THE GROWTH OF AGRICULTURAL OUTPUT AND PRODUCTVITY IN KOREA, 1918–1978*

BAN, SUNG-HWAN**

I. Introduction

The main objectives in this study are to estimate the ratio of growth of: 1) gross agricultural output; 2) factor inputs; 3) total productivity and the partial productivities with respect to land and labor over the 1918 to 1978 period. A related objective is to estimate the rate of growth of commodities as well as commodity groups and changes in the share of various commodity groups in total agricultural production. The analysis will be conducted for two major phases: the pre-war and post-war periods.

II. Trends in Agricultural Output

Total agricultural output in Korea has increased by 3.8 times over the past sixty years from 1918 to 1978, with an occasional decline due to unfavorable weather or the Korean conflict. The indexes of gross agricultural output together with gross value added in agriculture are depicted in Figure 1, and their annual average compound growth rates in selected periods are shown in Table 1. The two series move in very similar patterns, although the growth rate of gross value added is slightly less than that of gross output.

During the pre-war period (1920–1939), total agricutlrural output

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(1) For the pre-war period, the study is dependent on "Agricultural Growth in Korea 1918–1971," in Yujiro Hayami, et. al., ed., *Agriculsurar Growsh in Japan, Taiwan, Korea, and the Philippines*, The University Press of Hawaii, 1979.

(2) For the post-war period, the study was dependent on Sung H. Ban, et al., *Rural Development*, published by Council on East Asian Studies; Harvard University Press, 1980 and "Growth and Sources of Agricultural Production and Productivity" in *Modernization Process of Korean Agricursure*, Korea Rural Economics Institute, 1980.

** Professor, Seoul National University and Research Director, Korea Rural Economics Institute.

FIGURE 1 INDEXES OF GROSS OUTPUT AND GROSS VALUE ADDED IN AGRICULTURE (5 YEAR MOVING AVERAGES FOR 1920–1945, AND 3 YEAR MOVING AVERAGES FOR 1945–1977, SEMILOG SCALE)

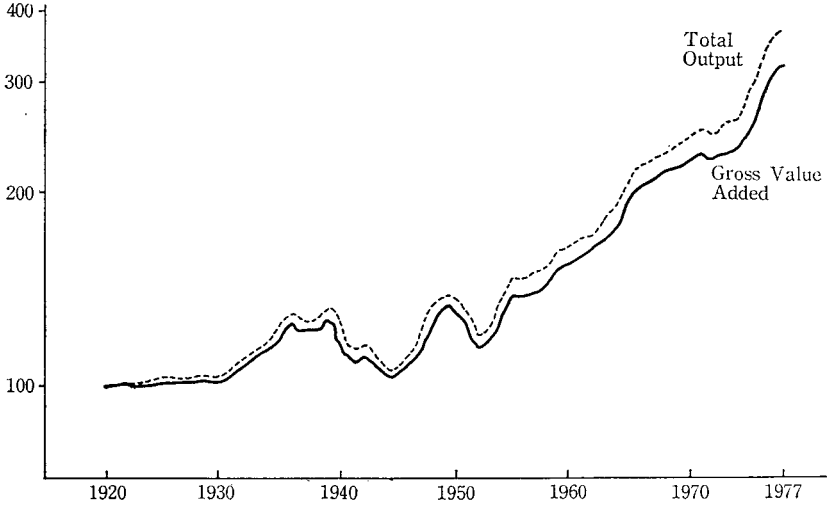

TABLE 1 GROWTH RATES OF TOTAL OUTPUT AND GROSS VALUE ADDED

(percent)

Period	Total Output	Gross Value Added
1920–1930	0.46	0.31
1930–1939	2.92	2.59
1939–1945	−3.46	−3.74
1946–1949	6.97	6.79
1949–1952	−4.87	−5.04
1952–1954	10.54	10.48
1954–1965	3.89	3.80
(1954–1960)	(2.53)	(2.35)
(1960–1965)	(5.55)	(5.57)
1965–1973	2.23	1.51
(1965–1970)	(2.84)	(2.14)
(1970–1973)	(1.21)	(0.48)
1973–1977	8.81	8.65
Long Term		
1920–1939	1.62	1.38
1946–1977	3.91	3.62
1946–1973	3.20	2.90
1953–1969	4.36	4.27
1920–1969	1.94	1.81

grew at a compound growth rate of 1.62 percent per annum. During the same period, gross value added grew at an annual rate of 1.38 percent per annum. For the post-war period (1946–1977), total agricultural output and gross value added in agricutlrue grew at an annual rate of

3.19 percent and 3.62 percent respectively. In both periods the growth rate of total agricultural output is higher than the growth rate of gross value added. The difference in growth rates between the two different concepts of production indicates the increasing use of intermediate products and the increasing dependence of Korean agriculture upon purchased inputs. In this respect, Korean agricultural progress is similar to what has occurred in the agricultural sectors of many advanced economies.

We can observe in Figure 1 that agricultural output has been growing steadily over the entire period except during both the Second World War and the Korean War. In spite of this steady growth, some distinct growth phases are observable during the period. We can notice that the growth rate during the post-war period (1945–1978) is higher than that of the pre-war period (1918–1945).

Agriculture was almost stagnant between 1920 and 1930. Output grew at an annual compound rate of only 0.46 percent. This slow growth appears to have been due to the ineffective implementation of policies for promoting agricultural production and to a lack of economic incentives for farmers.

