurement of technological effects on productivity change, some economists have suggested several alternative approaches. One of them is the total factor productivity approach based on the changes in total output per unit of input. In order to identify the factors influencing input-output relationship and investment, Lee, a co-author of this report, collaborated in 1958 with Dr. S. C. Hsieh, then Chief of JCRR Rural Economics Division, in making a study of the total factor productivity of Taiwan's agriculture which is reported in a book entitled "An Analytical Review of Agricultural Development in Taiwan—An Input-output and Productivity Approach." Since then, a continued series of output and input indices have been constructed. During this period, the compiling procedure and input items have been improved year by year. However, although the above-mentioned study has been recognized as an important pioneer effort in this part of the world, the methodology of index compiling, data collection and productivity measurement has never been published in any form. This shortcoming has led to many inquires from outside economists, and to difficulties in keeping consistency in data evaluation on inputs and outputs throughout the period.

To fill such a gap, we took the opportunity of attending a conference on agricultural productivity held in Hawaii in 1973 to write a paper about the methodology we used before.

The present report is based mostly on the paper presented at the Hawaii Conference. We would like to express our sincere appreciation

to Professor Herman M. Southworth for his invaluable help in editing the original draft. However, the authors alone are responsible for any error that may be found in this publication.

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PART I. GROWTH RATES OF TAIWAN AGRICULTURE, 1911-1972

The objective of the study as reported in Part I is to review agricultural development in Taiwan from 1911 to 1972, the period for which suitable time-series data are available. Emphasis is on the trend of agricultural output, changes in factor inputs in the agricultural sector, and the growth in total and partial factor productivities. The main findings are summarized in tables of compound annual growth rates and in charts.

Supplemental notes in the last section of Part I summarize Taiwan's agricultural history prior to the period of intensive analysis, and provide an interpretation of agricultural development in relation to changing general economic and political conditions.

A detailed explanation of sources of data, procedures of statistical data compilation, and methods of analysis is given in Part II. Annual time-series data and supplementary statistics are presented as Appendix Tables.

1. Definitions and Coverage

Agricultural output is the main indicator used in this study as a basis for estimating agricultural productivity. It consists of *domestic agricultural production* exclusive of the part used on farms as *intermediate goods* for further production, such as feeds and seeds. Agricultural output includes crops and livestock products but not forestry and fishery products.

The output index includes all the 109 farm products produced in Taiwan. Green manure and farm by-products (straw, sweet potato vines, sugarcane leaves, and animal manure) are excluded both from output and from intermediate goods. Imported and domestically processed products used for feed are treated as *nonfarm current inputs*, and therefore they, likewise, are not included in intermediate goods.

In calculating the output index, the individual farm products are aggregated at 1935-37 average prices.[1] The same base period is used

for the constant-price indexes of nonfarm current input, fixed capital, and cultivated land.

Productivities are estimated on the basis both of total output and of *gross value added*—the total output minus nonfarm current input. To calculate gross value added at constant prices, the total output at constant prices in each year is multiplied by the year's gross-value-added ratio, i.e. the ratio of gross value added to total output both measured at current prices.

To minimize the effects of weather and other irregular factors, five-year moving averages of the output and input indexes are used to compute the growth rates of output and productivity. Hence in the analysis that follows, reference is made to the whole period of the study as 1913 to 1970 (representing the averages of the years 1911-15 and 1968-72, respectively). Similarly, in explaining the growth rates of output, input and productivity throughout the report, references by year generally indicate averages of five-year periods centering on the year specified.

2. Phases of Agricultural Growth

For analytical purposes the period under study has been divided into six sub-periods that correspond to six reasonably distinct phases of agricultural development in Taiwan. The first phase was from 1913 to 1923, the initial period of agricultural development under Japanese colonial rule. The second phase, 1923 to 1937, was a period of success in agricultural transformation. The third phase, 1937 to 1946, was characterized by a downward trend of agricultural output as a result of war and typhoon damage. The fourth phase, 1946 to 1951, was a period of rapid recovery and rehabilitation of Taiwan agriculture immediately after World War II. The fifth phase, 1951 to 1960, was a time of further development. Finally, the sixth phase, 1960 to 1970, has brought down to the present a period of sustained agricultural growth characterizing the turning-point in the general economic development of Taiwan.

The selection of the years 1937, 1946, and 1951 as division points calls for further explanation. Agricultural output reached its prewar

peak in 1937. For the next several years output decreased year by year, reaching its lowest level in 1946. Then began the rapid recovery of agriculture from war damage. This was so successful that by 1951 output had surpassed the prewar peak.

3. Trends in Agricultural Output

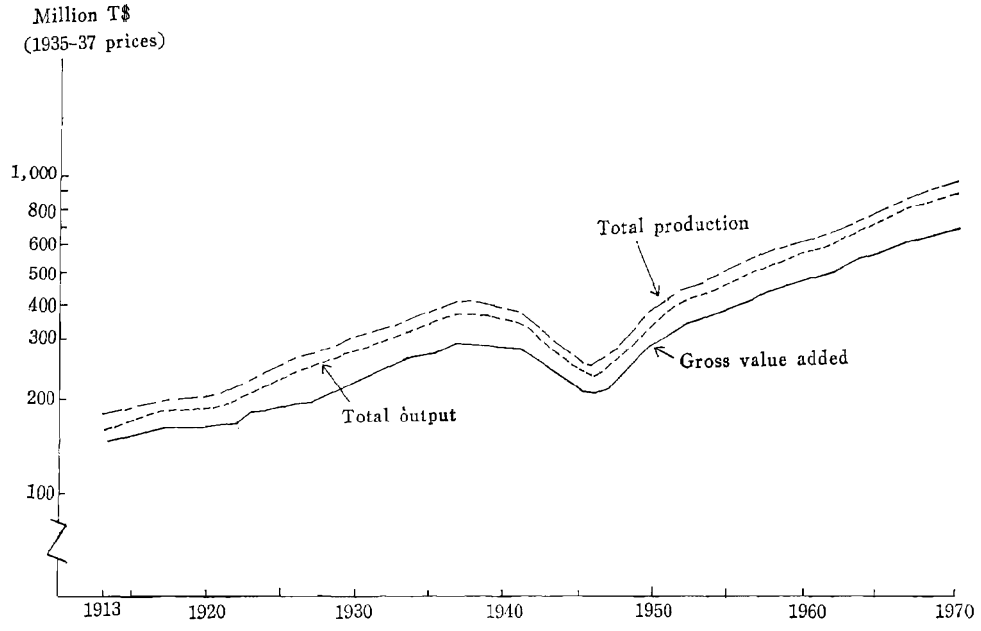
Except for the short-run decrease in output during World War II, the agriculture of Taiwan experienced a long upward trend of production throughout the 57 years from 1913 to 1970. The average annual growth rate of agricultural output for this entire period was 3.0 percent. A higher growth rate was observed in the postwar than in

Table 1. Growth rates of total production, total output and gross value added in agriculture (%)*

Phase of Development	Period	Total production	Total output	Gross value added
Initial phase of agricultural development under Japanese colonial rule	1913-23	2.7	2.8	1.9
Agricultural transformation under Japanese colonial rule	1923-37	4.0	4.1	3.8
Agricultural development under the impact of World War II	1937-46	-4.9	-4.9	-3.9
Recovery and rehabilitation phase of development of agriculture after World War II	1946-51	10.3	10.2	9.2
Further development of agriculture after the rehabilitation	1951-60	4.6	4.7	4.1
Sustained development of Taiwan agriculture at the economic turning point	1960-70	4.1	4.2	3.3
Average of pre-war period	1913-37	3.5	3.6	3.0
Average of post-war period	1946-70	5.5	5.6	4.8
	1951-70	4.3	4.4	3.7
Average of whole period	1913-70	3.0	3.0	2.6

* *Growth rates*, here and in subsequent tables, are annual compound rates of increase between five-year averages of the data centered at the years shown.

Figure 1. Trends in total production, total output, and gross value added in agriculture (1935-37 constant prices), five-year moving averages, semi-log scale.



the prewar period. Prior to World War II output expanded at an increasing rate, but after the war there has been a diminishing rate of growth. This can be seen in Figure 1, which shows the trends of agricultural production, output, and gross value added throughout the period. The average annual growth rates in the successive phases are presented in Table 1. The development situation and the factors associated with the growth in output will be reviewed briefly, phase by phase.

(1) Initial agricultural development:

From 1913 to 1923 the average annual growth rate of agricultural output was only 2.8 percent. The growth rate of total production was quite close to that of total output, but that for gross value added was smaller, only 1.9 percent per annum.

Expansion of the cultivated land area was the main factor contributing to the increase in agricultural output during this period. The cultivated land area increased from 687,000 hectares in 1911 to 775,000 hectares in 1925, an increase of 6,300 hectares per year.

Yields of rice and sugarcane, the two major crops, did not increase significantly in this decade. The yield of rice ranged from 1,300 to 1,500 kg per hectare, that of sugarcane seldom exceeded 30,000 kg per hectare.

(2) Agricultural transformation under Japanese colonial rule:

From 1923 to 1937, agricultural output increased by about three fourths, an annual growth rate of 4.1 percent. This rapid increase was the combined result of a rise in crop yields, an expansion in cultivated land area and an increase in multiple cropping.

The Japonica type of rice, *ponlai*, was successfully introduced during this period and was extended to farmers very quickly. In the 1930's, several important new varieties of special crops, fruits, and vegetables also were introduced. The yield of rice thus grew to over 2,200 kg per hectare, and that of sugarcane was more than doubled as compared with the previous phase. Use of chemical fertilizer also was important in the increase of crop yields.

The average increment of farm land area was 5,900 hectares per year from 1921 to 1939. Irrigation is essential in Taiwan because of the predominance of rice culture and the uneven distribution of rainfall throughout the year. The average annual capital investment in irrigation in 1911-20 was less than one million Taiwan dollars (1935-37 value), but it jumped sharply to 6.6 million Taiwan dollars in 1921-35.[2] As a result, the area of irrigated land increased from 311,000 hectares in 1921 to 532,000 hectares in 1938, and the irrigated portion of the cultivated land area increased from 41 percent to 62 percent during the period.

The increase in irrigated area made more multiple cropping possible. In 1932, the multiple cropping index for the first time rose above 130.

(3) War years:

From 1937 to 1946 agricultural production decreased rapidly due to typhoon and war damage. A 30 percent drop in per hectare yields together with a slight decrease in both crop area and cultivated land area brought down agricultural output by 36 percent, a decrease of 4.9 percent per year.

(4) Rehabilitation and recovery:

Taiwan's economy was in disorder at the end of the war. Inflation threatened the people's living, and food shortages were aggravated by the large influx of migrants from the Chinese mainland. The price of food was 40 percent higher than the general price level.

However, this situation did not last long. With the favorable price of farm products, and with continued supply of production inputs, particularly chemical fertilizer from the United Nation's Relief and Rehabilitation Administration, agricultural production steadily revived. By 1951 output surpassed the prewar peak. The growth rate of output in this period averaged 10.2 percent per year, the highest in the six phases.

Increase in crop area, rather than in crop yields, was the main factor contributing to the rapid increase in agricultural output. For instance, the multiple cropping index in 1945 was only 112, the lowest in the past 60 years. It increased to 170 in 1951. Yields of major crops were still less than the prewar records.

(5) Continuing development after rehabilitation:

Despite the inherently unfavorable basic conditions of insufficient land resources and small-scale farming, Taiwan agriculture advanced impressively in the period from 1951 to 1960. Annual growth of output averaged 4.7 percent, higher than at any time before the war.

The advancement of agricultural technology was remarkable in this period. New and improved methods and techniques were continuously being developed and put into general practice. New chemicals, fertilizers, and other production inputs became increasingly available, and small farmers made effective use of them. As a result of the technical advances in this period, considerable gains were made in boosting crop yields, and a better crop rotation system further increased the index of multiple cropping. Annual growth rates of crop yield and multiple cropping index for the period were 3.1 percent and 0.9 percent, respectively, just next to the recovery period.

(6) Sustained development of agriculture at the economic turning point:

The average growth rate of agricultural output from 1960 to 1970 was 4.2 percent, slightly lower than in the preceding phase. Output increased most rapidly in the first half of the decade, owing to the expansion in production of newly developed products, such as mushrooms and asparagus, and the strong demand for agricultural products in the international market.

However, in the second half of the decade, the economic structure of Taiwan reached a turning point. The vast outflow of rural people to urban areas led to a labor shortage in the agricultural sector. Agricultural wages went up sharply.

At the same time, unfavorable prices, especially of winter crops, also led to a decrease in crop area; consequently, there was a slight drop in multiple cropping index. Livestock production expanded rapidly, but the growth of total agricultural output slowed down.

4. Growth in Agricultural Production by Commodity Groups

Among the several groups of farm products we find considerable differences in rates of increase in production. The trends are compared in Figure 2, and the average annual rates of increase over the whole period and by sub-periods are shown in Table 2.

For the period as a whole, the average annual increase rate of agricultural production was 3.0 percent. However, livestock production increased at a higher rate, 3.9 percent, and crop production at a lower rate, 2.8 percent. In the prewar years livestock production lagged a little behind crop production, increasing by 3.4 percent per year versus 3.5 percent for crops. But in the postwar years this relationship was reversed: livestock production increased at the high annual rate of 9.1 percent for 1946-70 or 7.7 percent for 1951-70, compared with the more moderate rate of 4.9 percent or 3.6 percent for crop production.

Among the crop categories, fruit production increased the most rapidly—6.0 percent per year over the whole period. Vegetable production was next highest, averaging 5.1 percent per year. Both rates are much higher than the all-crop average of 2.8 percent. For the group of other common crops the rate was about average, 2.9

percent. For the special crops and for rice the rates of increase in production were below the average—2.5 and 2.3 percent per year, respectively.

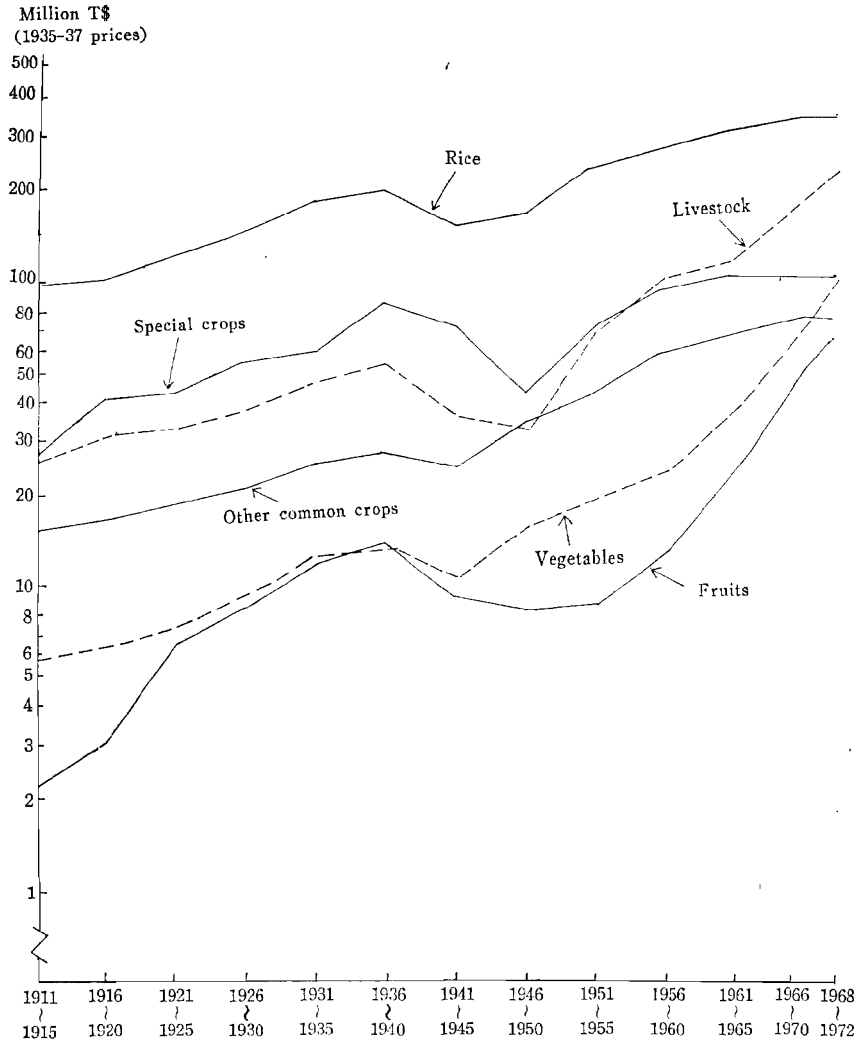
As a result of the unequal rates of increase in production of the different farm products, their relative importance changed considerably in the course of the period (Figure 3 and Appendix Tables 7 and 8). Besides, the change of economic structure of Taiwan has also greatly influenced the patterns of agricultural production.

Table 2. Growth rates of agricultural production by major commodity groups (%)

Period	Total production	Crops						Livestock
		All crops	Rice	Other common crops	Special crops	Fruits	Vegetables	
1913—23	2.7	2.7	1.9	1.9	4.9	11.4	2.7	2.6
1923—37	4.0	4.1	3.8	3.0	4.9	5.7	4.2	4.0
1937—46	− 4.9	− 4.4	− 3.9	0.1	− 8.4	− 7.8	− 0.7	− 7.8
1946—51	10.3	9.7	9.5	8.0	12.9	5.6	8.2	14.5
1951—60	4.6	4.0	3.3	5.6	4.6	6.9	3.9	8.1
1960—70	4.1	3.3	2.1	1.3	0.4	14.1	14.0	7.3
Average of prewar period:								
1913—37	3.5	3.5	3.0	2.5	4.9	8.0	3.6	3.4
Average of postwar period:								
1946—70	5.5	4.9	4.0	4.3	4.5	9.6	8.9	9.1
1951—70	4.3	3.6	2.7	3.3	2.4	10.6	9.1	7.7
Average of whole period:								
1913—70	3.0	2.8	2.3	2.9	2.5	6.0	5.1	3.9

As an indication of the strong predominance of rice culture in Taiwan's agriculture, the value of rice production, at current prices, constituted one half of the total value of agricultural production in 1911-15. But its relative share has gradually decreased, and it was less than one third of the total production value in 1968-72. Taiwan's sugar lost its foreign market in Japan after World War II, and the relative

Figure 2. Trends in agricultural production by commodity groups (1935–37 constant prices), five-year averages, semi-log scale



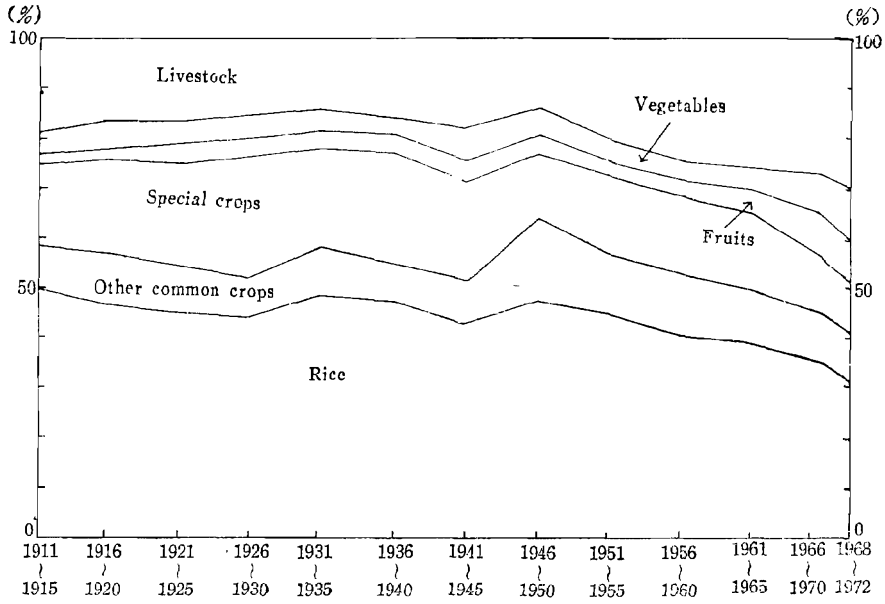
share of the special crops, which include sugarcane, dropped sharply from 24 percent in 1926-30 to about 10 percent in 1968-72. (Figure 3b and Appendix Table 7).

