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AN INTERNATIONAL COMPARISON OF AGRICULTURAL PRODUCTION AND PRODUCTIVITIES

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FOREWORD

Research for this study was initiated in 1967 at the Institute of Developing Economies, Tokyo, in association with Miss Kinuyo Inagi, Kenji Koike, and Yukihiko Fujita. An earlier result was published in Chujiro Ozaki, (ed.), *Koshinkoku Nogyo Hatten no Shojoken* (Conditions of Agricultural Development in Developing Countries), Institute of Developing Economies, 1968; its English version was Yujiro Hayami and Kinuyo Inagi, "International Comparison of Agricultural Productivities," *The Farm Economist,* Agricultural Research Institute, Oxford University, Volume 11, Number 10, 1969. Since my transfer to the University of Minnesota in 1968, I have continued to develop the study with the cooperation of Mrs. Barbara B. Miller, William W. Wade, and Miss Sachiko Yamashita.

I am indebted to Keith Bryant, Colin Clark, J.P. Houck, L.R. Martin, Kazushi Ohkawa, Chujiro Ozaki, W.L. Peterson, Philip Raup, V.W. Ruttan, and Mataji Umemura for suggestions and comments at various stages of the research. P.E. Stryg of the Royal Veterinary and Agricultural College, Denmark, helped this project by kindly providing data. I wish to thank the Rockefeller Foundation and the University of Minnesota Economic Development Center and Agricultural Experiment Station for financial support. I also thank the Institute of Developing Economies and *The Farm Economist* for the permission of utilizing some earlier materials for this study.

Yujiro Hayami

INTRODUCTION

Insights into the process of agricultural growth have resulted from the long history of inter-country comparisons of agricultural production and productivities following the pioneering work of Colin Clark.[1] However, these studies, including those of Clark, are becoming obsolete as improved data appear. This study utilizes more recent time periods for the inter-country comparisons than did previous studies. From these data, we attempted to derive preliminary hypotheses or "hunches" on the process of agricultural growth.

Most previous estimates of production are in terms of gross output minus seed and feed, and little effort has been made at any comparisons in value added terms.

The first step in updating the inter-country cross-section study of agricultural production was the construction of the series of agricultural output and value added in 1960 (1957-62) for the 43 countries.[2] We have expanded the previous study by constructing a series of agricultural outputs for 1955 (1952-56 averages) and 1965 (1962-66 averages). It would have been more appropriate to have used 1953-57 and 1963-67 averages; however, at the time this study was initiated, 1966 data were the most recent available. We also prepared historical time-series data for selected countries (the U.S., Japan, Denmark, France, and the U.K.) for 1880-1960 to examine the relationships derived from inter-country cross-section data and the historical growth processes.

Data for variables related to production were collected. In principle, flow variables, such as fertilizer inputs, are measured as averages of 1952-56, 1957-62, and 1962-66; stock variables, such as land area and the number of workers, are measured for 1955, 1960, and 1965. In all cases, the first priority in the specification of variables was placed on international and intertemporal comparability.

Major findings in this study of international comparison are: (1) There exist extremely large differences in both labor productivity and land productivity in agriculture; the gap in labor productivity among the developed and less developed countries appears much greater in agriculture than in nonagricultural sectors. (2) The large differences in productivities are associated with the equally large differences in the level of application to agriculture of modern technical inputs supplied from nonagriculture. (3) The differences in productivity and in the application of modern industrial inputs widened in the past decade (1955 to 1965). (4) Patterns of agricultural productivity growth and of the application of modern industrial inputs to agriculture appear to be influenced critically by the relative endowments of land and labor. In an economy in which labor is a relatively more scarce factor, the direction of agricultural growth is biased towards increasing labor productivity through the progress in mechanization. In an economy in which land is a relatively more scarce factor, however, the direction is biased towards increasing land productivity by applying more fertilizer and related inputs. (5) Such patterns of agricultural growth, suggested by the inter-country cross-section observations, seem consistent with the historical experiences of selected countries for the 1880-1960 period.

I. AGRICULTURAL PRODUCTION IN 1960 (1957-62 AVERAGES)

Output

To try to compare agricultural productivities internationally, it was necessary to construct an inter-country cross-section series of aggregate outputs in agriculture. The output variable employed in this study is specified as gross agricultural output net of agricultural intermediate products such as seed and feed. The series of 1957-62 average outputs were estimated as follows: (a) deduct the seed, feed (including imported feed), eggs for hatching, and milk for calf rearing from the quantities of individual agricultural commodities produced, (b) aggregate the quantities by the three sets of wheat relative prices derived from the farm-gate prices (or the import prices of commodities not produced domestically) for the U.S.A., Japan, and India, to produce three aggregate output series, and (c) combine these three series into a single composite series by taking their geometrical means. Denoting quantity produced of the jth commodity in the ith country by q_{ij}, the corresponding quantity to be deducted by d_{ij}, and the wheat relative price of the U.S.A., Japan, and India by w_{Uj}, w_{Jj} and w_{Ij}, respectively, our composite series of gross output, Y_i's, may be expressed as:

$$Y_i = \sqrt[3]{Y_{Ui}\, Y_{Ji}\, Y_{Ii}}$$

[1] Colin Clark's pioneering work is *The Condition of Economic Progress,* First Edition, Macmillan, London, 1940. Other early works were surveyed by Clark in his "World Supply and Requirement of Farm Products," *Journal of Royal Statistical Society,* Series A, Part III, 1954, pp. 263-291, and *The Condition of Economic Progress,* Third Edition, 1957. More recently, FAO attempted to compare land and labor productivities in agriculture for 1956-60 in *The State of Food and Agriculture 1963,* pp. 100-120. In this latter study, unfortunately, neither the details of aggregation procedures nor the numerical data for aggregate output were ever published.

[2] Yujiro Hayami and Kinuyo Inagi "International Comparison of Agricultural Productivities," *The Farm Economist,* Vol. XI, No. 10, 1969, pp. 407-419.

where $Y_{Ui} = \sum_j w_{Uj} (q_{ij} - d_{ij})$; $Y_{Ji} = \sum_j w_{Jj} (q_{ij} - d_{ij})$;

and $Y_{Ii} = \sum_j w_{Ij} (q_{ij} - d_{ij})$.

The underlying assumptions of the above aggregations procedures are: (a) there exist three types of relative price structures characteristic of the three stages of economic development, which may be called "Advanced Stage," "Midway Stage" and "Initial Stage," (b) these three stages may be represented by the U.S.A., Japan, and India, respectively, and (c) any bias arising from aggregating commodities by the prices of one of these representative countries will be cancelled out by the determination of the geometrical mean of three such series. Needless to say, it is arbitrary to assume three stages (why not four?) and to represent the three stages by the U.S.A., Japan, and India. Not theory, but the availability of data led us to selecting the above criteria for our analysis.

Data on the quantities produced were taken from *Production Yearbook* of the Food and Agricultural Organization of the United Nations (FAO) and data for the deduction of seed and feed from FAO's *Food Balance Sheets.*[3] The pertinent data in the latter publication limited the number of countries to 43. Because of the lack of necessary information, capital formation and stock changes, especially in the form of livestock and perennial plants, are not counted in computing output. Only the products of agriculture excluding fishery and forestry are included in agricultural output. However, the aggregate output of the primary sector including fishery and forestry was estimated with the price weights of Japan for the deduction of fishery and forestry workers, as explained later.[4] Quantities produced are measured in farm-gate forms, i.e., sugar cane or cocoon instead of sugar or silk. Major exceptions to this rule are meat products where more data are available in the form of meat than in the form of livestock.

Farm-gate prices were taken from various sources of the three governments.[5] Import prices into the three countries were obtained from the FAO *Trade Yearbook 1965.* Where the imports do not exist in farm-gate forms (e.g., imports of cocoon to the U.S.A.), the import prices in manufactured forms (e.g., silk) were multiplied by the ratios between the prices of the manufactured goods and their sources as raw materials in the exporting country (e.g., the price of cocoon relative to the price of silk in Japan).

Table A-1 shows prices at farm-gate or at port thus obtained as they are converted to wheat relative prices. Table A-2 shows the results of applying the aggregation procedures, as described above, with the weighing systems in table A-1 to determine agricultural output.

Value Added

To estimate value added in agriculture, it is necessary to estimate agricultural inputs supplied from nonagricultural sectors. It is almost impossible, however, to estimate such inputs directly for all 43 countries. Social account studies of agricultural sectors, which provide information on the ratios of value added to gross output, are limited to a handful of nations. To estimate value added in agriculture with any comparability for the 43 countries, we are limited to a very rough method with bold assumptions.

In this study we assumed the following: (a) agricultural inputs from nonagricultural sectors can be divided into two major categories, land substitutes and labor substitutes; and (b) the input of land substitutes is proportional to fertilizer input, and the input of labor substitutes is proportional to farm machinery imput.

With these assumptions we estimated the values of agricultural inputs supplied from nonagricultural sectors, using the U.S.A. and Japan as the bases of aggregation, to: (a) construct the indices of fertilizer input and farm machinery input with the inputs in the base countries being set equal to 1; (b) allocate the total values of the agricultural inputs in the base countries to the two major categories of inputs, land substitutes, and labor substitutes; and (c) add the inputs of land substitutes and of labor substitutes which are estimated by multiplying the fertilizer index by the value of land-substituting inputs in the base countries and the machinery index by the value of labor-substituting inputs. These two series of agricultural inputs, either with U.S. or Japanese weights, were deducted from the corresponding series of gross agricultural outputs (minus seed and feed) estimated in the previous section to produce the two series of value added in agriculture. The two series of value added ratios calculated on these data of gross output and value added were averaged geometrically to cancel any bias which may arise from the specific input structure of the U.S.A. or Japan. The above procedures are inconsistent with the previous ones because the aggregation using Indian weights was not attempted. The lack of appropriate data for agricultural inputs in Indian agriculture caused this inconsistency.

If we denote the input of fertilizer in the ith country by F_i, the input of farm machinery by M_i, the input values of land substitutes in the U.S.A. and Japan by f_U and f_J, respectively, and the input values of labor substitutes in the U.S.A. and Japan by m_U and m_J, respectively, the final series of value added in the ith country, V_i, can be expressed as:

$$V_i = Y_i \sqrt{r_{Ui}\, r_{Ji}}$$

where $r_{Ui} = \frac{1}{Y_{Ui}}\left[Y_{Ui} - (f_U \frac{F_i}{F_U} + m_U \frac{M_i}{M_U})\right]$

and $r_{Ji} = \frac{1}{Y_{Ji}}\left[Y_{Ji} - (f_J \frac{F_i}{F_J} + m_J \frac{M_i}{M_J})\right]$

[3] FAO, *Production Yearbook, 1960 to 1965; Food Balance Sheets 1957-59 Average and 1960-62 Average.*

[4] Forest output data measured as the cut volume of roundwood in cubic meters are from FAO, *Yearbook of Forest Product Statistics 1959 to 1963.* Fishery output data measured as the catch of fish are from FAO, *Yearbook of Fishery Statistics 1964,* and the data on the number of whales caught are from United Nations, *Statistical Yearbook of United Nations 1965.* Producers' price of roundwood in Japan was estimated from Ministry of Agriculture and Forestry, *35 Nendo Sangyo Renkanhyo Sakusei Shiryo (Data for the Construction of Input-Output Table for 1965)* No. 1 (mimeo.), 1966 and *40 Nendo Sangyo Renkanhyo Sakusei Shiryo (Data for the Construction of Input-Output Table for 1965)* (mimeo.), 1966. The prices of fish and whale were taken from FAO, *Yearbook of Fishery Statistics 1964* and Ministry of Agriculture and Forestry, *Pocket Norin Suisan Tokei 1965 (A Handbook of Agriculture, Forestry and Fishery Statistics).*

[5] The U.S. prices were calculated from USDA, *Agricultural Statistics 1964* as average unit prices. Prices in Japan were taken from the unpublished data prepared by *Statistical Research Division, the Ministry of Agriculture and Forestry* for the estimation of farm output (based on *The Farm Household Economy Survey*). In India, the national average prices of major field crops were calculated by averaging state prices using quantities produced as the weights. These farm-gate prices are from *Economic Survey of Indian Agriculture, 1963/64 and 1964/65,* and quantity weights are from *Estimates of Area and Production of Principal Crops in India, 1959-60 and 1960-61,* both by the Ministry of Agriculture. For the commodities for which farm-gate prices were not available, we calculated wheat relative prices from wholesale prices (Central Statistical Organization, Department of Statistics, *Statistical Abstract of Indian Union 1965*) or retail prices (Ministry of Food and Agriculture, *Agricultural Situation in India,* March 1957 to March 1963).

Data for fertilizer input, F_i's, are the 1957-62 averages of the simple sums of the N, P_2O_5, and K_2O contained in commercial fertilizers. The only data for farm machinery input which have any international comparability are the tractor horsepower of farm and garden tractors. These data are explained in the next section. Table 1 summarizes the estimation of the values of the agricultural inputs supplied from nonagricultural sources for the major categories in the U.S.A. and Japan.

Table 1. Agricultural inputs supplied from the nonagricultural sector, U.S.A. and Japan, 1957-62 averages*

Country	Unit	Land Substitutes	Labor Substitutes
U.S.A.[1]	Dollars (in millions)	1,845	8,906
	Wheat units (in thousands)	27,299 ($=f_U$)	137,747 ($=m_U$)
Japan[2]	Yen (in billions)	2,162	1,698
	Wheat units (in thousands)	5,895 ($=f_J$)	4,708 ($=m_J$)

*Agricultural inputs supplied from the nonagricultural sector are divided into "land substitutes," "labor substitutes," and "unclassifiable." The value of "unclassifiable" inputs are allocated to "land substitutes" and "labor substitutes" according to the proportions of inputs of both categories. The classification of items and the sources of data are:

[1]U.S.A.: U.S. Department of Agriculture, *Agricultural Statistics, 1964.*

Land substitutes	Fertilizer and lime
Labor substitutes	Repairs and operation of motor vehicles and machinery, depreciation of motor vehicles, other machinery, and implements
Unclassifiable	Repairs and operation of farm buildings, miscellaneous current farm expenses, depreciation of farm buildings, accidental damage of farm capital

[2]Japan: Ministry of Agriculture and Forestry, *Nogyo oyobi Noka no Shakai Kanjo (Social Accounts of Agriculture and Farm Households) 1967.*

Land substitutes	Fertilizer
Labor substitutes	Light and power, small equipment, repairs of machinery and implements, depreciation of machinery and implements
Unclassifiable	Agricultural medicines, repairs of farm buildings, depreciation of farm buildings, miscellaneous materials, miscellaneous expenses

Two series of value added ratios and final estimates of the value added are presented in table A-3. At a glance, one might wonder if the value added ratios in some of the advanced countries, especially the Scandinavian countries, had been underestimated. The tendency to **overestimate** the value added ratios in the industrialized countries seems inherent to our estimation procedures, however. For example, the fertilizer and machine series may not represent adequately the two major categories of inputs. More importantly, representing the input of labor substitutes by tractor horsepower is likely to lead to underestimating the input levels of labor substitutes in less-developed countries, where farmers are equipped primarily with animal plows and/or hand hoes. Furthermore, in highly industrialized countries the inputs of industrial origin, such as fertilizer and tractors, are supplied to farmers more cheaply relative to farm-product prices. This leads to the implication that value added ratios in these countries are relatively higher for their levels of inputs of these factors. The extremely low value added ratios estimated for the Scandinavian countries (Finland, Norway, and Sweden) seem to indicate that the relative prices of inputs and outputs are especially favorable for their farmers, rather than that their income is very low relative to gross sales.

II. INPUTS AND RELATED INDICATORS, 1960

To facilitate the analysis of agricultural production, data of inputs and other indicators of agricultural production comparable to output data were collected (tables A-4 and A-5). Production function analyses based on these inputs and output data are contemplated.

Land and Labor

Land and labor are the two primary factors of agricultural production. Used as the land variable was the area of agricultural land, including permanent meadows and pastures, in the year closest to 1960 as reported in FAO's *Production Yearbook.* There have been several attempts to aggregate arable land and unimproved pasture land using appropriate weights.[6] The results of such attempts tend to be arbitrary, however. The proportion of arable land to total agricultural land can be considered a variable which farmers can manipulate by changing the method of farming and the intensity of cultivation. We preferred, therefore, to use the unweighted sum of arable land and pasture land areas as the land variable, partly to avoid arbitrariness and partly to enable the making of comparisons at the equilibrium reached when the adjustments in land utilization resulting from changes in the demand for agricultural land are completed. This procedure, however, tends to overestimate the endowment of agricultural land in newly settled countries, such as Australia, primarily engaged in pastoral farming, leading to an underestimation of land productivity in these countries.

The number of economically active males in agriculture estimated from the International Labor Organization's (ILO) economically active population in agricultural occupations (agriculture, forestry, hunting, and fishing) was used as the labor variable.[7] Only males were counted to preserve the international comparability of data. The number of forestry and fishery workers (neglecting hunters) from the ILO's labor population in agricultural occupations, determined by multiplying the population by the ratio of the gross output in agriculture to the gross output of agriculture, forestry, and fishing (which were aggregated with Japan's wheat relative prices), was deducted. That is, the economically active male population in agriculture in country i, L_i, can be estimated from that in agricultural occupations, L_i', as

$$L_i = L_i'\left(\frac{Y_{Ji}}{Y_{Ji}'}\right) \text{(see } Y_{Ji} \text{ and } Y_{Ji}' \text{ in table A-2).}$$

This method is based on the assumption that labor productivities are equal between these agricultural occupations.

Fertilizer and Machinery

Fertilizer input ($N + P_2O_5 + K_2O$) and tractor horsepower (hp) were used as indices representing respectively these

[6]See FAO, *The State of Food and Agriculture 1963,* p. 110.
[7]ILO, *Yearbook of Labor Statistics 1965.*

agricultural inputs supplied by nonagricultural sectors: (a) land substitutes and (b) labor substitutes.

The series of 1957-62 average fertilizer inputs in terms of the simple sum of N, P_2O_5, and K_2O were compiled from FAO, *Fertilizer Annual Review.* Tractor horsepower data were obtained for OECD countries from OECD, *Evolution de la motorization de l'agriculture et de la consommation et des prix des carburant dans les pays membres, June 1963.* For countries outside of OECD, tractor horsepower was estimated from the number of farm tractors by assuming that 30 horsepower and 5 horsepower were the averages of farm tractors and garden tractors respectively. Data for the number of tractors were taken from the FAO, *Production Yearbook.*

Livestock

Livestock represent capital for agricultural production. We have aggregated livestock on farms in 1960 in terms of livestock units (conversion factors used: camels, 1.1; buffalo, horses, and mules, 1.0; cattle and asses, 0.8; pigs, 0.2; sheep and goats, 0.1; poultry, 0.01).[8]

Perennial plants are capital of the same nature, but we could not include perennial plants in this study due to lack of information.

Education

It has been recognized increasingly that education to improve the quality of labor, research to produce new techniques and inputs, and extension to propagate the new techniques are inputs that should be regarded as production factors.

As an indicator of the level of general education for farmers, it would be desirable to include the variable of average schooling years of farmers. Since such data are not available for most of the countries, we prepared two proxy variables for education: (a) the literacy rate and (b) the school enrollment ratio for the adjusted, combined first and second levels of education. These ratios are country-wide averages and are not exclusive to the agricultural sector. It seems reasonable to assume, however, that the average literacy and school enrollment ratios among rural populations are more or less parallel with the national averages. Data for the literacy rate are the estimates by UNESCO for the mid-20th Century (UNESCO, *World Illiteracy at Mid-Century, 1957,* pp. 38-44). School enrollment ratios are the averages of 1950, 1955, and 1960 figures taken from UNESCO, *Statistical Yearbook 1964.*

As a proxy variable for advanced technical education as the producer of research and extension, we prepared a series of 1958-62 averages of the number of graduates from the agricultural faculty in the third level of education per 10,000 male farm workers. Data for the number of graduates were taken from UNESCO, *Statistical Yearbook 1964.*

Number of Farms

Agricultural organization and technology are determined to a large extent by the average scale of farms which can be measured by output per farm, land area per farm, and other measures. To facilitate the analysis of agricultural production on a per-farm basis, data for the number of farms (agricultural holdings) are collected mainly from the FAO report on the 1960 World Census of Agriculture, supplemented by several other governmental and private publications.

Indicators of Industrialization

To analyze the linkage between agricultural and nonagricultural sectors or the linkage between agricultural productivity and activities in the rest of the economy, we prepared two proxy variables for industrialization. (The term industrialization is used here as an increase in nonagricultural activities in the economy, leading to progress in the intersectoral division of labor.) These proxies are (a) the ratio of male workers in nonagricultural occupations to the total number of male workers active in the economy and (b) the ratio of national income generated from the nonagricultural sectors to the total national income. The former data were calculated from ILO, *Yearbook of Labor Statistics 1965* and the latter from UN, *Yearbook of National Account Statistics* (various issues).