The cadastral survey in Korea had been completed by 1918. An ambitious "Porgram for Increasing Rice Production" was launched in 1920. Rice production was to be increased by 9.2 million *suk* (about 1.3 million metric tons) over the succeeding 15 years through land improvement and the improvement of cultural practices. Although the program was given renewed emphasis in 1926 it achieved far less production than originally planned. The lack of success was due mainly to the lack of comprehensive policy implementation. The program should have been accompanied by measures to increase the supply of fertilizer and chemicals to control disease and insects and by a price policy providing farmers an incentive to increase production.

From 1930 to 1939 agricultural output showed a much higher growth rate, 2.92 percent per year. This appears to have been due mainly to the increased application of chemical fertilizer combined with the introduction of fertilizer-responsive, high-yielding rice varieties. The higher growth rate can also be attributed partly to the cumulative effects of the development of irrigation facilities and other forms of social overhead capital.

During the Second World War agricultureal output declined markedly, falling at a rate of 3.46 percent per year from 1939 to 1945. The period from 1946 to 1952 was characterized by ups and downs in agricultural output and a low growth rate. Total agricultural output grew at a rate of slightly less than 7 percent per year from 1946 to 1949. This high growth rate was mainly due to the recovery of production from disturbances during World War II when output declined markedly. By 1949 agriculture had nearly recovered to its pre-war peak level. The outbreak of the Korean War in 1950, however, brought agricultural output down again to an

annual rate of 4.87 percent per year from 1949 to 1952. As a result, over the the entire 1946–1952 period, agricultural output grew at only 0.88 percent per year. By the time the cease-fire talks began in 1952, agricultural output had fallen below the level of 1945. By 1954, however, total agricultural production had passed the peak production level of the pre-Korean War period as a result of an average annual growth rate of 10.54 percent betteen 1952 and 1954 made possible by the recovery of productive facilities from wartime devastation.

Since 1954, Korean agricutlrue has entered a steady and sustained long-run growth path. Total agricultural production, output, and gross value added in agriculture grew at an annual rate of 3.48 percent, 3.19 percent, and 2.83 percent repectively from 1954 to 1973. During the post-1954 period two different sub-periods are observable. Between 1954 and 1965 the annual growth rate of total agricultural output was 3.89 percent. Further more, during this period the growth rate was accelerating from 2.54 percent between 1954 and 1960 to 5.55 percent between 1960 and 1965. The rate of growth has been decelerating since 1965 from an annual growth rate of 2.84 percent between 1965 and 1970 to 1.21 percent between 1970 and 1973. However, agricultural production began to spurt since then. The agricultural output grew at an annual rate of 8.81 percent during the period from 1973 to 1977. This rapid growth is attributable to a few factors. The high yielding variety of rice called Tongil, i.e., a variant of IRRI 667, was introduced and widely disseminated. The yield of this new rice variety was approximately 30 percent higher than the idigenous variety. Furthermore, the price of the new rice variety was guaranteed at a reasonably high level by a government purchasing program. In fact, the growth rate of rice was 7.8 percent per year during the period from 1973 to 1977. Also the praid growth in the production of vegetables, fruits, special crops and livestock and its products are attributable to the high growth rate in total agricultural output. Annual growth rates are: fruits-15.8 percent, vegetables -18.2 percent, special crops -20.8 percent, and livestock and its products -11.7 percent.

III. Comparison of Commodity Growth

The major gricultural products of Korea may be grouped into the following categories: food-grains, fruits, vegetables, special crops, monopoly crops (i.e., leaf tobacco, ginseng), silk worn cocoons, livestock and livestock products. The food grains include rice, barley (common and naked barely) and wheat, miscellaneous grains (millet, corn, sorghum, buckwheat, etc.), the pulses (beans, soybeans and peas), and potatoes (both sweet and white). The chief fruits are apples, pears, peaches, grapes, and persimmons. More recently the production of oranges has been increasing rapidly on the southern island of Cheju. Many kinds of

vegetables are grown in Korea; among the major ones are Chinese or celery cabbage, radishes, garlic, red peppers, onions, watermelons, and sweet melons. Special crops include fiber crops such as cotton and hemp, oil crops such as seasame and perilla, and others. The main classes of livestock are Korean native cattle (used both as draft animals and for meat), hogs, and poultry. In recent years the number of dairy cattle has increased rapidly although the total cannot be compared with that for Korean native cattle.

In Table 2 the annual compound grwth rates of increase of production for the several farm products and groups of products are presented.

For most commodity groups the rates of increase are higher in the post war than in the pre-war period. However, for barley, miscellaneous grains, special crops and silkworm cocoons, the rates of increase in the pre-war period are higher than in the post-war period. The difference in rates between the two periods differs According to the farm commodity.

Tentatively, we may infer that most of the rapid increases during the post-war period reflect an expansion in production by specialized growers taking advantage of market opportunities in commodities with relatively high income-elasticities of demand, potatoes and silkworm cocoons being exceptions. We can notice that the growth rates for rice, pulses, special crops, fruits, vegetables, and livestock are all very high during the period from 1973 to 1977. All these commodities except rice represent farm products for which consumption is increasing rapidly with an increasing level of per capita income. On the other hand, during the same period the production of barley showed a negative growth rate of -8.84 percent per year with 1.16 percent for miscellaneous grains and only 0.04 percent for the production of potatoes. Barley and potatoes represent inferior consumption goods.