In contrast, the relative share of livestock production has increased greatly during the last two decades. By 1968-72 the importance of livestock production in total agricultural production was almost as large as that of rice production. (In fact, on a single-year basis the value of livestock production exceeded that of rice in 1971 and 1972.)

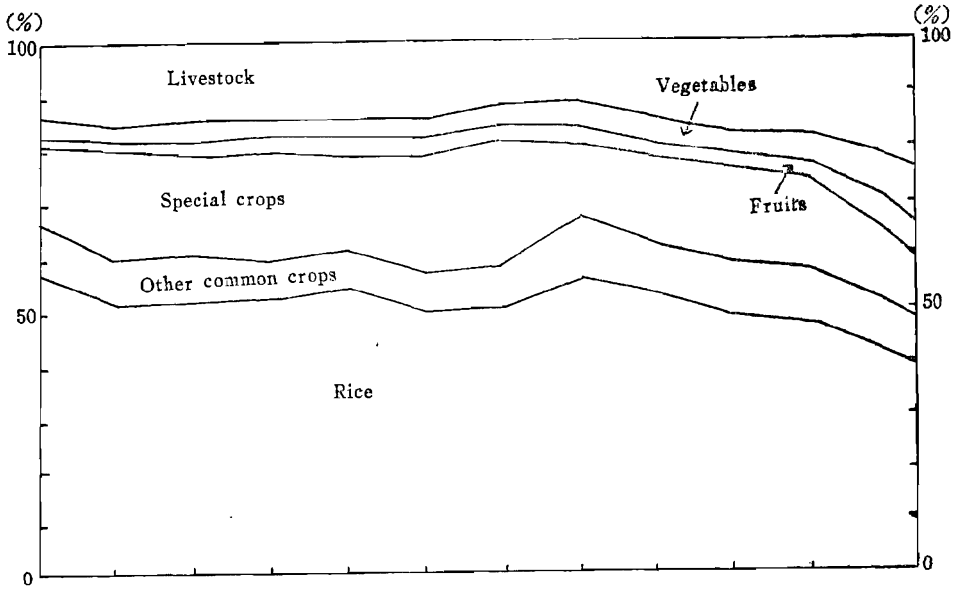
The strong demand for asparagus, mushrooms, and bananas and other fruits in both foreign and domestic markets stimulated rapid

Figure 3. Percentage composition of agricultural production by commodity groups

a. Real composition (at 1935-37 constant prices)



b. Nominal composition (at current prices)



growth of fruit and vegetable production in the latter half of the 1960's.

The rapid increase of livestock, fruit, and vegetable production in recent years, in conjunction with the increase in per capita income, has made possible a general improvement in people's dietary patterns, including higher protein consumption.

The relative importance of individual products in the total value of agricultural production obviously depends upon relative prices as well as upon quantity of production. If we value the products at their 1935–37 average prices (Figure 3a and Appendix Table 8), we find that the importance of rice comes out higher throughout the entire period than when current prices are used. This implies that the price of rice was relatively high in 1935–37.

The relative importance of fruits and of livestock products, on the other hand, is smaller when they are valued at 1935–37 prices throughout the period than when calculated at current prices, indicating that their prices were relatively low in 1935–37.

For the other commodity groups the differences are not uniform, although their relative importance in production tends most often to appear less in terms of 1935–37 prices than at current prices.

5. Trends in Factor Inputs

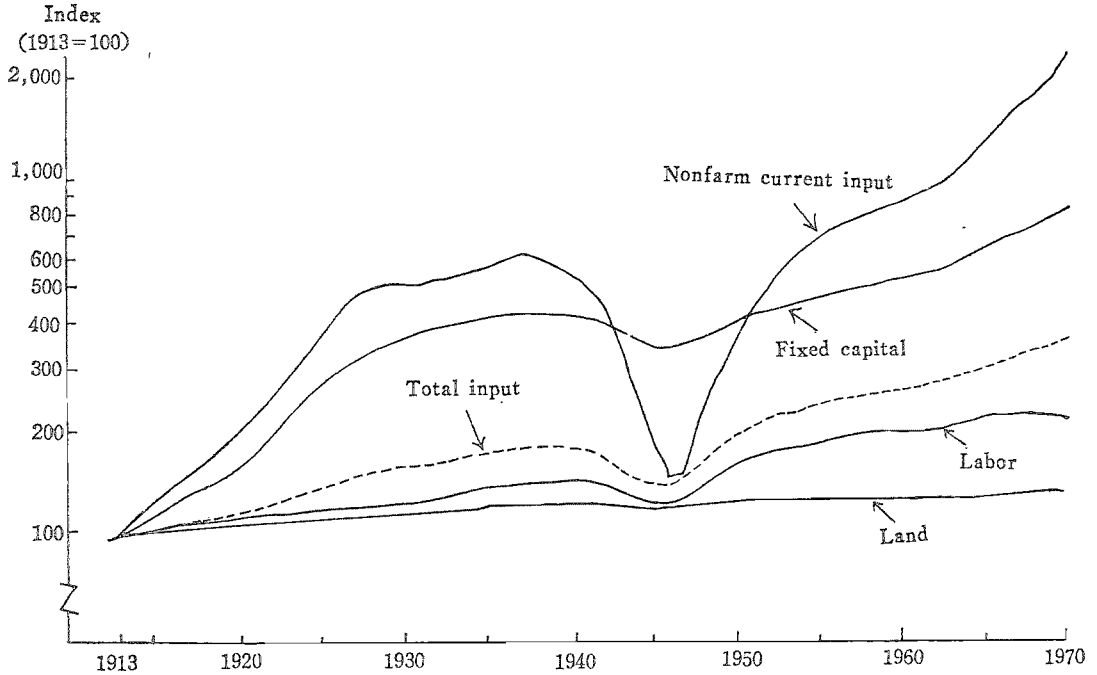
The expansion of agricultural output in Taiwan has been brought about in two ways: (1) by increase of factor inputs used in production, and (2) by improvement and advancement of agricultural technology. The factor inputs are discussed in this study in four categories: non-farm current input, land, labor, and fixed capital.[8] The high growth rate of agricultural output has been achieved with relatively small increases in cultivated land area and number of agricultural workers and relatively large increases in current inputs and fixed capital. The rates at which various inputs in agricultural production have increased in selected periods are shown in Table 3.

Of the four categories of factor inputs, current input had the most remarkable growth, averaging 5.7 percent per year over the entire period. This input category, in which fertilizer and feed are the largest components, has been the most important strategic factor in the expansion of agricultural output. The annual input of chemical fertilizers used in agricultural production averaged less than 6,000 metric tons in 1911–15, increased sharply to a prewar maximum of more than 456,000 metric tons in 1936–40, dropped drastically to less than 100,000 metric tons in 1945–49, but thereafter again increased rapidly,

Table 3. Growth rates of inputs used in agricultural production (%)

Period	Total input	Labor		Cultivated land	Fixed capital	Current inputs		
		Working day	Worker			Fertilizer	Feed	Total
1913—23	2.7	1.5	− 0.3	0.9	7.8	11.5	7.3	10.5
1923—37	2.4	1.3	1.3	0.8	5.0	8.2	5.2	5.8
1937—46	− 2.4	− 1.5	− 1.2	− 0.3	− 2.3	−16.9	−13.2	−14.6
1946—51	7.8	6.6	3.4	1.0	4.3	32.0	14.8	23.6
1951—60	2.7	1.7	0.3	0.0	2.4	8.0	8.9	8.5
1960—70	3.2	0.9	0.3	0.4	4.8	3.5	19.5	10.4
1913—37	2.6	1.4	0.7	0.9	6.2	9.9	6.0	7.7
1946—70	3.9	2.4	0.9	0.4	3.8	10.6	14.4	12.3
1951—70	2.9	1.3	0.3	0.2	3.7	5.6	14.3	9.5
1913—70	2.3	1.3	0.5	0.5	3.8	5.3	6.1	5.7

Figure 4. Trends in the indices of agricultural inputs (1913=100), five-year moving averages, semi-log scale.



reaching about one million metric tons in 1968-72. Fertilizer input increased at a faster rate in the prewar years than in the postwar years of 1951-70, while annual input of feed increased at a much faster rate in the postwar years than in the prewar years. A marked increase in feed input has occurred especially in the last decade in support of the rapid growth of livestock production.

The two major factor inputs, land and labor, measured in terms of cultivated land area and number of agricultural workers, both increased at about 0.5 percent per year on the average. (If labor input is measured in man-days of work, however, its growth rate averages 1.3 percent per year.)

The cultivated land area increased only 30 percent over the whole period, from about 692,000 hectares in 1911-15 to 904,000 hectares in 1968-72—an average annual increase of less than 4,000 hectares. But it comparatively expanded faster before the war.

The number of agricultural workers in Taiwan increased more or less continuously throughout much of the period under study. In the last few years, however, it decreased, due mainly to the large absorption of labor force by the nonagricultural sector. The total number of working days spent in farm operation also decreased slightly after 1966 because of the labor shortage in rural areas and a decline in crop area due to unfavorable prices of winter crops. As shown in Appendix Table 11, the total planted area of winter crops decreased from 325,000 hectares in 1964 to 266,000 hectares in 1972.

The growth rate of fixed capital input was relatively high over the whole period. It was particularly high before the war, reflecting the effort to overcome the inadequacy of farm buildings and equipment in the earlier years, and the incomplete statistics for these years. In the 1960's rapid mechanization was an important component in the high growth rate of fixed capital input.

6. Increase in Total Productivity

Dividing the aggregate output index by the aggregate input index gives an index of total productivity. In this study, five-year moving averages of the output and input indexes have been used for this

calculation. Two indexes of total productivity have been calculated, one on the basis of total output, the other on the basis of gross value added in agricultural production. In the latter the index of gross value added is divided by an input index that includes only the three categories: land, labor, and fixed capital. This means that, in calculating productivity on this basis, nonfarm current input is excluded from both the numerator and the denominator of the fraction.[4] The trends in total output, gross value added, and the corresponding measures of total input and total productivity are compared in Figure 5.

We turn first to the estimation of productivity on the total output basis. Over the study period as a whole the average rate of increase in agricultural output was 3.0 percent per year, that of input was 2.3 percent. Thus the average annual rate of increase in total productivity was 0.7 percent. About three fourths of the growth in output is therefore attributable to increase in input, only one fourth to increase in productivity. However, the contribution of increase in productivity

Table 4a. Growth rates of total output, total input and productivity in agriculture, and relative contributions of growth of input and productivity to growth of output (%)

Period	Annual compound rate of growth			Relative contribution by	
	Total output (1)	Total input* (2)	Total productivity (3)	Input (2/1)	Productivity (3/1)
1913—23	2.8	2.7	0.1	96	4
1923—37	4.1	2.4	1.7	59	41
1937—46	−4.9	−2.4	−2.5	49	51
1946—51	10.2	7.8	2.4	76	24
1951—60	4.7	2.7	2.0	57	43
1960—70	4.2	3.2	1.0	76	24
1913—37	3.6	2.6	1.0	72	28
1946—70	5.6	3.9	1.7	70	30
1951—70	4.4	2.9	1.5	66	34
1913—70	3.0	2.3	0.7	77	23

* Total input includes current input.

Table 4b. Growth rates of gross value added, total input and productivity in agriculture, and relative contributions of growth of input and productivity to growth of gross value added (%)

Period	Annual compound rate of growth			Relative contribution by	
	Gross value added (1)	Total input* (2)	Total productivity (3)	Input (2/1)	Productivity (3/1)
1913—23	1.9	1.7	0.2	89	11
1923—37	3.8	1.6	2.2	42	58
1937—46	−3.9	−1.2	−2.7	31	69
1946—51	9.2	3.9	5.5	40	60
1951—60	4.1	1.2	2.9	29	71
1960—70	3.3	1.0	2.3	30	70
1913—37	3.0	1.6	1.4	53	47
1946—70	4.8	1.6	3.2	33	67
1951—70	3.7	1.1	2.6	30	70
1913—70	2.6	1.1	1.5	42	58

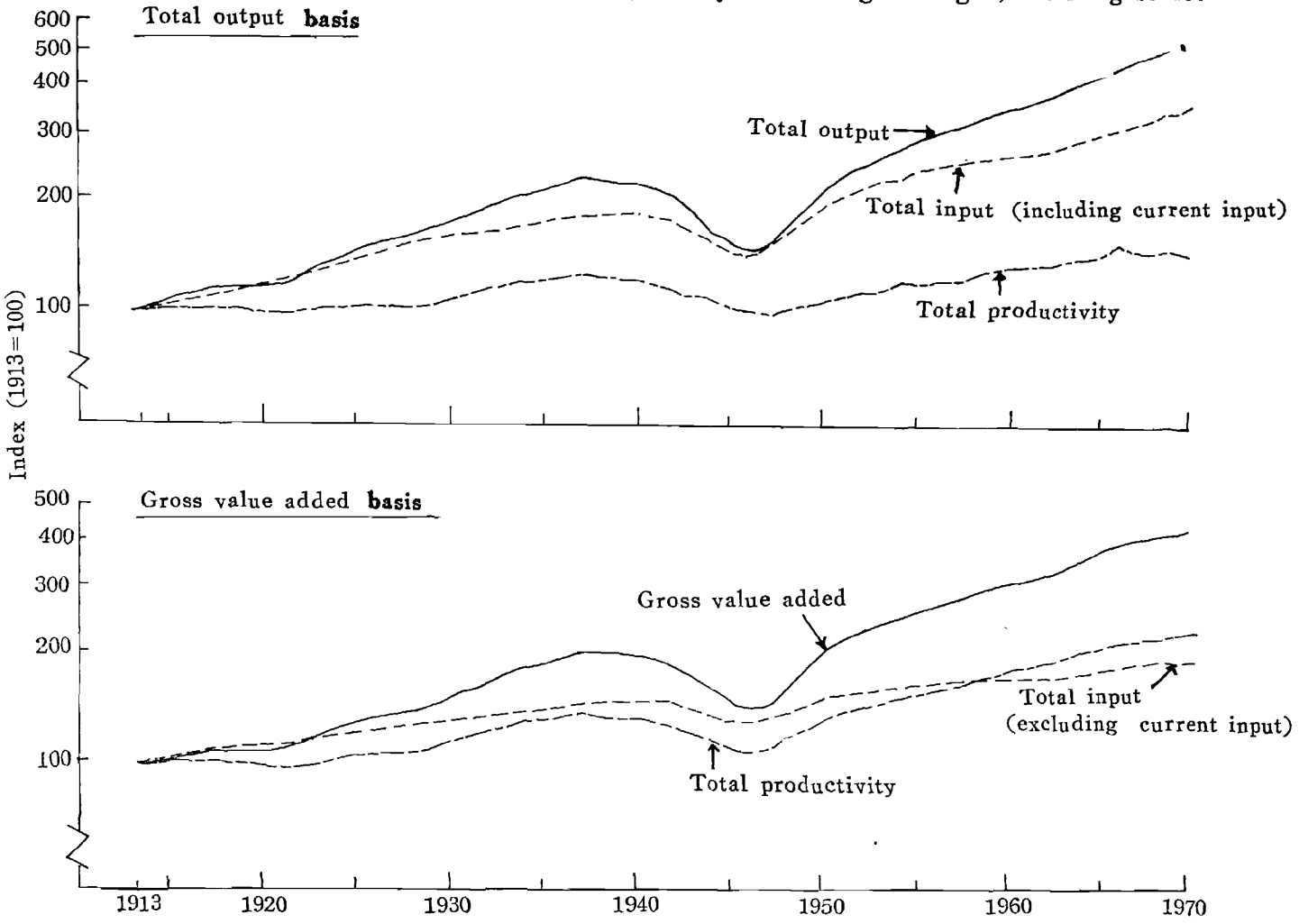
* Total input excludes current input.

to the growth in output was one third in the postwar period of 1951-70 (Table 4a).

In the prewar period, productivity increased most rapidly—and made the greatest relative contribution to growth in output—during the agricultural transformation phase, 1923-37. This was achieved mainly through the introduction and dissemination of new varieties of crops, especially the high-yielding Japonica type of rice.

In the period after the war, the greatest contribution of increase in productivity to growth in output occurred during the 1950's, the combined result of application of advanced farming techniques and of increased multiple cropping. In the 1960's much of the increase in total output came from expansion of livestock production, and this required a marked increase in feed input. As the output-input ratio in livestock raising is generally low, increase in productivity has played a relatively less important role in output growth during the most recent decade.

Figure 5. Trends in the indices of agricultural total output, gross value added, total input and total productivity (1913=100), five-year moving averages, semi-log scale.



Calculated on the basis of gross value added instead of total output, the rate of increase in productivity comes out somewhat higher, averaging 1.5 percent per year over the entire period. Gross value added increased at 2.6 percent per year, aggregate input excluding nonfarm current input at 1.1 percent. The growth of current input was the most significant among the four categories of inputs, and the exclusion of current input made the growth of total input much slower, and that of productivity faster. Thus, contrary to the relationship found on the total output basis of calculation, increase in productivity accounts for the major share—nearly 60 percent—of the growth in value added, and increase in input for only a little over 40 percent (Table 4b).

Also, the growth of current input in the postwar years was especially high mainly due to the large feed input. The rate of growth of total input excluding current input for the postwar period of 1946-70 was the same as for the prewar period. While the contribution of increase in input including current input to the growth of total output for the prewar period was not so much different from that for the postwar period, the relative contribution of increase in input on the gross value added basis was greater in the prewar period than in the postwar period.

7. Trends in Partial Productivity

In this section, we deal with agricultural productivity in terms of labor and land.

(1) Land productivity:

In a country where land is a limiting factor in agricultural production, the increase of land productivity is the chief means by which total agricultural output can be increased. In Taiwan's agricultural development, this has been achieved through improvement of irrigation facilities, development of new crop varieties, and the adoption of technological innovations. These advances have made it possible to increase yields per hectare of crop area with the aid of more use of nonfarm inputs such as fertilizers and other chemicals. They have also facilitated more intensive use of the available arable land through multiple cropping. Growing three or four crops a year on the same piece of land is very common in Taiwan.

Table 5 compares three measures of land productivity: total output per hectare of cultivated land area, crop output per hectare of cultivated land area, and yield of rice per hectare of planted area. The rate of growth in total output per hectare of cultivated land is the highest, but that of crop output per hectare of cultivated land is slightly less reflecting the fact that production of livestock on the average has expanded faster than that of crops.