[8] Based on the FAO's conversion factors. FAO, *Production Yearbook 1966,* p. 656.

III. COMPARISON OF PRODUCTIVITY FOR 1960

Since the major goal of agricultural development is to increase the output and income per worker engaged in agriculture, labor productivity is the most relevant indicator of agricultural productivity in the development context. In some densely populated countries, however, land places stronger limitations on agricultural production than does labor. Where land area is an important limiting factor, an increase in agricultural output and income can be attained by increasing yields per unit of land area. To derive the implications of agricultural growth from a comparison of countries with greatly different land and labor endowments, it is useful to compare land and labor productivities simultaneously.

Based on the previous data, land and labor productivities were calculated as output or value added per male worker and per hectare of agricultural land area (table 2). International differences in agricultural productivities are indeed great. Measured in WU's (Wheat Units), agricultural output per hectare ranged from 0.04 (Libya) to 10.24 (Taiwan), and value added per hectare from 0.03 to 9.48. Output per male worker ranged from 2.1 (India) to 141.8 (New Zealand) and value added per male worker from 2.1 to 107.2. These figures must be interpreted with caution. Extremely low estimates of land productivity for Australia and Libya, to a large extent, are due to the large area of unproductive grazing land included in agricultural land, thereby inflating the denominator of land productivity. Likewise, when we compare labor productivity, for example, between India and New Zealand, we have to consider the fact that women participate in agricultural labor in India. Discounting even these factors, however, agricultural productivity differences among countries seem extremely large.

Figures 1 and 2 show relative efficiencies of agricultural production with respect to the original factors of agricultural production in respective countries. These figures plot countries according to land productivity and labor productivity (data from table 2). In the figures, three distinct scatters or paths extending out from the origin can be observed: (a) the group of countries in the New Continents, represented by New Zealand, Australia, Canada, and the U.S.A., where man-land

Symbol key for all figures:

Argentina	Arg	Chile	Ch
Australia	Aus	Colombia	Co
Austria	Au	Denmark	De
Belgium		Finland	Fi
(& Luxemburg)	Be	France	Fr
Brazil	Br	Germany	Ge
Canada	Can	Greece	Gr
Ceylon	Ce	India	In

Ireland	Ir	Spain	Sp
Israel	Is	Surinam	Su
Italy	It	Sweden	S
Japan	Ja	Switzerland	Sw
Mauritius	Ma	Syria	Sy
Mexico	Me	Taiwan	Tai
Netherlands	Ne	Turkey	Tu
New Zealand	N.Z.	United Arab Republic	U.A.R.
Norway	No	United Kingdom	U.K.
Paraguay	Pa	United States	U.S.A.
Peru	Pe	Venezuela	Ve
Phillippines	Ph		
South Africa	S.A.		

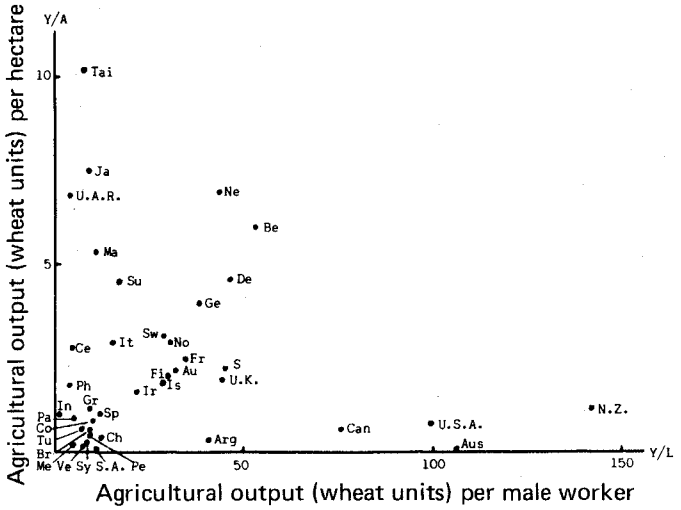


Figure 1. International comparison of agricultural output per male worker and per hectare of agricultural land. Output data are 1957-62 averages, and labor and land data are of year closest to 1960. Data from table 2.

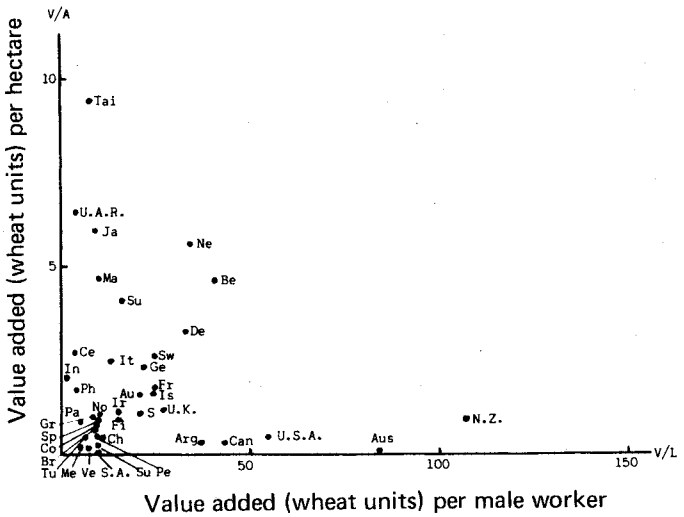


Figure 2. International comparison of value added in agriculture per male worker and per hectare of agricultural land. Value added data are 1957-62 averages, and labor and land data are of years closest to 1960. Data from table 2.

Table 2. Estimated land and labor productivities in agriculture, 43 countries, 1960, in wheat units

Country	Output		Value added	
	per hectare (Y/A)	per male worker (Y/L)	per hectare (V/A)	per male worker (V/L)
Argentina	0.37	39.9	0.35	37.6
Australia	0.09	106.4	0.07	84.2
Austria	2.33	31.7	1.62	22.1
Belgium (& Luxemburg)	6.12	52.7	4.68	40.5
Brazil	0.60	9.4	0.58	9.2
Canada	0.58	75.8	0.34	43.5
Ceylon	2.85	3.9	2.71	3.7
Chile	0.48	12.9	0.43	11.5
Colombia	0.84	10.3	0.81	9.8
Denmark	4.60	47.4	3.27	33.7
Finland	2.02	30.9	0.97	14.8
France	2.49	35.9	1.75	25.2
Germany, Fed. Rep.	4.00	38.6	2.37	22.9
Greece	1.22	9.9	1.08	8.7
India	1.06	2.1	1.05	2.1
Ireland	1.58	21.0	1.20	16.0
Israel	1.84	28.9	1.58	24.8
Italy	3.00	16.1	2.50	13.4
Japan	7.47	10.7	6.00	8.6
Libya	0.04	n.a.	0.03	n.a.
Mauritius	5.33	11.6	4.76	10.5
Mexico	0.27	5.2	0.25	4.9
Netherlands	7.21	43.1	5.69	34.0
New Zealand	1.19	141.8	0.96	107.2
Norway	3.09	31.1	1.07	10.7
Pakistan	n.a.	2.4	n.a.	2.4
Paraguay	0.94	5.0	0.93	4.9
Peru	0.56	10.2	0.52	9.6
Philippines	1.88	3.8	1.83	3.7
Portugal	n.a.	7.4	n.a.	6.7
South Africa	0.16	11.7	0.14	9.8
Spain	1.08	12.2	0.97	10.9
Surinam	4.46	17.1	4.13	15.8
Sweden	2.33	44.3	1.08	20.6
Switzerland	3.16	29.3	2.70	25.0
Syria	0.36	9.4	0.35	9.2
Taiwan	10.24	8.1	9.48	7.5
Turkey	0.59	7.1	0.56	6.8
U.A.R.	6.90	4.4	6.54	4.2
U.K.	1.94	44.0	1.18	26.8
U.S.A.	0.80	99.5	0.45	55.8
Venezuela	0.28	8.4	0.27	7.9
Yugoslavia	1.14	n.a.	1.01	n.a.

ratios are particularly favorable; (b) the group of countries in Asia, represented by Taiwan and Japan, where unfavorable man-land ratios prevail; and (c) the group of countries in Europe, represented by Denmark, Belgium, and The Netherlands, in which the condition of original factor endowments is between the other two groups. Each path seems to reflect the long-run process of agricultural growth under a given man-land

ratio. Land and labor are endowed historically to the agricultural sector. Under the given conditions, farmers would try to increase output and income. In one case, it is land which limits the increase in output; in the other, it is labor. To ease the limitation set by either land or labor, farmers would try to economize the use of the limiting original factor or to substitute for it with man-made inputs, e.g., fertilizer for land and tractors for labor. The growth path suggested by the countries in the New Continents seems to reflect the easing of the limitation set by labor, and the one suggested by Asian countries to reflect the easing of the limitation set by land.

This easing may be seen by comparing figures 1 and 2 with figure 3 which plots countries' fertilizer inputs ($N + P_2O_5 + K_2O$) per hectare of agricultural land and tractor horsepower per male worker (data from table 3). As discussed previously, the former represents the factors which substitute for land and the latter represents the factors which substitute for labor. The efficiency positions of respective countries in figures 1 and 2 roughly correspond to their positions of input mix in figure 3.

Despite large differences in climate, technology, and output mix, major variations in agricultural productivities of land and labor appear explainable in terms of differences in the levels of inputs which substitute for the original production factors.

The strategic problem is how a country can increase the input of land substitutes and/or labor substitutes to improve its position of agricultural production efficiency. Two major factors may be: (a) the creation and propagation of better techniques and (b) an adequate supply of agricultural inputs from nonagricultural sectors. For example, there is little reason to increase fertilizer usage unless better or improved varieties capable of withstanding and absorbing more fertilizer

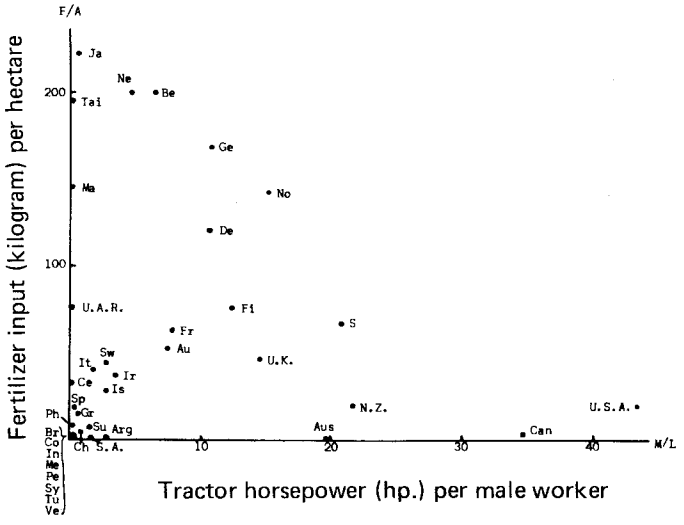


Figure 3. International comparison of tractor horsepower per male worker and fertilizer input per hectare of agricultural land. Fertilizer data are 1957-62 averages, and labor, land, and tractor data are of years closest to 1960. Data from table 3.

are selected and propagated. Also crucial for agricultural development are the nonconventional variables such as education, research, and extension which determine the creation and propagation of new techniques and inputs. Farmers cannot

Table 3. Agricultural land area per male worker, fertilizer input per hectare of agricultural land, and tractor horsepower per male worker, 1960

Country	Land area per male worker (A/L)	Fertilizer ($N+P_2O_5+K_2O$) per hectare (F/A)	Tractor horsepower per male worker (M/L)
	ha.	kg.	hp.
Argentina	106.4	0.1	2.69
Australia	1185.2	1.3	19.70
Austria	13.6	54.4	7.57
Belgium (& Luxemburg)	8.6	203.0	6.53
Brazil	15.8	1.4	0.23
Canada	129.9	5.1	34.71
Ceylon	1.4	33.1	0.01
Chile	27.8	5.6	0.92
Colombia	12.2	1.9	0.46
Denmark	10.3	123.5	10.65
Finland	15.3	75.9	12.30
France	14.4	63.2	7.93
Germany, Fed. Rep.	9.7	161.9	10.95
Greece	8.1	16.2	0.72
India	2.0	1.9	0.01
Ireland	13.3	38.1	3.62
Israel	15.7	26.8	2.78
Italy	5.4	39.0	1.93
Japan	1.4	224.6	1.07
Libya	n.a.	0.3	n.a.
Mauritius	2.2	146.3	0.16
Mexico	19.5	1.8	0.23
Netherlands	6.0	201.6	4.80
New Zealand	119.1	19.7	21.89
Norway	10.0	140.2	15.22
Pakistan	n.a.	n.a.	n.a.
Paraguay	5.3	n.a.	0.07
Peru	18.4	5.5	0.27
Philippines	2.0	8.3	0.03
Portugal	n.a.	n.a.	0.28
South Africa	71.5	2.1	1.59
Spain	11.2	19.5	0.42
Surinam	3.8	10.9	1.42
Sweden	19.0	66.7	20.81
Switzerland	9.3	45.9	2.80
Syria	26.3	0.7	0.26
Taiwan	0.8	196.1	0.03
Turkey	12.1	0.8	0.31
U.A.R.	0.6	79.4	0.05
U.K.	22.7	49.5	14.81
U.S.A.	124.2	16.4	43.91
Venezuela	29.5	0.7	0.49
Yugoslavia	n.a.	16.9	n.a.

afford to increase fertilizer applications unless the nonagricultural sector supplies them fertilizer at reasonable prices relative to farm product prices. Essential to agricultural productivity growth are the development of the nonagricultural sector and an increase in the efficiency of supplying agricultural inputs to the farmer resulting from progress in interindustry specialization and division of labor.

IV. CONSISTENCY CHECK OF 1960 DATA

In this section, the adequacy of our data will be checked by comparing our estimates with other variables and previous estimates.

Consistency with National Income Statistics

The United Nations' *Yearbook of National Accounts Statistics* provides from a large number of countries the data of income generated by the agricultural industry (agriculture, forestry, and fishing) as a major industrial classification. Major differences between the national income account data and our estimates of the value added in agriculture are that our estimates: (a) do not include forestry and fishing and (b) are designed to compare value added in real terms. The national account data, however, include the variations in agricultural prices relative to other product prices. The first difference can be adjusted with conversion factors for the labor force, assuming income per worker is the same for agriculture, forestry, and fishing. Thus adjusted, the national account data of income generated in agriculture in native currency, I_{ai} (i denotes country), may be viewed as the physical product in agriculture, Q_{ai}, multiplied by the price of agricultural products, P_{ai}:

$$I_{ai} = Q_{ai} P_{ai}$$

Conversion of I_{ai} by the exchange rate or purchasing power parity, r_i, produces:

$$I_{ai}/r_i = Q_{ai} (P_{ai}/r_i)$$

where P_{ai}/r_i measures the price of agricultural products relative to the general price (or exchange rate). To the extent r_i measures general price or purchasing power accurately, P_{ai}/r_i reflects the internal terms of trade between agriculture and the rest of the economy. Supposedly our estimates of value added in agriculture are Q_a's. P_{ai}/r_i can be estimated by dividing the national accounts data of agricultural income by our estimates.

Table 4 shows the procedure used to derive the estimates of implicit agricultural price relative to exchange rate — implicit in the sense that the price is implied in the national account data and in our data. Estimations were made for the countries which had available information on national accounts of income generated by industries in terms of gross domestic product (GDP) at factor cost and comparable wheat prices.[9]

[9] Income by industries in terms of net domestic product (NDP) is more desirable for comparison, but the number of countries for which the data are available in NDP terms rather than in GDP terms is very small.

Table 4. Estimated implicit agricultural price and producers' price of wheat

Country	Value added in agriculture: UN estimate[1]	Value added in agriculture: This study[2]	Adjustment factor[3]	Implicit agricultural price [(1) ÷ (2)] ÷ (3)	Wheat price[4]
	(million US dollars)	(1,000 wheat units)		(US dollars/ wheat units)	(US dollars/ metric ton)
Australia	1,818	33,265	1.062	51	58†
Austria	639	6,571	1.218	80	90‡
Belgium	732	8,687	1.049	80	94
Canada	2,281	21,076	1.456	74	64
Ireland	391	5,473	1.016	70	80
Italy	5,051	52,310	1.065	91	107
Japan	5,448*	42,106	1.401	92	106
Netherlands	991	13,175	1.048	72	80
Pakistan	3,613	44,855	1.052	77	74‡
Spain	2,668	32,937	1.114	73	78‡
U.K.	2,552	23,535	1.062	102	76

[1] GDP at factor cost in agriculture, converted to US dollars by exchange rate: UN, *National Account Statistics,* various issues.
[2] Extimated value added in agriculture: table A-3.
[3] Estimated ratio of workers in agriculture, forestry, and fishing to workers in agriculture.
[4] Producers' price, converted to US dollars by exchange rate: FAO, *Production Yearbook,* 1967, pp. 520-521.
*Original data in terms of NDP at factor cost converted to GDP by adding depreciation allowances (20 percent of NDP) based on the information in Japan, Ministry of Agriculture and Forestry, *Nogyo oyobi Noka no Shakai Kanjo* (Social Accounts of Agriculture and Farm Households), 1967.
†Export price.
‡Wholesale price converted to producers' price by assuming 10 percent of wholesale margin.

The estimates of the implicit agricultural price were compared with the price of wheat (figure 4). Except for the United Kingdom a high, positive correlation between these two variables can be observed. Although the prices of wheat do not reflect fully the variations in the aggregate price of agricultural products, the positive correlation between the price of wheat and the estimate of implicit agricultural price indicates that our estimates of implicit price measure the variations in the price of agricultural products fairly accurately. Since our estimates of agricultural price are implicit in the national account data and our data of value added in agriculture, the result shows a consistency between these two sets of data.

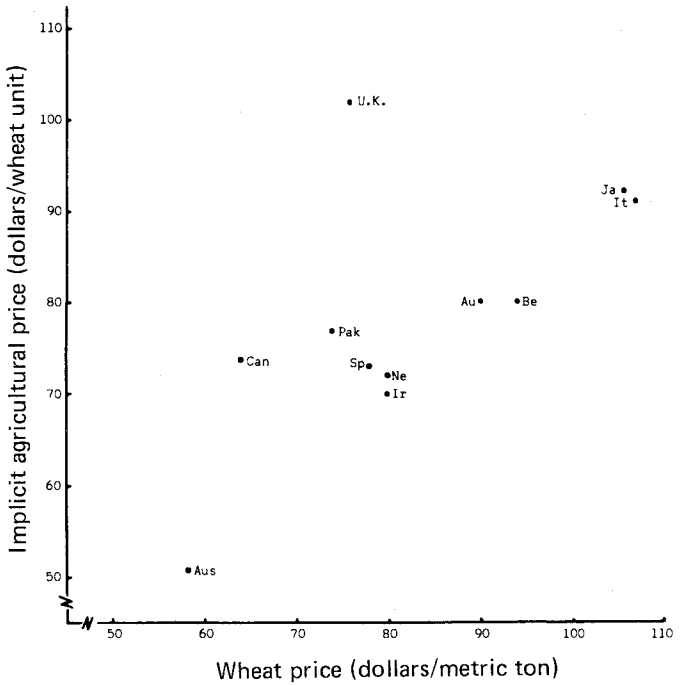


Figure 4. Relation between the estimated implicit agricultural price and producers' price of wheat. Data from table 4.

Also, it appears that the exceptional position of the United Kingdom can be explained by the relatively lower price of wheat compared to the prices of other agricultural commodities in the United Kingdom than in other countries. For example, if we compare the 1960 prices of wheat and barley (the major grains produced in the United Kingdom) according to the FAO statistics (*Production Yearbook*), wheat was underpriced relative to barley in the United Kingdom:

	Wheat	Barley	Wheat/Barley
	(U.S. cents/kg.)		
France	8.1	6.7	1.21
Japan	10.4	9.0	1.15
U.S.	6.4	3.8	1.68
U.K.	7.4	7.9	0.94

If the above reasoning is correct, the position of the United Kingdom, which disturbs the positive correlation between the price of wheat and the implicit agricultural price in figure 4, shows the inadequacy of wheat to represent agricultural prices in the United Kingdom rather than the deficiency in our output data.

Consistency with Wage Rates

If we assume that the underlying agricultural production function is linear homogeneous, the output per worker (and/or value added per worker) should be the increasing function of other inputs per worker (capital in the case of value added):

$$Y/L = f(K/L)$$

where K represents the aggregate of these inputs. If the wage rate is high relative to the prices of other inputs, (K/L) would be higher and, consequently, (Y/L) would be higher. If we assume that the exchange rate even roughly reflects the general commodity price level, (Y/L) would be the increasing function of the wage rate deflated by the exchange rate, because the price of other inputs (or capital) likely would be lower relative to the wage if the general commodity price level is lower.