The differences in growth rates among the various farm products over the years have altered the relative composition of total agricultural production, as shown in Table 3. Grain crops accounted for 75 percent of the value of gross agricultural production in 1918–20 but only 50 percent during 1976–78. On the other hand, the shares of the other commodity groups increased: vegetables from 5.1 to 17.9 percent, potatoes from 1.8 to 4.2 percent, fruits from 0.6 to 3.8 percent, and livestock and livestock products from 3.7 to 14.4 percent. The share of staple food grains has decreased: rice from 53.9 to 43.2 percent and barley from 12.5 to 3.8 percent. The shares of rice and barley will continue to decrease as the Korean economy continues to progress.

IV. Trends in Agricultural Inputs

The growth of agricultural output depends on changes in the productive factors (land, labor, and capital) and the rate of productivity growth.

TABLE 2 ANNUAL GROWTH RATES OF MAJOR GROUPS OF AGRICULTURAL PRODUCTS

(percent)

Products	1920–30	1930–39	1920–39	1946–52	1952–54	1954–65	1965–73	1973–77	1946–73	1946–77
Rice	−0.40	3.72	1.53	−1.78	13.31	2.68	1.30	7.77	2.01	2.73
Barleys	1.27	4.46	2.77	2.74	15.87	4.38	−0.59	−8.84	3.32	1.66
Pulses	−1.66	−2.05	−1.84	0.54	8.59	1.44	5.64	5.39	2.98	3.29
Miscellaneous Grains	2.80	−0.09	1.42	8.62	−13.06	2.14	−3.57	1.16	0.59	0.74
Special Crops	2.54	1.87	2.22	0.80	3.84	−4.10	5.30	20.80	−0.80	1.75
Potatoes	1.81	1.20	1.52	−0.40	15.59	1.58	−5.60	0.05	3.37	2.93
Fruits	4.62	3.30	3.99	13.01	5.31	8.97	9.81	15.76	9.82	10.57
Vegetables	2.74	−1.24	0.84	12.59	−6.23	4.24	6.24	18.20	5.80	7.33
All Crops	0.35	2.91	1.55	0.88	9.08	3.69	2.22	8.70	3.01	3.73
Silkworm Cocoons	10.34	1.98	6.30	−1.26	5.41	2.27	19.24	−1.27	6.43	5.41
Livestock and Its Products	0.27	3.19	1.64	0.43	33.73	6.46	5.21	11.70	6.52	7.17 1

TABLE 3 PERCENTAGE COMPOSITION OF AGRICULTURAL PRODUCTION BY COMMODITY GROUPS AT CURRENT PRICES, SELECTED THREE-YEAR AVERAGES, 1918–78

Period	Rice	Barleys	Beans and Peas	Miscellaneous Grains	Special Crops	Nursery Stock
1918–20	53.9	12.5	6.5	2.2	4.9	0.1
1927–30	49.1	12.9	5.2	2.8	5.9	0.2
1937–40	54.8	14.0	3.5	1.9	5.1	0.04
1959–61	49.3	16.3	2.2	0.9	2.8	0.1
1969–71	40.3	12.6	2.5	0.6	3.8	0.1
1976–78	43.2	3.8	2.8	0.3	4.7	—

Period	Vegetables	Potatoes	Fruits	Crop By-Products	Silkworm Cocoons	Livestock & Its Products
1918–20	5.1	1.8	0.6	8.0	0.7	3.7
1927–30	7.4	1.7	0.8	7.8	1.7	4.3
1937–40	4.5	1.7	0.8	7.8	1.7	4.2
1959–61	7.3	4.7	1.9	1.9	0.4	12.2
1969–71	13.7	5.5	3.0	1.8	1.4	14.8
1976–78	17.9	4.2	3.8	3.9	1.1	14.4

* 1929 excluded from period 1927–30 and 1939 excluded from period 1937–40 because both were drought years.

Source: For the period 1918–1971, Sung-Hwan Ban, "Agricultural Growth in Korea 1918–1971," in Yujiro Hayami et al., ed., *Agricultural Growth in Japan, Taiwan, Korea, and the Philippines*, The University Press of Hawaii, 1979. For the 1976–1978 period, Sung H. Ban, "Growth and Sources of Agricultural Production and Productivity," in *Modernization Process of Korean Agriculture*, Korea Rural Economics Institute, 1980.

This section attempts to measure the changes in the major inputs of land, labor, fixed capital, current inputs, and total input over the six-decade period.

The indexes of the major factors of production and aggregate input are depicted in Figure 2 and the growth rates of inputs are presented in Table 4. Of the two primary inputs to agricultural production, land and labor, cultivated land area increased only 6.7 percent over the sixty-year study period.