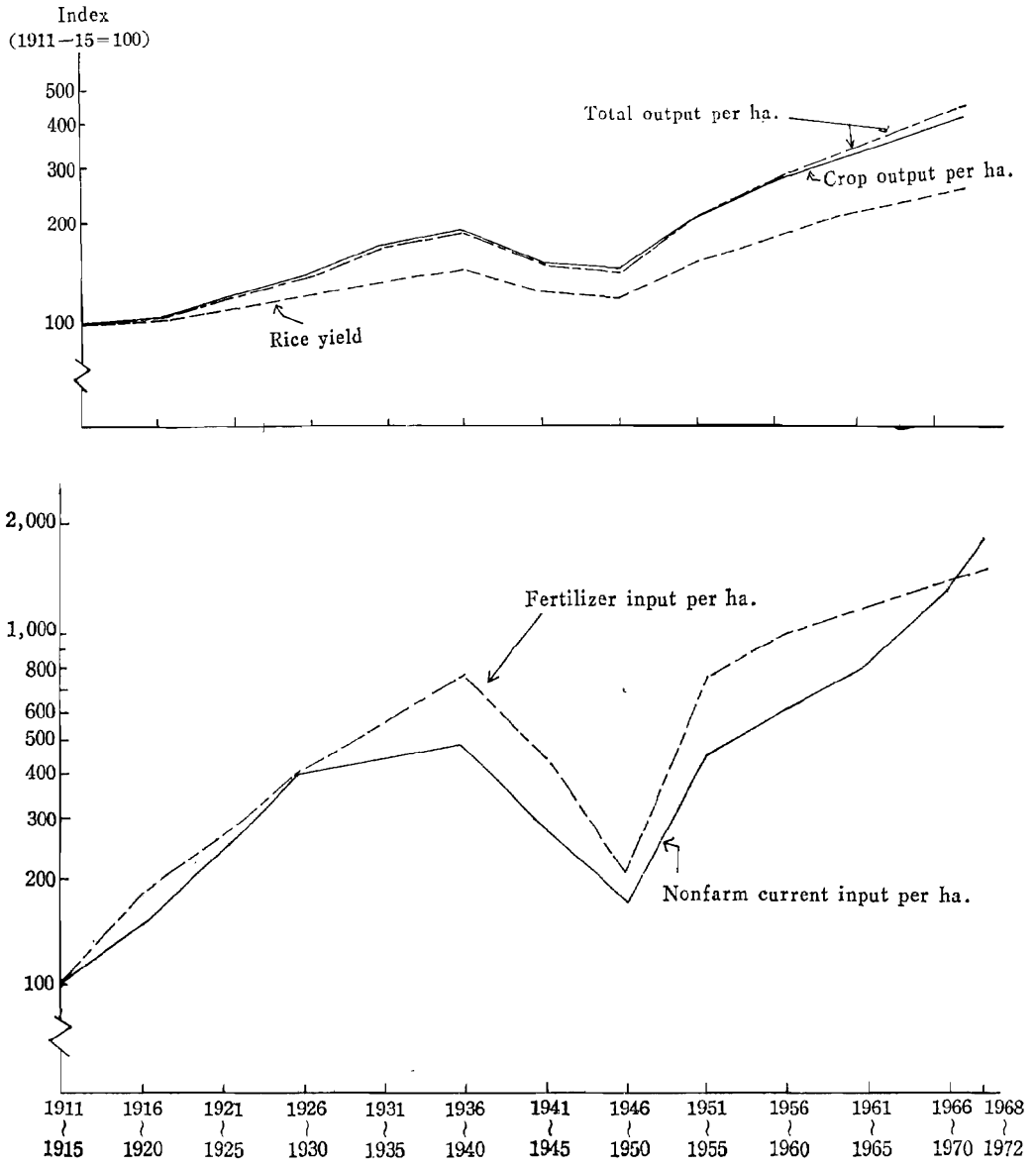
The growth of land productivity was slower but with an increasing rate in the prewar period, and faster in the postwar period with a diminishing rate.

Table 5. Growth rates of land productivity and nonfarm current inputs per hectare of arable land (%)

Period	Land productivity			Current inputs per ha. of arable land	
	Total output per ha. of arable land	Crop output per ha. of arable land	Rice yield per ha. planted	Total	Fertilizer
1913—23	1.9	2.0	1.3	9.5	10.5
1923—37	3.2	3.3	2.1	4.9	7.3
1937—46	− 4.7	− 4.2	− 3.4	−14.4	−16.7
1946—51	9.2	8.6	4.9	22.4	30.7
1951—60	4.6	4.0	3.2	8.5	8.0
1960—70	3.9	3.0	2.2	10.1	3.1
1913—37	2.7	2.7	1.7	6.8	8.7
1946—70	5.2	4.5	3.1	11.9	10.3
1951—70	4.2	3.5	2.7	9.3	5.4
1913—70	2.5	2.3	1.5	5.2	4.8

The increase in total crop output (Table 6) has been achieved primarily by increasing crop production per hectare of cultivated land area, and only secondarily by expansion of the area under cultivation. Over the whole period under review, the former accounted for more than 80 percent of the increase in crop production, the latter for less than 20 percent. The disparity has been even greater since the war: in the prewar period the relative proportions were 75 versus 25 percent, in

Figure 6. Trends in the indices of land productivity and nonfarm current input per hectare of arable land (1911−15=100), semi-log scale, five-year averages



the postwar period of 1946-70, 92 versus 8 percent, or in the years of 1951-70, 95 versus 5 percent.

The increase in crop output per hectare of cultivated land again is the combined effect of increase in yield per hectare of crop area and the growing of more crops per year on the land under cultivation—i.e. multiple cropping. There has been a sustained growth in crop yields,

Table 6. Growth rates of crop output and land productivity (%)

Period	Crop output	Crop output per unit of cultivated area	Cultivated land	Crop output per unit of crop area	Crop area	Multiple cropping index
1913—23	2.9	2.0	0.9	1.8	1.1	0.2
1923—37	4.1	3.3	0.8	2.7	1.4	0.6
1937—46	− 4.5	− 4.2	− 0.3	− 4.3	− 0.3	− 0.0
1946—51	9.6	8.6	1.0	3.5	6.0	5.0
1951—60	4.0	4.0	0.0	3.1	0.9	0.9
1960—70	3.4	3.0	0.4	3.1	0.3	− 0.1
1913—37	3.6	2.7	0.9	2.3	1.3	0.4
1946—70	4.9	4.5	0.4	3.2	1.7	1.3
1951—70	3.7	3.5	0.2	3.1	0.5	0.4
1913—70	2.8	2.3	0.5	1.6	1.2	0.7

averaging over 3 percent per year since the war. In the immediate postwar years there was also a rapid increase in multiple cropping, but this slowed down in the 1950's, and in the 1960's the multiple cropping index decreased.

In the most recent years, cultivated land area has begun to decrease, and crop area has been going down rather sharply. This is due partly to an increase in the area of perennial plants like fruit trees, but mostly to less multiple cropping of annual crops—especially the drastic decrease in plantings of winter crops. Decrease in total planted area has also been found in non-winter crops. This is largely because of the decrease in cultivated land area; thus it has not greatly affected the drop in multiple cropping index.

Neither further expansion of total cultivated area nor further increase in crop area appear promising as future sources of increase in agricultural output in Taiwan.

Throughout the study period, the 2.5 percent average annual growth in land productivity, in total output terms, had been achieved due mainly to technological innovation and associated increased application of

nonfarm current inputs, especially chemical fertilizers. Important types of technological innovation include improvement and standardization of crop varieties, pest and disease control, and cultural methods.

Technological innovations have made the intensive use of nonfarm current inputs possible. Thus the rapid increase in nonfarm current input has contributed greatly to the growth in land productivity in Taiwan.

(2) Labor productivity:

Productivity of labor is generally regarded as an important indicator of economic efficiency. Increase in labor productivity can raise people's incomes and levels of living. Increase in productivity of farm workers is therefore as important a facet of agricultural development as increase in land productivity.

The two types of productivity are closely related in agriculture. Suppose the total agricultural output is Y, the input of labor L, and the input of cultivated land A; then labor productivity, land productivity, and average cultivated land area per farm worker (or land-labor ratio) are $\frac{Y}{L}$, $\frac{Y}{A}$, and $\frac{A}{L}$, respectively, and the relationship between

Table 7. Growth rates of land-labor ratios and capital intensities (%)

Period	Arable land area per worker	Fixed capital per worker	
		Total	Machinery & implements
1913—23	1.2	8.1	38.6
1923—37	− 0.5	3.7	8.8
1937—46	1.0	− 1.1	− 0.3
1946—51	− 2.3	0.9	3.5
1951—60	− 0.3	2.1	5.4
1960—70	0.0	4.5	9.9
1913—37	0.2	5.5	20.3
1946—70	− 0.6	2.8	6.0
1951—70	− 0.1	3.4	7.8
1913—70	− 0.0	3.3	10.7

labor productivity and land productivity can be expressed by the following formula:

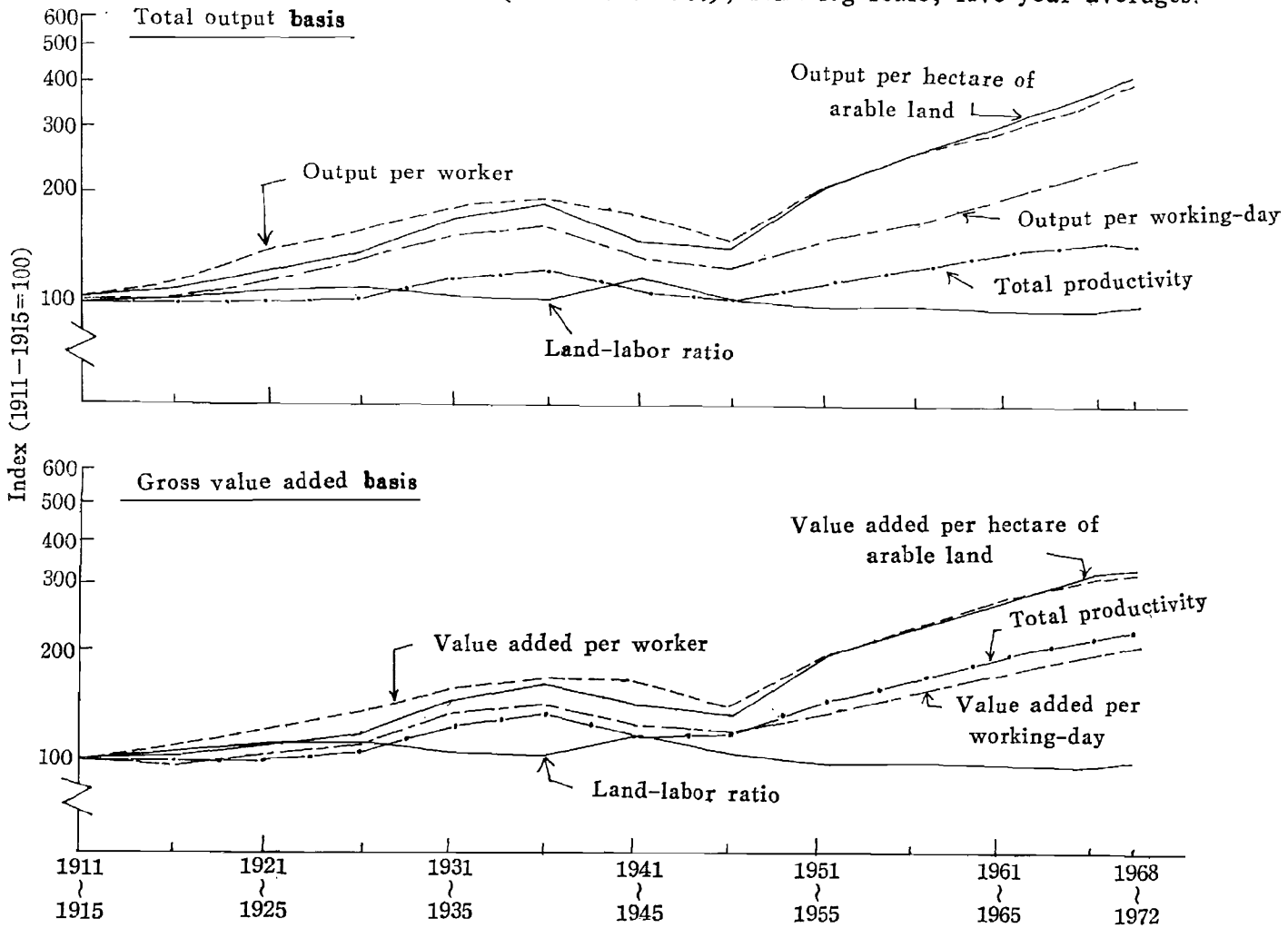
$$\frac{Y}{L}=\frac{Y}{A}\cdot\frac{A}{L}$$

In Taiwan the cultivated land area per farm worker, or land-labor ratio, $\frac{A}{L}$, showed a slight decrease during the period under study (Table 7). Thus over the period as a whole, the increase of labor productivity, $\frac{Y}{L}$, had depended entirely upon increasing land productivity, $\frac{Y}{A}$. Only during the first decade of the study period, 1913-23, was there an improvement in the land-labor ratio that contributed to increasing labor productivity. (The ratio increased also during the war, when the number of agricultural workers fell sharply, but in this period productivity also fell sharply.)

Table 8a. Growth rates of labor and land productivity and relative contributions of land productivity growth to labor productivity growth (%)
(on total output basis)

Period	Annual compound rate of growth in output per			Relative contribution to labor productivity growth by land produdtivity growth	
	Worker (1)	Man-day (2)	Ha. of arable land (3)	(3)/(1)	(3)/(2)
1913—23	3.1	1.3	1.9	61	146
1923—37	2.7	2.7	3.2	119	119
1937—46	−3.6	−3.5	−4.7	131	134
1946—51	6.3	3.5	9.2	146	263
1951—60	4.4	2.9	4.6	105	159
1960—70	3.9	3.3	3.9	100	118
1913—37	2.9	2.1	2.7	93	129
1946—70	4.6	3.2	5.2	113	163
1951—70	4.1	3.1	4.2	102	135
1913—70	2.5	1.7	2.5	100	147

Figure 7. Trends in the indices of total productivity, land and labor productivities, and land-labor ratio (1911–1915=100), semi-log scale, five-year averages.



These statements are true whether productivity is measured on the basis of total output or of gross value added. In either case, the growth in labor productivity was smaller in the prewar than in the postwar period. Since the rates of increase in gross value added are uniformly lower than in total output, our estimates of growth both of land and of labor productivity are smaller on the gross value added basis than when measured in terms of total output (Tables 8a and 8b).

The rise in productivity per farm worker in Taiwan has been due partly to the great increase in days worked per year. The annual working time per farm worker rose from 120 man-days in 1911-15 to almost 200 man-days in 1968-72, an increase of more than 60 percent. The rate of increase in labor productivity is correspondingly lower when measured in terms of man-days instead of number of farm workers.

Farm operation in Taiwan is generally characterized by intensive use of labor. In addition to the increase of multiple cropping, the

Table 8b. Growth rates of labor and land productivity and relative contributions of land productivity growth to labor productivity growth (%)
(on gross value added basis)

Period	Annual compound rate of growth in gross value added per			Relative contribution to labor productivity growth by land productivity growth	
	Worker (1)	Man-day (2)	Ha. of arable land (3)	(3/1)	(3/2)
1913—23	2.1	0.4	0.9	43	225
1923—37	2.5	2.5	3.0	120	120
1937—46	−2.5	−2.4	−3.6	144	150
1946—51	5.3	2.4	8.1	153	338
1951—60	3.8	2.4	4.1	108	171
1960—70	3.0	2.4	3.0	100	125
1913—37	2.3	1.6	2.1	91	131
1946—70	3.8	2.4	4.4	116	183
1951—70	3.4	2.4	3.5	103	146
1913—70	2.1	1.3	2.2	105	169

production of labor-intensive crops such as asparagus and mushrooms has expanded rapidly. Labor input per hectare of cultivated land increased from 201 man-days in 1911-15 to 326 man-days in 1968-72, a total increase of 62 percent, whereas labor input per hectare of crop area increased only from 166 man-days to 181 man-days—less than 10 percent. The increase in farm mechanization in the last decade has involved some substitution of machinery for human labor, but the number of working days per hectare of crop area has still shown some increase during this period (Appendix Table 10).

8. Conclusion

In spite of scarce land resources and small-scale farming, agriculture in Taiwan has performed successfully over the past 60 years. Even allowing for the sharp setback during World War II, the average annual compound rate of increase in agricultural output was 3.0 percent from 1913 to 1970 (based on five-year averages centering on those years). The average rate of increase in the prewar period of 1913-37 was 3.6 percent per year; that in the postwar period of 1946-70, or of 1951-70, was 5.6 percent, or 4.3 percent per year. Rapid expansion of livestock production has made a major contribution to the high growth rate of total output achieved since the war.

As a result of increase in per capita real income and changes in the economic structure of Taiwan, the pattern of agricultural production has changed substantially. The importance of rice production in the national economy has gradually diminished. Its relative share in total agricultural production, valued at 1935-37 prices, dropped from 57 percent in 1911-15 to 39 percent in 1968-72. Over the same period, the relative share of fruit production increased from 1.2 to 6.4 percent, that of vegetable production from 3.3 to 10.4 percent, and that of livestock production from 14.6 to 23.7 percent. This has brought a great improvement in the dietary pattern of the population.

The growth rate of 3.0 percent per year achieved in agricultural output can be explained as the combined result of increase in factor inputs and improvement in farming techniques. During the period under review, total input, including nonfarm current input, increased at an average rate of 2.3 percent per year. Thus, the average growth rate of total productivity was only 0.7 percent per year. In other words, about 77

percent of the high growth rate in total output came from the use of additional inputs, about 23 percent from increase in total productivity.[5] The relative contribution of increase in input to growth in total output showed a downward trend prior to the war, but in recent years has again increased. On the average, the relative contribution of increase in productivity to growth in both total output and gross value added was greater in the postwar years than in the prewar years. It was especially significant at the gross value added basis.

Among the four categories of inputs, the increase in nonfarm current input has been the most remarkable: it increased more than 20-fold from 1911-15 to 1968-72. Fixed capital increased sevenfold, and labor input measured in man-days more than doubled, but cultivated land area expanded only 30 percent.

It is evident that the increasing use of nonfarm current input has played an important role in agricultural development in recent years. We believe that continuing increase in the use of current inputs will be essential for the expansion of agricultural output in the years ahead.

Cultivated land is a limiting factor of agricultural production in Taiwan. This is especially true in the postwar years. The expansion of cultivated land area in the last two decades amounted to only 35,000 hectares, a 4 percent increase, and average farm size decreased from 2.0 hectares in the second phase of agricultural development (1923-37) to only 1.0 hectare in the late 1960's. As shown in Table 6, crop output has increased 4.9 percent per annum since the war in spite of the negligible expansion of total cultivated area. Land productivity—crop output per hectare of cultivated land—increased by 4.5 percent per year, thus accounting for nearly all the increase in crop output. More intensive use of land through multiple cropping made possible an increase in crop area of 1.7 percent per year, and this has been an important factor in the increase both of land productivity and of total crop output.

In the current phase of economic development in Taiwan, agriculture for the first time has experienced a shortage of labor. The crop area has tended to decrease in the last few years as the multiple cropping index has shown a slight decline. It seems quite unlikely that labor and land input will make any great contribution to

the growth in agricultural output in the future. Furthermore, we anticipate that the growth rate of agricultural output will also slow down, and that continuing increase in agricultural output will require further increase in factor input.

9. Supplementary Notes[6]

This section deals with (1) the early history of agriculture in Taiwan, prior to the period of the preceding analyais; and (2) the general economic and administrative conditions affecting agricultural development during the study period.

Professor R. H. Myers has suggested that we start from 1901, instead of 1911, in our analysis of Taiwan's agricultural development. One reason for excluding the period 1901-10 is the lack of statistical data for a serial estimate. Output figures for the period before 1911 are both incomplete and inaccurate, and the data on various inputs are even less adequate. There simply is no basis for analyzing the agricultural situation before 1911 using systematic time series data.

Instead, we have drawn upon some fragmentary data to review the broad situation of agriculture in the period before 1911, and we have attempted to extend this period back to the seventeenth century, when agriculture was first brought to the island. It is hoped that this review may help readers form a broad picture of the earlier history of agriculture in Taiwan.

The growth of agricultural output, various inputs, and total productivity in Taiwan have been discussed from an analytical economic viewpoint in the previous sections. In this section we supplement that analysis with a discussion of the direct or indirect contributions of external economies to the growth of output and productivity, in a systematic, sequential and comprehensive way. This section may thus be helpful in providing a broader understanding of the why and how of the successful achievement of agricultural development in Taiwan.

For convenience, the period reviewed has been further divided into three parts based on the different political administrations. The first part covers the years before 1895, starting with the period of Dutch control, followed by over two centuries of Chinese rule. The second part, from

1895 to 1945 is the Japanese colonial period. The third part, from 1945 to the present, is the period since the restoration of Taiwan to the Government of The Republic of China.

1. Primitive Stagnation of Agriculture before 1895

Agriculture was first brought to Taiwan by Chinese immigrants from the mainland around 1600. Large-scale immigration began only after 1624, during the period of Dutch control of the island. Shortages of labor and of animal power limited the expansion of agricultural production, and in order to increase its revenue from taxes on land and customs duties, the Dutch East India Company encouraged Chinese immigration and also imported cattle for land reclamation and farming.

The important crops in this period included rice, sugarcane, beans, and vegetables. The average per hectare yield of rice was initially about 8.74 *koku*, which is equivalent to 1.0 metric ton of brown rice. Introduction of new farming skills from South China increased this yield, and it was maintained at around 1.3 metric tons per hectare until 1895, although the land gradually became less fertile. Without the use of fertilizers, soil fertility usually decreased after two or three years of cultivation, and farmers had to shift to new land. As land began to be scarce, organic fertilizers came to be applied to restore the lost fertility. Other more advanced farming practices were adopted. Small irrigation facilities and catchment ponds were constructed to supply water for rice cultivation in the dry season. Changing the rice variety from year to year was one method by which degeneration of the crop was prevented, although improved seeds in the modern sense did not exist.