Data of farm wage rates were collected as shown in table 5 and were plotted against our estimates of output per worker

Table 5. Farm wage rates, male workers' wages including board, 1957-62 averages

Country	US dollars per day	Country	US dollars per day
Austria	2.51*	Mauritius	0.97§
Belgium	3.69	Mexico	0.75
Canada	7.36	New Zealand	5.76‡
Ceylon	0.57	Norway	5.13
Denmark	4.47	Peru	1.09
Finland	3.04†	Philippines	0.97
France	2.01*§	Portugal	0.87
Germany	3.43†§	Sweden	6.40†
India	0.26‖	Turkey	1.23§
Ireland	2.98	U.K.	6.36‡
Japan	1.21§	U.S.A.	6.40

*Converted from monthly wages assuming 22 work days in a month.
†Converted from hourly wage assuming 8 work hours in a day.
‡Converted from weekly wages assuming 5 work days in a week.
§Ten percent of cash wage added for board.
‖Including female.
Source: UN, *Production Yearbook,* 1967, pp. 649-659.

(figure 5) and against the value added per worker (figure 6). The high correlations in figures 5 and 6 indicate the consistency of our data with wage rate data.

Figure 6 shows that the value added per worker is exceptionally low relative to the wage rate for Scandinavian countries, particularly Finland, Norway, and Sweden. These countries' value added ratio estimates are exceptionally low. The adequacy of the value added estimates for these three countries is questioned by comparison with wage rates. The rather low value added per worker relative to the wage rate in the U.K. in figure 6 and the exceptional position of the U.K. in figure 4 suggest that the value added for the U.K. might be underestimated.

The high correlation between the output or value added per worker and the wage rate seems to indicate the consistency between these variables.[10]

[10]High linear correlations among log-transformed variables imply the CES (Constant Elasticity of Substitution) production function. See K.J. Arrow et. al., "Capital-Labor Substitution and Economic Efficiency," *The Review of Economics and Statistics,* Vol. 43, August 1961, pp. 225-250.

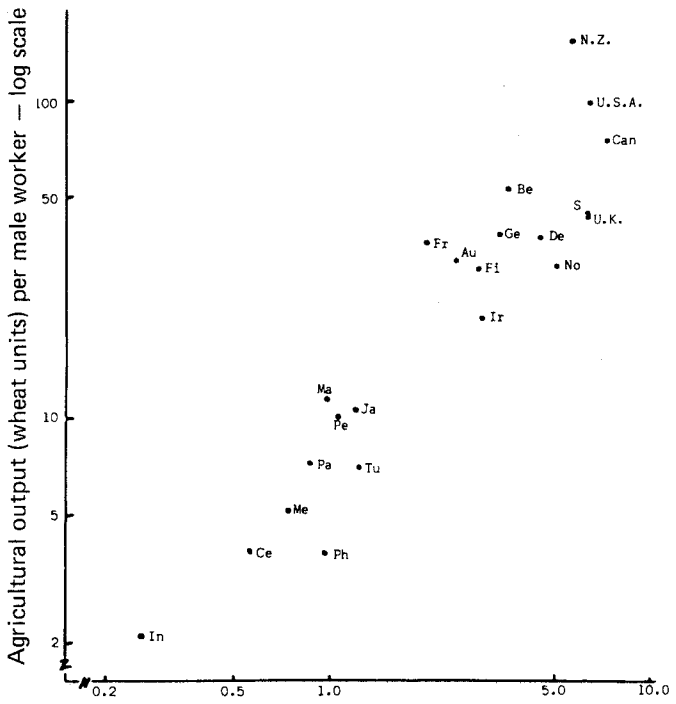


Figure 5. Relation between farm wage rate and agricultural output per male farm worker. Data from tables 2 and 5.

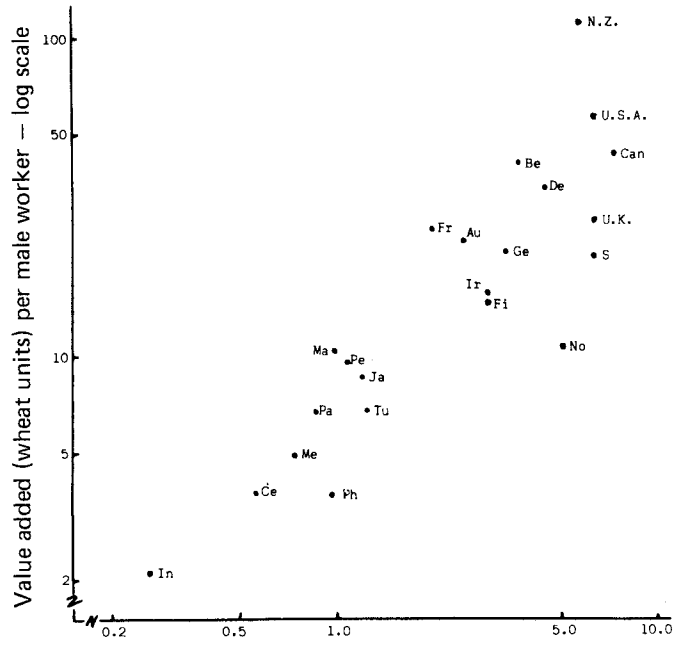


Figure 6. Relation between farm wage rate and value added per male farm worker. Data from tables 2 and 5.

Comparison with Colin Clark's Estimates

It is of interest to compare our estimates of agricultural output for 1957-62 with Colin Clark's estimates for 1949-52. Clark's estimates of agricultural output per male worker in IU's (International Unit = a quantity of goods exchangeable for one U.S. dollar from 1925 to 34) are converted to figures in WU's (Wheat Unit = a quantity of goods exchangeable for one metric ton of wheat) by dividing the IU's by 32.7 (the 1925-34 average producers' price of wheat in the U.S.). The results are compared with our estimates in table 6 and figure 7. Although these series are based on different aggregation procedures (Clark's output data are aggregates using 1925-34 average U.S. prices), the labor productivity rankings of countries are similar. With the exception of Norway, our estimates are larger than Clark's, which is consistent with our knowledge that in most countries labor productivity in agriculture increased during the 1950's. That labor productivity in agriculture retrogressed in Norway is not consistent with our expectations, however. This must be explained by the bias from different aggregation procedures. Although it is difficult to identify the particular procedure causing this result, the rather strange results for Scandinavian countries in this comparison seem to parallel those of the previous comparison with wage rates.

Table 6. Comparison of Colin Clark's and this study's estimates of agricultural output per male worker

Country	Agricultural output per male worker (WU's)	
	Clark 1949-52[1]	This study 1957-62[2]
Argentina	30.1	39.9
Australia	66.8	106.4
Austria	13.4	31.7
Belgium	28.3	52.7
Canada	48.8	75.8
Chile	8.1	12.9
Colombia	8.1	10.3
Denmark	40.3	47.4
Finland	14.5	30.9
France	17.8	35.9
Germany	25.1	38.6
Ireland	14.2	21.0
Italy	6.9	16.1
Japan	6.7	10.7
Netherlands	30.3	43.1
New Zealand	131.2	141.8
Norway	38.5	31.1
South Africa	7.3	11.7
Spain	8.8	12.2
Sweden	20.0	44.3
Switzerland	16.4	29.3
Turkey	3.9	7.1
U.K.	35.4	44.0
U.S.A.	49.4	99.5
Venezuela	6.9	8.4

[1] Colin Clark, "World Supply and Requirements of Farm Products," *Journal of Royal Statistical Society*, Series A, Part III, 1954, Vol. 117, pp. 263-291.
[2] From table 2.

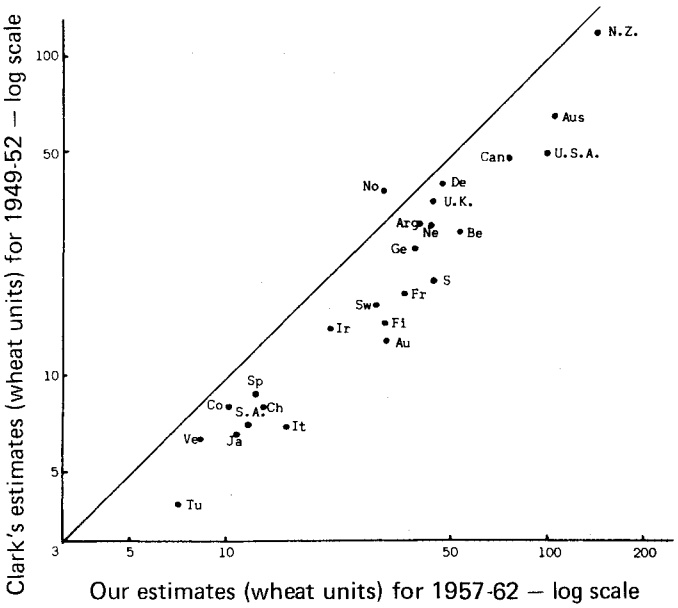


Figure 7. Comparison of Colin Clark's estimates (1949-52) and our estimates (1957-62) of agricultural output per male worker. Data from table 6.

V. CHANGE IN PRODUCTION AND PRODUCTIVITY, 1955 TO 1965

To compare agricultural production and productivity at one point in time and their changes over time, we have compiled data of agricultural output and inputs for 1955 and 1965 (tables B-1 through 9). Appendix B presents procedural details as they relate to estimation and compilation of the variables for these years.

Output

It would be consistent to prepare the output variable data for 1955 and 1965 by the same procedures used for the 1960 data, i.e., to aggregate individual products by their prices (as in table A-1). This would involve huge efforts, however. Instead we extended our 1957-62 (for 1960) output data to 1952-56 (for 1955) and 1962-66 (for 1965) by using FAO's indices of agricultural production for the respective countries. The FAO index, with 1952-56 equaling 100, was spliced to the inter-country cross-section series of agricultural output in Wheat Units for 1957-62. It would be desirable to have data for the averages of 1953-57 and 1963-67, but when this study was started, the FAO index was available only through 1966.

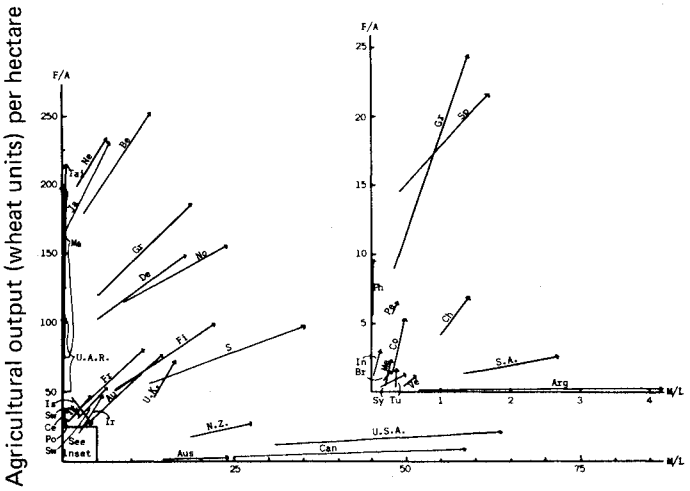
The FAO index is based on the same definition of production as ours — gross output minus seeds and feed. Individual commodities are aggregated by regional product prices. The data of output produced by splicing the production indices of different regional weight systems would have characteristics similar to the Divisia index.

Inputs and Related Indicators

Data about agricultural inputs and related indicators, comparable to those collected for 1960 in section II, also were compiled for 1955 and 1965. The data specifications for these variables were the same as for 1960 data. To be consistent with output data, the fertilizer inputs were averaged for 1952-56 and 1962-66. Stock variables such as land and labor were measured for 1955 and 1965. Original data for these stock variables measured for 1955 and 1965 are not always available. In these cases, we used the observations nearest to 1955 and 1965 and estimated the values for 1955 and 1965 by interpolation and/or extrapolation.

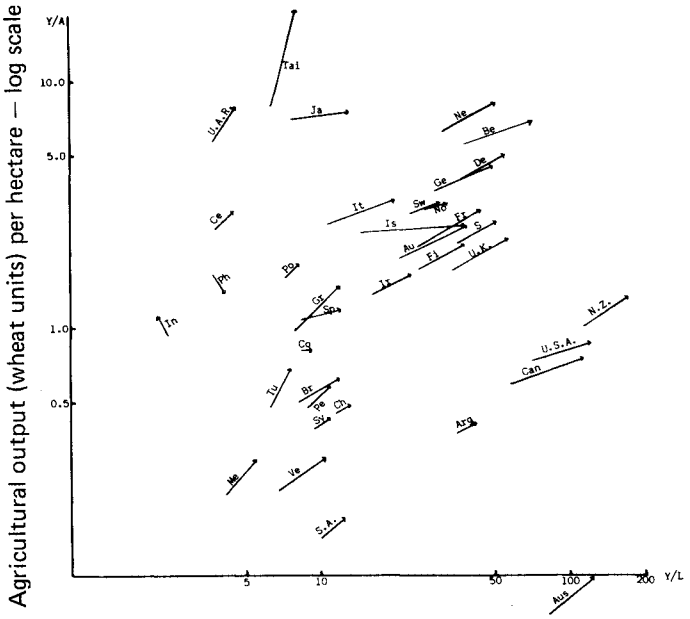
Growth in Productivity

Estimates of two partial productivity ratios, output per male worker and output per hectare of agricultural land, for 1955 and 1965 are given in table 7. (Corresponding factor proportions are in table 8.) Changes in these productivity ratios are compared both in absolute terms (figure 8) and in logarithms or percentage terms (figure 9).



Agricultural output (wheat units) per male worker

Figure 8. Inter-country comparison of changes in agricultural output per male worker and in output per hectare of agricultural land from 1955 to 1965.



Agricultural output (wheat units) per male worker — log scale

Figure 9. Inter-country comparison of changes in agricultural output per male worker and in output per hectare of agricultural land from 1955 to 1965.

Table 7. Estimated land and labor productivities in agriculture, 1955 and 1965

Country	Output per male worker (Y/L)		Output per hectare (Y/A)		Percent annual compound rate of change in	
	1955	1965	1955	1965	Output per male worker	Output per hectare
	(wheat units)					
Argentina	34.7	42.9	0.36	0.41	2.2	1.8
Australia	80.6	125.8	0.07	0.10	4.5	1.2
Austria	21.2	39.2	1.92	2.63	6.2	3.2
Belgium (& Luxemburg)	38.6	71.8	5.50	6.98	6.1	2.4
Brazil	8.1	10.4	0.48	0.63	2.7	2.7
Canada	58.7	115.2	0.59	0.75	6.7	2.5
Ceylon	3.8	4.5	2.49	3.02	2.0	2.0
Chile	11.7	13.4	0.45	0.49	1.4	0.9
Colombia	8.3	9.0	0.80	0.81	0.8	0.1
Denmark	36.9	55.7	4.00	5.02	4.1	2.3
Finland	24.7	38.2	1.73	2.29	4.4	2.8
France	25.1	45.4	2.21	2.95	5.9	2.9
Germany, Fed. Rep.	28.5	49.6	3.56	4.49	5.5	2.3
Greece	7.9	12.1	0.99	1.53	4.4	4.5
India	2.4	2.2	0.94	1.13	−1.0	1.9
Ireland	16.4	24.3	1.37	1.63	4.0	1.8
Israel	14.8	38.9	2.36	2.54	10.0	0.8
Italy	10.8	20.1	2.64	3.31	6.2	2.3
Japan	7.7	13.1	7.02	7.54	5.4	0.8
Libya	n.a.	n.a.	0.04	0.05	n.a.	3.6
Mauritius	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Mexico	4.1	5.5	0.21	0.29	3.1	3.6
Netherlands	31.6	53.2	6.18	8.28	5.2	2.9
New Zealand	113.4	166.7	1.01	1.33	3.9	2.8
Norway	26.4	33.4	3.01	3.15	2.3	0.4
Pakistan	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Paraguay	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Peru	9.1	11.1	0.47	0.60	2.0	2.4
Philippines	3.7	4.1	1.63	1.39	1.0	−1.6
Portugal	7.3	8.6	1.59	1.83	1.7	1.4
South Africa	9.9	12.6	0.14	0.17	2.4	2.4
Spain	8.5	12.2	1.10	1.21	4.8	0.9
Surinam	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Sweden	36.7	50.1	2.23	2.69	3.0	1.8
Switzerland	23.3	31.5	2.87	3.18	2.9	1.0
Syria	9.4	11.2	0.38	0.43	1.8	1.4
Taiwan	6.7	8.1	7.85	11.92	2.0	4.2
Turkey	6.3	7.6	0.48	0.68	1.9	3.6
U.A.R.	3.7	4.6	0.56	7.75	2.2	3.3
U.K.	34.2	57.3	1.70	2.33	5.1	3.2
U.S.A.	71.2	123.5	0.74	0.87	5.5	1.7
Venezuela	6.9	10.6	0.24	0.29	4.4	2.0
Yugoslavia	n.a.	n.a.	0.82	1.28	n.a.	4.5

Table 8. **Agricultural land area per male worker, fertilizer input per hectare of agricultural land, and tractor horsepower per male worker, 1955 and 1965**

Country	Land area per male worker (A/L)		Fertilizer ($N+P_2O_5+K_2O$) per hectare (F/A)		Tractor horsepower per male worker (M/L)		Percentage annual compound rate of change in:		
	1955	1965	1955	1965	1955	1965	Land area per male worker	Fertilizer input per hectare	Horsepower per male worker
	(hectare)		(kilogram)		(horsepower)				
Argentina	98.7	102.2	0.1	0.2	0.69	4.22	0.4	3.9	19.8
Australia	889.5	1239.9	1.1	1.7	14.39	24.22	3.3	4.3	5.3
Austria	11.0	14.9	26.3	76.3	3.42	14.69	3.0	11.2	15.2
Belgium (& Luxemburg)	7.0	10.3	178.2	252.6	2.99	12.74	3.7	3.5	14.9
Brazil	16.7	16.6	0.6	1.5	0.18	0.27	0.0	10.7	4.1
Canada	99.6	152.7	3.8	8.2	24.68	58.40	4.2	8.0	8.6
Ceylon	1.5	1.5	19.1	37.4	0.01	0.04	0.0	7.0	22.9
Chile	26.2	27.4	3.9	7.0	0.95	1.38	0.5	6.0	3.8
Colombia	10.4	11.1	1.3	5.3	0.30	0.48	0.7	15.0	4.7
Denmark	9.2	11.1	102.5	150.0	5.00	17.78	1.8	3.9	13.3
Finland	14.3	16.7	51.8	98.1	5.74	22.08	1.6	6.6	14.2
France	11.3	15.4	39.0	82.8	2.79	11.76	3.0	7.8	15.0
Germany, Fed. Rep.	8.0	11.0	119.2	186.8	5.18	18.69	3.2	4.6	13.2
Greece	8.0	7.9	8.9	24.7	0.31	1.34	−0.1	10.7	16.0
India	2.6	1.9	0.7	3.4	<0.01	0.17	−2.9	17.0	14.3
Ireland	12.0	14.9	18.8	47.5	2.09	6.00	2.2	9.7	10.9
Israel	6.3	15.3	47.2	29.4	1.33	3.96	9.2	−4.9	11.4
Italy	4.1	6.1	29.8	45.5	0.94	3.88	3.9	4.3	14.5
Japan	1.1	1.7	162.3	231.7	0.08	6.68	4.6	3.7	53.7
Libya	n.a.	n.a.	0.2	0.3	n.a.	n.a.	n.a.	4.4	n.a.
Mauritius	2.3	2.2	73.6	198.4	0.13	0.14	0.0	10.4	0.9
Mexico	19.7	18.8	0.5	2.4	0.20	0.29	−0.5	18.1	3.8
Netherlands	5.1	6.4	190.7	235.3	2.11	6.36	2.3	2.1	11.4
New Zealand	112.2	125.4	14.6	27.3	17.94	27.29	1.1	6.5	4.2
Norway	8.8	10.6	115.5	156.4	8.38	23.63	1.9	3.0	10.7
Pakistan*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Paraguay	6.5	6.5	n.a.	0.7	n.a.	n.a.	−0.6	n.a.	n.a.
Peru	19.3	18.5	5.5	6.4	0.29	0.38	−0.4	1.5	2.6
Philippines	2.3	2.7	5.5	9.6	0.05	0.04	2.6	5.1	−2.0
Portugal	4.6	4.7	23.7	32.0	0.01	0.01	0.3	3.0	12.9
South Africa	72.0	72.2	1.4	2.5	1.30	2.68	0.0	5.7	7.6
Spain	7.7	10.1	14.4	21.7	0.21	1.32	3.9	4.3	21.3
Surinam	n.a.	3.5	10.3	20.0	n.a.	1.61	n.a.	7.1	n.a.
Sweden	16.4	18.6	56.3	91.9	12.43	34.78	4.8	4.9	10.5
Switzerland	8.1	9.9	29.9	55.9	2.21	6.55	1.9	6.5	11.2
Syria	24.7	25.7	0.4	1.4	0.13	0.47	0.4	14.8	13.8
Taiwan	0.9	0.7	122.7	217.4	0.01	0.05	−2.2	5.8	13.2
Turkey	13.1	11.1	0.4	1.8	0.33	0.32	−1.7	17.2	−0.4
U.A.R.	0.7	0.6	47.8	104.9	0.05	0.05	−1.1	8.2	−1.0
U.K.	20.2	24.6	42.5	74.6	13.00	16.33	1.9	5.8	2.2
U.S.A.	96.8	142.4	12.3	21.3	30.63	63.35	3.8	5.7	7.3
Venezuela	28.9	36.8	0.4	1.2	0.47	0.68	2.4	11.4	3.7
Yugoslavia	n.a.	n.a.	3.1	26.5	n.a.	n.a.	n.a.	23.8	n.a.