From 1920 to 1939 the area of total cultivated land increased only by 2 percent or 0.10 percent per year. The area of total cultivated land showed a negative growth rate during the World War II period and remained at an almost constant level from 1942 to 1952 due to a negative growth of -1.19 percent per year during the Korean War period. Total cultivated land increased at an annual compound rate of about 0.53 percent from 1952 to 1960. From 1960 to 1965 this rate accelerated to 2.04 percent per year. The rapid expansion of cultivated land, notably upland, was mainly due to the passage of the Land Reclamation Act in 1962 and was motivated by the increased demand for cash crops, on the one hand,

FIGURE 2 INDEXES OF INPUTS USE IN AGRICULTURAL PRODUCTION, FIVE-YEAR MOVING AVERAGES FOR PRE-WAR PERIOD AND THREE-YEAR MOVING AVERAGES FOR POSTWAR PERIOD, SEMILOG SCALE

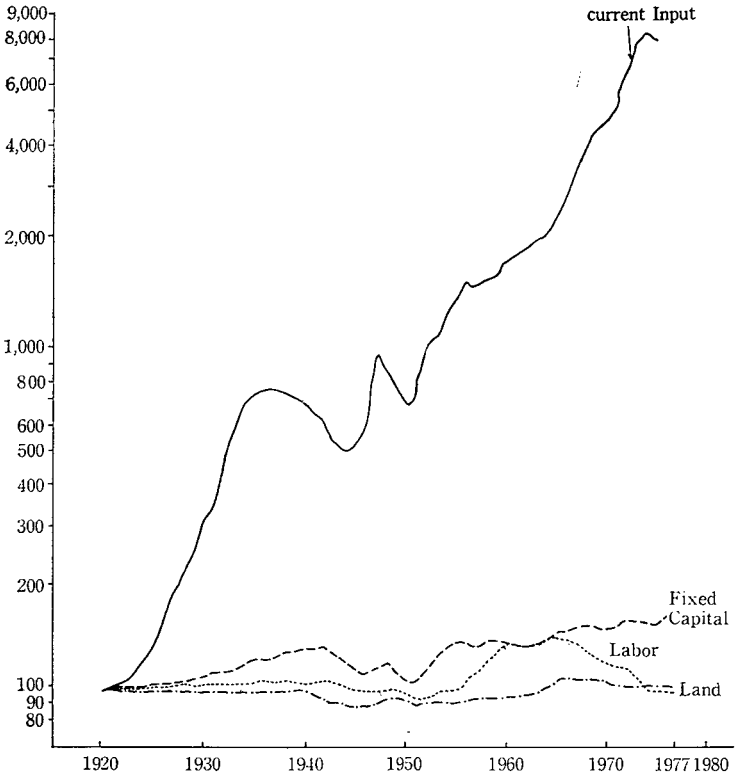

TABLE 4 GROWTH RATES OF INPUTS TO AGRICULTURE, 1920–77

(percent)

Period	Cultivated Land	Labor Used	Fixed Capital	Current Inputs	Total Inputs
1920–30	0.07	0.59	1.09	10.75	1.16
1930–39	0.14	0.35	2.03	11.82	2.14
1939–45	−0.84	−0.98	−1.91	−6.14	−1.86
1946–52	0.0012	−0.87	0.54	6.92	2.15
1952–54	0.52	3.25	7.23	12.46	3.42
1954–60	0.53	5.23	0.78	6.89	2.98
1960–65	2.04	0.74	1.16	5.07	1.95
1965–70	0.47	−2.57	0.99	14.46	1.10
1970–77	−0.39	−3.28	1.57	10.32	0.72
1920–39	0.10	0.48	1.53	11.25	1.62
1954–65	1.21	3.16	0.95	6.06	2.51
1965–73	0.0027	−3.23	1.15	12.48	0.65
1946–77	0.45	−0.03	1.41	8.87	1.87

and by a government subsidy program using US PL480 grains for reclamation on the other. Since 1968 both cultivated upland and paddy have been declining at rates of -0.98 percent and -0.37 percent per year from 1968 to 1973. Total cultivated land declined at an annual rate of -0.39 percent per year from 1970 to 1977. The reduction of cultivated land reflects the conversion of existing farm land to urban development, industrial sites, and highway construction.

Labor input, estimated in terms of man-equivalent units of labor actually used in agricultural production, remained at an almost constant level from 1920 to 1977 with ups and downs in various years. It increased at a rate of 0.48 percent per year between 1920 and 1939, declined at a rate of -0.98 percent between 1939 and 1945 and -0.87 percent per year during the 1946–1952 period. The agricultural labor force increased remarkably after the Korean conflict due to the influx of refugees from North Korea, the addition of workers displaced from devastated urban industries and the natural growth of the rural population. The agricultural labor force increased at a rate of 5.23 percent per year during the period from 1954 to 1960, but this rate declined to 0.74 percent per year between 1960 and 1965 as the rehabilitation and expansion of the urban sector began to absorb workers. Since 1965, the agricultural labor input has been consistently declining at an annual rate of -2.57 percent between 1965 and 1970 and -3.28 percent between 1970 and 1977.

Fixed capital input is measured by the sum of depreciation charges on farm machinery and equipment, perennial fruit trees, and farm buildings, the service value of draft animals and irrigation fees. It increased both in the pre-war and in the post-war periods but decreased at a rate of -1.91 percent per year during the war period from 1939 to 1945. The growth rates were 1.53 percent per year from 1920 to 1939 and 1.41 percent during the 1946–1977 period.

Working capital, or non-farm current input, comprises the expenditures for chemical fertilizer, chemicals used to control insects and disease, purchased seeds, farm tools and other minor farming materials. Expenditure for purchased feed, estimated on the basis of the import of feeds and by-products of imported food grains, has also been included since 1945. It is assumed that no feed was imported prior to that year.