The problems of disease and insects, typhoons and droughts, as well as the social instability during the initial period of Taiwan settlement, presumably kept agriculture in a state of primitive stagnation or of cyclical alternation between slow progress and regression throughout these two centuries.

2. Agricultural Development from 1895 to 1940

At the end of the first Sino-Japanese war in 1895, Taiwan was ceded to Japan. The Japanese imposed a colonial economy on the island

for the purpose of increasing agricultural production to supply Japan.

Population and labor force data are not available for 1895, but on the basis of average growth rates between 1905 and 1915, agricultural population and labor force in 1895 are estimated to have approximated 1.8 million and 1.0 million persons, respectively.

Cultivated land area is judged to have been underestimated in the official reports because of nonreporting (largely to avoid taxes). The revised estimate of total cultivated land area for 1895 is 550,000 hectares, with an average farm size of around 1.8 hectares. The multiple cropping index is estimated to have been 110, making the crop area 605,000 hectares, on the basis of the rate of increase in crop area recorded in later years. Irrigated land area was officially reported to have been 107,716 hectares in 1895. Although an irrigation survey was conducted in 1900, and the Public Irrigation Law was passed in 1901, no new irrigation projects were initiated before 1907, but only repairs to existing facilities. Thus the estimate of 180,000 hectares in 1900 is probably a more reliable indication of irrigated land area for 1895. This was roughly 32 percent of total cultivated land area.

Yields of major crops in 1895 have been estimated on the basis of official reports for 1900-10. The yield of rice averaged 1.3 metric tons per hectare in 1901-05, and since the rice improvement program was not started until 1905 we may presume that this yield had already been achieved in 1895.

The sugarcane program started earlier than the rice program, and new sugarcane varieties introduced from the Hawaiian Islands in 1896 yielded 20 metric tons per hectare and contained 7.5 percent of sugar. The sweet potato yield in 1895 is estimated at 5.0 metric tons per hectare, based on the trend for 1900-10.

Using these yield estimates for the three major crops and assuming constant yields for minor crops, the price-weighted index of aggregate crop yield with 1911-15 as base period is only 85 percent for 1895.

In the early years of the period, agricultural development efforts were concentrated mainly on sugarcane and rice. Experiment stations were established, initially to make simple indigenous improvements in

technology and plant varieties. In conjunction with this program, specialists were brought in to engage in more extensive research in agricultural technology. As a result, 300 Indica rice varieties, out of the 1,679 varieties grown in Taiwan, were retained, and Hawaiian sugarcane varieties such as Rose Bamboo and Lohaina were introduced. Beginning in 1902, application of chemical fertilizers was encouraged for sugarcane production, at first with a subsidy. Production of green manure and compost was introduced to the rice-growing farmers. Irrigation projects had previously consisted largely of repairing damaged canals, but now expansion of paddy land and protection from the hazard of drought became main goals.

Institutional roles changed significantly in this period. A landlord class was created, the leaders of the *Pao-chia* system. They were convinced that agricultural improvement was to their benefit under the new land-tenure system and land-tax payment. They were encouraged to direct villagers to adopt new seed varieties and better cultivation methods. The extension of new agricultural technology in Taiwan was very cheap in terms of government expenditure and crop production costs. Under the influence of the landlord class and the government, most farmers responded favorably to new technology.

The profitability of the new technology, however, was not broadly recognized by cultivators until 1922, when the new variety of Ponlai rice appeared and previous investment in agriculture began to show results. Alteration of the old cultivation methods and extension of use of the new varieties in this period was not brought about by persuasion but rather by government enforcement. Police stayed in the local communities and effectively participated in agricultural extension services.

The first farmers' association in Taiwan was established in September 1900. These associations were organized by the administration under the local top officials in cooperation with landlords and community leaders. Their purpose was to improve farm practice, introduce new seeds, and purchase fertilizer. Under the regulation governing farmers' associations issued in 1908 there were 12 associations, one in each prefecture, and their role in agricultural improvement and extension was emphasized. The government undertook effective control of them. Farmers were compelled to join them and to pay dues, and they were

granted a government subsidy.

In 1927, as a result of the adjustment of administrative territories, the number of farmers' associations was reduced to one in each of the eight prefectures. They became associated units of government administration, providing an important transmission belt to introduce new technology into agriculture through serving as strategic links between the administrators and the farmers. They were effectively organized with strong government support and control.

Agricultural improvement stations were also established in each prefecture to supply information on new technology to the farmers' associations.

Irrigation came under government control in 1901, when the Taiwan Governor-General's Office promulgated "The Regulations Governing Public Irrigation Canals" to supervise the administration of irrigation organizations and give them financial assistance. In 1907 the government started the construction of six large-scale irrigation systems, covering 39,000 hectares. The rate of investment was modest, however, until 1919. Under "The Regulations Governing Irrigation Associations" promulgated in 1922, irrigation associations were organized on a regional basis for the control and operation of all public irrigation canals.

In the early years of Taiwan agriculture the rice varieties had been mostly of the indica type, and more than 1,000 varieties were planted. Under the Japanese regime, new rice varieties were successfully bred, and the so-called "ponlai rice" varieties, of the japonica type, were made public on May 5, 1926. Ecological experimentation for the establishment of this kind of rice was then carried on in various counties. The area planted to ponlai rice gradually expanded from foothill paddy land down to the plains, and cultivation shifted from one crop a year to two crops a year. Under the overall rice improvement program ponlai rice progressively replaced the native varieties, and the total number of ponlai and native varieties was greatly reduced, the inferior varieties being largely eliminated.

Besides variety improvements, increased application of chemical fertilizers also contributed greatly to increased yields of rice, sugarcane, and other crops. It also made highly intensive cultivation possible.

The quantity of fertilizer used per hectare increased as it had become difficult to expand the size of farms.

The sugar industry pioneered heavy fertilization. Chemical fertilizers were initially distributed free to sugarcane farmers by the sugar companies, because they could not persuade the farmers to buy chemical fertilizers. In 1903, free distribution was replaced by partial subsidy. Finally, in 1916 the fertilizer subsidies to sugarcane farmers were discontinued. The idea and practice of using chemical fertilizer were soon taken up by farmers who grew other crops.

The efforts of the government to improve fertilization practices in rice fields were less vigorous. Use of organic matter and green manure was encouraged as part of the extension of improved cultivation techniques for rice farming. After 1926, cultivation of rice was rapidly expanded in Taiwan, and heavy chemical fertilization of rice fields began. This rapid increase in the use of fertilizer required changes in crop variety and improvement in cultivation practices. For example, the new Ponlai rice was found to be more responsive to chemical fertilizers than were the native varieties. As the adoption of the Ponlai variety spread in the 1920's, fertilizer consumption increased. It reached its prewar peak in 1938, and the average yield of rice per hectare also set a new record in that year. The direct application of oil cake, which constituted more than 50 percent of fertilizer usage in 1931, was gradually replaced by use of mixtures of chemical fertilizers with bean cake, which made up about 70 percent of the total consumption in 1941.

Many improvements were made in cultivation techniques and in pest and disease control in this period. In 1908 the government promulgated regulations for the eradication and prevention of crop diseases and pests. Close planting of rice to increase yield was also adopted. The number of rice seedlings planted per *tsubo* (6×6 feet or 1/30th are) rose from 37 in early years to 49 in 1922 and later to 60. In 1924 official encouragement of weeding was announced by agricultural agencies of the government.

Efforts by the government to promote agricultural development through institutional and technological improvements continued in the

1930's. The guiding principle was maximum utilization of invested capital to achieve profitable production. Methods of implementation shifted from police enforcement to persuasion through proof of the profitability of improved technology. The people's participation and financial support were considered indispensable to development programs in this period.

The rapid expansion of the Japanese economy in the 1920's and the subsequent recession in the 1930's forced Taiwan to manage its agricultural production more efficiently. The comparatively high prices of rice and sugar in the Japanese market also provided an incentive to Taiwan's farmers to increase their production. However, regulation of rice exports was announced in 1932, intended to maintain and stabilize the price of rice in the Japanese market so as to support the income of Japanese farmers. For Taiwan, this was an opportunity to restrict rice production chiefly to domestic consumption and to start industrialization. Diversification and rotational cropping patterns were then widely adopted.

As a result of increased agricultural output and productivity in this period, both land rents and land prices went up sharply. This retarded economic transformation and further agricultural development. The adjustment of land rent to safeguard the interest of cultivators was publicly urged.

3. Agricultural Development after the War

At the end of World War II, Taiwan was restored to the Government of the Republic of China, which promptly emphasized programs for the recovery and rehabilitation of agriculture. These included measures to restore a high technical level of farm cultivation and to reorganize the farmers' associations.

The most significant of all agricultural undertakings in the initial years of the period, however, was the land reform program started in 1949. The first step was the reduction of land rent. This produced dramatic results in providing an incentive for more intensive use of both human and land resources through application of modern farming techniques and adjustment of farm organization and operation. The program required farm rental rates, which had averaged 50 percent of

the annual main crop yield, to be reduced to not more than 37.5 percent.

The sale of public lands to the tenants who cultivated them, the second stage of land reform, began in 1952, and by the end of 1961 a total of 96,000 hectares of public land had been sold by the government at a price of 2.5 times the annual crop yield.

The Land-to-the-Tiller program, the last step of land reform, began in February 1953. Under this program the government compulsorily purchased all privately owned tenanted holdings exceeding three hectares of paddy land or six hectares of dry land and resold them to their tenant cultivators. Both the purchase and the resale prices were fixed at 2.5 times the annual crop yield.

The implementation of the land reform program has resulted in the adoption of multiple-crop farming with subsequent rapid growth in land productivity. It also has widened the employment opportunities of the surplus labor in agriculture. With the serious shortage of land and the high pressure of population in agriculture, implementation of the program gave the new owner-cultivators an incentive to engage in labor-intensive, diversified farming. Although it is difficult to separate the effects of land reform from those of other factors influencing agricultural production, it is reasonable to believe that a large part of the increase in agricultural productivity has been motivated by the land reform program.

Supply of chemical fertilizer, also, was considered one of the most important responsibilities of the government. Rice and sugarcane production were given top priority to receive fertilizer. The paddy-fertilizer barter system, started after the war when there was inflation and shortage of both chemical fertilizer and food, encouraged farmers to increase production by assuring them the fertilizer they needed. At the same time, it provided the government a large quantity of paddy rice for use in stabilizing food prices. The benefits from using chemical fertilizer were convincingly demonstrated to farmers, and the demand for it increased rapidly. This, in turn, greatly stimulated the development of the fertilizer industry in Taiwan.

The application of power machinery to rice cultivation in Taiwan started with the import from the United States of seven different makes

and models of garden tractors by the Joint Commission on Rural Reconstruction in 1954 and the purchase of two power tillers from Japan the following year. They were tested at various agricultural research and improvement stations and agricultural schools.[7]

Domestic manufacture of power tillers began in 1956, and by the late 1960's more than 3,500 tillers per year were being produced. Imports were discontinued in 1966. By 1972 over 35,000 power tillers had been put into use in Taiwan, more than 85 percent of them manufactured domestically.

The growth in the number of power tillers used in Taiwan has been followed by a sharp decrease in the number of draft animals. In 1960 there were 417,000 draft cattle; by 1972 the number had decreased to 227,000. In order to use the power tiller more efficiently and profitably, the system of custom performance of mechanized farming operations has been widely adopted.

Thus in Taiwan today, mechanization of land preparation, especially for paddy fields, is no longer in the experimental stage but has become well established.

The decrease of farm size and the fragmentation of holdings are current problems in Taiwan agriculture. The increase in the number of farm households together with equal right of inheritance have resulted in the splitting of farm holdings, which were already small, and the gradual fragmentation of them into many small plots scattered in several locations. This interferes with economical use of land, creates difficulties in farm operation, and eventually hinders technological progress.

As an experimental attack on this problem, the first in a series of land consolidation projects was undertaken in 1959 in conjunction with an irrigation program. In these projects the farm plots in irrigated areas are rearranged and consolidated into rectangular shapes of larger size. These improvements have greatly facilitated the work of cultivators and have also made the use of farm machinery practical. By the end of 1971, about 260,000 hectares of farm land in Taiwan had been consolidated, a little less than the program goal of 300,000 hectares.

In the first stage of postwar agricultural development in Taiwan, the new techniques and innovations introduced were mostly labor-intensive in character. It was only by such techniques that the surplus labor in rural areas could be well utilized and labor productivity improved. But in later years, as agriculture has become well developed, the scarcity of land has begun to prevent further increase of labor input. At the same time, the rapid development of the economy has drastically increased the demand for labor by other sectors. Thus an outflow of labor from the agricultural sector has begun to occur. The absolute number of agricultural workers began to decrease in the late 1960's, and this has caused seasonal or partial labor shortages in agriculture. A result has been an increase in capital input in the form of labor-saving machines and other facilities purchased in order to replace human labor and maintain agricultural productivity.

With the long-standing scarcity of land, pressure on labor to move out of agriculture is not a new problem. However, out-migration has accelerated in recent years by two forces—"pull" from outside and "push" from inside, to use demographic terminology. In a recent small scale study by the National Taiwan University and the Joint Commission on Rural Reconstruction, only 26 percent of the 129 young out-migrants surveyed were "pushed" out from agriculture, while 74 percent of them were "pulled" out by forces outside the agricultural sector.[8)]

The labor shortage in agriculture together with the low agricultural price policy in Taiwan have retarded considerably the growth of agricultural production.

Footnotes

1) At the suggestion of Professor Ramon H. Myers of the University of Miami, the effects of using the alternative base periods 1950-52 and 1965-67 have been examined. A comparison of the results is included in Part II and Appendix Tables 12, 13, and 14.

2) E. L. Rada and T.H. Lee, *Irrigation Investment in Taiwan—An Economic Analysis of Feasibility, Priority and Repayability Criteria*, Economic Digest Series No. 15, Joint Commission on Rural Reconstruction, Taipei, Taiwan, China, February 1963.

3) Definitions of these categories and explanation of the methods used in measuring them are presented in Part II.

4) Inputs have been aggregated in a chain-linked index using as weights the current relative shares of the factors in production. Details of these calculations are given in Part II.

5) One qualification regarding these figures should be mentioned at this, point. Organic fertilizers, such as green manure and compost, have played an important role in the growth of agricultural output. This was especially true in the prewar period and the immediate postwar period. If organic fertilizers were included in current input, we believe that the rate of increase in total input would be somewhat smaller, and the growth of productivity in total output terms would be correspondingly higher. The contribution of improvement in total productivity to the growth in total output would then appear a little greater than stated.

6) This section draws heavily on the following books: T. H. Lee, *Intersectoral Capital Flows in the Economic Development in Taiwan*, Cornell University Press, December 1971; and S. C. Hsieh and T. H. Lee, *Agricultural Development and Its Contributions to Economic Growth in Taiwan*, Economic Digest Series No. 17, Joint Commission on Rural Reconstruction, Taipei, Taiwan, China, April 1966.

7) Tieng-song Peng, "The Development of Mechanized Rice Culture in Taiwan," JCRR, June 1969.

8) Tsong-shien Wu, "Rural Youth Migration and Their Occupational Achievements," *The Bulletin of the Institute of Ethnology*, Academia Sinica, No. 29, 1970.

PART II. DATA AND METHODS[1]

1. Agricultural Output

Output of agricultural products, as used in this study, is the net output obtained by subtracting the portion of production used within agriculture for seed and feed from gross agricultural production. The main sources of production data are *Taiwan Agricultural Statistics, 1901-1965*[2] and *Taiwan Agricultural Yearbook*[3]. Some information for earlier years not available in these publications has been estimated by the authors.

Altogether, 109 agricultural products are included in the indexes of total production and output. They are grouped into six categories: rice, other common crops, special crops, fruits, vegetables, and livestock (including sericultural products). The number of items and the main products of each category are as follows:

Category	Main Products	No. of Items
a. Rice	Rice	1
b. Other common crops	Sweet potatoes, wheat, corn, barley, soybeans, other beans, fresh edible sugarcane	14
c. Special crops	Sugarcane, tea, peanuts, tobacco, jute, sesame, rapeseed, flax, cotton, sisal, cassava, citronella, arrow root	22
d. Fruits	Bananas, pineapple, citrus fruits, longan, mango, papaya, grapes, guavas, wax apples, peaches, loquats	21
e. Vegetables	Radishes, potatoes, onions, asparagus, carrots, cabbage, celery, leaf-mustard, water melons, cucumbers, cauliflower, eggplant, tomatoes, peas, mushrooms	38
f. Livestock	Cattle, hogs, poultry, milk, eggs, honey, silkworms	13
Total		109

To obtain economic measures of aggregate production and output, the physical quantities of all products are multiplied by their respective prices, and these values are summed, by commodity groups and in total, to obtain aggregate values. Time series of the results of these calculations using current prices are shown in Appendix Table 2.

Since the prices of agricultural products change over time, however, aggregate value at current prices is not a satisfactory measure for physical output over long periods. For this purpose it is preferable to use constant prices of a selected base period. In this study, average prices of the years 1935-37 have been used for this evaluation (Appendix Table 3).

An index of total output has been calculated, using the Laspeyres formula, with 1935-37 as base period. To reduce transient distortions, a five-year moving average of the index has been computed, and it has been converted to make the reference base the start of the study period—i.e., 1913 (actually, the 1911−15 average)=100 (Appendix Table 1a).

An index of gross value added in agriculture has also been calculated, in which total output is reduced by nonfarm current input (Appendix Table 1b). The method of computing this index, in constant dollar terms, is fully described in Part I.

Regarding selection of the base period for price weights, in order to find out the effects of alternative bases, aggregate production indexes have been calculated using average prices of 1950-52 and of 1965-67 as weights. Annual compound rates of increase in agricultural production derived from these different indexes compare as follows (in percent):

Period*	Base Period 1935-37	Base Period 1950-52	Base Period 1965-67
1913—23	2.7	3.0	2.8
1923—37	4.0	4.2	4.0
1937—46	−4.9	−5.4	−5.0
1946—51	10.3	10.7	10.3
1951—60	4.6	5.1	4.7
1960—70	4.1	4.6	4.7
1913—37	3.5	3.7	3.5
1946—70	5.5	6.0	5.8
1913—70	3.0	3.2	3.1

* Each year is a 5-year average centered at the year shown.

It is evident that higher growth estimates are generally obtained using the 1950-52 base than using either of the other two. Between the 1935-37 and the 1965-67 bases there is no significant difference in the estimates except for the period 1960 to 1970.

Thus there appear to have been significant changes in the price structure of agricultural commodities that introduce some bias into the Laspeyres index. From the standpoint of competitive conditions in the markets, agricultural prices were distorted in 1950-52. The markets in 1935-37 and 1965-67 conformed more nearly to the ideal of perfect competition, and the prices in these periods seem more appropriate as guides to resource allocation. As between these two, the significantly higher growth estimate for 1960 to 1970 obtained using the 1965-67 base period appears to be due mainly to the rapid expansion of fruit production in this decade in combination with the higher relative prices of fruits in 1965-67 than in 1935-37.

For reasons of statistical consistency and comparability of data, we have tentatively kept the 1935-37 base index for this study. (Further comparisons of statistics using the three base periods are shown in Appendix Tables 12, 13, and 14.

There are several studies related to long-term estimation of an agricultural output index for Taiwan. Among them, the output index computed by Hsieh and Lee in *An Analytical Review of Agricultural Development in Taiwan* and *Agricultural Development and Its Contributions to Economic Growth in Taiwan* and by Ho in his book *Agricultural Development of Taiwan, 1903-1960*[4] are the most comprehensive and cover a rather long period.

The output index computed by Hsieh and Lee is actually what is defined in this study as a production index: the amount of domestic agricultural production used on farms as intermediate goods is not subtracted in the computation of the index. The *production index* compiled in this study is, in fact, a revision and extension of the Hsieh-Lee index. The two series use the same base period, the same weights, and the same formula. The only difference between these two series is in the coverage of agricultural products.

The production index in the Hsieh-Lee study is based wholly upon

the official statistics, which are incomplete for some agricultural products in the earlier years. Consequently, the growth rates of agricultural production derived from the Hsieh-Lee index are considered to be too high in these years. In the present study we have attempted to estimate missing data and to correct for possible misreporting before constructing the agricultural production index. The correction and estimation of production figures made in this study are as follows:

(1) Data of vegetable production in the period 1911-22 have been estimated from the side of consumption. The per capita consumption of vegetables is estimated to have been 50 kg in 1911 and to have gradually increased year by year. Total annual production of vegetables in this period has been estimated by multiplying per capita consumption by total mid-year population.