*Data available for arable land only.

A most conspicuous aspect is that, in absolute terms, the large differences in agricultural productivity between developed and less developed countries has widened further (figure 8). Judging from the arrows in figure 9, these differences have not begun to lessen. Table 9 shows that the output per male worker increased at the annual compound rate of 4.7 percent in 13 Developed Countries (DC) and 1.7 percent in 12 Less Developed Countries (LDC).[11] The growth rates of output per hectare were of equal magnitudes, but land area per male worker increased 2.6 percent annually in the DC while it declined 0.4 percent in the LDC. This difference accounts for the difference in the labor productivity growth rates. In the DC, where industry has developed enough to pull a significant amount of labor out of agriculture, the growth rates of labor productivity were increased by improvements in the land-labor ratio. In the LDC, however, industrial growth did not keep up with population growth, and the increased labor density per hectare of agricultural land depressed growth in labor productivity.

Such different patterns of agricultural productivity growth correspond to the different patterns of inputs of factors supplied from the nonagricultural sector relative to the endowments of land and labor (figures 10 and 11). In the

Table 9. Rates of growth in productivity and factor proportions, 1955 to 1965, annual compound percentage rate.

Group of countries	Output per male worker (Y/L)	Output per hectare (Y/A)	Land area per male worker (A/L)	Fertilizer per hectare (F/A)	Machinery per male worker (M/L)
Developed countries	4.7	2.1	2.6	5.1	9.8
Intermediate countries	4.4	2.0	2.4	5.8	15.8
Less developed countries	1.4*	2.1*	−0.4	10.9	6.4
New Continents	3.3	2.0	1.3	8.1	6.3
Brazil	2.7	2.7	0.0	10.7	4.1
U.S.A.	5.5	1.7	3.8	5.7	7.3
Europe	4.7	2.2	2.5	5.7	13.0
European Economic Community	5.8	2.6	3.2	4.5	13.8
Asia and Africa	1.9*	2.0*	0.0	9.9	12.8
India	−1.0	1.9	−2.9	17.0	14.3
Japan	5.4	0.8	4.6	3.7	53.7

Developed countries	Australia, Belgium, Canada, Denmark, France, Germany, Netherlands, New Zealand, Norway, Sweden, Switzerland, U.K., U.S.A.
Intermediate countries	Argentina, Austria, Chile, Finland, Greece, Ireland, Israel, Italy, Japan, Portugal, South Africa, Spain, Venezuela.
Less developed countries	Brazil, Ceylon, Colombia, India, Mauritius, Mexico, Peru, Philippines, Syria, Taiwan, Turkey, U.A.R.
New continents	Argentina, Australia, Brazil, Canada, Chile, Colombia, Mexico, New Zealand, Peru, South Africa, U.S.A., Venezuela.
Europe	Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, U.K.
Asia and Africa	Ceylon, India, Japan, Mauritius, Philippines, Syria, Taiwan, Turkey, U.A.R.

*Excluding Mauritius.

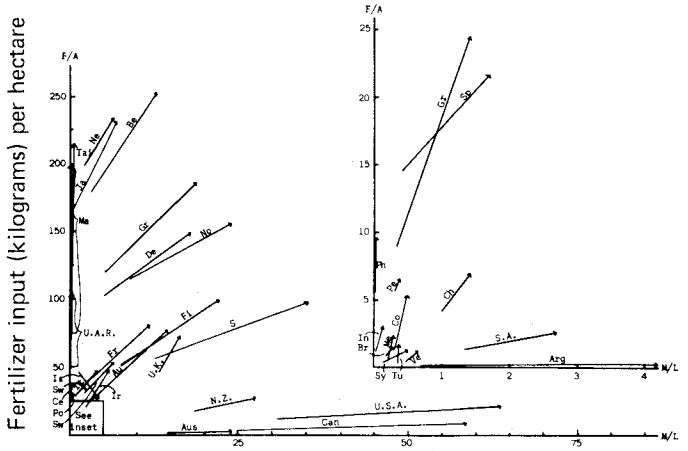


Figure 10. Inter-country comparison of changes in tractor horsepower per worker and in fertilizer input (N + P_2O_5 + K_2O) per hectare of agricultural land from 1955 to 1965.

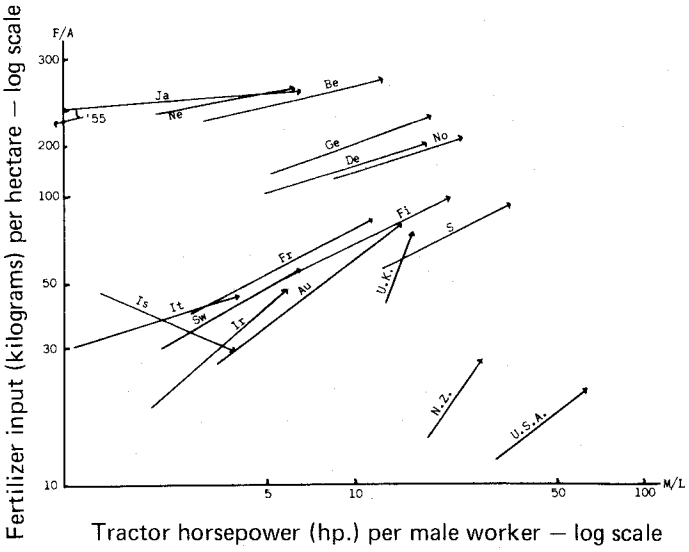


Figure 11. Inter-country comparison of changes in tractor horsepower per worker and in fertilizer input (N + P_2O_5 + K_2O) per hectare of agricultural land from 1955 to 1965.

[11] Countries with a per capita GDP higher than 700 U.S. dollars and with a percentage of male workers in nonagricultural occupations, compared to the total male labor force, higher than 70 in 1960 are classified as DC. Countries with a per capita GDP lower than 350 U.S. dollars and a percentage of male workers in nonagricultural occupations lower than 65 are classified as LDC.

LDC, where labor productivity growth was brought about primarily through increased land productivity, the fertilizer input per hectare increased faster than machinery per worker (probably even more than table 7 indicates, because a significant part of the increase in tractor horsepower would have occurred as it replaced work animals in the LDC). In contrast, the progress of mechanization was equally or more dominant in raising output per worker in the DC.

There is an indication, however, that production structures and factor proportions have started to converge (compare figures 8 and 10 with figures 9 and 11). According to table 7 data, increases in output per worker in the New Continent countries, which are characterized by high labor productivity and low land productivity, resulted more from the gain in land productivity than from the increase in land area per worker. In contrast, increases in output per worker in Europe, especially in the European Economic Community (EEC), came more from the increase in area per worker. This relationship is most pronounced in Japan. If labor migration out of agriculture continues at the present rate, the factor proportion and production structure in Europe and Japan (in the distant future) would eventually converge to the New Continental pattern.

Countries in the New Continents are by no means homogeneous. In a country like Brazil, in which industrial growth is lagging behind population growth, the tendency is towards increased labor productivity through increased land productivity. In the U.S.A., however, the labor outmigration has been improving the land-labor ratio rapidly, and the major gain in output has come from the progress of mechanization, despite remarkable biological and chemical innovations.

In Asia, except Japan, the major source of agricultural growth was yield increase per hectare during periods of high population growth, which tend to outpace the growth in employment opportunities in the nonagricultural sector. In India the output per worker even declined because of the rapid rise in labor density per hectare of agricultural land.

Though the factor proportion and production structures started to converge in the New Continents and Europe (and Japan) relationship, they still are diverging in comparing the U.S. and Asia (typically India). If countries in Asia succeed in "take-off" for sustained economic growth and industrialization, agriculture in these countries would follow the path of the Japanese experience. With the present rate of population growth, however, it would take a long time for such a stage for conversion in factor proportion and production structure to emerge in these countries.

VI. HISTORICAL EXPERIENCE OF SELECTED COUNTRIES

Implications for agricultural growth derived from inter-country comparisons can be reinforced by comparing the long-range historical growth processes of selected countries with inter-country cross-section observations.

Countries selected for this purpose are: (a) the U.S., representing the New Continent countries, where man-land ratios are particularly favorable, (b) Japan, representing mainly the Asian countries, where unfavorable man-land ratios prevail, and (c) Denmark, France, and the U.K., representing mainly the countries in Europe, where the man-land ratios are between the above two groups. In terms of data availability and the important implications of their historical experience on development economics, there was little problem in selecting the U.S. and Japan to represent the first two groups. As it was difficult to choose a single country for the third group, we selected Denmark, France, and the U.K. to represent respectively the agricultural product exporting countries, the agriculturally self-sufficient countries, and the agricultural product importing countries.

Tables C-1 through C-5 show historical data and the procedures for compiling these data so they would be comparable with inter-country cross-section observations.

The time-series paths of agricultural productivity growth in the selected countries are plotted in figures 12, 13, and 14 (which are enlargements of figure 1). The time-series path of the United States is along a line passing the center of the scatter of New Continental countries (figure 12); the path of Japan is along a line passing the center of the scatter of Asian countries (figure 13). The productivity positions of European countries in 1960 are either within or in the fringe of the envelope formed by the growth paths of Denmark and the U.K. These observations appear to support a hypothesis that the scatters of inter-country cross-section observations for 1960 of the three groups of countries are the long-range growth paths of agricultural productivities for different endowments of land and labor.

We do not have comparable historical data about fertilizer and farm machinery for these countries. Here we postulate that the levels of applications of these nonagricultural inputs increase as manufacturing and service sectors of the economy develop and the inter-sectoral division of labor progresses, resulting in price declines in these inputs relative to the prices of farm products and original resources (land and labor). It was hypothesized that, through this process, the agriculture of a country moves to a higher efficiency position in a northeastern direction in figure 1 (and figures 12-14) as industrialization proceeds.

As a measure of industrialization and the inter-sectoral division of labor accompanying it, we calculated the percentages of male workers in agriculture compared to the total number of male workers active in the economy (shown in parentheses in figures 12-14). There are some similarities, although very crude, among the historical relationships and the inter-country relationship between the levels of industrialization and agricultural productivity. The fact that countries such as Australia and New Zealand, which are the prime exporters of agricultural products, are high in this ratio for their high agricultural efficiencies suggests that industrialization provides momentum for growth in agricultural productivity.

We do not claim, however, that this association between agricultural productivity and industrialization always holds. A line connecting India, the U.A.R., and Taiwan (figure 13) might indicate the existence of a path of agricultural growth characterized by the growth in land productivity based on the development of irrigation more than on increases in nonagricultural inputs. In the European scene, the growth paths of Denmark and the U.K. show an interesting contrast (figure 14). Denmark, which has specialized more in agriculture than the remaining European community, has attained a high labor productivity in agriculture and supported its economy by increasing the output per unit of land. In contrast, the U.K., which long since has specialized in nonagricultural activities, has attained its high agricultural efficiency mainly by enlarging the agricultural land area per worker in response to the labor absorption by nonagricultural occupations. High efficiency in Danish agriculture, for its relatively large percentage of workers engaged in agriculture, seems to result from the division of labor among countries in Western Europe.

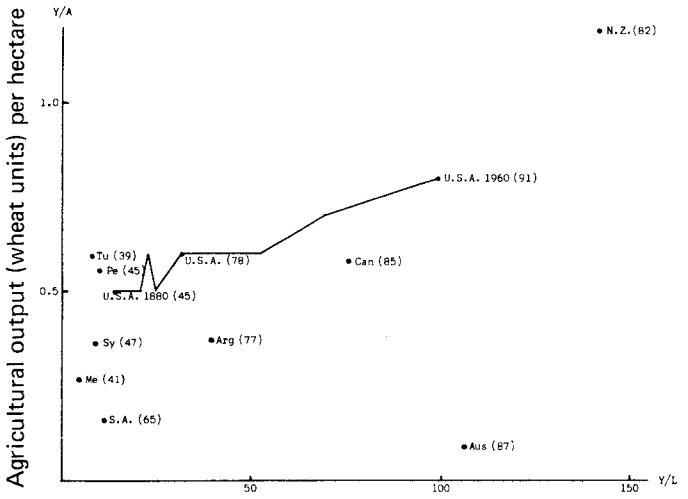


Figure 12. Historical growth path of agricultural productivity in the United States, 1880-1960, and inter-country cross-section observations, 1960. Values in parentheses are the percentages of male workers employed in nonagriculture.

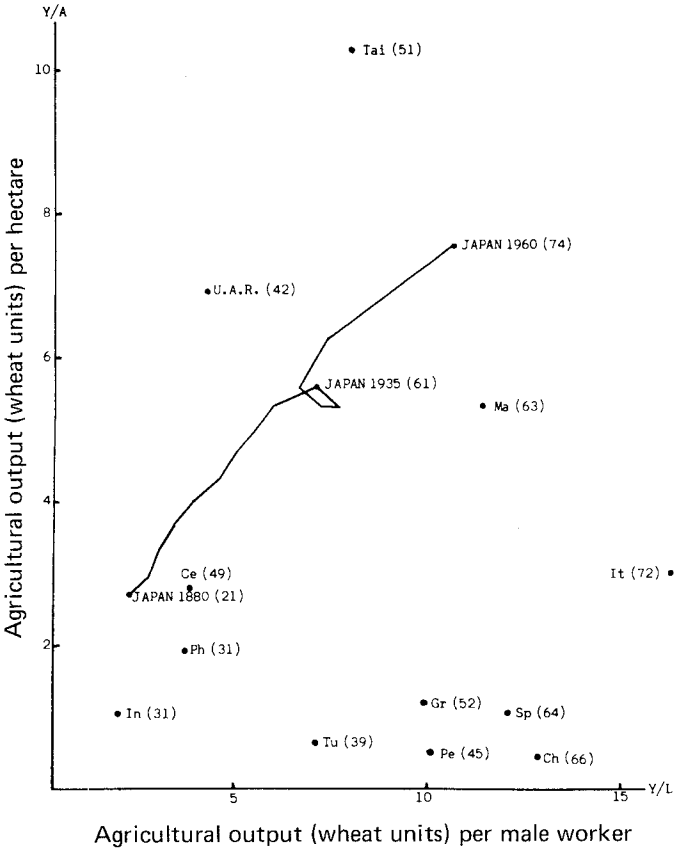


Figure 13. Historical growth path of agricultural productivity in Japan, 1880-1960, and inter-country cross-section observations in 1960. Values in parentheses are the percentages of male workers employed in nonagriculture.

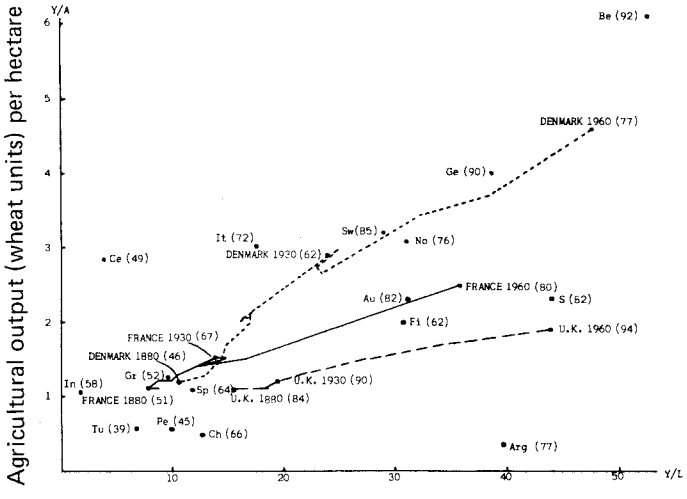


Figure 14. Historical growth path of agricultural productivity in Denmark, France, and the United Kingdom, 1880-1960, and inter-country cross-section observations in 1960. Values in parentheses are the percentages of male workers employed in nonagriculture.

The parallel relationships, between the growth path of the U.S. and the scatter of New Continent countries and between the path of Japan and the scatter of Asian countries, seem to suggest that the direction of technical change and productivity growth in agriculture is strongly constrained by the original factor endowments. In Japan, land has been the limiting factor, and the efforts of farmers, public institutions, and agricultural supply firms to exploit new opportunities have brought about significant biological and chemical innovations, such as seed improvements with larger applications of fertilizer. In the U.S., where labor has been more limiting, advances in mechanical technology have become the main features of agricultural development.

APPENDIX A: MAJOR INTER-COUNTRY CROSS-SECTION DATA, 1960

Tables A-1, A-2, and A-3 include the detail data on agricultural commodities and the results (in Wheat Units) of the weighting procedures used in the calculation of agricultural output and value added in agriculture. Procedural details are included in the main text.

Tables A-4 and A-5 include data on the conventional and nonconventional inputs which are the bases for the relations between these input factors and for the relations between output and input, as shown in tables 7-9.

Table A-1. Weights for aggregation: wheat-relative prices per metric ton, 1957-1962*

Commodity	U.S.A. (w_U)	Japan (w_J)	India (w_I)
Grains			
Wheat	1.00	1.00	1.00
Barley	0.61	1.00	0.69
Buckwheat	0.74	1.24	0.84
Maize	0.63	0.72	0.78
Millet	0.68	0.74	0.87
Oats	0.63	0.70	0.69
Rice (rough)	1.58	1.61	0.94
Rye	0.58	0.77	0.69
Sorghum	0.55	0.81	0.81
Mixed grain	0.61	0.74	0.69
Starchy roots			
Cassava	0.16	0.11	0.58
Potatoes	0.57	0.27	0.58
Sweet potatoes	0.81	0.22	0.58
Sugar			
Beets, not processed	0.19	0.15	0.15
Cane, not processed	0.12	0.18	0.10
Pulses and oil crops			
Copra	0.84	0.48	3.10
Cottonseed	0.75	0.83	0.78
Groundnuts	3.39	2.55	1.21
Linseed	1.30	0.66	1.50
Olives	1.66	1.31	1.13
Palm kernels	1.13	0.76	3.10
Pulses (all)	2.12	1.94	0.84
Rapeseed	0.87	1.45	1.91
Sesame seed	4.56	3.98	2.07
Soybeans	1.16	1.50	1.22
Sunflower seed	2.50	1.17	1.11
Nuts			
Unshelled	13.14	2.31	5.24
Fruits			
Bananas	0.65	1.52	0.63
Citrus	0.98	1.15	1.40
Dates	2.05	0.55	3.33
Other (fresh)	1.27	0.94	1.79
Unspecified	1.13	1.05	1.79
Vegetables			
All	0.83	0.42	1.31
Livestock products			
Beef and veal	12.36	9.99	5.00
Mutton and lamb	12.58	5.03	5.00
Pork	9.51	7.36	5.00
Poultry	6.47	5.15	2.98
Eggs	7.35	5.12	5.24
Milk	1.36	0.76	1.21
Fibers			
Abaca	5.77	3.88	4.12
Cotton	10.30	6.06	2.17
Flax	5.50	3.37	6.27
Hemp	6.94	6.29	1.70
Henequen	2.54	2.30	2.41
Jute	3.11	2.30	1.93
Silk, cocoon basis	17.32	12.86	18.88
Sisal	2.54	2.30	2.41
Wool, greasy basis	14.44	13.52	14.58
Miscellaneous			
Cocoa	8.27	6.30	6.16
Coffee	10.84	7.82	8.21
Rubber	9.33	6.74	7.14
Tea	15.70	3.44	8.88
Tobacco	19.47	8.56	4.63
Timber	–	0.15†	–
Marine products			
Fish	–	1.44	–
Whale	–	13.96‡	–

*Farm-gate values of 1 metric ton of wheat in native currencies were: 67.6 dollars in the U.S.A., 36072 yen in Japan, and 46.4 rupees in India. See sources and estimation procedures in the main text.
†Per cubic meter of round wood.
‡Per whale.