Non-farm current input increased the most rapidly of all input categories. The pre-war annual growth rate, 11.25 percent, is much higher than the post-war rate, 8.87 percent. The use of chemical fertilizer, especially, increased rapidly following the construction of a plant in Korea in the late 1920's to manufacture nitrogen-fertilizer for the domestic market.

It is interesting to note that the growth of non-farm current input since the war has been slower than in the pre-war period, whereas the growth rates of fixed capital are almost the same for both periods. This implies that while land-saving technology received the main emphasis before the

war, labor-saving technology has become increasingly important in recent years.

V. Growth of Productivities

A. Aggregate Input and Aggregate Productivity

The trends of total output, total input, and total productivity are compared in Figure 3. The corresponding growth rates are shown in Table 5 and also the relative contributions of input increase and productivity improvement to the growth of output.

For the period from 1920 to 1939 both aggregate input and aggregate productivity grew at an annual rate of 1.62 percent. Therefore, all output growth is attributable to input increase. For the post-war period from 1946 to 1977 total input grew at an annual rate of 1.87 percent and total productivity at 2.0 percent. Therefore, about 48 percent of output growth

FIGURE 3 Indexes of Total Output, Input and Productivity, and Indexes of Land and Labor Productivities and of Land-Labor Ratio; Five-Year Moving Averages for Prewar Period and Three-Year Moving Averages for Postwar Period, Semilog Scale

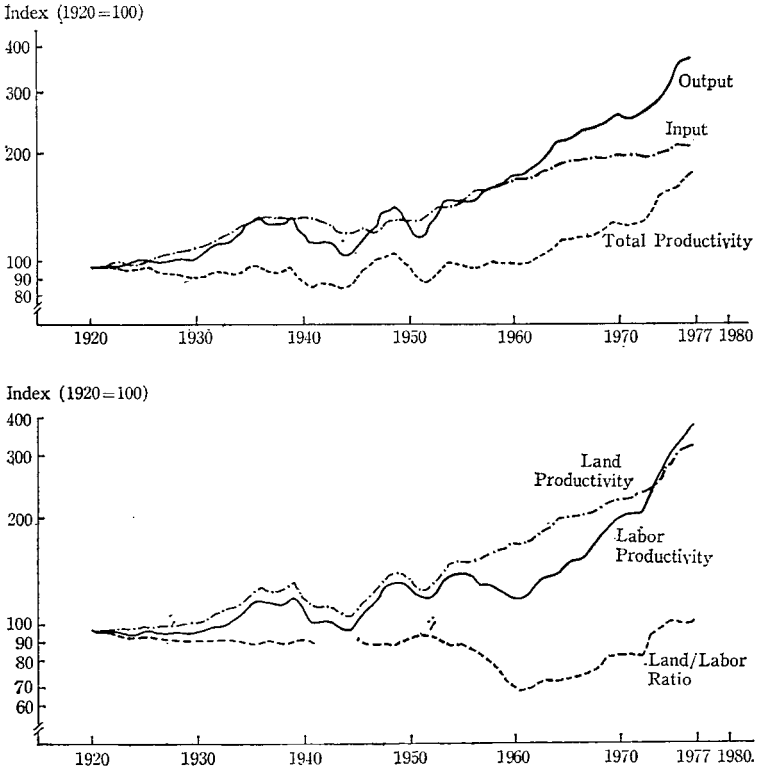

TABLE 5 GROWTH RATES OF TOTAL AGRICULTURAL OUTPUT AND OF TOTAL INPUT AND PRODUCTIVITY MEASURED ON THE TOTAL OUTPUT BASIS*

(percent)

Period	Growth Rates			Relative Contributions	
	Output (1)	Input (2)	Productivity (3)	Input (2)/(1)	Productivity (3)/(1)
1920–30	0.46	1.16	−0.70	252	−152
1930–39	2.92	2.14	0.77	73	27
1939–45	−3.46	−1.86	−1.61	54	46
1946–49	6.82	3.13	3.57	46	52
1949–52	−4.83	1.17	−5.92	24	−123
1952–54	10.87	3.42	7.20	31	66
1954–65	3.99	2.51	1.44	63	36
1965–70	3.13	1.10	2.01	35	64
1970–77	5.47	0.72	4.74	13	87
Long-Run					
1920–39	1.62	1.62	−0.01	100	0
1954–73	3.48	1.72	1.73	49	51
1946–73	3.41	1.94	1.44	57	43
1946–77	3.91	1.87	2.00	48	52

* Total input includes nonfarm current input.

is attributable to input increase and the remaining 52 percent to productivity improvement.

We can notice that the relative contributions are quite different in the pre-war and post-war periods. In the pre-war period the increase of total input accounted for most of output growth. Since the war, however, total productivity has grown substantially. Furthermore, the productivity gains have been accelerating. From 1954 to 1965 productivity grew by 1.44 percent per annum, and it has contributed to output growth by 36 percent. In the 1965–1970 period it grew by 2.01 percent per year and was the source of 64 percent of output growth. From 1970 to 1977 it grew by 4.74 percent per year and was the source of 87 percent of output growth. The accelerating growth in productivity has been achieved through an increased level of education and agricultural extension and research. The recent development of a new high yielding variety of rice contributed substantially to the productivity gains.