(2) The estimates of production of corn (maize), five special crops (citronella, sisal, cassava, flax, and arrowroot), and two fruits (guava and mango) are mainly based on historical changes in cultivation and yield as recorded in *Taiwan noka benran*[5] (Farmers' Manual).

(3) There are no official data on fresh edible sugarcane production before 1937. Production has been estimated by extrapolation using the trend of raw sugarcane production during this period.

(4) Official statistics on egg production before 1955 are not available. Egg production has been estimated by multiplying the total numbers of ducks and laying hens by the egg production per bird in the respective years based on economic survey.

Annual compound growth rates of agricultural production based on the original Hsieh-Lee index and on the revised index of the present study compare as follows (in percent):

Period	Hsieh-Lee	Present
1911—22	2.2	2.1
1922—39	3.8	3.8
1939—45	−12.3	−12.3
1945—52	12.9	12.7
1952—60	4.0	4.1
1911—39	3.2	3.1
1945—60	8.1	8.0
1911—60	2.6	2.5

It is obvious that the growth rates in this study are smaller than in the original one. However, the difference between the two indexes is not significant.

Agricultural output as defined in Ho's study excludes the part of agricultural products used on farms as intermediate goods, and hence is conceptually the same as in this study. However, three major differences can be found in the two indexes. (1) The number of agricultural products covered in Ho's index is only 74, while that in the current study is 109. (2) Ho uses the base period 1952-56, while in this study, 1935-37 is used. (3) Ho's estimates and corrections of production figures are partially in terms of gross value, while the estimates in this study are all in terms of physical output, based on the historical development of newly developed products in Taiwan as recorded in *Taiwan noka benran*.

Supporting data on yields and planted areas of major crops are in Appendix Tables 5 and 6, and the percentage breakdown of total production by commodity groups is shown in Appendix Tables 7 (at current prices) and 8 (at 1935-37 prices).

2. Factor Inputs

Factor inputs as defined in this study have been divided into four categories: nonfarm current inputs, land, labor, and fixed capital. These concepts, sources of data, and the method of estimation are briefly explained in this section.

a. Nonfarm current inputs:

Nonfarm current inputs are nonfarm products used in producing farm products. In the current study, imported feeds and those processed from domestic farm products, chemical fertilizers, other supplies, irrigation expenses, and expenses for electric power make up this category. (The electric power consumed by the agricultural sector is in part used in irrigation, so that there is a slight double counting.) They are further aggregated at 1935-37 constant prices for constructing the index of nonfarm current input.

Feeds include imported corn, bean cake, wheat bran, and rice bran,

aggregated at 1935-37 constant prices. The estimates are based on available feed supply rather than actual current consumption, in that carryover of feeds on farms is not taken into consideration.

Chemical fertilizer data for the prewar period and for the earliest postwar years are mainly taken from the *Taiwan Agricultural Yearbook*. Estimated consumption is calculated by the following formula:

$$C = P + I - M$$

where: C = estimated consumption of chemical fertilizer.

P = quantity of domestic production.

I = quantity imported.

M = quantity of raw materials imported for domestic processing.

The data on annual fertilizer consumption in the years since 1950 are obtained from the Plant Industry Division of the Joint Commission on Rural Reconstruction. The figures show the actual amounts of fertilizer distributed for agricultural production in the respective years. The average prices of the years 1935-37 have been used to calculate the real cost of total chemical fertilizer for the period under study.

Other supplies include all the other materials necessary in farm production. In the 1960's, expenditures on pesticides and insecticides made up the greater part of this item. The estimates since 1935 are mainly based on the Rice Production Cost Survey conducted semi-annually by the Provincial Food Bureau. Before 1935, the data are estimated from the periodic reports of crop production surveys. The expenses of materials at 1935-37 constant prices are obtained by deflating the current-price value by the general wholesale price index.

Irrigation expense data for the period from 1911 to 1960 are taken from *Irrigation Investment in Taiwan*. Those for the years 1961 to 1972 are provided by the Provincial Water Conservancy Bureau. The data include expenditures for administration, maintenance, repair, and repayment of loans, and hence they are different from irrigation fees. Irrigation expenses at current value are deflated by the general wholesale price index in order to convert them to the 1935-37 constant-price basis.

Electric power expenses are calculated from data on electric power consumption obtained from the Taiwan Power Company evaluated at their average unit prices of 1935-37.

b. Labor:

In this study, both the number of agricultural workers and the number of man-equivalent days spent on farms are used as measures of labor input. The number of farm workers measures the availability of labor rather than the actual labor input. Since the changing number of annual working days per farm worker is difficult to estimate, it has seemed more reasonable to measure labor input as the total number of working days required in crop and livestock production, estimated from crop and livestock production cost data. However, the total number of agricultural workers is used for calculating labor productivity per farm worker. In calculating the man-equivalent days spent on farm, we have also taken into consideration those labor inputs indirectly required for agricultural production, i.e., procurement of farm inputs, marketing of farm products, repair of farm implement, repair of farm building (50%), preparation of compost, and participation of training class and other activities relating to the improvement of farm techniques.

The annual total man-equivalent days spent on farms has been estimated by the following formula:

$$N_t = \Sigma D_{it} \cdot H_{it} + \Sigma B_{jt} \cdot G_{jt} + C_t \cdot L_t$$

where:

N_t = total working days in year t.

D_{it} = working days required for growing one hectare of the i-th crop in year t.

H_{it} = number of hectares planted to the i-th crop in year t.

B_{jt} = workig days required for raising one unit of j-th livestock in yeat t.

G_{jt} = units of j-th livestock in year t.

C_t = working days indirectly required for agricultural production per hectare of cultivated land in year t.

L_t = total acreage of cultivated land in hectare in year t.

The working days required for growing one hectare of crop and raising one unit of livestock have changed over the period. However, for the years before 1935 constant values of D_i and B_j have been used because of inadequate information on changing labor requirements.

In order to obtain the factor share for labor, agricultural wage rates throughout the period are used to calculate the cost of labor input. The daily wage rates of agricultural workers for the years before 1935 come from *The Fifty-one Years Statistical Abstract*,[6] and those for the period after 1935 are compiled from the Rice Production Cost Surveys conducted by the Provincial Food Bureau.

For estimates of the numbers of agricultural workers in postwar years, the labor force data compiled by the Provincial Department of Civil Affairs from household registration have been widely used. But on the basis of other sources, it is felt that these data overestimate the total number of agricultural workers. At the beginning of 1972, the Manpower Division of the Council for International Economic Cooperation and Development attempted to revise the labor force data for the period 1952-71. The revised data appear more accurate and have been used in this study. The data on agricultural workers for the period before 1952 have been estimated mostly on the basis of the household surveys and of the population censuses conducted periodically in the Japanese period. The estimate for 1972 is taken from the *Report on Labor Force Survey*.[7]

c. Land:

Data on cultivated land area in Taiwan for the period from 1911 to 1965 are taken from *Taiwan Agricultural Statistics, 1911-1965*, those for more recent years from the *Taiwan Agricultural Yearbook*. Cultivated land is classified into three categories according to irrigation conditions: double-crop paddy land, single-crop paddy land, and dry land. Double-crop paddy land is land with adequate water supply to produce two crops of paddy a year. Single-crop paddy land is land with water supply sufficient only for one crop of paddy, in either the first or the second half of the year. Dry land is land lacking irrigation facilities and therefore not used for the production of paddy rice.

The proportions of paddy and dry land have changed over the

period studied. For the first half of the period about 50 percent of the total cultivated area was dry land, but the proportion decreased to about 40 percent in the second half of the period. The three categories of land differ completely in cropping patterns and productivity. Therefore, in calculating the index of land input we have weighted the area of each category by the average price of such land in 1935-37.

d. Fixed capital:

Fixed capital in agriculture consists of four items: farm buildings, farm implements and machinery, large plants or trees, and livestock. They are also aggregated at 1935-37 constant prices for making a single index of fixed capital. The data on fixed capital are taken mainly from *Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960*[8] and *Agricultural Development and Its Contribution to Economic Growth in Taiwan, 1945-1970*.[9] Data and method of estimation of fixed capital are briefly explained as follows.

Farm buildings—In a society where farms are small and farming is not specialized, farmers' dwellings are sites of production activities, and it is hard to determine how much of their value should be considered capital used in production. In this study, we have allocated half the value of farm houses as production capital.

The estimates of the total value of farm buildings are based on farm economic surveys, using interpolation for years when no such surveys were made. The data for the period after 1958 are compiled from *Reports on Farm Record-keeping Families*,[10] adjusted for differences in cultivated area and crop area between the sample farms for record keeping and the provincial average.

In constructing the aggregate index of all fixed capital valued at 1935-37 prices, the current value of farm buildings has been deflated by the general wholesale price index (1935−37=100).

Farm implements and machinery—Data on the value of farm implements and machinery for the years before 1935 are estimated from values of annual production of these goods reported in *The Fifty-one Years Statistical Abstract*. We suspect that these data underestimate the annual production of farm implements and machinery for the years

before 1920, but no adjustment has been made, owing to insufficient information. The procedures for estimating the value of farm implements and machinery for the years after 1935 are the same as those for estimating the value of farm buildings.

The real value of farm implements and machinery at 1935-37 prices is obtained by using the general wholesale price index as deflator.

Large plants and trees—In this study, the category large plants and trees includes tea, sisal, perfume plants, and most fruit trees. The value of each species in each year is derived by capitalization of prospective annual profit per hectare, using the formula

$$P_t = H_t \cdot R_t \cdot \frac{(1+i)^n - 1}{i\,(1+i)^n}$$

where

P_t = value of the species in year t.

i = annual interest rate (8 percent).

H_t = crop area in hectares in year t.

R_t = profit per hectare in year t.

n = number of years in which the plants will yield profit (remaining productive life).

$\frac{(1+i)^n - 1}{i\,(1+i)^n}$ = present value of a unit annuity for n years discounted at interest rate i.

The total capitalized value of large plants and trees in year t is the sum of the P_t for all species. No allowance has been made for salvage value. Real value in terms of 1935-37 average prices is obtained by using as weights the per hectare average profit ($R_{1935-37}$) from the species in these years instead of using the annual per hectare profit in the respective years.

Livestock—Cattle, breeding hogs, and goats are included in fixed capital; meat hogs and other livestock are considered agricultural output. The data on livestock are mostly taken directly from *The Fifty-one Years Statistical Abstract* and *Taiwan Agricultural Yearbook*. The number of breeding hogs is not available for years before 1950. It has been estimated by extrapolation using the trend of the total number of

female hogs in those years. The several classes of livestock are aggregated by using 1935-37 average prices as weights in constructing the index of total fixed capital.

Data on inputs in the several categories are shown in Appendix Table 4.

3. Factor Shares

The four categories of inputs are aggregated by using factor shares as weights for compiling the single index of total input. The factor share of each input is the proportion of the cost of the input in the total factor cost—i.e., the cost of each input divided by the total factor cost, the costs being estimated at current prices. Data and method for the calculation of the cost of various nonfarm current inputs have been explained in the preceding section. Factor cost of land, labor, and fixed capital are calculated as follows:

Labor—The annual cost of labor input is obtained simply by multiplying the number of annual working days by the current daily wage rate. The sources and methods of estimating daily wage rates and annual working days have been explained in the preceding section.

Land—Services rendered by cultivated land are usually evaluated in terms of land rent, which normally reflects the productivity of land. In Taiwan, however, under the Farm Rent Reduction Program implemented in 1949, the land rent actually paid by tenants ceased to represent a free market evaluation of the actual value of services rendered by land. Farm rent paid to a landlord by a tenant could not exceed 37.5 percent of the standard total annual yield of the main crop. The standard amounts were established in 1949 and have remained unchanged since. Land rent does not increase as land productivity goes up or land improvement occurs. It is not determined by the demand and supply of land. Thus in the last two decades the amount of land rent is meaningless in representing land input. In this study we therefore have used interest on land value as an indicator of the cost of land input. The annual rate of interest used is 8 percent.

Data on land value per hectare for the prewar years are estimated from various surveys. Those for the postwar years have been obtained

from the Provincial Land Bureau and estimated from the *Report on Farm Record-Keeping Families*.

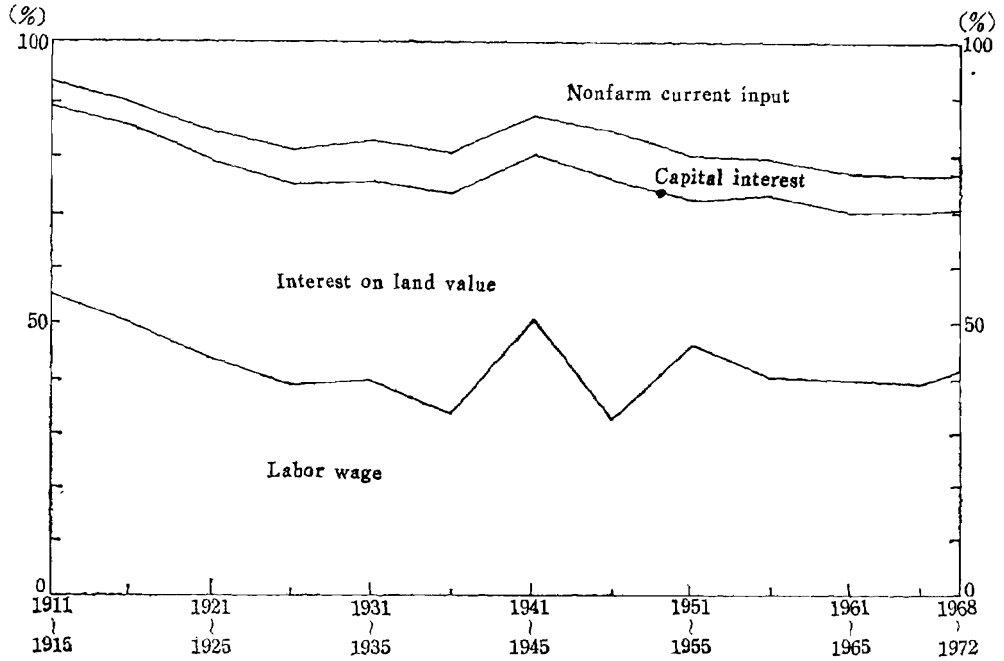
Fixed capital—The annual cost of fixed capital input has been estimated as 8 percent of the current value of investment in fixed capital.

Based the costs of the four factor inputs, estimated as just described, the factor shares in total agricultural production have been computed, using five-year averages to minimize the effects of irregular and unexpected fluctuations in any single year. The results are shown in Appendix Tables 9a and 9b.

Taiwan agriculture in the earlier years can be characterized as labor intensive and capital extensive. From 1911 to 1915 the weight of labor cost in the total cost of agricultural production (including current input, Appendix Table 9a) was more than 50 percent, while the costs of current input and fixed capital input together accounted for only 11 percent. (See also Figure 8.)

Among the four categories of factors, the share of current input increased the most remarkably over the period, rising from 7 percent in

Figure 8. Factor shares in the total cost of agricultural production, five-year averages. (%)



1911-15 to 23 percent in 1968-72—a 230 percent increase. Fixed capital input also showed an upward trend in relative importance over most of the period, but its share decreased slightly in the last two decades. The great increase in farm machinery in the last decade was partially offset by the decrease in the number of draft cattle. The share of land cost in the total cost of agricultural production has averaged around one third. The relative importance of labor input was as high as 55 percent in the very early period, gradually decreased to 40 percent in 1926-30, and has shown no persistent change since.

If current input is excluded from the calculation of factor shares (Appendix Table 9b), the relative importance of each remaining factor is comparatively more stable. Labor accounts for about half of total factor cost for the period as a whole. The factor share of land input averages a little more than 40 percent, and that of fixed capital input is about 4 percent in the earlier years, then gradually increased to about 10 percent, but has remained between 8 and 9 percent for the years since 1956.

4. Construction of the Index of Total Input

As previously mentioned, the total input index has been calculated by aggregating the indexes of the four categories of factor inputs, weighting them by their respective shares in total cost of production. The substantial changes in the factor shares over the period of the study, however, makes it inappropriate to use constant weights taken from a particular base period. Not only would the selection of base period be arbitrary, but its choice would greatly affect the index, and comparisons made using the index would be less and less accurate the longer the period over which the comparisons were made.

Therefore, in the present study, instead of calculating a fixed-base index, a chain-link index with varying weights has been adopted. Average factor shares have been computed for successive five-year intervals over the entire period of the study, in order to avoid the disturbing influence of irregular fluctuations in particular years, and these averages have been used as weights for aggregating the factor indexes within the corresponding five-year intervals. Thus, in effect, the weights used in calculating the index are revised every five years.

The procedure for calculating the chain-link index of total input is thus as follows:

(1) Average factor shares of four (or three) categories of inputs were calculated for each successive five-year interval.

(2) The index of the quantity of each factor input was converted to a link index, i.e., to a series of successive year-to-year ratios.

(3) These link indexes of the individual factor inputs in each interval were than aggregated, using the average factor shares of the respective interval as weights.

(4) These annual link aggregates of total input were finally combined by successive multiplication to produce the chained series for the whole period.

The method of calculation may be represented by the index formula of Divisia:

$$I_t = I_{t-1} \cdot \Sigma W_{i,t-1} \cdot \frac{Q_{i,t}}{Q_{i,t-1}}$$

where

I_t = index of total input in year t (but I in 1911=100)

W_{it} = average share of ith factor input in total factor cost in the five-year interval that includes year t.

Q_{it} = index of quantity or constant value of ith factor input in year t.

A five-year moving index was finally computed from the chained series derived from above formula, and it was further converted to make 1913 (actually, the 1911-15 average) as base period. The resulting index of total input of the four factors, land, labor, fixed capital, and nonfarm current input, is presented in Appendix Table la, along with the index of total productivity calculated from this index in conjunction with the index of total output.

An index of total input of the first three factors only, excluding current input, has been calculated similarly, and is shown in Appendix Table lb, where it is used in conjunction with the index of gross value added to calculate the index of total productivity on this basis.

Indexes of partial productivities of land and of labor in terms of total output and of gross value added are also shown in Appendix Tables 1a and 1b.

Footnotes

1) The data and method used in this sutdy are mostly adapted from studies by S.C. Hsieh and T.H. Lee: *An Analytical Review of Agricultural Development in Taiwan—An Input-output Approach*, Economic Digest Series No. 12, Joint Commission on Rural Reconstruction, Taipei, Taiwan, China, July 1958; and *Agricultural Development and Its Contributions to Economic Growth in Taiwan*, *ser. cit.* No. 17, April 1966. The present study is actually a revision and extension of those two studies.

2) *Taiwan Agricultural Statistics, 1901-1965*, Economic Digest Series No. 18, Joint Commission on Rural Reconstruction, Taipei, Taiwan, China, December 1966.

3) Taiwan Provincial Department of Agriculture and Forestry, *Taiwan Agricultural Yearbook*, annual, Taiwan, China.

4) Yhi-min Ho, *Agricultural Development of Taiwan, 1903-1960*, Vanderbilt University, 1966.

5) *Taiwan Noka Benran* (Farmers' Manual), Sixth edition, 1944.

6) Taiwan Provincial Government, *The Fifty-one Years Statistical Abstract*, Taipei, Taiwan, December 1946.

7) Taiwan Provincial Labor Force Survey & Research Institute, *Quarterly Report on the Labor Force Survey in Taiwan, Republic of China*, No. 40.

8) T. H. Lee, *Intersectoral Capital Flows in the Economic Development of Taiwan, 1895-1960*, Ph. D. thesis, Cornell University, Ithaca, New York, June 1968.

9) T. H. Lee, *Agricultural Development and Its Contribution to Economic Growth in Taiwan, 1945-1970*, JCRR, Taipei, Taiwan, China, May 1972, mimeo.

10) Provincial Department of Agriculture and Forestry: *Report on Farm Record-keeping Families in Taiwan*, annual, Nantou, Taiwan, China.