Table A-2. Agricultural output, 1957-62, averages of 43 countries, in 1,000 wheat units*

Country	U.S.A. weights	Japan weights		India weights	Composite
		Agriculture	Agriculture, forestry, fishery		
	(Y_U)	(Y_J)	(Y_J')	(Y_I)	($Y = \sqrt[3]{Y_U Y_J Y_I}$)
Argentina	63,698	49,814	51,748	43,378	51,626
Australia	49,800	38,451	40,853	38,841	42,054
Austria	11,414	7,908	9,635	9,260	9,419
Belgium (& Luxemburg)	14,312	9,392	9,852	10,911	11,361
Brazil	96,753	80,409	97,277	71,317	82,162
Canada	43,960	33,340	48,538	33,554	36,633
Ceylon	6,617	3,483	3,608	5,124	4,906
Chile	7,605	5,658	7,064	6,705	6,607
Colombia	19,973	16,310	19,526	14,030	16,594
Denmark	18,411	12,528	13,713	12,889	14,378
Finland	7,145	4,578	11,439	5,832	5,756
France	101,537	71,462	78,595	87,972	86,093
Germany, Fed. Rep.	70,189	48,047	52,866	54,999	57,023
Greece	13,222	8,813	9,428	11,150	10,911
India	216,477	193,272	197,107	153,821	185,986
Ireland	9,117	6,193	6,290	6,562	7,182
Israel	2,412	1,940	1,964	2,368	2,229
Italy	72,348	49,281	52,461	69,189	62,709
Japan	60,770	47,646	66,771	49,828	52,436
Libya	599	338	495	533	476
Mauritius	630	834	846	534	655
Mexico	32,811	26,572	27,541	23,483	27,354
Netherlands	21,250	13,021	13,651	16,866	16,709
New Zealand	20,724	13,149	13,968	14,702	15,882
Norway	4,118	2,496	6,338	3,174	3,195
Pakistan	56,317	40,345	42,445	40,454	45,125
Paraguay	1,215	1,066	1,340	1,183	1,153
Peru	9,046	7,100	12,547	7,252	7,751
Philippines	16,057	14,133	15,698	14,715	14,946
Portugal	9,020	6,306	7,865	8,794	7,937
South Africa	19,218	15,294	16,631	15,414	16,547
Spain	45,107	28,507	31,764	38,539	36,727
Surinam	258	206	258	162	205
Sweden	12,177	8,378	15,183	9,721	9,971
Switzerland	8,346	5,355	5,905	7,121	6,827
Syria	5,334	4,027	4,032	4,256	4,504
Taiwan	10,122	8,507	9,049	8,493	9,009
Turkey	37,213	25,300	26,642	34,347	31,856
U.A.R.	20,890	15,986	16,331	16,714	17,737
U.K.	49,882	32,493	34,511	35,510	38,605
U.S.A.	435,480	330,953	380,166	304,332	352,619
Venezuela	5,960	5,694	6,522	4,738	5,437
Yugoslavia	20,133	14,475	16,986	17,087	17,075

*Gross output minus seeds and feed. See estimation procedures in the main text.

Table A-3. Estimated value added in agriculture, 1957-62, averages of 43 countries*

Country	Value added ratio			Value added (1,000 WU) ($V = rY$)
	U.S.A. weights (r_U)	Japan weights (r_J)	Composite ($r = \sqrt{r_U r_J}$)	
Argentina	0.953	0.936	0.944	48,753
Australia	0.822	0.762	0.791	33,265
Austria	0.760	0.640	0.698	6,571
Belgium (& Luxemburg)	0.817	0.715	0.765	8,687
Brazil	0.975	0.969	0.972	79,875
Canada	0.648	0.510	0.575	21,076
Ceylon	0.966	0.935	0.951	4,663
Chile	0.909	0.874	0.891	5,889
Colombia	0.961	0.950	0.956	15,862
Denmark	0.772	0.653	0.710	10,210
Finland	0.615	0.374	0.479	2,759
France	0.760	0.647	0.701	60,367
Germany, Fed. Rep.	0.681	0.518	0.594	33,849
Greece	0.906	0.855	0.880	9,606
India	0.991	0.990	0.991	184,274
Ireland	0.813	0.715	0.762	5,473
Israel	0.874	0.839	0.856	1,909
Italy	0.869	0.801	0.834	52,310
Japan	0.829	0.777	0.803	42,106
Libya	0.878	0.772	0.823	392
Mauritius	0.879	0.910	0.895	586
Mexico	0.947	0.932	0.939	25,692
Netherlands	0.843	0.738	0.788	13,175
New Zealand	0.852	0.757	0.803	12,753
Norway	0.545	0.218	0.345	1,102
Pakistan	0.995	0.993	0.994	44,855
Paraguay	0.988	0.986	0.987	1,138
Peru	0.949	0.935	0.942	7,303
Philippines	0.978	0.974	0.976	14,588
Portugal	0.920	0.883	0.901	7,154
South Africa	0.859	0.816	0.837	13,850
Spain	0.921	0.873	0.897	32,937
Surinam	0.938	0.917	0.928	190
Sweden	0.586	0.370	0.465	4,641
Switzerland	0.889	0.821	0.854	5,833
Syria	0.974	0.964	0.969	4,366
Taiwan	0.933	0.920	0.926	8,346
Turkey	0.964	0.944	0.954	30,398
U.A.R.	0.954	0.940	0.947	16,797
U.K.	0.705	0.527	0.610	23,535
U.S.A.	0.635	0.496	0.561	197,788
Venezuela	0.946	0.941	0.944	5,131
Yugoslavia	0.905	0.864	0.884	15,100

*Agricultural output estimated in table A-2 minus inputs supplied from the nonagricultural sector including depreciation. See estimation procedures in the main text.

Table A-4. Conventional inputs in agriculture, 1960

Country	Number of male workers		Agricultural land		Livestock[5]	Fertilizer[6] $N+P_2O_5+K_2O$	Tractor horsepower[7]
	Estimated in agriculture[1]	Agriculture, forestry, fishery[2]	Area[3]	Arable land ratio[4]			
	(1,000)	(1,000)	(1,000 ha.)	(percent)	(1,000 units)	(1,000 m. tons)	(1,000 h.p.)
Argentina	1,295	1,346	137,829	14.1	46,043	14	3,485
Australia	395	420	468,135	6.4	30,223	605	7,782
Austria	297	362	4,050	43.3	2,794	221	2,247
Belgium (& Luxemburg)	215	226	1,857	55.1	3,030	377	1,405
Brazil	8,698	10,523	137,034	21.7	87,705	191	1,972
Canada	484	704	62,848	66.6	10,963	324	16,800
Ceylon	1,263*	1,308	1,723	89.3	2,093	57	13
Chile	512	639	13,742‡	40.1	3,906	77	473
Colombia	1,612	1,930	19,653	25.7	15,194	38	741
Denmark	303	332	3,127	89.0	4,746	386	3,227
Finland	187	466	2,849	93.6	2,074	216	2,288
France	2,395	2,634	34,539	62.0	20,949	2,183	18,996
Germany, Fed. Rep.	1,477	1,625	14,254	60.0	14,939	2,307	16,173
Greece	1,101	1,178	8,911	41.5	3,595	144	818
India	86,847	88,570	176,036	92.1	207 ,240	340	686
Ireland	343	348	4,560	29.9	4,695	174	1,243
Israel	77	78	1,210	34.0	267	32	214
Italy	3,898	4,150	20,930	75.6	11,762	816	7,536
Japan	4,897	6,863	7,020	86.5	4,558	1,577	5,234
Libya	n.a.	n.a.	11,285	22.2	694	3	71
Mauritius	56	57	123	75.6	38	18	9
Mexico	5,287	5,480	102,909	23.1	37,599	188	1,229
Netherlands	387	406	2,317	44.8	4,202	467	1,857
New Zealand	112	119	13,341	4.8	10,284	263	2,452
Norway	103	261	1,033	81.7	1,398	145	1,568
Pakistan	18,464	19,425	n.a.	n.a.	40,023	48	117
Paraguay	231	291	1,222	42.3	4,352	n.a.	17
Peru	758	1,340	13,956	14.0	6,656	76	204
Philippines	3,959	4,397	7,954	85.2	6,305	66	128
Portugal	1,075	1,341	n.a.	n.a.	2,256	123	309
South Africa	1,415	1,539	101,170	10.2	15,523	213	2,250
Spain	3,023	3,368	33,880§	60.6	9,277	659	1,273
Surinam	12	15	46	87.0	38	1	17
Sweden	225	408	4,282	84.0	2,797	286	4,682
Switzerland	233	257	2,161	20.1	1,864	99	652
Syria	477	478	12,566	47.9	1,110	9	123
Taiwan	1,116	1,187	880	98.8	1,180	173	37
Turkey	4,469	4,706	54,018	46.9	20,255	45	1,375
U.A.R.	4,046	4,133	2,569	96.6	5,322	204	220
U.K.	877†	931	19,894	36.7	14,971	984	12,989
U.S.A.	3,542	4,069	439,941	42.0	100,834	7,225	155,540
Venezuela	650	745	19,178	12.9	6,544	13	320
Yugoslavia	n.a.	n.a.	14,923	56.0	8,541	253	1,134

[1] Number of male workers in agricultural occupations (ILO, *Yearbook of Labor Statistics,* 1966, pp. 39-131) divided by the conversion factor, column (2).
[2] Output in agriculture, forestry, and fishery.
[3] Agricultural land area, including permanent pasture and meadows in year closest to 1960 (FAO, *Production Yearbook,* various issues).
[4] Arable land area divided by agricultural land area, column (3).
[5] Various kinds of livestock animals existing on farm in year closest to 1960 (FAO, *Production Yearbook,* various issues) aggregated by the following weights: horse = 1.0, mule = 1.0, ass = 0.8, cattle = 0.8, pig = 0.2, sheep = 0.1, goat = 0.1, buffalo = 1.0, camel = 1.1, poultry = 0.01.
[6] $N + P_2O_5 + K_2O$ in commercial fertilizers consumed, 1957-1962 averages. Data from FAO, *Fertilizers — Annual Review,* various issues.
[7] Tractor horsepower for OECD countries are the 1960 figures from OECD, *Evolution de la motorization de l'agriculture et de la consommation et de la prix des carburants dans les pays membres,* 1963 (mimeo). Tractor horsepower for other countries is estimated from the number of farm tractors and garden tractors assuming that the average h.p.'s are 30 and 5 respectively. Tractor number data are from FAO, *Production Yearbook,* various issues.
*1953 figure interpolated for 1960, estimated from figures of 1953 and 1965, assuming constant growth rate during the period.
†1951 figure interpolated for 1960, estimated from figures of 1951 and 1965, assuming constant growth rate during the period.
‡ Estimated from figures of 1955 and 1965, assuming constant growth rate during the period.
§ Including rough grazing, which was estimated from figures of 1955 and 1965, assuming constant growth rate during the period.

Table A-5. Number of farms and the indicators of education and industrialization, 1960

Country	Number of farms[1]	Indicators of education			Indicators of industrialization	
		Literacy ratio[2]	School enrollment ratio[3]	College graduates in agriculture per 10,000 farm workers[4]	Ratio of non-agricultural labor[5]	Ratio of non-agricultural income[6]
	(1,000's)	(percent)	(percent)	(number)	(percent)	(percent)
Argentina	472	87.5	69	1.82	77.1	84.2
Australia	252	98.5	89	9.02	86.7	86.9
Austria	402	98.5	72	5.79	82.0	87.9
Belgium (& Luxemburg)	269	96.5	92	11.77	91.6	92.6
Brazil	3,350	47.5	39	0.60	34.2	72.7
Canada	481	97.5	77	11.40	85.1	93.1
Ceylon	1,174	62.5	67	0.03	49.4	52.3
Chile	174	77.5	68	2.21	65.6	88.5
Colombia	1,210	52.5	40	0.39	36.8	65.1
Denmark	197	98.5	86	5.20	77.1	85.5
Finland	388	98.5	82	7.81	62.2	80.2
France	1,994	96.5	80	2.46	79.9	90.5
Germany, Fed. Rep.	1,678	98.5	87	7.62	90.4	93.9
Greece	1,156	72.5	70	0.97	51.8	70.1
India	48,882	17.5	26	0.41	31.4	52.6
Ireland	360	98.5	98	4.64	57.7	74.5
Israel	70	92.5	85	8.05	85.9	88.3
Italy	4,294	87.5	56	1.50	72.4	81.7
Japan	6,057	97.5	90	14.24	74.4	84.0
Libya	146	7.5	25	n.a.	n.a.	n.a.
Mauritius	22	52.5	52	5.34	62.7	72.5
Mexico	1,365	62.5	44	0.15	41.1	80.6
Netherlands	77	98.5	90	11.15	87.5	89.8
New Zealand	301	98.5	97	19.23	82.3	87.9
Norway	434	98.5	85	10.06	75.9	89.0
Pakistan	12,155	17.5	23	0.26	26.6	47.5
Paraguay	161	67.5	57	n.a.	38.7	63.4
Peru	870	47.5	49	1.66	45.2	78.1
Philippines	1,639	62.5	76	1.60	30.8	66.4
Portugal	n.a.	57.5	52	1.64	52.4	74.0

[1] Number of agricultural holdings reported in the FAO's report on the 1960 World Census of Agriculture for all countries except: Chile — Committee on Inter-American Development, *Land Tenancy and Socio-economic Development,* Santiago 1966, p. 42; France — Interpolated from 1955 and 1963 data in Ministere de l'agriculture, *Enquête communautaire sur la structure des exploitations agricole en 1967,* 1968, p. 7; India — Directorate of Economics and Statistics, Ministry of Food, Agriculture, Community Development and Cooperation, *Indian Agriculture in Brief,* 1967, p. 65; Israel and Syria — Marion Clawson and others, *Agricultural Potential of the Middle East,* Part I and II, Resources for the Future, Inc. (mimeo) 1969, pp. 8-16; Mauritius — Number of sugar planters in J.E. Mead, *The Economic and Social Structure of Mauritius,* London 1961, p. 75; Switzerland — Extrapolated from 1950 and 1955 data in *Dritter Bericht der Bundesversammlung über die Lage der Schweizerischen Landwirtschaft und die Agrarpolitik des Bundes,* Berne 1965, p. 6; U.A.R. — M.M. El-Kammash, *Economic Development in Egypt,* New York 1968, p. 260.

[2] Median of the interval estimate of literacy rate in UNESCO, *World Illiteracy at Mid-century,* 1957.

[3] Adjusted ratio of school enrollment in the primary and secondary levels of education, average of 1950, 1955, and 1960. Data from UNESCO, *Statistical Yearbook,* 1964, pp. 99-114.

[4] Number of graduates who majored in agriculture in the third level of education per 10,000 male workers in agriculture. The number of graduates is the 1958-62 average. Data from UNESCO, *Statistical Yearbook,* 1964 (pp. 228-305), and 1965 (pp. 326-341). The figure for Switzerland is the average of Austria, France, and Germany.

[5] Ratio of male workers in agricultural occupations to the total number of male workers. Data from ILO, *Yearbook of Labor Statistics,* 1965, pp. 39-131.

[6] Ratio of NDP or GDP in nonagriculture to total NDP or GDP. Data from UN, *Yearbook of National Account Statistics,* various issues. Data from New Zealand, Sweden, and Switzerland are estimated from the following regression:

$$\log I_V = 1.178 + \underset{(0.049)}{0.402} \log I_p \,, \quad \bar{R}^2 = 0.645$$

which regressed the ratio of male workers in nonagricultural occupations (I_p) to the ratio of NDP or GDP in nonagriculture in the 36-country data.

Table A-5. (continued)

Country	Number of farms[1]	Indicators of education			Indicators of industrialization	
		Literacy ratio[2]	School enrollment ratio[3]	College graduates in agriculture per 10,000 farm workers[4]	Ratio of non-agricultural labor[5]	Ratio of non-agricultural income[6]
	(1,000's)	(percent)	(percent)	(number)	(percent)	(percent)
South Africa	110	42.5	58	1.57	65.0	89.1
Spain	3,008	82.5	61	0.93	63.6	74.5
Surinam	16	72.5	73	0.00	74.9	86.4
Sweden	265	98.5	79	6.89	82.1	88.7
Switzerland	185	98.5	72	5.27	85.3	90.0
Syria	418	27.5	39	2.43	46.8	64.9
Taiwan	808	47.5	59	6.18	50.8	69.1
Turkey	3,410	32.5	39	1.15	38.9	58.1
U.A.R.	2,946	22.5	35	3.66	42.2	69.6
U.K.	396	98.5	79	7.40	93.5	95.9
U.S.A.	3,711	96.5	100	21.82	91.4	96.0
Venezuela	320	52.5	56	0.83	62.0	92.6
Yugoslavia	2,624	72.5	63	n.a.	n.a.	72.1

[1] Number of agricultural holdings reported in the FAO's report on the 1960 World Census of Agriculture for all countries except: Chile – Committee on Inter-American Development, *Land Tenancy and Socio-economic Development,* Santiago 1966, p. 42; France – Interpolated from 1955 and 1963 data in Ministere de l'agriculture, *Enquête communautaire sur la structure des exploitations agricole en 1967,* 1968, p. 7; India – Directorate of Economics and Statistics, Ministry of Food, Agriculture, Community Development and Cooperation, *Indian Agriculture in Brief,* 1967, p. 65; Israel and Syria – Marion Clawson and others, *Agricultural Potential of the Middle East,* Part I and II, Resources for the Future, Inc. (mimeo) 1969, pp. 8-16; Mauritius – Number of sugar planters in J.E. Mead, *The Economic and Social Structure of Mauritius,* London 1961, p. 75; Switzerland – Extrapolated from 1950 and 1955 data in *Dritter Bericht der Bundesversammlung uber die Lage der Schweizerischen Landwirtschaft und die Agrarpolitik des Bundes,* Berne 1965, p. 6; U.A.R. – M.M. El-Kammash, *Economic Development in Egypt,* New York 1968, p. 260.

[2] Median of the interval estimate of literacy rate in UNESCO, *World Illiteracy at Mid-century,* 1957.

[3] Adjusted ratio of school enrollment in the primary and secondary levels of education, average of 1950, 1955, and 1960. Data from UNESCO, *Statistical Yearbook,* 1964, pp. 99-114.

[4] Number of graduates who majored in agriculture in the third level of education per 10,000 male workers in agriculture. The number of graduates is the 1958-62 average. Data from UNESCO, *Statistical Yearbook,* 1964 (pp. 228-305), and 1965 (pp. 326-341). The figure for Switzerland is the average of Austria, France, and Germany.

[5] Ratio of male workers in agricultural occupations to the total number of male workers. Data from ILO, *Yearbook of Labor Statistics,* 1965, pp. 39-131.

[6] Ratio of NDP or GDP in nonagriculture to total NDP or GDP. Data from UN, *Yearbook of National Account Statistics,* various issues. Data from New Zealand, Sweden, and Switzerland are estimated from the following regression:

$$\log I_v = 1.178 + \underset{(0.049)}{0.402} \log I_p \,, \quad \bar{R}^2 = 0.645$$

which regressed the ratio of male workers in nonagricultural occupations (I_p) to the ratio of NDP or GDP in nonagriculture in the 36-country data.

APPENDIX B: MAJOR INTER-COUNTRY CROSS-SECTION DATA, 1955 AND 1965

Tables B-1 through B-9 present the major inter-country cross-section data series of agricultural outputs, inputs, and related indicators for 1955 and 1965. The data of original reporting and the growth rates based on these original data also are presented for estimating the 1955 and 1965 values by interpolation and/or extrapolation. Basic procedures are described in the main text (chapter V). Special remarks and exceptions follow.

Land

Three problems were encountered in compiling pasture land data: (1) Concerning Chile and Peru, definition changes involving rough grazing land occurred from the first period to the second. This resulted in about a 10,000,000 hectare jump in land area. The problem was resolved by holding grazing land constant in each case. (2) Concerning Pakistan, no pasture land was reported, so no estimate of pasture land is included. (3) Concerning the U.A.R., pasture land is given in only one volume of the *Production Yearbook,* so this amount was entered as a constant for both 1955 and 1965.

Labor

Due to the lack of adequate conversion factors, the numbers of male workers in agriculture for 1955 and 1965 were transformed from the numbers of male workers active in agricultural occupations using 1960 conversion factors, i.e., the ratios of agricultural output to the output of agriculture, forestry, and fishing combined (table A-3, see the explanations for chapter II).

The lack of 1965 data for economically active males in agriculture required that an estimation process be used. The male agricultural work force was estimated from the total agricultural work force. The percentage of males in the agricultural work force for 1960 was calculated, and this ratio was assumed to prevail in 1965. 1955 to 1960 data on the same subject were found to be stable with few exceptions. Where fluctuation in the ratio was greater than 5.0 percent, economic considerations did not seem to indicate that a linear projection to 1965 on the basis of events occurring through 1960 would yield a better estimate than a projection on the basis of the ratio of males in 1960.

Tractor Horsepower

The two sources employed for tractor horsepower were FAO, *Production Yearbooks,* Section VII, and OECD, *Evolution de la motorization de l'agriculture et de la consommation et des prix des carburants dans les pays membres,* Paris, June 1963.