B. Trends in Partial Productivities

A partial productivity measures the relationship of output to a single input used in production. Therefore a partial productivity measure neglects interfactor substitution. The use of labor productivity as a measure of the progress of technological change is likely to result in an upward bias because of the changing input mix (capital-using production process) and output mix (capital-intensive enterprise). However, partial pro-

ductivities are convenient indicators of the efficiency of production. Furthermore, a partial productivity is a good measure of technological progress if technological change is neutral—that is, if the marginal rate of substitution is constant over the study period. And labor productivity, especially, has merit as an indicator of the level of living.

The trend of labor and land productivities in Korean agriculture is depicted in Figure 3 and the corresponding growth rates are shown in Table 6. The productivities of both inputs have increased substantially since 1920 and both have positive growth rates in most subperiods except for the Second World War, (1939–45) and the Korean War, (1950–52). In addition, labor productivity declined slightly during the first decade, (1920–30). The productivity growth rates for both inputs during the post-war period are higher than for the pre-war period.

TABLE 6 GROWTH RATES OF LABOR AND LAND PRODUCTIVITIES AND RELATIVE CONTRIBUTION OF GROWTH IN LAND PRODUCTIVITY TO GROWTH IN LABOR PRODUCTIVITY MEASURED ON THE TOTAL OUTPUT BASIS

(percent)

Period	Productivity Growth Rates		Relative Contribution
	Labor (1)	Land (2)	(2)/(1)
1920–30	—0.13	0.39	—300
1930–39	2.58	2.79	108
1939–45	—2.53	—2.68	106
1946–49	6.44	5.67	88
1949–52	—2.70	—3.69	137
1952–54	7.04	9.99	141
1954–65	0.70	2.64	377
1965–70	5.57	2.37	42
1970–77	9.08	5.91	65
1920–39	1.14	1.52	133
1954–73	2.76	2.47	89
1946–73	2.85	2.65	93
1946–77	3.94	3.44	87

Land productivity grew faster than labor productivity during the pre-war period (1920-39) with an average growth rate of 1.52 percent per year compared to 1.14 percent for labor productivity.

However, labor productivity grew faster than land productivity during the post-war period (1946–77). Its average growth rate was 3.94 percent per year compared to 3.44 percent for land productivity.

It seems clear that until the early 1960's Korean agricultural development depended upon raising land productivity. The supply of land has been highly inelastic and there has been great population pressure on land. (As is also shown in Figure 3, the land-labor ratio was decreasing during

most of the period up to the early 1960's.)

The growth of land productivity during the pre-war period came mainly from the more intensive use of land and increasing applications of technical inputs. From 1918 to 1941 the total cultivated area increased about two percent, but the crop area increased nearly 14 percent. During this period a substantial amount of upland was converted to rice paddy and the multiple cropping index increased from 137 in 1918 to 153 in 1941. In addition, the application of chemical fertilizer per hectare increased remarkably.

Thus, the productivity of land in terms of cultivated area, was increased, first of all, by the conversion of upland into paddy fields on which the yield of rice is generally higher in value than that of other crops on upland. Secondly, the yield of rice was increased substantially by the planitng of varieties more responsive to fertilizer, improvement of irrigation facilities, and the use of more chemical fertilizer. Higher product value was thus obtained from the existing area of cultivated land.

Land productivity decreased during the Second World War because of the shortage of chemical fertilizer and other inputs. Post-war recovery was interrupted by the Korean conflict. Finally, in 1953, land productivity began a new upward trend that has continued to the present time with a growth rate higher than that during the pre-war period.

Increased intensity of land use, however, has not been the major factor in productivity growth in the present period as it was before the war. The multiple cropping index has remained almost constant. The increase in land productivity since the war has been brought about by biological innovation, improvement of land quality, increased application of commercial fertilizer and of chemicals to control disease and insects, and changes in product mix—a shift from crops like the miscellaneous cereals that have a relatively low value of product per unit of land to products of higher value such as vegetables, fruits, and livestock. The level of current input per unit of land has increased with the consumption of pesticides, especially, going up very rapidly. The recent rapid growth in land productivity is mainly due to the wide dissemination of a high yielding variety of rice.

Growth in labor productivity depends upon the quantity and productivity of other resources associated with a given quantity of labor and upon the quality of the labor force itself. As previously mentioned, cultivated land per worker decreased almost continuously until the early 1960's, declining from 2.4 tanbo in the 1918–20 period to 1.4 tanbo in the 1961–63 period(A tanbo is about 10 ares or 1/10th hectare). Therefore, the growth in labor productivity depended cheifly upon growth in land productivity during that period. Since 1962 when the Land Reclamation Act was passed, however, the cultivated area per worker has begun to increase slightly. From 1920 to 1940 both productivities increased mod-

erately. Then, during World War II, both decreased. After the war both productivities again began to gain until 1950 when the Korean war broke out. From 1954 until 1965 land productivity increased at an annual rate of 2.64 percent, but labor productivity at 0.70 percent per year. This was a period of very heavy population pressure on the land due to the lack of non-agricultural employment because of the devastation of industry by the war and to the large influx of refugees from North Korea.

Finally, in the most recent past, labor productivity has made impressive and accelerating gains. From 1970 to 1977 it increased at an annual rate of 9.08 percent, compared to 5.91 percent for land productivity. This has occurred due to the improvement of the man-land ratio and farm mechanization in addition to gains in land productivity.