APPENDIX TABLES

Table 1a. Indices of total agricultural output, inputs and productivity, five-year moving averages (on total output basis) (1913=100)

Year	Total output	Total inputs	Total productivity	Labor productivity		Land productivity		Rice yield per hectare planted	
				per worker	per working day	per ha. of cultivated land	per ha. of crop area	kg. of brown rice	index
	(1)	(2)	(3)=(1)/(2)	(4)	(5)	(6)	(7)	(8)	(9)
1913	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1,346	100.0
1914	102.1	102.5	99.6	101.7	100.6	101.3	101.1	1,360	101.0
1915	108.3	105.0	103.1	108.1	104.3	106.4	105.9	1,416	105.2
1916	110.6	108.2	102.2	111.4	103.1	107.5	106.0	1,393	103.5
1917	114.3	111.0	103.0	116.8	104.4	109.6	108.0	1,413	105.0
1918	114.7	113.4	101.2	117.9	103.7	108.6	107.9	1,411	104.8
1919	115.5	115.7	99.9	119.2	103.7	108.3	107.9	1,417	105.3
1920	116.8	118.9	98.2	120.7	103.5	108.6	107.6	1,425	105.9
1921	118.2	121.4	97.3	121.9	105.2	109.3	109.1	1,425	105.9
1922	123.6	125.1	98.8	127.0	108.9	113.6	113.2	1,468	109.1
1923	132.1	130.3	101.4	135.4	114.0	120.6	118.4	1,526	113.4
1924	138.8	135.6	102.4	140.9	117.6	125.4	122.0	1,552	115.3
1925	144.8	140.3	103.2	145.5	122.1	129.3	126.0	1,585	117.8
1926	152.8	147.1	103.9	151.9	126.7	134.5	131.0	1,643	122.1
1927	156.4	152.0	102.9	153.6	128.6	136.2	133.2	1,642	122.0
1928	161.0	155.8	103.3	156.5	131.2	138.9	135.8	1,651	122.7
1929	167.2	158.8	105.3	160.4	135.5	143.6	139.7	1,675	124.4
1930	177.7	161.4	110.1	167.7	141.4	151.9	145.3	1,723	128.0
1931	182.8	162.4	112.6	169.5	144.3	155.8	146.7	1,744	129.6

Table 1a. (Continued)

Year	Total output	Total inputs	Total productivity	Labor productivity		Land productivity		Rice yield per hectare planted	
				per worker	per working day	per ha. of cultivated land	per ha. of crop area	kg. of brown rice	index
	(1)	(2)	(3)=(1)/(2)	(4)	(5)	(6)	(7)	(8)	(9)
1932	191.1	164.9	115.9	173.7	148.8	162.0	150.2	1,808	134.3
1933	200.0	168.3	118.9	179.6	152.7	168.8	153.7	1,849	137.4
1934	209.7	172.4	121.6	185.9	156.3	175.5	157.8	1,913	142.1
1935	213.7	176.2	121.3	187.1	157.8	177.0	159.6	1,924	142.9
1936	224.0	179.0	125.1	193.6	163.4	183.9	166.6	2,014	149.6
1937	231.3	181.6	127.4	197.5	165.6	188.4	170.3	2,038	151.4
1938	229.4	183.2	125.3	192.8	162.7	185.5	167.9	2,004	148.9
1939	225.7	182.7	123.6	190.8	159.7	182.0	164.3	1,970	146.4
1940	223.0	181.8	122.7	190.5	156.5	179.9	161.6	1,950	144.9
1941	215.5	180.2	119.6	188.3	150.4	174.3	155.7	1,873	139.2
1942	202.5	174.7	115.9	188.6	142.9	165.7	147.0	1,813	134.7
1943	181.8	163.5	111.2	178.9	135.2	150.4	138.3	1,692	125.7
1944	165.4	152.1	108.7	162.7	130.9	137.7	130.7	1,642	122.0
1945	152.7	147.6	103.4	148.9	125.6	127.7	119.8	1,560	115.9
1946	146.9	146.5	100.3	139.9	120.5	122.4	110.7	1,492	110.9
1947	152.4	153.0	99.6	135.8	120.3	125.3	108.6	1,463	108.7
1948	176.7	168.4	104.9	149.6	128.8	143.4	114.8	1,603	119.1
1949	197.6	185.5	106.5	164.0	132.1	158.8	119.1	1,663	123.6
1950	217.5	199.6	109.0	178.0	135.5	173.1	125.4	1,768	131.4
1951	239.0	212.7	112.4	193.0	142.7	189.8	134.8	1,892	140.6
1952	255.4	223.6	114.2	203.9	149.3	202.4	142.5	2,003	148.8

Table 1a. (Continued)

Year	Total output	Total inputs	Total productivity	Labor productivity		Land productivity		Rice yield per hectare planted	
				per worker	per working day	per ha. of cultivated land	per ha. of crop area	kg. of brown rice	index
	(1)	(2)	(3)=(1)/(2)	(4)	(5)	(6)	(7)	(8)	(9)
1953	265.7	230.4	115.3	210.0	153.1	210.4	148.0	2,065	153.4
1954	280.3	228.5	122.7	219.7	158.5	221.9	155.1	2,145	159.4
1955	295.2	245.5	120.3	231.2	163.4	233.9	162.1	2,215	164.6
1956	308.3	252.6	122.1	242.0	166.8	243.6	167.4	2,280	169.4
1957	320.9	257.2	124.8	252.8	169.9	253.4	172.5	2,322	172.5
1958	334.9	261.7	128.0	264.6	173.7	264.7	177.8	2,391	177.7
1959	349.3	266.0	131.3	276.2	178.8	276.3	183.5	2,449	182.0
1960	360.6	269.2	134.0	283.5	184.6	285.3	188.2	2,512	186.6
1961	368.2	272.4	135.2	287.9	188.6	292.2	191.7	2,588	192.3
1962	383.4	278.3	137.8	298.3	195.2	303.9	198.0	2,697	200.4
1963	405.8	287.3	141.3	313.4	202.0	320.1	207.3	2,805	208.4
1964	425.3	296.7	143.4	325.7	206.2	333.6	215.1	2,893	214.9
1965	447.9	307.4	145.7	339.3	211.8	349.0	224.4	2,975	221.0
1966	476.1	321.1	148.3	357.6	220.7	368.6	236.2	3,049	226.5
1967	494.6	333.3	148.4	369.2	226.9	380.2	244.6	3,052	226.8
1968	511.3	344.2	148.6	381.7	235.4	391.7	253.9	3,079	228.8
1969	527.7	353.9	149.1	396.1	244.3	403.7	264.6	3,090	229.6
1970	544.8	368.3	148.0	415.1	254.9	417.1	277.1	3,135	232.9

Table 1b. Indices of gross value added, inputs and productivity, five-year moving averages (on gross value added basis) (1913=100)

Year	Gross value added (1)	Total inputs (2)	Total productivity (3)=(1)/(2)	Labor productivity per worker (4)	Labor productivity per working day (5)	Land productivity per ha. of cultivated land (6)	Land productivity per ha. of crop area (7)
1913	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1914	100.51	101.56	98.97	100.07	98.97	99.67	99.50
1915	105.31	103.31	101.94	105.08	101.48	103.52	103.01
1916	106.69	106.06	100.59	107.51	99.42	103.66	102.27
1917	109.56	108.08	101.37	112.00	100.11	105.13	103.60
1918	108.96	109.69	99.33	111.95	98.49	103.14	102.46
1919	109.32	110.83	98.64	112.81	98.12	102.47	102.10
1920	109.42	112.79	97.01	113.10	96.96	101.73	100.86
1921	109.12	113.55	96.10	112.54	97.18	100.92	100.73
1922	112.83	115.36	97.81	116.00	99.45	103.68	103.33
1923	120.24	118.01	101.89	123.27	103.75	109.74	107.80
1924	124.78	120.64	103.59	126.72	105.73	112.77	109.67
1925	128.69	122.46	105.09	129.36	108.52	114.91	111.99
1926	133.05	125.03	106.41	132.31	110.33	117.15	114.08
1927	134.37	126.89	105.89	131.96	110.49	117.03	114.45
1928	137.30	128.71	106.67	133.47	111.93	118.48	115.86
1929	142.25	130.16	109.29	136.41	115.28	122.13	118.83
1930	153.88	132.29	116.32	145.20	122.47	131.56	125.81
1931	159.74	133.77	119.41	148.07	126.05	136.12	128.21
1932	167.94	135.74	123.72	152.67	130.77	142.38	131.99
1933	176.58	138.03	127.93	158.54	134.77	149.03	135.71

Table 1b. (Continued)

Year	Gross value added (1)	Total inputs (2)	Total productivity (3)=(1)/(2)	Labor productivity		Land productivity	
				per worker (4)	per working day (5)	per ha. of cultivated land (6)	per ha. of crop area (7)
1934	185.25	141.00	131.38	164.23	138.08	154.98	139.38
1935	186.63	143.09	130.43	163.40	137.86	154.56	139.40
1936	196.60	145.23	135.37	169.95	143.37	161.36	146.19
1937	203.53	147.55	137.94	173.75	145.70	165.73	149.86
1938	201.20	148.86	135.16	169.06	142.66	162.70	147.24
1939	198.97	149.19	133.37	168.21	140.73	160.40	144.83
1940	199.01	149.44	133.17	170.01	139.68	160.50	144.19
1941	194.73	149.35	130.39	170.14	135.86	157.45	140.64
1942	186.08	147.25	126.37	173.36	131.33	152.29	135.08
1943	170.60	141.85	120.27	167.91	126.92	141.10	129.76
1944	159.64	136.25	117.17	157.06	126.36	132.91	126.14
1945	146.83	132.52	110.80	143.18	120.73	122.85	115.17
1946	142.47	131.77	108.12	135.67	116.86	118.73	107.35
1947	146.79	133.95	109.59	130.85	115.90	120.69	104.61
1948	167.07	139.81	119.50	141.39	121.77	135.61	108.52
1949	184.30	146.67	125.66	152.98	123.21	148.13	111.05
1950	203.49	152.98	133.02	166.58	126.74	161.98	117.33
1951	220.79	157.02	140.61	178.26	131.82	175.36	124.56
1952	230.90	159.63	144.65	184.34	134.98	182.99	128.86
1953	239.72	161.55	148.39	189.43	138.12	189.88	133.56
1954	249.50	163.66	152.45	195.56	141.10	197.55	138.01

Table 1b. (Continued)

Year	Gross value added (1)	Total inputs (2)	Total productivity (3)=(1)/(2)	Labor productivity		Land productivity	
				per worker (4)	per working day (5)	per ha. of cultivated land (6)	per ha. of crop area (7)
1955	260.93	165.82	157.36	204.36	144.43	206.73	143.26
1956	270.84	168.24	160.98	212.61	146.53	214.05	147.05
1957	285.59	170.48	167.52	224.94	151.15	225.53	153.57
1958	297.37	172.49	172.40	234.98	154.24	235.04	157.86
1959	309.14	173.93	177.74	244.46	158.18	244.55	162.41
1960	317.75	174.10	182.51	249.86	162.68	251.44	165.88
1961	322.90	174.28	185.28	252.46	165.39	256.19	168.13
1962	333.86	175.40	190.34	259.71	169.96	264.61	172.48
1963	352.54	178.44	197.57	272.21	175.48	278.12	180.10
1964	369.12	182.02	202.79	282.66	178.92	289.57	186.70
1965	387.01	185.67	208.44	293.17	183.01	301.53	193.92
1966	406.97	188.90	215.44	305.67	188.64	315.11	201.93
1967	415.95	191.28	217.46	310.50	190.82	319.72	205.70
1968	423.42	191.91	220.63	316.08	194.92	324.41	210.25
1969	434.79	192.28	226.12	326.32	201.29	332.59	218.04
1970	439.70	192.07	228.93	334.98	205.71	336.63	223.62

Table 2. Value of agricultural production, output and gross value added at current farm prices

Unit: million T$

Year	Rice (1)	Other common crops (2)	Special crops (3)	Fruits (4)	Vegetables (5)	Livestock (6)	Total production (7)=(1)~(6)	Agricultural intermediate products (8)	Total output (9)=(7)-(8)	Current input (10)	Gross value added (11)=(9)-(10)
1911	50.8	9.5	18.0	2.4	3.3	18.2	102.2	10.2	92.0	4.6	87.4
1912	56.6	9.9	14.7	1.9	3.9	19.8	106.8	10.8	96.0	6.6	89.4
1913	65.3	10.0	11.7	2.4	3.9	21.0	114.3	9.3	105.0	6.8	98.2
1914	44.4	7.9	14.9	2.0	3.4	20.6	93.2	7.9	85.3	7.0	78.3
1915	37.3	6.4	19.7	2.5	3.0	17.5	86.4	6.9	79.5	9.0	70.5
1916	42.5	6.9	25.7	3.2	3.3	17.8	99.4	8.5	90.9	11.0	79.9
1917	64.8	12.9	35.2	3.5	4.4	22.1	142.9	14.3	128.6	15.6	113.0
1918	93.3	22.9	34.7	5.0	6.1	30.9	192.9	20.7	172.2	17.7	154.5
1919	132.2	31.0	35.1	4.6	9.0	43.9	255.8	24.9	230.9	25.8	205.1
1920	109.0	21.6	34.6	6.2	10.7	45.9	228.0	21.5	206.5	32.2	174.3
1921	88.1	19.0	47.8	8.8	8.4	37.8	209.9	19.4	190.5	26.3	164.2
1922	80.6	17.1	45.8	6.7	7.9	35.3	193.4	17.0	176.4	28.3	148.1
1923	85.7	18.1	42.2	10.3	8.1	35.1	199.5	16.9	182.6	30.3	152.3
1924	130.7	21.4	49.6	11.2	9.0	37.8	259.7	19.4	240.3	38.2	202.1
1925	162.4	25.6	61.6	11.6	9.9	44.7	315.8	25.1	290.7	48.8	241.9
1926	144.1	24.7	65.8	10.1	10.7	44.5	299.9	25.6	274.3	52.3	222.0
1927	130.8	24.1	58.2	10.7	11.1	45.6	280.5	24.5	256.0	52.6	203.4
1928	134.0	26.0	70.8	12.2	11.7	47.5	302.2	27.3	274.9	67.8	207.1
1929	127.9	25.5	84.8	12.9	12.1	47.4	310.6	29.6	281.0	60.9	220.1
1930	107.2	20.4	76.0	10.8	10.2	42.6	267.2	23.4	243.8	48.6	195.2
1931	85.2	15.7	63.7	9.1	9.3	35.0	218.0	19.1	198.9	40.5	158.4

Table 2. (continued)

Year	Rice (1)	Other common crops (2)	Special crops (3)	Fruits (4)	Vegetables (5)	Livestock (6)	Total production (7)=(1)~(6)	Agricultural intermediate products (8)	Total output (9)=(7)-(8)	Current input (10)	Gross value added (11)=(9)-(10)
1932	134.9	22.1	73.4	10.6	10.2	36.4	287.6	22.6	265.0	39.0	226.0
1933	125.0	22.4	38.2	10.8	10.3	39.6	246.3	21.2	225.1	46.1	179.0
1934	165.2	24.1	44.8	12.6	11.5	44.4	302.6	23.7	278.9	52.8	226.1
1935	197.3	28.3	70.2	12.5	13.5	51.2	373.0	28.7	344.3	62.4	281.9
1936	213.9	31.3	70.8	14.1	14.0	57.8	401.9	30.2	371.7	73.5	298.2
1937	208.8	29.7	86.2	15.0	14.6	62.2	416.5	30.8	385.7	74.5	311.2
1938	237.9	33.0	100.3	18.7	15.7	71.1	476.7	35.9	440.8	81.2	359.6
1939	241.7	38.2	155.3	24.2	19.6	91.7	570.7	46.6	524.1	93.6	430.5
1940	213.4	49.9	138.7	32.4	24.4	108.1	566.9	45.0	521.9	102.2	419.7
1941	246.5	45.0	129.8	36.8	30.6	119.6	608.3	37.7	570.6	100.7	469.9
1942	248.0	46.2	169.7	32.5	36.5	138.1	671.0	41.2	629.8	88.9	540.9
1943	256.7	46.0	164.5	25.0	36.5	130.2	658.9	44.7	614.2	80.5	533.7
1944	319.3	65.5	156.1	32.9	65.9	84.8	724.5	51.4	673.1	67.9	605.2
1945	470.3	77.6	86.1	19.4	62.9	147.2	863.5	67.9	795.6	68.7	726.9
1946	28,040.3	3,898.8	1,134.1	779.1	1,403.1	3,336.2	38,591.6	2,100.3	36,491.3	1,582.8	34,908.5
1947	64,925.9	23,879.4	20,010.6	7,505.5	7,523.3	23,666.0	147,510.7	17,049.1	130,461.6	22,432.0	108,029.6
1948	551,126.5	350,938.7	139,435.4	59,460.8	61,179.7	93,229.1	1,255,370.2	141,175.8	1,114,194.4	114,490.5	999,703.9
1949	626.0	191.3	370.0	66.3	103.1	262.5	1,619.2	140.2	1,479.0	181.7	1,297.3
1950	1,255.1	298.1	523.6	128.1	169.1	582.2	2,956.2	214.2	2,742.0	449.7	2,292.3
1951	1,507.7	417.8	787.0	197.4	226.1	917.6	4,053.6	379.5	3,674.1	477.5	3,196.6
1952	2,932.9	663.3	983.6	176.5	239.3	1,124.9	6,120.5	530.7	5,589.8	823.1	4,766.7
1953	4,582.2	797.6	1,683.0	177.5	277.1	1,605.1	9,122.5	769.4	8,353.1	1,349.6	7,003.5

Table 2. (Continued)

Year	Rice (1)	Other common crops (2)	Special crops (3)	Fruits (4)	Vegetables (5)	Livestock (6)	Total production (7)=(1)~(6)	Agricultural intermediate products (8)	Total output (9)=(7)-(8)	Current input (10)	Gross value added (11)=(9)-(10)
1954	3,531.4	861.6	1,169.6	192.3	320.8	1,800.0	7,875.7	579.9	7,295.8	1,542.1	5,753.7
1955	4,357.2	1,106.3	1,623.2	252.2	386.7	2,264.7	9,990.3	783.1	9,207.2	1,588.3	7,618.9
1956	4,786.0	1,331.4	1,782.4	271.6	431.5	2,552.8	11,155.7	909.7	10,246.0	1,950.9	8,295.1
1957	5,447.1	1,477.6	2,188.7	372.6	474.4	3,095.2	13,055.6	999.9	12,055.7	2,174.7	9,881.0
1958	5,679.8	1,803.6	2,336.6	475.6	699.8	3,481.1	14,476.5	1,165.5	13,311.0	2,489.4	10,821.6
1959	6,021.5	1,958.2	2,800.8	578.9	767.9	4,442.2	16,569.5	1,184.1	15,385.4	2,447.5	12,937.9
1960	9,394.1	2,603.8	2,863.7	698.8	930.8	5,328.7	21,819.9	1,646.2	20,173.7	3,664.1	16,509.6
1961	10,278.8	2,848.7	3,471.7	754.2	984.4	6,044.5	24,382.3	1,783.2	22,599.1	4,547.4	18,051.7
1962	9,984.5	2,825.3	3,327.2	912.7	1,099.0	6,581.3	24,730.0	1,799.8	22,930.2	4,524.7	18,405.5
1963	10,362.2	2,288.1	3,707.3	1,114.8	1,580.3	6,881.7	25,934.4	1,854.7	24,079.7	4,959.8	19,119.9
1964	11,264.8	3,385.9	5,746.3	1,856.6	1,464.7	7,378.4	31,096.7	2,301.4	28,795.3	5,480.6	23,314.7
1965	11,845.2	3,258.9	4,408.8	2,746.1	1,961.9	7,935.8	32,156.7	2,183.2	29,973.5	5,791.0	24,182.5
1966	12,469.7	3,657.0	4,067.8	2,956.9	2,249.2	8,568.9	33,969.5	2,469.2	31,500.3	6,418.8	25,081.5
1967	13,273.1	4,270.4	4,096.5	3,345.0	2,579.0	9,644.9	37,208.9	2,825.9	34,383.0	7,344.2	27,038.8
1968	14,104.7	4,065.9	4,253.0	3,599.2	3,376.4	11,231.2	40,630.4	2,832.1	37,748.3	9,185.5	28,562.8
1969	12,582.5	4,233.1	4,224.9	3,376.8	3,725.0	11,335.4	39,477.7	3,002.6	36,475.1	9,296.3	27,178.8
1970	13,681.0	3,914.9	4,345.5	3,587.5	4,837.1	12,822.4	43,218.4	2,992.4	40,226.0	10,208.6	30,017.4
1971	12,894.4	3,890.3	4,496.2	3,838.8	4,920.6	14,246.4	44,286.7	2,963.0	41,323.7	9,378.0	31,945.7
1972	14,524.5	4,123.3	4,771.9	3,834.1	5,692.3	15,857.7	48,803.8	3,090.0	45,713.8	13,277.5	32,436.3