FAO tabulated the number of farm tractors and, where available, the number of garden tractors. In some cases, the number of garden tractors is included in the number of farm tractors. OECD presents both the number of farm tractors and the aggregate horsepower through 1960, but no data about garden tractors. To estimate the tractor horsepower for other than OECD countries, farm tractors were considered to be 30 hp. and garden tractors were considered to be 5 hp. The following calculations were employed:

(a) where farm and garden tractors were tabulated separately, tractor horsepower was computed as farm tractors times 30 plus garden tractors times 5;

(b) where garden tractors were included in the number of farm tractors, tractor horsepower was computed as farm tractors times 20; and

(c) where no data were given for garden tractors, tractor horsepower was computed as farm tractors times 30 times 1.05.

These procedures applied to the data from FAO and provided the general framework within which the OECD data were considered. For the 16 OECD countries, the U.S.A., and Canada, both the number of farm tractors and the total horsepower were provided through 1960. The average horsepower was computed for 1955 and found to be other than 30 in six countries. This average then was applied to the number of farm tractors for 1965 (taken from FAO) to compute farm tractor horsepower in 1965. Data about 1955 tractor horsepower were taken directly from table 6. The allowance for garden tractor horsepower was made in the same manner as before.

Thus, for the OECD countries, the total farm tractor horsepower is given for 1955. Garden tractor horsepower was estimated and added to give total 1955 horsepower. The average horsepower per tractor was computed from this data, and the 1965 horsepower estimated.

Two exceptions must be noted about the 1965 estimate:

(a) Taiwan data were taken from the Asian production organization, *Export Group Meeting on Agricultural Mechanization,* Vol. 1, June, 1968, p. 268.

(b) Canada's and U.S.A.'s average horsepower per tractor is increasing at a rapid pace as new tractors exceed 100 horsepower. USDA-ERS, *"The Farm Cost Situation."* FCS-36, November, 1964, gives average horsepower per tractor through 1963. Horsepower for 1965 was extrapolated as 37 for Canada and 40 for the U.S.A.

School Enrollment Ratio

The school enrollment ratio is the combined adjusted school enrollment ratio for first and second levels. The ratio is based on the total enrollment at first and second levels related to an adjusted population of 5-19 year olds. First level includes students in an arbitrary age group 5-14; second level includes students 15-19 years old.

The adjusted ratio relates enrollment to a population estimate to correspond with the actual duration of schooling in each country in an attempt to minimize the effect of differences in the national school systems. The adjusted ratio, therefore, is more internationally comparable than is the unadjusted ratio.

The data are taken from UNESCO, *Statistical Yearbook,* 1966. UNESCO provides the school enrollment ratios for 1950, 1955, 1960, and 1965. Data for 1945 were estimated in a linear fashion

$$1945 = 1950 \times \frac{1950}{1955}$$

Data were then averaged over 1945-50-55 for 1955 and 1955-60-65 for 1965.

Number of Graduates from Agricultural Schools in the Third Level of Education

Graduates in agriculture make up the third level of education. What is considered the third level may be either the equivalent of a 4-year college degree or, in some cases, 2 years of college or technical school. UNESCO, *Statistical Yearbook,* 1965, 1967, and UNESCO, *Basic Facts and Figures,* the

precursor of the *Statistical Yearbook* for years prior to 1963, are the references from which the data were taken. Although data about graduates are used in this study, there are eight cases where from the first period to the second, the number of graduates declined or increased inversely with the change in the number of students. This is inconsistent with what would be expected and denotes a radical change in the ratio of graduates to students.

The eight inconsistencies for the period from around 1955 to around 1965 are:

(1) Argentina, the number of students in agriculture doubled and graduates remained constant;
(2) Belgium and Luxemburg, the number of students increased 36 percent and graduates declined slightly;
(3) Chile, the number of students declined slightly and graduates increased tenfold;
(4) W. Germany, the number of students doubled and graduates increased only slightly;
(5) Israel, the number of students increased 10 percent and graduates quadrupled;
(6) Pakistan, the number of students tripled and graduates declined 40 percent;
(7) Philippines, the number of students declined 20 percent and graduates increased 30 percent; and
(8) Portugal, the number of students increased 50 percent and graduates declined 25 percent.

Table B-1. Agricultural output, 1955 and 1965, in 1,000 wheat units*

Country	Agricultural output	
	1955 (average 1952-56)	1965 (average 1962-66)
Argentina	49,003	57,253
Australia	34,947	49,279
Austria	7,825	10,472
Belgium (& Luxemburg)	10,281	12,501
Brazil	60,964	92,842
Canada	36,705	48,414
Ceylon	4,261	5,698
Chile	5,800	7,118
Colombia	14,201	17,590
Denmark	12,468	15,219
Finland	4,956	6,598
France	74,402	100,195
Germany, Fed. Rep.	50,761	63,147
Greece	8,585	13,283
India	158,609	200,046
Ireland	6,432	7,695
Israel	1,332	3,108
Italy	55,171	67,751
Japan	44,088	57,921
Libya	346	596
Mauritius	n.a.	n.a.
Mexico	19,432	32,743
Netherlands	14,260	18,681
New Zealand	13,264	18,128
Norway	3,108	3,176
Pakistan	39,980	50,621
Paraguay	n.a.	n.a.
Peru	6,487	8,815
Philippines	12,346	17,242
Portugal	7,688	8,981
South Africa	13,436	18,804
Spain	32,728	42,092
Surinam	n.a.	n.a.
Sweden	10,041	10,061
Switzerland	6,237	6,909
Syria	3,944	5,675
Taiwan	7,323	10,737
Turkey	25,791	37,097
U.A.R.	14,647	20,699
U.K.	32,905	45,731
U.S.A.	326,384	381,252
Venezuela	4,263	7,291
Yugoslavia	12,106	18,820

*Agricultural output minus seeds and feed. Composite series of agricultural output, 1957-62 averages, in table A-2 extrapolated to 1952-56 and 1962-66 by FAO's index of agricultural production (FAO, *Production Yearbook,* various issues).

Table B-2. Estimated agricultural land area, 1955 and 1965*

Country	Agricultural land area				Annual compound rate of change	Estimated agricultural land area	
	Nearest to 1955		Nearest to 1965				
	Year	Total	Year	Total		1955	1965
		(1,000 ha.)		(1,000 ha.)	(percent)	(1,000 ha.)	(1,000 ha.)
Argentina	1942	143,151	1960	137,829	−0.2	139,287	136,386
Australia	1955	385,442	1965	485,837	2.3	385,442	485,837
Austria	1955	4,080	1965	3,984	−0.2	4,080	3,984
Belgium (& Luxemburg)	1955	1,870	1965	1,791	−0.4	1,870	1,791
Brazil	1955	126,728	1960	137,034	1.6	126,728	148,178
Canada	1956	62,476	1966	64,361	0.3	62,291	64,170
Ceylon	1954	1,693	1965	1,889	1.0	1,710	1,889
Chile†	1955	12,964	1965	14,594	1.2	12,964	14,594
Colombia	1956	18,116	1960	19,653	2.1	17,751	21,759
Denmark	1955	3,117	1965	3,033	−0.3	3,117	3,033
Finland	1955	2,863	1965	2,883	0.1	2,863	2,883
France	1955	33,668	1965	34,001	0.1	33,668	34,001
Germany, Fed. Rep.	1955	14,251	1965	14,059	−0.1	14,251	14,059
Greece	1955	8,698	1965	8,678	−0.0	8,698	8,678
India	1955	169,496	1965	177,243	0.4	169,496	177,243
Ireland	1955	4,705	1965	4,709	0.0	4,705	4,709
Israel	1955	564	1965	1,223	8.0	564	1,223
Italy	1955	20,904	1965	20,440	−0.2	20,904	20,440
Japan	1956	6,404	1960	6,944	2.0	6,276	7,683
Libya	1951	9,041	1962	11,285	2.0	9,800	11,988
Mauritius	1955	129	1965	124	−0.4	129	124
Mexico	1950	85,945	1960	102,909	1.8	94,045	112,608
Netherlands	1955	2,307	1965	2,255	−0.2	2,307	2,255
New Zealand	1955	13,125	1965	13,634	0.4	13,125	13,634
Norway	1955	1,033	1965	1,008	−0.2	1,033	1,008
Pakistan‡	1955	24,404	1964	27,681	1.4	24,404	28,071
Paraguay	1954	1,222	1964	1,584	2.0	1,246	1,615
Peru§	1955	13,730	1965	30,031	0.7	13,730	14,701
Philippines‖	1955	7,588	1965	11,318	4.1	7,588	11,318
Portugal	1959	4,864	1963	4,900	0.2	4,828	4,918
South Africa	1955	97,340	1960	102,448	1.0	97,340	107,824
Spain	1955	29,633	1965	34,769	1.6	29,633	34,769
Surinam	1955	39	1965	55	3.5	39	55
Sweden	1955	4,495	1965	3,735	−1.8	4,495	3,735
Switzerland	1955	2,173	1964	2,178	0.0	2,173	2,179
Syria	1955	10,391	1964	12,762	2.3	10,391	13,057
Taiwan	1955	933	1965	901	−0.3	933	901
Turkey	1955	53,827	1965	54,378	0.1	53,827	54,378
U.A.R.	1955	2,713	1965	2,767	0.2	2,713	2,767
U.K.	1955	19,404	1965	19,623	0.1	19,404	19,623
U.S.A.	1954	444,236	1964	440,201	−0.1	443,831	439,800
Venezuela	1955	17,800	1961	21,925	3.5	17,800	25,193
Yugoslavia	1955	14,752	1965	14,756	0.0	14,752	14,756

*Agricultural land refers to arable land, land under permanent crops, and meadows plus pasture land.
†Rough grazing entered as a constant for 1955 and 1965.
‡Arable land only; no pasture land reported.
§Rough grazing deleted for 1955 and 1965.
‖1966 reported value used for 1965 estimate.

Table B-3. Estimated number of male workers in agricultural occupations, 1955 and 1965*

Country	Number of male workers†				Annual compound rate of change	Estimated number of male workers in agriculture§	
	Nearest to 1955		Nearest to 1965‡				
	Year	Number	Year	Number		1955	1965
		(1,000's)		(1,000's)	(percent)	(1,000's)	(1,000's)
Argentina	1947	1,534	1965	1,386	−0.6	1,411	1,334
Australia	1954	465	1965	416	−1.0	433	392
Austria	1951	512	1965	325	−3.2	369	267
Belgium (& Luxemburg)	1947	392	1965	183	−4.1	266	174
Brazil	1955	9,154	1965	10,781	1.6	7,566	8,911
Canada	1956	875	1965	612	−3.9	625	420
Ceylon	1953	1,147	1965	1,300	1.0	1,131	1,255
Chile	1952	606	1965	666	0.7	496	533
Colombia	1951	1,930	1965	2,342	1.4	1,704	1,957
Denmark	1955	370	1965	299	−2.1	338	273
Finland	1950	542	1965	433	−1.5	201	173
France	1955	3,387	1965	2,426	−2.9	2,969	2,205
Germany, Fed. Rep.	1950	2,316	1965	1,400	−3.3	1,780	1,273
Greece	1951	1,152	1965	1,173	0.1	1,083	1,096
India	1951	59,313	1965	93,151	3.3	66,165	91,339
Ireland	1951	436	1965	321	−2.2	393	316
Israel	1955	91	1965	81	−1.2	90	80
Italy	1955	5,460	1965	3,582	−4.1	5,129	3,364
Japan	1955	8,043	1965	6,167	−2.6	5,745	4,405
Libya	1955	n.a.	1964	141	n.a.	n.a.	n.a.
Mauritius	1952	55	1962	57	0.4	55	57
Mexico	1955	4,952	1965	6,217	2.3	4,778	5,998
Netherlands	1947	578	1965	368	−2.5	451	351
New Zealand	1956	123	1965	115	−0.7	117	109
Norway	1950	332	1965	243	−2.1	118	95
Pakistan	1951	16,096	1965	24,414	3.0	17,233	23,206
Paraguay	1950	212	1965	312	2.6	191	248
Peru	1940	1,060	1965	1,408	1.1	711	797
Philippines	1956	3,758	1965	4,646	2.4	3,305	4,183
Portugal	1950	1,330	1965	1,306	−0.1	1,060	1,047
South Africa	1951	1,405	1965	1,624	1.0	1,351	1,493
Spain	1950	4,853	1965	3,421	−2.3	3,868	3,442
Surinam	1955	n.a.	1965	20	n.a.	n.a.	n.a.
Sweden	1950	579	1965	364	−3.0	274	201
Switzerland	1950	325	1965	242	−1.9	267	219
Syria	1960	463	1966	519	1.9	420	508
Taiwan	1956	1,187	1965	1,404	1.9	1,095	1,320
Turkey	1955	4,341	1965	5,168	1.8	4,122	4,907
U.A.R.	1947	3,645	1965	4,606	1.3	3,960	4,509
U.K.	1951	1,099	1965	848	−1.8	961	799
U.S.A.	1955	5,265	1965	3,547	−3.9	4,584	3,088
Venezuela	1950	669	1965	784	1.1	616	685
Yugoslavia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

*Agricultural occupations refer to farm workers only. Fishing, hunting, and forestry occupations are excluded in the estimates for 1955 and 1965.
†Data of male workers economically active in agriculture reported by FAO and ILO include fishing, hunting, and forestry occupations.
‡1965 data of males were estimated from the total economically active agricultural labor force.
§ Farm workers only.
Sources: FAO, *Production Yearbook,* various issues.
ILO, *Yearbook of Labor Statistics,* various issues.
Statistical Abstract of the United States, 1968.

Table B-4. Estimated livestock, 1955/56 and 1965/66*

Country	Livestock units (estimated)	
	1955	1965
	(1,000's)	(1,000's)
Argentina	50,412	48,270
Australia	28,274	31,220
Austria	2,846	2,720
Belgium (& Luxemburg)	2,751	3,216
Brazil	75,358	107,713
Canada	10,605	11,689
Ceylon	2,032	2,417
Chile	3,525	4,030
Colombia	12,646	14,522
Denmark	4,009	4,610
Finland	1,972	2,023
France	19,840	21,360
Germany, Fed. Rep.	14,106	15,789
Greece	3,410	3,271
India	186,441	224,483
Ireland	4,652	5,480
Israel	202	336
Italy	10,806	11,704
Japan	4,276	4,801
Libya	575	787
Mauritius	40	49
Mexico	29,060	41,716
Netherlands	3,451	4,590
New Zealand	9,056	11,781
Norway	1,390	1,280
Pakistan	35,742	41,607
Paraguay	4,250	5,314
Peru	6,029	7,006
Philippines	6,225	7,307
Portugal	2,061	2,367
South Africa	15,209	15,949
Spain	8,001	7,803
Surinam	32	42
Sweden	2,636	2,367
Switzerland	1,764	1,903
Syria	1,566	1,404
Taiwan	1,072	1,131
Turkey	17,682	20,555
U.A.R.	4,222	4,709
U.K.	13,387	15,635
U.S.A.	99,987	107,238
Venezuela	6,808	7,130
Yugoslavia	8,039	8,146

*Various livestock animals on farms in years closest to 1955 and 1965, aggregated by the following weights: horse = 1.0, mule = 1.0, ass = 0.8, cattle = 0.8, pig = 0.2, sheep = 0.1, goat = 0.1, buffalo = 1.0, camel = 1.1, and poultry = 0.01.

Source: FAO, *Production Yearbook,* various issues.

Table B-5. Estimated commercial fertilizer, 1955 and 1965*

Country	1955† (1952-56 average)	1965† (1962-66 average)	Annual compound rate of change
	(1,000 metric tons)	(1,000 metric tons)	(percent)
Argentina	17	24	3.7
Australia	433	819	6.6
Austria	108	304	11.0
Belgium (& Luxemburg)	333	452	3.1
Brazil	71	228	12.3
Canada	237	527	8.3
Ceylon	33	71	8.0
Chile	51	102	7.2
Colombia	24	116	17.1
Denmark	319	455	3.6
Finland	148	283	6.7
France	1,312	2,816	7.9
Germany, Fed. Rep.	1,699	2,627	4.5
Greece	78	214	10.7
India	121	599	17.4
Ireland	88	224	9.7
Israel	27	36	3.1
Italy	624	931	4.1
Japan	1,018	1,780	5.7
Libya	2	4	6.4
Mauritius	10	25	10.0
Mexico	43	266	19.9
Netherlands	440	531	1.9
New Zealand	192	373	6.9
Norway	119	158	2.8
Pakistan	9	103	27.7
Paraguay	n.a.	1	n.a.
Peru	75	94	2.2
Philippines	42	109	10.1
Portugal	114	158	3.2
South Africa	141	270	6.7
Spain	426	755	5.9
Surinam	<1	1	10.6
Sweden	253	343	3.1
Switzerland	65	122	6.5
Syria	4	18	17.1
Taiwan	115	196	5.5
Turkey	20	100	17.3
U.A.R.	125	280	8.4
U.K.	824	1,464	5.9
U.S.A.	5,444	9,380	5.6
Venezuela	7	30	14.9
Yugoslavia	46	391	23.8

*Commercial fertilizers are the sum of nitrogen (N), phosphate (P_2O_5), and potash (K_2O). Tonnage refers to the nutrients, not to the tonnage of commercial fertilizer compounds. Ground rock phosphate is excluded.

†$\frac{\text{1956}}{\text{1952}} \frac{\Sigma N + P_2O_5 + K_2O}{5} = 1955$ $\quad$ $\frac{\text{1966}}{\text{1962}} \frac{\Sigma N + P_2O_5 + K_2O}{5} = 1965$

Source: *FAO, Fertilizer Annual Review,* various issues.

Table B-6. Estimated tractor horsepower, 1955 and 1965*

Country	Nearest to 1955		Nearest to 1965		Annual compound rate of change	Estimated tractor horsepower	
	Year	Horse-power	Year	Horse-power		1955	1965
		(1,000's)		(1,000's)	(percent)	(1,000's)	(1,000's)
Argentina	1956	1,156	1964	4,725	19.2	969	5,634
Australia	1955	6,235	1965	9,491	4.3	6,235	9,491
Austria	1955	1,263	1965	3,922†	12.0	1,263	3,922
Belgium (& Luxem-burg)	1955	796	1965	2,217	10.8	796	2,217
Brazil	1954	1,280	1962	2,000	5.7	1,353	2,364
Canada	1955	15,435	1962	21,359‡	4.7	15,435	24,549
Ceylon	1955	6	1965	51	23.9	6	51
Chile	1955	472	1964	702	4.5	472	734
Colombia	1955	519	1965	741	6.1	519	940
Denmark	1955	1,687	1965	4,861	11.2	1,687	4,861
Finland	1955	1,152	1965	3,819	12.7	1,152	3,819
France	1955	8,282	1965	25,934†	12.1	8,282	25,934
Germany, Fed. Rep.	1955	9,212	1965	23,782†	9.9	9,212	23,782
Greece	1955	331	1965	1,467†	16.1	331	1,467
India	1956	369	1962	976	17.6	314	1,587
Ireland	1955	821	1965	1,895	8.7	821	1,895
Israel	1955	120	1965	317	10.2	120	317
Italy	1955	4,839	1965	13,055	10.4	4,839	13,055
Japan	1955	473	1963	12,883	51.1	473	29,431
Libya	1955	6	1962	80	44.8	6	243
Mauritius	1955	7	1965	8	1.3	7	8
Mexico	1950	715	1964	1,638	6.1	961	1,738
Netherlands	1955	954	1965	2,234†	8.9	954	2,234
New Zealand	1955	2,099	1964	2,866	3.5	2,099	2,967
Norway	1955	987	1965	2,250	8.6	987	2,250
Pakistan	1951	24	1965	50	5.4	30	50
Paraguay	1953	16	1965	n.a.	n.a.	n.a.	n.a.
Peru	1955	208	1966	311	3.7	208	300
Philippines	1955	169	1963	164	–0.4	169	163
Portugal	1955	146	1965	489	12.8	146	489
South Africa	1955	1,760	1963	3,400	8.6	1,760	4,008
Spain	1955	798	1965	4,546	19.0	798	4,546
Surinam	1955	8	1964	22	11.9	8	25
Sweden	1955	3,403	1965	6,985	7.5	3,403	6,985
Switzerland	1955	590	1965	1,438†	9.3	590	1,438
Syria	1955	56	1965	241	15.7	56	241
Taiwan	1955	15	1965	61§	15.1	15	61
Turkey	1955	1,379	1965	1,590	1.4	1,379	1,590
U.A.R.	1955	215	1962	219	0.3	215	221
U.K.	1955	12,491	1965	13,037	0.4	12,491	13,037
U.S.A.	1955	140,410	1965	195,625‡	3.4	140,410	195,625
Venezuela	1955	292	1964	446	4.8	292	467
Yugoslavia	1955	378	1965	1,403	14.0	378	1,403

* Tractor horsepower estimated as: farm tractors = 30 hp. and garden tractors = 5 hp.