APPENDIX TABLE 1 INDEXES OF TOTAL AGRICULTURAL OUTPUT AND GROSS VALUE ADDED, 1920 = 100

Year	Total Output	Gross Value Added	Year	Total Output	Gross Value Added	Year	Total Output	Gross Value Added
1920	100.0	100.0	1940	123.3	117.6	1960	173.8	163.9
1921	100.1	100.1	1941	115.1	109.9	1961	175.5	164.9
1922	100.7	100.6	1942	117.6	112.7	1962	183.7	172.5
1923	101.7	101.6	1943	113.2	109.0	1963	195.1	183.3
1924	102.5	102.2	1944	106.0	102.3	1964	210.0	197.6
1925	104.5	104.1	1945	109.8	105.9	1965	227.8	214.8
1926	103.4	102.8	1946	116.2	112.0	1966	231.9	218.0
1927	103.4	102.4	1947	126.9	121.6	1967	238.0	222.3
1928	104.7	103.5	1948	138.7	132.4	1968	245.4	227.5
1929	104.7	103.2	1949	144.2	136.4	1969	253.3	232.8
1930	104.7	103.1	1950	134.2	128.9	1970	262.0	238.8
1931	109.8	107.9	1951	120.2	115.4	1971	260.5	235.5
1932	113.3	110.9	1952	122.5	116.8	1972	264.1	237.4
1933	115.9	112.7	1953	133.6	127.0	1973	271.7	242.3
1934	119.4	115.2	1954	149.7	142.6	1974	294.7	259.4
1935	129.3	124.2	1955	149.7	141.8	1975	329.4	288.2
1936	133.8	128.0	1956	151.1	142.5	1976	363.6	318.9
1937	129.4	123.4	1957	155.0	145.6	1977	381.0	336.9
1938	130.7	124.6	1958	164.3	155.0			
1939	135.6	129.8	1959	167.6	157.8			

Note: Five year moving averages for the period from 1920 to 1945, and three year moving averages for the period from 1946 to 1977.

APPENDIX TABLE 2 INDEXES OF LABOR, LAND, FIXED CAPITAL, CURRENT INPUT AND LAND-LABOR RATIOS, 1920 = 100

Year	Labor	Cultivated Land	Crop Area	Fixed Capital	Current Input	Land-Labor Ratio
1920	100.0	100.0	100.0	100.0	100.0	100.0
1921	100.9	100.1	100.5	101.9	104.6	99.2
1922	101.5	100.2	100.8	103.2	106.9	98.7
1923	102.6	100.3	101.3	104.1	111.5	97.8
1924	103.1	100.4	102.0	104.9	121.2	97.4
1925	103.7	100.5	102.8	105.6	136.2	96.9
1926	104.2	100.5	103.7	106.1	158.7	96.4
1927	105.2	100.5	104.9	106.9	193.6	95.5
1928	105.7	100.6	106.2	108.4	230.8	95.2
1929	106.1	100.6	107.4	109.1	253.4	94.8
1930	106.2	100.7	108.4	111.4	277.8	94.8
1931	107.0	100.8	109.8	114.0	217.6	94.2
1932	107.3	100.9	111.2	116.4	373.5	94.0
1933	107.4	101.0	112.3	118.7	450.5	94.0
1934	107.8	101.2	113.0	122.1	571.0	93.9
1935	108.6	101.3	113.7	124.5	670.2	93.3
1936	108.8	101.5	113.8	126.7	752.6	93.3
1937	107.7	101.7	112.3	128.9	777.1	94.4
1938	108.8	101.9	111.7	131.2	785.5	93.7
1939	109.6	102.0	111.4	133.5	758.8	93.1
1940	108.4	102.0	109.6	135.5	725.9	94.1
1941	108.4	102.0	109.6	135.5	725.9	93.0
1942	109.3		108.6	138.5	626.0	
1943	107.1		106.3	130.3	554.8	
1944	104.0		102.3	124.2	491.1	
1945	103.3		100.4	118.8	518.7	
1946	101.4	92.8	97.9	114.8	561.6	91.5
1947	100.7	92.2	96.9	119.3	741.3	91.6
1948	102.5	94.6	99.4	124.1	950.2	92.3
1949	102.9	96.3	100.3	114.6	812.1	93.6
1950	99.8	94.9	97.7	108.9	724.5	95.1
1951	96.0	93.1	95.5	107.2	660.4	97.0
1952	96.2	92.8	96.0	118.6	839.0	96.5
1953	99.9	93.0	99.8	127.3	998.0	93.1
1954	102.6	93.8	103.0	136.4	1,061.4	91.4
1955	103.9	93.9	105.1	142.1	1,222.6	90.4
1956	107.1	95.4	106.5	143.2	1,350.1	89.1
1957	113.3	95.7	106.3	139.7	1,497.8	84.5
1958	122.3	96.1	105.4	141.7	1,463.5	78.6
1959	130.6	96.4	104.8	144.6	1,524.7	73.8
1960	139.3	96.8	106.2	142.8	1,582.6	69.5
1961	138.1	97.6	108.1	140.1	1,701.1	70.7
1962	138.2	98.4	110.7	138.9	1,789.8	71.2
1963	137.4	100.6	113.5	142.8	1,863.4	73.2
1964	142.4	103.7	117.9	146.6	1,967.8	72.8
1965	144.5	107.1	120.4	151.3	2,026.8	74.1