Table 3. Value of agricultural production, output and gross value added at 1935-37 constant farm prices

Unit: million T$

Year	Rice (1)	Other common crops (2)	Special crops (3)	Fruits (4)	Vegetables (5)	Livestock (6)	Total production (7)=(1)~(6)	Agricultural intermediate products (8)	Total output (9)=(7)-(8)	Gross value added ratio (10) (%)	Gross value added (11)=(9)×(10)
1911	99.7	14.0	34.0	2.5	5.6	24.2	180.0	16.8	163.2	95.04	155.1
1912	89.9	13.6	26.1	2.2	5.7	25.4	162.9	16.0	146.9	93.10	136.8
1913	113.8	17.0	19.9	1.9	5.9	26.4	184.9	15.8	169.1	93.58	158.2
1914	102.3	16.8	24.5	2.1	6.1	26.6	178.4	16.6	161.8	91.86	148.6
1915	106.3	17.0	31.7	2.4	6.1	27.9	191.4	17.2	174.2	88.71	154.5
1916	103.2	15.5	40.2	3.1	6.2	30.4	198.6	17.9	180.7	87.92	158.9
1917	107.4	15.5	52.8	3.2	6.4	30.8	216.1	19.1	197.0	87.87	173.1
1918	102.9	17.0	45.9	4.0	6.5	30.0	206.3	18.4	187.9	89.72	168.6
1919	109.3	19.5	40.3	2.1	6.6	31.8	209.6	18.0	191.6	88.83	170.2
1920	107.5	16.3	30.1	3.0	6.8	31.6	195.3	17.5	177.8	84.41	150.1
1921	110.5	17.0	34.1	4.0	7.1	32.4	205.1	17.6	187.5	86.19	161.6
1922	120.9	18.0	42.5	4.7	7.4	32.3	225.8	18.8	207.0	83.96	173.8
1923	108.1	18.4	43.0	7.4	7.6	33.1	217.6	18.1	199.5	83.40	166.4
1924	135.0	20.4	48.1	8.4	7.9	34.7	254.5	18.9	235.6	84.09	198.1
1925	143.1	20.7	52.1	8.4	8.2	35.6	268.1	20.8	247.3	83.21	205.8
1926	138.0	20.8	51.3	8.4	8.8	36.3	263.6	21.7	241.9	80.93	195.8
1927	153.2	22.6	46.2	8.3	9.1	39.2	278.6	23.0	255.6	79.47	203.2
1928	150.9	22.9	55.9	8.4	9.6	41.5	289.2	24.6	264.6	75.33	199.3
1929	143.9	20.8	66.3	8.9	10.0	41.4	291.3	25.6	265.7	78.33	208.1
1930	163.7	21.1	63.7	9.9	10.7	41.2	310.3	25.9	284.4	80.06	227.7
1931	166.1	25.5	60.2	10.5	11.4	45.6	319.3	26.4	292.9	79.61	233.1

Table 3. (continued)

Year	Rice (1)	Other common crops (2)	Special crops (3)	Fruits (4)	Vegetables (5)	Livestock (6)	Total production (7)=(1)~(6)	Agricultural intermediate products (8)	Total output (9)=(7)-(8)	Gross value added ratio (10) (%)	Gross value added (11)=(9)×(10)
1932	198.7	25.4	70.4	12.3	12.4	46.8	366.0	25.1	340.9	85.27	290.7
1933	185.7	24.7	51.2	12.1	12.7	46.4	332.8	26.5	306.3	79.53	243.6
1934	201.8	27.2	54.5	13.3	13.2	51.0	361.0	28.1	332.9	81.05	269.9
1935	202.6	28.4	74.5	12.8	14.0	54.6	386.9	29.3	357.6	81.89	292.8
1936	212.3	30.0	73.2	14.8	14.3	57.1	401.7	29.8	371.9	80.23	298.4
1937	205.0	30.8	80.5	14.3	13.8	59.3	403.7	30.6	373.1	80.69	301.1
1938	218.0	30.3	84.4	14.9	13.6	61.3	422.5	31.7	390.8	81.56	318.7
1939	203.2	23.6	114.2	14.4	12.5	57.4	425.3	33.1	392.2	82.15	322.2
1940	175.5	27.0	92.9	13.6	12.3	50.7	372.0	29.9	342.1	80.42	275.2
1941	186.4	30.2	81.9	14.0	11.6	44.6	368.7	26.7	342.0	82.35	281.6
1942	182.1	27.5	96.1	14.0	12.5	44.4	376.6	25.7	350.9	85.88	301.4
1943	175.0	24.1	90.1	10.7	10.9	45.7	356.5	26.9	329.6	86.89	286.4
1944	166.1	26.9	73.8	6.0	10.4	26.4	309.6	23.8	285.8	89.91	257.0
1945	99.3	19.6	35.1	3.8	9.7	25.8	193.3	19.7	173.6	91.36	158.6
1946	139.0	24.6	17.0	4.6	11.4	24.6	221.2	13.0	208.2	95.66	199.2
1947	155.3	34.0	23.6	10.1	16.5	29.4	268.9	21.5	247.4	82.81	204.9
1948	166.1	39.3	45.3	9.8	15.9	33.8	310.2	27.6	282.6	89.72	253.6
1949	188.8	40.4	70.3	8.7	17.0	35.4	360.6	30.4	330.2	87.71	289.6
1950	221.0	43.0	66.6	9.3	18.6	45.9	404.4	32.1	372.3	83.60	311.3
1951	230.8	40.2	57.9	9.1	19.5	57.2	414.7	36.7	378.0	87.00	328.9
1952	244.1	42.9	70.2	9.1	19.7	61.3	447.3	37.5	409.8	85.27	349.4
1953	255.2	45.6	92.6	8.8	19.8	76.1	498.1	40.2	457.9	83.84	383.9

Table 3. (Continued)

Year	Rice (1)	Other common crops (2)	Special crops (3)	Fruits (4)	Vegetables (5)	Livestock (6)	Total production (7)=(1)~(6)	Agricultural intermediate products (8)	Total output (9)=(7)-(8)	Gross value added ratio (10) (%)	Gross value added (11)=(9)×(10)
1954	263.5	51.2	79.9	8.5	20.4	78.6	502.1	38.4	463.7	78.86	365.7
1955	251.0	51.2	81.8	9.6	21.1	81.5	496.2	39.8	456.4	82.75	377.7
1956	278.2	54.8	88.2	9.3	22.7	87.0	540.2	42.9	497.3	80.96	402.6
1957	285.9	58.3	99.9	11.4	23.7	95.9	575.1	43.8	531.3	81.96	435.5
1958	294.5	65.2	105.8	13.8	24.8	108.5	612.6	48.5	564.1	81.30	458.6
1959	288.6	65.6	111.2	14.2	24.9	108.2	612.7	45.8	566.9	84.09	476.7
1960	297.2	68.6	102.0	16.3	27.3	104.7	616.1	46.1	570.0	81.84	466.5
1961	313.4	74.3	114.9	17.7	28.3	115.4	664.0	49.0	615.0	79.88	491.3
1962	328.5	72.6	102.7	19.7	28.4	121.2	673.1	49.8	623.3	80.27	500.3
1963	327.8	54.2	108.5	19.8	44.4	119.8	674.5	48.1	626,4	79.40	497.4
1964	349.2	76.2	113.9	29.5	44.8	131.2	744.8	54.1	690.7	80.97	559.2
1965	365.0	74.0	135.5	38.5	49.1	145.5	807.6	55.0	752.6	80.68	607.2
1966	369.9	81.2	119.9	44.2	58.3	160.6	834.1	60.2	773.9	79.62	616.2
1967	375.2	88.9	110.1	53.5	62.4	181.0	871.1	63.5	807.6	78.64	635.1
1968	391.4	82.0	119.2	58.9	74.1	193.9	919.5	63.6	855.9	75.67	647.7
1969	360.9	82.0	113.4	55.6	85.9	208.6	906.4	65.0	841.4	74.51	626.9
1970	382.8	80.0	108.5	52.3	102.3	229.4	955.3	66.3	889.0	74.62	663.4
1971	359.7	78.2	111.7	70.5	115.4	236.8	972.3	64.6	907.7	77.31	701.8
1972	379.3	73.7	104.6	69.2	119.2	261.9	1,007.9	60.7	947.2	70.96	672.1

Table 4. Agricultural inputs at 1935-37 constant prices

Year	Labor		Land(1,000 ha.)		Fixed capital (million T$)					Current inputs (million T$)			
	Worker (1,000 workers)	Working day(mil. days)	Crop area	Cultivated area	Livestock	Plants	Machinery and implements	Farm building	Total	Fertilizer	Feed	Others	Total
1911	1,106.1	138.9	821.1	687.2	18.0	37.3	0.2	9.6	65.1	2.4	3.9	2.2	8.5
1912	1,137.6	137.1	822.1	689.9	17.0	39.1	0.3	10.0	66.4	3.8	4.5	2.3	10.6
1913	1,170.0	136.4	835.9	691.0	16.4	40.7	0.3	10.4	67.8	4.2	4.7	2.1	11.0
1914	1,194.0	140.0	853.2	693.2	16.0	42.0	0.3	10.9	69.2	4.4	5.3	2.5	12.2
1915	1,165.4	142.6	852.1	700.1	15.8	42.9	0.4	13.5	72.6	7.5	5.4	3.0	15.9
1916	1,131.5	149.8	863.6	716.2	15.2	51.3	0.5	22.3	89.3	7.9	6.3	2.6	16.8
1917	1,124.6	152.5	872.8	720.6	15.0	53.7	0.5	24.4	93.6	8.2	7.0	2.4	17.6
1918	1,113.9	160.9	923.4	732.3	15.5	54.7	0.5	25.6	96.3	7.6	6.7	2.0	16.3
1919	1,111.6	154.9	913.2	737.9	16.4	55.1	0.5	26.8	98.8	9.3	7.9	2.0	19.2
1920	1,137.0	150.9	876.7	749.4	17.4	47.7	0.7	29.5	95.3	11.0	8.3	3.2	22.5
1921	1,107.8	155.1	894.0	752.8	16.9	48.5	2.2	35.8	103.4	9.8	7.3	8.3	25.4
1922	1,115.8	162.6	932.1	750.5	16.0	51.4	5.2	58.5	131.1	10.8	8.2	8.2	27.2
1923	1,126.0	157.0	916.7	752,1	15.7	61.0	7.5	62.1	146.3	12.5	8.1	8.6	29.2
1924	1,129.4	163.0	949.2	761.8	15.3	61.6	9.9	71.6	158.4	15.5	10.9	7.7	34.1
1925	1,152.3	167.8	975.1	775.5	15.4	61.7	11.6	96.6	185.3	17.9	13.2	11.1	42.2
1926	1,161.4	169.9	987.7	790.0	16.6	61.7	15.5	96.9	190.7	18.8	13.1	15.3	47.2
1927	1,173.9	166.5	979.6	797.2	17.0	61.4	22.7	112.1	213.2	20.4	14.9	16.2	51.5
1928	1,188.5	170.9	988.5	806.8	17.6	63.9	24.5	114.5	220.5	23.0	14.9	28.2	66.1
1929	1,202.7	170.1	981.7	805.0	17.7	65.3	25.5	114.5	223.0	22.6	16.7	20.9	60.2
1930	1,212.1	175.2	1,021.3	812.1	18.0	65.9	30.9	143.4	258.2	23.4	17.5	18.0	58.9
1931	1,243.0	174.9	1,038.1	810.3	17.8	65.9	31.6	149.6	264.9	26.2	17.8	16.7	60.7
1932	1,272.0	182.3	1,088.4	814.5	17.6	68.5	29.1	151.4	266.6	24.8	18.7	10.9	54.4

Table 4. (continued)

Year	Labor		Land(1,000 ha.)		Fixed capital (million T$)					Current inputs (million T$)			
	Worker (1,000 workers)	Working day(mil. days)	Crop area	Cultivated area	Livestock	Plants	Machinery and implements	Farm building	Total	Fertilizer	Feed	Others	Total
1933	1,298.2	178.4	1,083.9	820.0	18.2	68.2	31.2	153.6	271.2	28.2	19.5	11.6	59.3
1934	1,325.1	181.9	1,092.8	825.7	18.1	70.2	32.3	156.1	276.7	32.0	21.8	11.6	65.4
1935	1,291.8	193.3	1,141.4	831.0	17.9	71.7	28.7	162.2	280.5	37.2	19.4	12.3	68.9
1936	1,325.0	196.8	1,155.4	846.0	17.1	73.3	27.4	168.0	285.8	38.6	23.5	10.2	72.3
1937	1,353.7	190.7	1,128.4	856.7	16.8	74.7	27.1	176.7	295.3	40.6	19.4	9.3	69.3
1938	1,382.5	190.5	1,109.1	857.8	15.5	75.0	28.9	171.6	291.0	41.5	18.1	8.5	68.1
1939	1,409.6	199.7	1,148.8	859.6	15.4	76.6	29.2	166.7	287.9	43.0	16.5	9.0	68.5
1940	1,399.8	202.6	1,176.2	860.4	13.3	77.9	31.3	155.6	278.1	48.8	12.1	10.2	71.1
1941	1,283.2	199.2	1,186.2	859.4	13.0	80.0	32.7	157.1	282.8	39.7	11.0	10.2	60.9
1942	1,282.9	198.3	1,154.8	854.5	13.9	76.8	34.1	156.6	281.4	29.5	11.1	10.6	51.2
1943	1,231.7	196.5	1,127.8	847.0	14.2	67.4	33.3	152.0	266.9	30.8	7.8	8.4	47.0
1944	998.9	188.3	1,119.5	808.2	13.1	58.4	25.6	145.4	242.5	14.6	4.3	6.8	25.7
1945	1,068.5	152.1	913.0	816.0	10.6	50.5	22.1	144.3	227.5	5.8	2.6	2.0	10.4
1946	1,285.3	143.0	980.7	832.0	11.7	51.2	23.6	136.3	222.8	1.8	4.3	2.8	8.9
1947	1,336.0	165.6	1,193.6	834.0	13.6	61.6	25.2	128.3	228.7	8.0	7.7	3.6	19.3
1948	1,373.4	198.5	1,346.2	863.2	14.3	65.5	26.7	138.1	244.6	7.8	8.1	3.7	19.6
1949	1,412.7	221.3	1,437.9	864.9	15.5	66.4	29.6	147.8	259.3	13.3	9.1	7.4	29.8
1950	1,413.9	225.4	1,483.5	870.6	15.8	70.6	32.5	157.5	276.4	26.2	11.8	7.8	45.8
1951	1,418.9	229.0	1,483.4	873.9	18.1	76.4	35.4	163.9	293.8	30.3	9.4	6.6	46.3
1952	1,433.6	241.9	1,506.4	876.1	19.1	76.7	36.9	170.2	302.9	38.7	10.2	6.8	55.7

Table 4. (Continued)

Year	Labor		Land(1,000 ha.)		Fixed capital (million T$)					Current inputs (million T$)			
	Worker (1,000 workers)	Working day(mil. days)	Crop area	Cultivated area	Livestock	Plants	Machinery and Implements	Farm building	Total	Fertilizer	Feed	Others	Total
1953	1,471.2	246.6	1,505.9	872.7	19.3	75.3	37.9	171.3	303.8	43.3	13.6	7.2	64.1
1954	1,493.4	246.1	1,519.0	874.1	18.6	77.5	38.5	175.8	310.4	51.1	16.8	10.3	78.2
1955	1,488.6	242.8	1,495.7	873.0	18.8	80.5	40.7	178.7	318.7	49.3	17.0	9.5	75.8
1956	1,478.6	251.7	1,537.6	875.8	20.2	82.9	43.1	181.5	327.7	54.8	19.5	10.1	84.4
1957	1,439.0	268.6	1,563.5	873.3	20.7	88.1	45.3	184.3	338.4	58.4	17.8	11.2	87.4
1958	1,454.3	275.5	1,590.9	883.5	19.8	92.7	45.6	183.3	341.4	62.2	21.0	12.8	96.0
1959	1,469.1	274.7	1,594.1	877.7	19.5	92.6	54.1	183.6	349.8	62.2	19.3	13.3	94.8
1960	1,464.4	269.7	1,596.0	869.2	19.7	94.3	56.6	183.8	354.4	54.3	24.2	16.0	94.5
1961	1,473.5	267.0	1,620.6	871.8	19.2	100.1	59.3	186.3	364.9	61.5	26.2	18.3	106.0
1962	1,480.4	267.8	1,613.5	871.9	17.8	93.9	68.6	189.6	369.9	64.1	25.2	23.5	112.8
1963	1,496.4	275.0	1,612.1	872.2	16.7	100.2	74.2	198.2	389.3	67.0	28.6	26.2	121.8
1964	1,506.4	283.0	1,657.7	882.2	16.7	111.6	79.2	201.1	408.6	76.5	28.6	28.7	133.8
1965	1,520.0	300.7	1,686.0	889.6	17.4	128.6	82.1	208.2	436.3	67.9	38.7	33.1	139.7
1966	1,536.0	307.5	1,703.2	896.3	17.3	125.3	100.5	218.4	461.5	75.9	38.5	36.8	151.2
1967	1,562.1	303.7	1,690.8	902.4	15.8	132.7	111.0	224.2	483.7	81.8	49.3	41.5	172.6
1968	1,561.7	304.7	1,694.5	899.9	15.8	140.8	125.7	231.3	513.6	89.6	91.6	41.2	222.4
1969	1,553.8	298.6	1,685.7	914.9	15.4	146.7	135.9	242.3	540.3	85.0	104.9	45.8	235.7
1970	1,520.0	295.5	1,652.9	905.3	14.1	153.1	154.2	245.5	566.9	80.4	127.2	47.9	255.5
1971	1,494.4	299.0	1,620.4	902.6	15.0	165.8	161.6	250.8	593.2	84.0	125.1	53.2	262.3
1972	1,448.1	288.1	1,574.6	898.6	17.9	173.3	176.1	276.6	643.9	89.7	237.6	55.6	382.9

Table 5. Crop yields per hectare of hervested area Unit: 100 kg/ha.