† Average horsepower per farm tractor: Austria = 20, France = 25, Germany = 20, Greece = 35, Netherlands = 25, and Switzerland = 15.
Source: OECD, *Evolution de la Motorization de l'Agriculture et de la Consommationet des Prix de Carburants dans les Pays Membres,* Paris, June 1963.

‡ Average horsepower per farm tractor: Canada = 37 and U.S.A. = 40.
Source: USDA, ERS, "The Farm Cost Situation," FCS-36, Nov. 1964.

§ Source: Asian Production Organization, *Export Group Meeting on Agricultural Mechanization,* Vol. I, 1968, p. 268.

Table B-7. Indicators of nonconventional inputs, 1955 and 1965

Country	School enrollment ratios*			College graduates in agriculture per 10,000 farm workers		
	1945-55† average	1955-65 average	Annual compound rate of change	1955 estimated	1965 estimated	Annual compound rate of change
	(percent)	(percent)	(percent)	(number)	(number)	(percent)
Argentina	64	73	1.3	2.11	2.18	0.3‡
Australia	83	91	0.9	3.12	24.72	23.0
Austria	76	70	–0.8	3.80	8.46	8.3
Belgium (& Luxemburg)	84	99	1.7	9.65	12.03	2.2‡
Brazil	30	50	5.2	0.45	0.90	7.1
Canada	71	81	1.3	7.10	15.61	8.2
Ceylon	68	77	1.3	0.08	n.a.	n.a.
Chile	62	74	1.8	0.46	5.48	28.1‡
Colombia	31	51	5.1	0.13	1.01	22.7
Denmark	80	88	1.0	5.03	7.13	3.6
Finland	76	83	0.9	5.66	10.44	6.3
France	78	91	1.6	1.60	3.75	8.9
Germany, Fed. Rep.	91	86	–0.6	5.86	8.65	5.9‡
Greece	70	72	0.3	0.90	2.05	8.6
India	21	33	4.6	0.27	0.99	14.2
Ireland	100	95	–0.6	2.98	4.80	4.9
Israel	74	88	1.7	2.45	11.25	16.5‡
Italy	53	60	1.2	1.85	1.65	–1.2
Japan	86	89	0.3	8.77	20.54	8.9
Libya	13	40	11.9	n.a.	n.a.	n.a.
Mauritius	53	78	3.9	3.90	6.72	5.6
Mexico	40	59	4.0	0.07	0.20	10.5
Netherlands	85	91	0.7	8.49	13.73	4.9
New Zealand	88	91	0.3	11.48	24.09	7.7
Norway	77	88	1.3	7.54	13.09	5.7
Pakistan	20	27	3.0	0.32	0.13	–8.8‡
Paraguay	51	62	2.0	n.a.	n.a.	n.a.
Peru	46	57	2.2	1.94	4.59	9.0
Philippines	80	75	–0.6	1.39	1.15	–1.9‡
Portugal	41	61	4.1	0.60	0.42	–3.6‡
South Africa	49	70	3.6	1.29	2.50	8.4
Spain	53	67	2.4	1.36	0.77	–4.9
Surinam	68	80	1.6	n.a.	n.a.	n.a.
Sweden	75	79	0.5	4.49	8.20	6.2
Switzerland	64	66	0.3	n.a.	n.a.	n.a.
Syria	35	42	1.8	2.76	2.22	–2.2
Taiwan	48	70	3.8	3.91	7.25	6.4
Turkey	33	46	3.4	0.34	1.51	14.3
U.A.R.	26	43	5.2	1.33	5.51	15.3
U.K.	75	85	1.3	6.10	8.51	3.4
U.S.A.	100	100§	0.3	18.76	29.78	4.7
Venezuela	41	70	5.5	0.31	0.91	11.2
Yugoslavia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

*The school enrollment ratio is the combined adjusted enrollment ratio for the first and second levels.
†1945 data estimated in a linear manner.
‡The change in the number of students is inconsistent with the change in the number of graduates. See appendix B.
§Reported figures exceed 100.
Source: UNESCO, *Statistical Yearbook,* various issues.

Table B-8. Indicators of industrialization, labor, 1955 and 1965

Country	Number of actively employed males				Annual compound rate of change	Estimated number of actively employed males		Ratio of non-agricultural labor*	
	Nearest to 1955		Nearest to 1965						
	Year	Number	Year	Number		1955	1965	1955	1965
		(1,000's)		(1,000's)	(percent)	(1,000's)		(percent)	
Argentina	1947	5,163	1960	5,884	1.0	5,596	6,188	73.8	77.6
Australia	1954	2,857	1961	3,166	1.5	2,899	3,358	84.1	87.6
Austria	1951	2,111	1961	2,010	−0.5	2,070	1,971	78.3	83.5
Belgium (& Luxemburg)	1947	2,757	1966	2,750	−0.0	2,754	2,751	89.9	93.3
Brazil	1950	14,610	1960	18,597	2.4	16,483	20,982	44.5	48.6
Canada	1956	4,352	1961	4,730	1.7	4,280	5,056	78.7	87.9
Ceylon	1953	2,308	1963	2,742	1.7	2,389	2,839	50.9	54.2
Chile	1952	1,642	1960	1,854	1.5	1,719	2,001	64.0	66.7
Colombia	1951	2,810	1964	4,102	3.0	3,157	4,223	35.4	44.5
Denmark	1955	1,414	1960	1,448	0.5	1,414	1,482	73.8	79.8
Finland	1950	1,176	1960	1,232	0.5	1,204	1,262	58.2	65.7
France	1954	12,848	1967	13,802	0.6	12,919	13,651	74.7	82.2
Germany, Fed. Rep.	1950	15,262	1966	17,364	0.8	15,890	17,225	87.7	91.9
Greece	1951	2,329	1961	2,445	0.5	2,375	2,493	51.2	52.9
India	1951	99,548	1961	129,171	2.6	110,498	143,380	38.9	35.0
Ireland	1951	947	1961	822	−1.4	895	776	55.3	58.6
Israel	1955	476	1961	556	2.6	476	616	80.9	86.8
Italy	1955	15,042	1966	14,364	−0.4	15,042	14,424	63.7	75.2
Japan	1955	24,540	1965	29,519	1.9	24,540	29,519	67.7	79.1
Libya	n.a.	n.a.	1964	382	n.a.	n.a.	n.a.	n.a.	n.a.
Mauritius	1952	131	1962	154	1.6	138	162	59.6	64.4
Mexico	1950	7,208	1960	9,297	2.6	8,186	10,558	39.5	41.1
Netherlands	1947	2,923	1960	3,241	0.8	3,114	3,372	84.8	89.1
New Zealand	1956	623	1961	671	1.5	614	711	79.8	83.8
Norway	1950	1,060	1960	1,085	0.2	1,072	1,098	72.1	77.8
Pakistan	1955	24,910	1961	26,444	1.0	24,910	27,518	27.2	11.3
Paraguay	1950	337	1962	454	2.5	381	488	36.8	36.1
Peru	1940	1,598	1961	2,445	2.0	2,166	2,652	42.0	46.9
Philippines	1956	5,771	1961	6,352	1.9	5,661	6,859	35.2	32.3
Portugal	1950	2,551	1960	2,817	1.0	2,681	2,961	50.7	55.9
South Africa	1951	3,684	1960	4,390	2.0	3,983	4,839	63.1	66.4
Spain	1950	9,085	1966	9,300	0.1	9,151	9,286	52.9	63.2
Surinam	n.a.	n.a.	1964	61	n.a.	n.a.	n.a.	n.a.	n.a.
Sweden	1950	2,286	1960	2,278	−0.0	2,282	2,274	78.3	84.0
Switzerland	1950	1,515	1965	1,914	1.6	1,638	1,914	82.0	87.3
Syria	n.a.	n.a.	1960	990	n.a.	n.a.	n.a.	n.a.	n.a.
Taiwan	1956	2,415	1965	2,961	2.3	2,360	2,961	50.6	52.6
Turkey	1955	6,813	1965	8,405	2.1	6,813	8,405	36.3	38.5
U.A.R.	1947	5,819	1960	7,164	1.6	6,613	7,760	38.8	40.6
U.K.	1951	10,070	1961	16,648	5.2	12,313	20,356	91.7	95.8
U.S.A.	1950	43,553	1966	52,350	1.1	46,131	51,752	88.6	93.1
Venezuela	1950	1,403	1961	1,929	2.9	1,622	2,166	56.5	64.7
Yugoslavia	1953	5,145	1961	5,387	0.6	5,205	5,513	47.1	71.5

*Fishing, forestry, and hunting in the traditional usages are considered agricultural occupations.

Source: ILO, *Yearbook of Labor Statistics,* various issues.

Table B-9. Indicators of industrialization and nonagricultural income, 1955 and 1965

Country	Ratio of nonagricultural income*				Annual compound rate of change	Estimated ratio of nonagricultural income	
	Nearest to 1955		Nearest to 1965				
	Year	Percent	Year	Percent		1955	1965
						(percent)	
Argentina	1955	84.0	1965	83.0	−0.1	84.0	83.0
Australia	1958	86.0	1965	90.0	0.7	84.3	90.0
Austria	1958	86.0	1965	91.0	0.8	83.9	91.0
Belgium (& Luxemburg)	1958	93.0	1964	94.0	0.2	92.5	94.2
Brazil	1958	74.0	1965	70.0	−0.8	75.8	70.0
Canada	1958	93.0	1965	94.0	0.2	92.6	94.0
Ceylon	1958	53.0	1965	58.0	1.3	51.0	58.0
Chile	1958	87.0	1965	90.0	0.5	85.7	90.0
Colombia	1958	63.0	1965	68.0	1.1	61.0	68.0
Denmark	1958	84.0	1965	89.0	0.8	81.9	89.0
Finland	1958	79.0	1965	82.0	0.5	77.7	82.0
France	1958	90.0	1965	92.0	0.3	89.2	92.0
Germany, Fed. Rep.	1958	93.0	1965	96.0	0.5	91.7	96.0
Greece	1958	72.0	1965	75.0	0.6	70.8	75.0
India	1958	51.0	1965	52.0	0.3	50.6	52.0
Ireland	1958	74.0	1965	79.0	0.9	72.0	79.0
Israel	1958	87.0	1965	91.0	0.6	85.3	91.0
Italy	1958	81.0	1965	87.0	1.0	78.6	87.0
Japan	1958	82.0	1965	88.0	1.0	79.6	88.0
Libya	1958	74.0	1965	95.0	3.6	66.5	95.0
Mauritius	1958	70.0	1965	75.0	1.0	68.0	75.0
Mexico	1958	79.0	1965	83.0	0.7	77.3	83.0
Netherlands	1958	89.0	1965	92.0	0.5	87.7	92.0
New Zealand	1958	n.a.	1965	n.a.	n.a.	n.a.	n.a.
Norway	1958	88.0	1965	91.0	0.5	86.7	91.0
Pakistan	1958	48.0	1965	53.0	1.4	46.0	53.0
Paraguay	1958	65.0	1965	64.0	−0.2	65.4	64.0
Peru	1958	66.0	1963	78.0	3.4	59.7	83.4
Philippines	1958	67.0	1965	67.0	0.0	67.0	67.0
Portugal	1958	73.0	1965	79.0	1.1	70.6	79.0
South Africa	1958	87.0	1965	90.0	0.5	85.7	90.0
Spain	1958	75.0	1965	82.0	1.3	72.2	82.0
Surinam	1958	84.0	1963	88.0	0.9	81.7	89.7
Sweden	1958	90.0	1965	93.0	0.5	88.7	93.0
Switzerland	1958	n.a.	1965	n.a.	n.a.	n.a.	n.a.
Syria	1958	68.0	1965	63.0	−1.1	70.3	63.0
Taiwan	1958	69.0	1965	73.0	0.8	67.4	73.0
Turkey	1958	54.0	1965	64.0	2.5	50.2	64.0
U.A.R.	1963	73.0	1965	71.0	−1.4	81.6	71.0
U.K.	1958	96.0	1965	97.0	0.1	95.6	97.0
U.S.A.	1958	95.0	1965	97.0	0.3	94.2	97.0
Venezuela	1960	93.0	1965	92.0	−0.2	94.0	92.0
Yugoslavia	1958	71.0	1965	71.0	0.0	71.0	71.0

* Data are taken as gross domestic product at factor cost.

Source: United Nations: *Yearbook of National Account Statistics,* various issues.

APPENDIX C: HISTORICAL DATA, SELECTED COUNTRIES

Historical time-series data of agricultural output (in Wheat Units) per male farm worker and per hectare of agricultural land for selected countries (U.S., Japan, Denmark, France, and U.K.) are compiled so that they are comparable with the inter-country data (tables C-1 through C-5). The procedures are: a) the index of agricultural output minus inputs supplied from the agriculture sector is divided by indices of the number of male farm workers and of agricultural land area to produce the indices of output per worker and per hectare, and b) these indices are spliced to the inter-country outputs per worker and per hectare for 1957-1962 (table 2) in wheat units. These procedures are adopted to adjust for the differences between the time-series labor force and land area data (shown in parentheses) collected for inter-temporal comparability and the inter-country cross-section data (table 7) collected for international comparability.

In principle, data for a flow variable (agricultural output) are averaged for the 5 years centering on the years shown, and those for stock variables (labor force and land area) are measured in the years shown.

Table C-1. Time-series data for the U.S., 1880-1960

Year	Index 1960 = 100					Output per male worker[6]	Output per hectare[7]	Percent of male workers in nonagriculture[8]
	Agricultural output[1]	Number of male workers[2]	Agricultural land[3]	Output per male worker[4]	Output per hectare[5]			
	percent					WU	WU	percent
1880	29	200 (7,959)*	46 (202)†	15	63	14.6	0.5	45
1885	32	214 (8,551)	50 (219)	15	64	15.0	0.5	
1890	35	230 (9,142)	54 (235)	15	65	15.1	0.5	52
1895	40	238 (9,511)	64 (277)	17	63	16.8	0.5	
1900	46	248 (9,880)	73 (318)	18	62	18.2	0.5	57
1905	47	254 (10,120)	75 (325)	19	63	18.4	0.5	
1910	48	260 (10,359)	77 (333)	19	63	18.4	0.5	64
1915	51	259 (10,290)	80 (348)	20	64	19.6	0.5	
1920	53	256 (10,221)	83 (363)	21	63	20.6	0.5	69
1925	56	246 (9,818)	80 (350)	23	70	22.8	0.6	
1930	60	236 (9,414)	88 (381)	25	69	25.3	0.5	74
1935	56	224 (8,950)	94 (409)	25	59	24.8	0.5	
1940	68	214 (8,487)	94 (411)	32	72	31.7	0.6	78
1945	78	186 (7,419)	102 (444)	42	76	41.5	0.6	
1950	84	160 (6,352)	104 (451)	52	81	52.1	0.6	85
1955	90	130 (5,163)	104 (454)	69	87	68.9	0.7	
1960	100	100 (3,973)	100 (435)	100	100	99.5	0.8	91

[1] Index of gross farm output minus intermediate goods produced in agriculture. Source: U.S. Dept. Agr., *Changes in Farm Production and Efficiency,* Stat. Bull. No. 233, 1964, p. 50.

[2] Index calculated from the data shown in parentheses of the number of male workers, 1900-1960: Economically active population (population census data adjusted by Kaplan and Casey). 1880-1890: Number of gainful workers (population census data adjusted by Edwards). Sources: D.L. Kaplan and M.C. Casey, *Occupational Trends in the United States, 1900 to 1950,* U.S. Bureau of Census Working Report No. 5, 1958; U.S. Bureau of Census, *U.S. Census of Population: 1960. Detailed Characteristics. U.S. Summary,* Final Report PC (1)–1D, p. 563; A.M. Edwards, *Comparative Occupational Statistics for the United States, 1870-1940,* U.S. Dept. Commerce, 1943, p. 100.

[3] Index calculated from the data shown in parentheses of agricultural land, including permanent pasture. From the Census of Agriculture. 1955 and 1960 figures are those of the 1954 and 1959 censuses. Sources: U.S. Dept. Agr., Agricultural Statistics, 1967, p. 512; and *Major Statistical Series of the U.S. Department of Agriculture,* Agriculture Handbook No. 118, 1957, p. 4.

[4] Column (1) / column (2).

[5] Column (1) / column (3).

[6] Index in column (4) spliced with inter-country cross-section series of output per worker for 1957-62 (table 2).

[7] Index in column (5) spliced with inter-country cross-section series of output per hectare for 1957-62 (table 2).

[8] Sources: same as for column (2).

*( ) in 1,000 males.

†( ) in million hectares.

Table C-2. Time-series data for Japan, 1880-1960

Year	Index 1960 = 100					Output per male worker[6]	Output per hectare[7]	Percent of male workers in nonagriculture[8]
	Agricultural output[1]	Number of male workers[2]	Agricultural land[3]	Output per male worker[4]	Output per hectare[5]			
	percent					WU	WU	percent
1880	28	126 (7,842)*	78 (5,507)†	22	36	2.4	2.7	21
1885	32	125 (7,766)	79 (5,584)	25	40	2.7	3.0	24
1890	35	109 (7,677)	81 (5,708)	28	43	3.0	3.2	28
1895	37	124 (7,751)	83 (5,839)	29	44	3.1	3.3	31
1900	42	123 (7,680)	86 (6,031)	34	49	3.6	3.7	35
1905	46	122 (7,617)	87 (6,147)	38	53	4.1	4.0	38
1910	53	122 (7,606)	92 (6,471)	43	57	4.6	4.3	43
1915	60	122 (7,585)	95 (6,701)	49	63	5.2	4.7	47
1920	65	122 (7,593)	99 (6,957)	53	66	5.6	5.0	52
1925	65	122 (7,586)	97 (6,860)	53	66	5.6	5.0	55
1930	69	122 (7,579)	98 (6,914)	57	71	6.1	5.3	57
1935	73	112 (6,972)	101 (7,080)	66	73	7.1	5.5	61
1940	73	102 (6,365)	101 (7,100)	72	73	7.7	5.5	64
1945	63	98 (6,310)	95 (6,660)	64	67	6.8	5.0	62
1950	71	124 (7,720)	96 (6,795)	57	73	6.1	5.5	60
1955	83	118 (7,350)	99 (6,938)	70	84	7.5	6.3	66
1960	100	100 (6,230)	100 (7,043)	100	100	10.7	7.5	74

Unless otherwise noted, data are from Kazushi Ohkawa, et. al., ed., *Long Term Economics Statistics of Japan since 1868,* Vol. 9, 1966 (henceforth abbreviated as LTES).

[1] Index of gross agricultural output minus intermediate goods produced in agriculture. This index was calculated by multiplying the index of gross agricultural production (Series 10, table 33, pp. 222-223, *LTES*) by one minus the ratio of the 1934-36 constant price aggregate of agricultural intermediate goods (Series 6-7, table 16, pp. 186-187, *LTES*) to the 1934-36 constant price aggregate of gross agricultural production (Series 14, table 4, pp. 152-153, *LTES*).

[2] Index calculated from the data shown in parentheses of the number of gainfully occupied male workers (Series 1, table 33, pp. 218-219, *LTES*).

[3] Index calculated from the data shown in parentheses of the agricultural land area including permanent pasture which were estimated by multiplying arable land area (Series 14, table 32, pp. 216-217 *LTES*), by 1.16, which is the ratio of agricultural land area to arable land area in 1960 *Census of Agriculture.*

[4] Column (1) / column (2).

[5] Column (1) / column (3).

[6] Index in column (4) spliced to inter-country cross-section series of output per worker for 1957-62 (table 2).

[7] Index in column (5) spliced with inter-country cross-section series of output per hectare for 1957-62 (table 2).

[8] Percentages calculated from (a) the population census data for census years, (b) linear interpolations for inter-census, and (c) the percentage in 1920 (the 1st census year) multiplied by the ratios on the number of gainful workers in agriculture to the total number of gainful workers in Kazushi Ohkawa et. al., *The Growth Rate of Japanese Economy,* Tokyo, 1957.

*( ) in 1,000 males.

†( ) in 1,000 hectares.