APPENDIX TABLE 2 (CONTINUED)

Year	Labor	Cultivated Land	Crop Area	Fixed Capital	Current Input	Land-Labor Ratio
1966	144.8	109.3	122.2	156.5	2,226.2	75.5
1967	141.4	110.4	121.8	159.8	2,543.5	78.1
1968	136.3	110.6	122.9	160.6	2,978.2	81.1
1969	129.7	110.5	122.7	159.2	3,467.3	85.2
1970	126.9	109.6	120.1	159.0	3,982.3	86.4
1971	123.5	108.6	117.0	159.8	4,316.5	87.9
1972	121.6	107.7	113.9	164.2	4,665.2	88.6
1973	111.0	107.1	113.8	165.8	5,192.0	96.5
1974	104.6	107.1	112.3	165.7	6,271.9	102.4
1975	99.7	107.0	111.8	160.1	7,382.2	107.3
1976	101.5	106.9	108.9	171.5	7,993.8	105.3
1977	100.4	106.7	107.2	177.3	7,829.8	106.3

Note: Five year moving averages for 1920–1945 and three year averages for 1946–1977.

APPENDIX TABLE 3 INDEXES OF TOTAL AGRICULTURAL OUTPUT, TOTAL INPUT, TOTAL PRODUCTIVITY AND LABOR AND LAND PRODUCTIVITIES MEASURED ON THE TOTAL OUTPUT BASIS[a]

Year	Total Output (1)	Total Input[b] (2)	Productivities		
			Total (3)	Labor (4)	Land (5)
1920	100.0	100.0	100.0	100.0	100.0
1921	100.1	100.8	99.3	99.1	100.0
1922	100.7	101.3	99.4	99.1	100.5
1923	101.7	102.0	99.7	99.1	101.4
1924	102.5	102.8	99.7	99.4	102.1
1925	104.5	103.8	100.7	100.8	104.0
1926	103.4	105.1	98.4	99.2	102.9
1927	103.4	107.1	96.5	98.3	102.9
1928	104.7	109.2	95.9	99.1	104.1
1929	104.7	110.6	94.6	98.7	104.1
1930	104.7	112.2	93.2	98.6	104.0
1931	109.8	114.9	95.6	102.6	108.9
1932	113.3	117.7	96.2	105.7	112.3
1933	115.9	121.1	95.7	107.9	114.8
1934	119.4	125.9	94.8	110.8	118.0
1935	129.3	130.2	99.3	119.1	127.6
1936	133.8	133.3	100.4	123.0	131.8
1937	129.4	134.2	96.4	120.2	127.0
1938	130.7	135.5	96.5	120.1	128.3
1939	135.6	135.7	99.9	124.1	133.2
1940	123.3	134.9	91.4	113.8	120.9
1941	115.1	133.3	86.4	106.1	114.1
1942	117.6	131.6	89.3	107.6	117.8
1943	113.2	127.5	88.8	105.7	114.6
1944	106.0	122.7	86.4	101.9	108.4

APPENDIX TABLE 3 (Continued)

Year	Total Output (1)	Total Input[b] (2)	Productivities		
			Total (3)	Labor (4)	Land (5)
1945	109.8	121.2	90.6	106.4	113.2
1946	116.2	119.8	97.0	114.6	119.8
1947	126.9	123.2	103.0	126.1	130.8
1948	138.7	130.2	106.5	135.3	141.4
1949	142.2	131.4	108.3	138.2	145.7
1950	134.2	131.1	102.4	134.5	138.4
1951	120.2	131.1	91.7	125.1	126.3
1952	122.5	136.1	90.0	127.3	129.0
1953	133.6	141.6	94.4	133.9	140.6
1954	149.7	145.6	102.8	145.9	156.0
1955	149.7	149.6	100.0	144.1	154.7
1956	151.1	153.5	98.5	141.1	154.8
1957	155.0	158.3	98.0	136.8	158.4
1958	164.3	162.9	100.9	134.4	167.2
1959	167.6	168.4	99.5	128.4	169.8
1960	173.8	173.6	100.1	124.8	175.5
1961	175.5	174.8	100.4	127.1	175.7
1962	183.7	176.8	103.9	132.9	182.5
1963	195.1	180.0	108.4	142.0	189.4
1964	210.0	186.5	112.6	147.5	197.9
1965	227.8	191.2	119.1	157.6	207.9
1966	231.9	195.5	118.6	160.2	207.4
1967	238.0	197.8	120.3	168.3	210.8
1968	245.4	199.5	123.0	180.0	216.8
1969	253.3	199.8	126.8	195.4	224.6
1970	262.0	202.0	129.7	206.6	233.8
1971	260.5	202.0	120.0	211.0	234.8
1972	264.1	203.3	129.9	217.3	240.0
1973	271.7	201.4	134.9	244.7	247.9
1974	294.7	204.6	156.9	281.6	263.3
1975	329.4	208.1	259.6	330.5	294.6
1976	363.6	213.8	164.2	358.2	325.4
1977	381.0	212.4	179.4	379.6	341.9

[a] Five year moving averages for 1920–1945 and three year moving averages for 1946–1977.

[b] Includes nonfarm current input.

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