Year	Rice	Sweet potato	Peanut	Soybean	Sugarcane	Tea	Tobacco	Banana	Pineapple	Citrus	Vegetables
1911	13	65	5	5	324	5	12	138	78	41	85
1912	12	61	5	4	247	4	12	49	75	24	73
1913	15	70	6	5	138	4	13	85	82	37	83
1914	13	72	5	5	210	4	14	85	82	30	79
1915	14	74	6	6	274	4	13	96	87	34	85
1916	14	67	6	6	302	4	16	106	91	42	87
1917	15	68	6	5	399	4	10	101	86	37	92
1918	14	70	7	6	279	4	13	104	91	37	89
1919	14	83	7	5	289	4	14	86	85	31	85
1920	14	74	6	5	250	3	12	92	71	32	91
1921	14	74	7	6	255	3	15	87	71	42	89
1922	15	79	8	5	294	3	14	91	75	40	93
1923	14	81	7	5	352	3	16	90	73	58	96
1924	16	93	8	6	391	3	14	96	60	48	95
1925	17	93	9	6	419	3	13	94	67	52	101
1926	16	93	9	6	430	3	14	100	72	50	100
1927	17	102	9	6	460	3	15	93	75	57	99
1928	17	105	9	5	553	3	17	93	121	68	100
1929	16	96	8	5	633	3	17	81	126	67	98
1930	17	106	9	6	657	2	18	110	136	65	101
1931	17	112	9	6	683	2	17	116	142	66	102

Table 5. (continued)

Year	Rice	Sweet potato	Peanut	Soybean	Sugarcane	Tea	Tobacco	Banana	Pineapple	Citrus	Vegetables
1932	19	110	9	6	758	2	18	101	129	67	104
1933	18	106	8	6	646	2	20	94	135	75	102
1934	19	113	9	6	603	3	23	98	128	76	101
1935	19	118	10	5	685	3	20	97	128	71	104
1936	20	123	10	6	636	3	18	93	143	74	102
1937	20	127	10	6	709	3	18	103	126	67	98
1938	22	128	9	7	696	3	18	97	121	79	102
1939	21	101	9	6	790	3	19	93	140	74	97
1940	17	114	9	6	590	3	19	91	130	60	93
1941	18	119	9	6	534	3	19	88	128	71	90
1942	19	103	7	5	655	3	18	97	134	61	91
1943	18	87	6	5	645	2	18	88	128	54	85
1944	18	92	6	7	567	1	15	46	79	42	83
1945	11	87	5	3	386	1	5	57	51	47	86
1946	16	76	7	5	278	1	3	52	55	54	85
1947	15	84	7	13	266	2	7	81	71	54	79
1948	15	89	7	6	366	3	9	62	73	64	82
1949	16	92	7	6	506	3	10	61	88	57	79
1950	18	94	7	6	481	3	12	80	92	61	80
1951	19	87	7	6	452	3	14	68	92	56	78
1952	20	90	7	6	490	3	16	68	107	60	80

Table 5. (continued)

Year	Rice	Sweet potato	Peanut	Soybean	Sugarcane	Tea	Tobacco	Banana	Pineapple	Citrus	Vegetables
1953	21	96	7	6	741	3	18	76	121	62	81
1954	22	103	7	7	660	3	17	79	119	57	80
1955	22	99	7	7	781	3	19	79	124	58	81
1956	23	112	8	7	698	3	18	61	129	61	82
1957	23	118	9	8	721	3	19	82	138	63	84
1958	24	129	9	9	741	4	19	80	163	60	85
1959	24	128	10	8	816	4	20	81	164	58	85
1960	25	126	10	9	705	4	20	90	171	65	88
1961	26	137	11	9	791	4	21	88	178	61	90
1962	27	132	10	10	657	5	21	91	183	66	89
1963	28	95	10	10	691	6	20	90	171	70	90
1964	29	136	11	11	710	5	22	148	216	77	96
1965	30	134	12	12	857	10	20	165	208	78	89
1966	30	147	12	12	844	6	20	145	225	86	85
1967	31	157	14	14	748	7	18	147	250	88	92
1968	32	143	11	15	862	7	19	147	263	92	102
1969	30	159	11	15	751	8	17	156	261	83	110
1970	32	150	14	15	695	8	19	118	265	95	119
1971	32	151	11	15	888	8	19	156	274	104	120
1972	33	139	12	17	785	8	21	161	255	112	115

Table 6. Planted area of major crops

Unit: 1,000 ha.

Year	Rice	Other common crops		Special crops				Fruits	Vegetables	Total crop area	Cultivated land area
		Sub-total	Sweet potato	Sub-total	Sugarcane	Tea	Peanut				
1911	478.8	154.3	104.9	161.9	87.4	32.4	18.1	6.2	19.9	821.1	687.2
1912	481.2	157.3	110.2	153.3	76.9	34.0	18.0	6.8	23.5	822.1	689.9
1913	494.3	169.1	116.8	144.1	66.7	35.8	18.8	6.9	21.5	835.9	691.0
1914	499.7	168.4	113.9	155.0	75.5	36.7	19.3	7.0	23.1	853.2	693.2
1915	491.1	164.3	110.1	167.1	86.3	37.6	20.4	7.8	21.8	852.1	700.1
1916	471.7	159.3	107.5	202.1	113.8	43.0	20.9	8.8	21.7	863.6	716.2
1917	466.2	158.4	107.5	218.1	127.5	45.2	21.6	9.1	21.0	872.8	720.6
1918	483.3	168.2	115.8	239.8	146.8	45.5	23.6	10.0	22.1	923.4	732.3
1919	497.2	172.4	119.9	210.9	116.8	46.4	24.7	9.2	23.5	913.2	737.9
1920	500.2	157.7	112.8	185.7	105.1	37.8	22.8	10.3	22.8	876.7	749.4
1921	495.4	164.5	120.7	196.7	116.3	38.1	23.6	13.3	24.1	894.0	752.8
1922	511.2	162.2	120.2	217.7	137.8	38.5	23.8	17.1	23.9	932.1	750.5
1923	507.8	161.7	121.8	199.6	113.1	44.8	24.3	23.6	24.0	916.7	752.1
1924	531.5	157.2	121.1	207.3	119.5	45.8	25.3	28.2	25.0	949.2	761.8
1925	550.8	157.6	122.9	214.8	126.5	46.2	25.3	27.0	24.9	975.1	775.5
1926	567.2	157.8	124.5	209.1	120.2	45.9	26.3	26.8	26.8	987.7	790.0
1927	585.0	156.8	124.8	184.4	96.7	45.1	26.3	25.3	28.1	979.6	797.2
1928	584.9	153.2	122.8	193.8	105.0	45.2	26.2	27.3	29.3	988.5	806.8
1929	567.9	150.1	123.5	205.1	116.4	46.0	25.7	27.5	31.1	981.7	805.0
1930	614.4	152.6	125.2	195.7	106.1	45.7	26.7	26.3	32.3	1,021.3	812.1
1931	633.7	157.3	129.2	184.7	96.1	44.6	27.2	28.3	34.1	1,038.1	810.3
1932	664.3	159.1	130.7	196.1	106.2	44.2	28.4	32.5	36.4	1,088.4	814.5

Table 6. (continued)

Year	Rice	Other common crops		Special crops				Fruits	Vegetables	Total crop area	Cultivated land area
		Sub-total	Sweet potato	Sub-total	Sugarcane	Tea	Peanut				
1933	675.5	161.9	133.9	173.9	81.8	43.9	29.8	35.3	37.3	1,083.9	820.0
1934	667.0	166.0	138.2	184.4	88.4	44.4	30.8	36.0	39.4	1,092.8	825.7
1935	678.7	167.0	138.2	217.4	118.0	44.7	30.5	37.7	40.6	1,141.4	831.0
1936	681.6	168.0	140.1	222.5	124.5	44.7	30.7	40.8	42.5	1,155.4	846.0
1937	657.7	162.2	139.0	224.3	120.8	44.5	31.5	41.7	42.5	1,128.4	856.7
1938	625.4	161.6	134.6	239.4	130.2	44.5	31.1	42.0	40.7	1,109.1	857.8
1939	626.1	155.4	126.4	286.7	162.4	44.8	29.3	41.4	39.2	1,148.8	859.6
1940	638.6	162.5	132.5	294.5	169.0	45.6	30.6	40.2	40.4	1,176.2	860.4
1941	646.9	181.3	142.2	274.9	157.2	44.8	24.8	43.9	39.2	1,186.2	859.4
1942	616.5	188.0	151.6	266.8	156.4	42.8	18.7	41.0	42.5	1,154.8	854.5
1943	610.0	190.3	161.0	253.8	156.5	39.6	17.2	34.3	39.4	1,127.8	847.0
1944	600.7	199.4	165.6	250.4	149.5	35.1	20.6	29.9	39.1	1,119.5	808.2
1945	510.8	161.4	134.7	186.9	107.7	34.3	24.6	18.6	35.3	913.0	816.0
1946	564.0	212.2	176.0	141.5	36.2	35.5	50.8	22.7	40.3	980.7	832.0
1947	677.6	258.5	213.4	163.7	29.9	39.4	65.1	31.6	62.2	1,193.6	834.0
1948	717.7	287.4	224.2	246.7	85.2	40.2	73.4	34.7	59.7	1,346.2	863.2
1949	747.7	301.6	236.2	288.0	122.4	40.8	77.1	32.4	68.2	1,437.9	864.9
1950	770.3	308.2	233.1	299.4	121.9	42.0	83.4	31.3	74.3	1,483.5	870.6
1951	789.1	307.5	231.4	276.4	79.2	42.7	84.9	31.8	78.6	1,483.4	873.9
1952	785.7	314.7	233.5	296.3	98.0	44.1	81.0	32.4	77.3	1,506.4	876.1
1953	778.4	319.8	237.8	301.9	113.2	44.7	82.6	28.6	77.2	1,505.9	872.7
1954	776.7	337.1	247.6	298.1	95.7	46.2	94.0	28.1	79.0	1,519.0	874.1

Table 6. (continued)

Year	Rice	Other common crops		Special crops				Fruits	Vegetables	Total crop area	Cultivated land area
		Sub-total	Sweet potato	Sub-total	Sugarcane	Tea	peanut				
1955	750.7	349.3	245.5	286.7	77.9	47.0	96.0	28.5	80.5	1,495.7	873.0
1956	783.6	336.6	230.2	307.1	90.9	47.6	98.3	28.4	81.9	1,537.6	875.8
1957	783.3	343.4	228.8	321.0	98.2	48.0	103.6	31.6	84.2	1.563.5	873.3
1958	778.2	355.9	228.7	333.1	101.5	48.3	104.0	36.4	87.3	1,590.9	883.5
1959	776.1	361.9	226.5	331.2	99.2	48.4	99.1	36.6	88.3	1,594.1	877.7
1960	766.4	372.9	235.4	327.3	95.5	48.4	100.5	37.8	91.6	1,596.0	869.2
1961	782.5	372.5	235.8	333.9	100.2	47.6	98.6	41.1	90.6	1,620.6	871.8
1962	794.2	364.7	233.7	316.6	93.5	37.8	96.3	43.7	94.3	1,613.5	871.9
1963	749.2	364.7	235.7	329.5	95.0	38.4	97.7	66.2	102.5	1,612.1	872.2
1964	765.0	367.1	246.2	341.4	97.8	38.2	100.9	82.5	101.7	1,657.7	882.2
1965	772.9	353.1	234.1	356.3	111.9	37.6	103.6	94.0	109.7	1,686.0	889.6
1966	778.6	372.3	235.6	331.0	107.0	37.4	98.2	107.2	114.1	1,703.2	896.3
1967	787.1	364.2	236.8	310.0	91.0	37.1	97.9	113.5	116.0	1,690.8	902.4
1968	789.9	358.6	240.4	309.2	96.8	36.1	95.4	117.1	119.7	1,694.5	899.9
1969	786.6	341.7	233.8	303.6	94.3	35.7	91.5	119.4	134.4	1,685.7	914.9
1970	776.1	332.9	228.7	281.6	87.5	34.4	87.5	119.9	142.4	1,652.9	905.3
1971	753.5	325.6	225.5	275.8	90.5	34.3	86.5	117.6	147.9	1,620.4	902.6
1972	741.6	312.9	210.7	260.9	91.3	33.5	76.3	109.6	149.6	1,574.6	898.6

Table 7. Percentage composition of agricultural production by commodity groups at current prices (five-year averages)

Years	Rice	Other common crops	Special crops	Fruits	Vegetables	Livestock
1911—15	49.4	8.5	15.8	2.3	4.9	19.1
1916—20	46.6	9.8	19.2	2.5	4.8	17.1
1921—25	45.2	8.6	21.0	4.1	4.7	16.4
1926—30	43.9	8.2	24.3	3.9	4.2	15.5
1931—35	48.8	7.9	20.8	4.0	3.9	14.6
1936—40	46.6	7.5	22.2	4.2	3.6	15.9
1941—45	43.0	7.9	20.6	4.3	6.5	17.7
1946—50	48.3	15.2	13.6	4.1	5.2	13.6
1951—55	44.8	10.4	17.0	2.9	4.1	20.8
1956—60	40.6	11.9	15.8	3.1	4.2	24.4
1961—65	39.1	10.6	14.8	5.1	5.1	25.3
1966—70	34.1	10.4	10.9	8.7	8.5	27.4
1968—72	31.4	9.4	10.2	8.5	10.4	30.1

Table 8. Percentage composition of agricultural production by commodity groups at 1935-37 constant prices (five-year averages)

Years	Rice	Other common crops	Special crops	Fruits	Vegetables	Livestock
1911—15	57.0	8.7	15.2	1.2	3.3	14.6
1916—20	51.7	8.2	20.3	1.5	3.2	15.1
1921—25	52.7	8.1	18.7	2.8	3.3	14.4
1926—30	52.3	7.6	19.7	3.1	3.4	13.9
1931—35	54.1	7.4	17.6	3.4	3.6	13.9
1936—40	50.0	7.0	22.0	3.6	3.3	14.1
1941—45	50.6	8.2	23.0	2.9	3.6	11.7
1946—50	56.2	11.7	13.4	2.8	5.1	10.8
1951—55	52.9	9.8	16.1	1.9	4.3	15.0
1956—60	48.9	10.6	17.1	2.2	4.2	17.0
1961—65	47.3	9.9	16.1	3.5	5.4	17.8
1966—70	42.0	9.3	12.8	5.9	8.4	21.6
1968—72	39.4	8.3	11.8	6.4	10.4	23.7

Table 9a. Factor shares in total cost of agricultural production, five-year averages (including current input) (%)

Years	Current input	Land	Labor	Fixed Capital
1911—15	7.01	34.03	54.89	4.07
1916—20	10.31	36.19	49.88	3.62
1921—25	15.68	35.12	44.23	4.97
1926—30	18.31	35.62	39.83	6.24
1931—35	17.61	35.06	40.51	6.82
1936—40	19.70	39.16	34.28	6.86
1941—45	12.05	29.21	51.32	7.42
1946—50	15.42	43.45	32.87	8.26
1951—55	19.21	25.67	46.75	8.37
1956—60	19.94	32.84	40.64	6.58
1961—65	23.00	30.35	39.97	6.68
1966—70	23.22	31.12	39.15	6.51
1968—72	22.52	29.45	41.71	6.32

Table 9b. Factor shares in total cost of agricultural production, five-year averages (excluding current input) (%)

Years	Land	Labor	Fixed capital
1911—15	36.5	59.1	4.4
1916—20	40.4	55.6	4.0
1921—25	41.8	52.3	5.9
1926—30	43.6	48.8	7.6
1931—35	42.6	49.1	8.3
1936—40	48.8	42.6	8.6
1941—45	33.3	58.2	8.5
1946—50	50.8	39.3	9.9
1951—55	31.9	57.8	10.3
1956—60	41.0	50.8	8.2
1961—65	39.4	51.9	8.7
1966—70	40.6	50.9	8.5
1968—72	38.1	53.7	8.2

Table 10. Intensity of labor input (five-year averages)

Years	Working days per ha. of cultivated land	Working days per ha. of crop area	Working days per worker
1911—15	200.81	166.13	120.48
1916—20	210.36	172.84	136.90
1921—25	212.37	172.61	143.04
1926—30	212.58	171.96	143.60
1931—35	202.01	167.26	141.66
1936—40	229.03	171.44	142.73
1941—45	223.05	169.73	160.03
1946—50	223.01	147.55	139.14
1951—55	276.09	160.62	165.13
1956—60	306.01	169.99	183.49
1961—65	318.18	170.42	186.72
1966—70	334.19	179.17	195.26
1968—72	325.95	180.64	196.14

Table 11. Planted acreages of winter crops

Unit: 1,000 ha.

Crop	1964	1965	1966	1967	1968	1969	1970	1971	1972
Fall sweet potato	132.4	122.6	120.6	119.1	119.4	118.2	112.7	114.9	106.5
Hu-tzu sweet potato	48.3	43.1	43.9	44.9	46.1	41.9	39.9	36.2	32.7
Wheat	9.5	11.1	14.5	11.9	7.7	4.7	2.0	1.0	0.7
Corn	8.5	5.8	7.9	9.3	7.6	7.0	10.7	9.4	11.9
Soybeans	31.3	37.1	37.0	38.2	37.4	34.6	32.7	31.0	27.8
Other beans	9.9	9.1	9.3	8.3	9.5	11.2	10.5	12.2	14.0
Other cereals	0.8	1.0	0.9	0.9	0.7	1.1	0.6	0.6	0.5
Rapeseed	19.6	18.0	7.8	4.5	2.9	2.2	1.7	1.5	1.5
Tobacco	8.7	8.0	7.6	10.0	11.1	12.0	11.1	8.7	7.9
Flax	4.5	5.5	4.2	4.0	4.5	3.3	3.1	3.4	2.7
Vegetables	51.6	50.9	50.7	53.4	55.9	60.2	61.8	59.6	59.6
Total	325.1	312.2	304.4	304.5	302.8	296.4	286.8	278.5	265.8

Table 12. Indices of agricultural production
five-year averages at 1935-37 prices

Years	Total agricultural production	Crops						Livestock
		All crops	Rice	Common crops	Special crops	Fruits	Vegetables	
1911—15	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1916—20	114.28	113.58	103.58	106.73	153.59	138.51	111.06	118.42
1921—25	130.45	130.72	120.60	120.62	161.29	294.56	130.04	128.84
1926—30	159.65	160.78	146.42	137.97	207.96	394.36	164.42	153.00
1931—35	196.74	198.34	186.51	167.26	228.00	547.12	217.46	187.39
1936—40	225.60	226.73	198.04	180.56	326.72	646.10	226.82	218.95
1941—45	178.77	184.80	157.96	163.59	276.72	434.69	187.99	143.30
1946—50	174.38	182.00	169.94	231.40	163.54	381.01	270.50	129.62
1951—55	262.71	261.17	243.08	294.57	280.61	404.17	342.89	271.81
1956—60	329.38	319.67	282.09	398.47	372.06	583.68	421.31	386.44
1961—65	397.03	382.04	328.89	448.13	422.28	1,121.63	665.13	485.16
1966—70	499.79	457.90	367.23	527.84	419.10	2,370.95	1,307.27	746.08
1968—72	530.43	473.27	366.04	504.67	409.10	2,747.83	1,695.46	866.47

Table 13. Indices of agricultural production

five-year averages at 1950-52 prices

Years	Total agricultural production	Crops						Livestock
		All crops	Rice	Common crops	Special crops	Fruits	Vegetables	
1911—15	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1916—20	117.89	117.81	103.58	107.04	160.05	137.78	111.06	118.18
1921—25	134.99	136.67	120.60	119.95	170.34	298.37	130.03	129.23
1926—30	166.83	170.72	146.42	139.74	223.12	422.91	164.42	153.46
1931—35	204.46	209.76	186.51	165.43	246.02	612.71	218.48	186.28
1936—40	238.53	245.61	198.04	178.63	352.88	737.82	227.78	214.22
1941—45	185.44	199.80	157.96	160.38	297.99	498.14	190.40	136.13
1946—50	174.10	188.31	169.94	229.26	171.42	416.47	267.20	125.32
1951—55	270.39	270.67	243.08	293.09	293.08	454.52	350.63	269.41
1956—60	347.91	337.31	282.09	397.88	388.81	674.72	439.27	384.31
1961—65	422.86	406.37	328.89	444.98	433.12	1,255.38	682.90	479.52
1966—70	554.69	502.45	367.23	529.51	436.91	2,564.03	1,314,47	734.09
1968—72	590.32	513.92	366.04	501.26	419.54	2,879.58	1,564.93	852.20

Table 14. Indices of agricultural production

five-year averages at 1965-67 prices

Years	Total agricultural production	Crops						Livestock
		All crops	Rice	Common crops	Special crops	Fruits	Vegetables	
1911—15	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1916—20	113.94	113.86	103.58	105.13	159.01	156.16	111.06	114.83
1921—25	132.13	134.23	120.60	120.54	164.84	410.23	130.04	124.98
1926—30	160.53	165.35	146.42	142.29	213.72	524.90	164.42	144.08
1931—35	198.43	204.94	186.51	169.63	235.43	715.09	219.15	176.20
1936—40	226.68	232.62	198.04	183.35	338.13	823.30	228.44	206.39
1941—45	175.72	188.11	157.96	164.82	284.38	545.45	188.66	133.40
1946—50	173.84	189.45	169.94	231.24	170.05	460.26	269.76	120.53
1951—55	262.54	266.27	243.08	289.49	289.33	473.32	345.83	249.79
1956—60	330.19	324.17	282.09	378.09	381.35	622.09	419.60	350.73
1961—65	401.47	390.10	328.89	413.79	420.35	1,261.17	656.38	440.31
1966—70	528.89	489.22	367.23	486.46	432.23	2,878.35	1,241.43	664.40
1968—72	562.54	508.30	366.03	467.26	427.97	3,086.72	1,655.28	747.79