Table C-3. Time-series data for Denmark, 1880-1960

Year	Index 1960 = 100					Output per male worker[6]	Output per hectare[7]	Percent of male workers in nonagri-culture[8]
	Agricul-tural output[1]	Number of male workers[2]	Agricultural land[3]	Output per male worker[4]	Output per hectare[5]			
	percent					WU	WU	percent
1880	24	107 (321)*	92 (2,859)†	22	26	10.5	1.2	46
1885	25	107 (325)	93 (2,889)	23	26	10.9	1.2	
1890	27	108 (326)	94 (2,913)	26	29	11.9	1.3	49
1895	29	108 (327)	94 (2,907)	27	31	12.6	1.4	
1900	31	103 (312)	94 (2,912)	30	33	14.1	1.5	53
1905	35	111 (336)	94 (2,918)	31	37	14.8	1.7	
1910	41	114 (346)	93 (2,883)	36	44	16.9	2.0	55
1915	43	118 (358)	93 (2,875)	36	46	17.1	2.1	
1920	44	130 (395)	103 (3,172)	34	43	16.1	2.0	58
1925	48	133 (404)	104 (3,217)	36	46	16.9	2.1	
1930	66	131 (398)	104 (3,229)	51	64	23.9	2.9	62
1935	69	129 (390)	105 (3,242)	53	65	25.2	3.0	
1940	63	129 (391)	104 (3,218)	49	60	23.0	2.8	67
1945	60	122 (371)	103 (3,180)	49	59	23.4	2.7	
1950	76	113 (342)	102 (3,146)	67	75	31.9	3.4	77
1955	90	111 (336)	101 (3,117)	81	81	38.4	3.7	74
1960	100	100 (303)	100 (3,094)	100	100	47.4	4.6	77

[1] Index of gross agricultural output minus intermediate goods produced in agriculture. Sources: Kjeld Bjerke and Niels Ussing, *Studier Over Danmarks National Produkt, 1870-1950,* p. 144; USDA, *Indices of Agricultural Production in Western Europe, 1950-1968,* ERS-Foreign 266, July 1969, pp. 25-26.

[2] Index calculated from the data shown in parentheses of the economically active males in agriculture excluding fishing, hunting, and forestry. Males in agriculture are estimated as a percentage of the total agricultural labor force given by Bjerke with data from Dovring of males in agriculture for 1900, 1930, and 1950. Sources: Bjerke, p. 142; Folke Dovring, *Land and Labor in Europe in the Twentieth Century,* 3rd ed., The Hague: Martines Nijhoff, 1965, p. 63.

[3] Index calculated from the data shown in parentheses of agricultural land including temporary fallow and grass plus permanent pasture. Sources: Einar Jensen, *Danish Agriculture,* Copenhagen: J.W. Schultz Forlag, 1937, p. 389; Danmarks Statistik, *Land Brusstatistik, 1900-1965,* Copenhagen, 1968, pp. 8-9.

[4] Column (1) / column (2).

[5] Column (1) / column (3).

[6] Index in column (4) spliced with inter-country cross-section series of output per worker for 1957-62 (table 2).

[7] Index in column (5) spliced with inter-country cross-section series of output per hectare for 1957-62 (table 2).

[8] Percentage of males economically active in nonagriculture estimated from percentage of labor force in nonagriculture given by Bjerke by splicing ILO data of males in nonagriculture at 1950, 1955 average. Source: Bjerke, p. 142.

*( ) in 1,000 males.

†( ) in 1,000 hectares.

Table C-4. Time-series data for France, 1880-1960

Year	Index 1960 = 100					Output per male worker[6]	Output per hectare[7]	Percent of male workers in nonagriculture[8]
	Agricultural output[1]	Number of male workers[2]	Agricultural land[3]	Output per male worker[4]	Output per hectare[5]			
	percent					WU	WU	percent
1880	43	193 (4,970)*	100 (34,594)†	22	43	7.9	1.1	51
1885	43	183 (4,720)	100 (34,514)	24	43	8.5	1.1	
1890	44	178 (4,580)	99 (34,429)	25	45	8.9	1.1	55
1895	46	200 (5,160)	100 (34,800)	23	46	8.2	1.1	
1900	47	195 (5,020)	101 (35,200)	24	47	8.7	1.2	56
1905	50	192 (4,960)	104 (35,950)	26	48	9.4	1.2	
1910	53	190 (4,910)	106 (36,799)	28	50	10.0	1.2	60
1915	53	183 (4,720)	106 (36,669)	29	50	10.5	1.3	
1920	54	176 (4,540)	104 (36,219)	31	52	10.9	1.3	60
1925	58	166 (4,290)	105 (36,294)	35	55	12.5	1.4	
1930	62	157 (4,040)	103 (35,566)	40	60	14.2	1.5	67
1935	62	150 (3,870)	101 (34,883)	41	61	14.8	1.5	
1940	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
1945	52	149 (3,840)	93 (32,328)	35	56	12.5	1.4	67
1950	60	128 (3,300)	97 (33,562)	47	62	16.7	1.5	
1955	71	115 (2,970)	97 (33,706)	61	73	22.0	1.8	75
1960	100	100 (2,580)	100 (34,681)	100	100	35.9	2.5	80

[1]Index of gross agricultural output minus intermediate goods produced in agriculture. Source: J.C. Toutain, "le produit de l'agriculture francaise de 1700 á 1958; II: La Croissance," *Histoire Quantitative de l'Economie Francaise,* Vol. 2, (Paris: I.S.E.A., 1961), pp. 6, 128-129. (Lumber deducted from table 110, pp. 128-129);EEC, *Agrarstatistik*, 4, 1968, pp. 26-27.

[2]Index calculated from the data shown in parentheses of the economically active males in agriculture excluding fishing, hunting, and forestry. Source: Toutain, pp. 200-201.

[3]Index calculated from the data shown in parentheses of agricultural land comprised of arable land including temporary fallow and grass plus permanent pastures. Source: Ministére de l'Economie et des Finances, *Annuaire Statistique de la France, Résumé Retrospectif,* p. 177.

[4]Column (1) / column (2).

[5]Column (1) / column (3).

[6]Index in column (4) spliced with inter-country cross-section series of output per worker for 1957-62 (table 2).

[7]Index in column (5) spliced with inter-country cross-section series of output per hectare for 1957-62 (table 2).

[8]Same as column (2).

*( ) in 1,000 males.

†( ) in 1,000 hectares.

Table C-5. Time-series data for the United Kingdom, 1880-1960

Year	Index 1960 = 100					Output per male worker [6]	Output per hectare[7]	Percent of male workers in nonagri-culture[8]
	Agricul-tural output[1]	Number of male workers[2]	Agricultural land[3]	Output per male worker[4]	Output per hectare[5]			
	percent					WU	WU	percent
1880	54	151 (1,288)*	95 (18,949)†	36	57	15.7	1.1	84
1885	55	148 (1,263)	96 (19,139)	37	57	16.4	1.1	
1890	56	145 (1,235)	97 (19,331)	39	58	17.0	1.1	86
1895	56	142 (1,210)	98 (19,466)	39	57	17.2	1.1	
1900	55	138 (1,178)	99 (19,602)	40	55	17.4	1.1	88
1905	56	140 (1,198)	98 (19,547)	40	57	17.5	1.1	
1910	56	143 (1,221)	98 (19,484)	39	57	17.3	1.1	88
1915	56	141 (1,203)	97 (19,359)	40	58	17.6	1.1	
1920	56	135 (1,154)	96 (19,121)	42	58	18.3	1.1	89
1925	57	140 (1,194)	100 (19,798)	41	57	17.8	1.1	
1930	60	134 (1,151)	99 (19,611)	45	61	19.7	1.2	90
1935	64	132 (1,131)	98 (19,571)	49	66	21.6	1.3	
1940	71	126 (1,079)	98 (19,453)	56	72	24.7	1.4	90
1945	76	121 (1,034)	98 (19,539)	63	78	27.7	1.5	
1950	82	115 (985)	98 (19,518)	71	83	31.2	1.6	91
1955	85	109 (928)	98 (19,405)	78	88	34.5	1.7	92
1960	100	100 (853)	100 (19,894)	100	100	44.0	1.9	94

[1] Index of gross agricultural output, net of intermediate goods produced in agriculture. Sources: Colin Clark, *The Conditions of Economic Progress,* 3rd ed., London: Macmillan & Co., 1957, p. 267. Minister of Agriculture, Fisheries and Food, *A Century of Agricultural Statistics, Great Britain, 1866-1966,* London: HMSO, 1968, pp. 76-77. E.M. Ojala, *Agriculture and Economic Progress,* London: Goeffrey, Cumberlege, 1952, p. 210.

[2] Index calculated from data shown in parentheses of the economically active males in agriculture excluding fishing, hunting, and forestry. Source: Clark, p. 264. FAO, *Production Yearbook*, various issues.

[3] Index calculated from the data shown in parentheses of agricultural land area including temporary fallow and grass plus permanent pasture. Source: Central Statistics Office, *Annual Abstract of Statistics,* London: HMSO, various issues.

[4] Column (1) / column (2).

[5] Column (1) / column (3).

[6] Index in column (4) spliced with inter-country cross-section series of output per worker for 1957-62 (table 2).

[7] Index in column (5) spliced with inter-country cross-section series of output per hectare for 1957-62 (table 2).

[8] Percentage of males economically active in nonagriculture is estimated from percentage of labor force in nonagriculture given by Deane & Cole by splicing ILO data of males in nonagriculture at 1950-55 average. Source:. Phyllis Deane and W.A. Cole, *British Economic Growth, 1688-1959,* Cambridge: Cambridge University Press, 1967, p. 142. ILO, *Annual Yearbook,* various issues.

*( ) in 1,000 males.

†( ) in 1,000 hectares

APPENDIX D. PRICE WEIGHTS

Three sets of price weights in the form of wheat relative prices are based on the 1957-62 average prices in the United States, Japan, and India. In principle, prices are measured at farm gate, and import prices (cif) are used for commodities not produced domestically. Since the FAO trade statistics are available only since 1959, we used 1959-62 average import prices of these commodities relative to 1959-62 average wheat price at farm gate. When farm-gate prices were not available, we supplemented them with wholesale prices or retail prices. The prices of mixed grain are assumed to be simple averages of rye and oats prices. The prices of fruits (unspecified) are assumed to be simple averages of citrus and other fresh fruits prices.

1. U.S. weight

Farm-gate prices are "season average prices (per unit) received by farmers" in the USDA, *Agricultural Statistics 1964.* Explanations by individual commodities are summarized in table D-1.

For commodities for which farm-gate prices were not available, we used unit import price (total value of import divided by total quantity of import) calculated from the FAO, *Trade Yearbook 1965.* Since the United States cif prices are not available, we adopted fob prices. Explanations by individual commodities are summarized in table D-2.

2. Japan weight

Farm-gate prices were calculated as unit prices from the unpublished data of the Statistical Research Division, Ministry Agriculture and Forestry, *Gross Value of Production and Income Produced in Agriculture.* These data are based on the Ministry's annual Farm Household Economy Survey. Estimation procedures are summarized in table D-3.

The same procedures as used for the United States were followed for import prices except that cif prices were used for Japan. Estimation procedures are summarized in table D-4.

3. India weights

The construction of India weights was subject to severe data limitations. Table D-5 shows what kind of prices were used for respective commodities.

Farm-gate Prices

Farm-gate prices were available only for 11 commodities. These prices, as reported in the original sources, are not all Indian averages but averages of the major producing states. We calculated weighted averages using quantities produced by states as weights (see table D-6).

Wholesale and Retail Prices

Price weights of 20 commodities were estimated from wholesale prices. Those wholesale prices, as reported in original sources, are the prices at selected markets. We tried to choose the prices in the markets located in the major producing regions of the respective commodities (see table D-7). In cases where wholesale prices were not available, we supplemented them with retail prices.

Import and Export Prices

Calculations of price weights based on import prices were the same as used for Japan (see table D-8). Export prices were used in the case of India to fill the data gap (see table D-9).

Other Sources

For the commodities for which price data were not available, we made the following assumptions:

rye, oats, mix grains = same as barley
buckwheat = simple average of millet and sorghum
sweet potato, cassava = same as potato
other fresh fruits, fruits (unspecified) = simple average of citrus fruits, dates, and bananas
soybeans = same as ground nuts
palm kernel = same as copra
beef, veal, and pork = same as mutton

Table D-1. Estimation procedures of U.S. price weights based on farm-gate prices, 1957-62 averages

Commodity	Original unit	Weight of original unit in pounds	Farm-gate prices: U.S. dollars per metric ton	Farm-gate prices: Wheat relative (W_U)	Explanation of estimation procedures
Wheat*	bushel	60	67.6	1.00	
Rice (rough)*	bag	100	106.9	1.58	
Rye*	bushel	56	38.9	0.58	Price of No. 2 rye.
Barley*	bushel	48	41.2	0.61	
Oats*	bushel	32	42.4	0.63	
Maize*	bushel	56	42.5	0.63	Price of corn for grain.
Sorghum*	bushel	56	37.4	0.55	
Buckwheat*	bushel	50	50.3	0.74	
Potatoes			38.6	0.57	
Sweet potatoes			54.8	0.81	
Pulses, all	bag	100	143.4	2.12	Weighted average price of dry edible beans and dry field peas.
Nuts (unshelled)			888.1	13.14	Weighted average price of almonds, filberts, pecans, and walnuts.

Table D-1. (continued)

Commodity	Original unit	Weight of original unit in pounds	Farm-gate prices: U.S. dollars per metric ton	Farm-gate prices: Wheat relative (W_U)	Explanation of estimation procedures
Vegetables			56.3	0.83	Weighted average price of artichokes, asparagus, lima beans, snap beans, beets, broccoli, brussels sprouts, cabbage, cantaloupe, carrots, cauliflower, celery, sweet corn, cucumbers, eggplant, escarole, garlic, honeyball melons (prior to 1954), honeydew melons, kale, lettuce, onions, green peas, green peppers, shallots, spinach, tomatoes, and watermelons.
Citrus fruits	box		66.1	0.98	Weighted average price of orange, grapefruit, lemon, lime, and tangerine.
Orange		90			
Grapefruit		80			
Lemon		76			
Lime		80			
Tangerine		90			
Dates			138.7	2.05	
Other fresh fruits			85.5	1.27	Weighted average price of apples, pears, plums, prunes, cherries, peaches, apricots, grapes, and figs.
Apples	bushel	60			
Pears					
Plums					
Prunes					
Cherries					
Peaches	bushel	60			
Apricots					
Grapes					
Figs					
Cottonseed			50.6	0.75	
Groundnuts (unshelled)			229.3	3.39	Weighted average price of peanuts picked and threshed.
Soybeans	bushel		78.3	1.16	
Sugar cane			8.3	0.12	Prices do not include government payments
Sugar beets			12.8	0.19	under the Sugar Act.
Cotton			696.4	10.30	Gross weight price, including bagging and ties, except extra long staple cotton is included at net weight. Includes allowances for loans unredeemed at date of maturity.
Wool, greasy basis			976.2	14.44	Average price is for the marketing season (April-March).
Tobacco			1,316.2	19.47	
Beef and veal				12.36	Converted from live weight to dressed carcass weight using factors 0.549 for cattle and 0.555 for calves.
Pork				9.51	Converted from live weight to dressed carcass weight by using factors: 0.57 for pork 0.48 for sheep 0.89 for chicken 0.90 for turkey
Mutton and lamb				12.58	
Poultry			437.5	6.47	
Milk			91.9	1.36	Average price at average fat test for all milk sold at wholesale to plants and dealers.
Eggs	dozen	39.05	496.4	7.35	

*Includes an allowance for loans unredeemed at the end of the crop marketing season and for quantities bought by the government under purchase agreement when such transactions are of significant volume.

Source: U.S. Department of Agriculture, *Agricultural Statistics 1964,* Washington, D.C., 1964.

Table D-2. Estimation procedures of U.S. price weights based on import prices, 1957-62 averages

Commodity	Import prices		Explanation of estimation procedures (values inside of parentheses are SITC numbers)
	U.S. dollars per metric ton	Wheat relative (W_U)	
Wheat	(67.6)	1.00	1959-1962 average producers' price.
Millet	45.6	0.68	Unit price of cereals not especially specified (045.9).
Cassava*	10.7	0.16	Import price, France.
Bananas	43.7	0.65	(51.3).
Copra	57.1	0.84	(221.2).
Linseed	87.9	1.30	World average import price (221.5).
Sesame seed	308.4	4.56	(EX 221.8).
Olive	112.2	1.66	Original data in olive oil price converted to olive price by assuming an extraction ratio 0.2 (421.5).
	(560.9)		
Palm kernels	76.3	1.13	World average import price (221.3).
Rapeseed	58.7	0.87	Price of rape and mustard seed (EX 221.8).
Cocoa	559.1	8.27	Price of cocoa beans, raw or roasted (72.1).
Coffee	732.8	10.84	Price of coffee, green or roasted, and coffee substitutes containing coffee (71.1).
Tea	1,061.1	15.70	(74.1).
Abaca	390.3	5.77	Price of Manila fiber and Manila tow and waste (265.5).
Flax	371.7	5.50	Price of flax and flax tow and waste (265.1).
Hemp	469.0	6.94	Price of true hemp and true hemp tow and waste (265.2).
(Henequen)		2.54	Same as sisal.
Jute	210.5	3.11	(264.0).
	171.8	2.54	Sisal and other agave fibers, and their wastes (265.4).
Cocoon	1,170.7	17.32	Original data in silk price (in parentheses) converted to cocoon price by multiplying by 0.138, the ratio of cocoon price to silk price in Japan† (261.0).
	(8,483.4)		
Rubber	630.4	9.33	Price of natural rubber and similar natural gum (231.1).

Source: FAO, *Trade Yearbook 1965,* Rome, 1966, except:
*FAO: *Production Yearbook,* 1965, p. 355, Import price, France.
†Japan Ministry of Agriculture and Forestry, Silk Bureau, *Sanshi Yoran 1962,* Tokyo, 1962.

Table D-3. Estimation procedures of Japan weights based on farm-gate prices, 1957-62 averages

Commodity	Farm-gate prices		Explanation of estimation procedures
	Yen per metric ton	Wheat relative (W_J)	
Wheat	36,072	1.00	
Rice (rough)	72,369	1.61 [2.01x(0.8)]	Converted from brown rice to paddy by factor 0.8.
Rye	27,600	0.77	
Barley	36,199	1.00	Unit price of barley and naked barley combined.
Oats	25,348	0.70	
Maize	26,037	0.72	
Millet	26,834	0.74	Unit price of.
Sorghum	29,210	0.81	
Buckwheat	44,660	1.24	
Potatoes	9,620	0.27	
Sweet potatoes	8,008	0.22	
Pulses, all	70,000	1.94	Unit price of six kinds of pulses.
Nuts (unshelled)	83,293	2.31	
Vegetable	15,155	0.42	Unit price of 18 kinds of vegetables.
Citrus fruits	41,573	1.15	Unit price of 4 kinds of citrus fruits.
Other fresh fruits	33,958	0.94	Unit price of 9 kinds of fruits.
Ground nuts	91,922	2.55	
Sesame seed	143,457	3.98	
Soybeans	54,135	1.50	
Rapeseed	52,165	1.45	
Sugar cane	6,448	0.18	
Sugar beets	5,338	0.15	
Tea (dry)	31,055	3.44 [0.86x(4)]	Converted from raw to dry by factor 4.
Flax (fiber)	23,137	3.37 [0.64x(1/0.19)]	Converted from dried stem to fiber by factor 0.19.
Hemp (scutch fiber + tow)	129,257	6.29 [3.58x(1/0.57)]	Converted from dried stem to fiber by factor 0.57.
Cocoon	463,756	12.86	
Wool (greasy basis)	487,590	13.52	
Tobacco	308,860	8.56	
Beef & veal	360,213	9.99	Converted from price per head to meat price by assuming: 1 cattle = 205 kilograms; 1 calf = 32 kilograms
Pork	265,577	7.36	1 pig = 52 kilograms
Mutton & lamb	181,422	5.03	1 sheep = 20 kilograms; 1 goat = 10 kilograms
Poultry	185,899	5.15	1000 chickens = 1,300 kilograms; 1000 broilers = 740 kilograms
Eggs	184,860	5.12	1000 eggs = 53.5 kilograms
Milk	27,464	0.76	

Source: Japan Ministry of Agriculture and Forestry, Statistical Research Division, unpublished data.

Table D-4. Estimation procedures of Japan weights based on import prices, 1959-62 averages

Commodity	Import prices		Explanation of estimation procedures (values inside of parentheses are SITC numbers)
	U.S. dollars per metric ton	Wheat relative (W_J)	
(Wheat)	(100.1)	1.00	1959-62 average producers' price.
Cassava	10.7	0.11	Import price in the United States.
Dates	54.8	0.55	(052.0)
Bananas	152.4	1.52	(051.3)
Cottonseed	82.7	0.83	(221.6)
Copra	48.0	0.48	(221.2)
Linseed	65.6	0.66	(221.5)
Olive (oil)	130.3(651.3)	1.30(6.51)	Original data in olive oil price (in parentheses) converted to olive price by assuming an extraction ratio, 0.2. (421.5)
Palm kernels	144.4	1.44	(221.3)
Sunflower seed	116.7	1.17	(EX 221.8)
Cocoa	630.5	6.30	Price of cocoa beans (raw or roasted). (72.1)
Coffee	782.4	7.82	Price of coffee (green or roasted) and coffee substitutes containing coffee. (71.1)
Abaca	388.7	3.88	Price of Manila fiber and Manila tow and waste. (265.5)
Cotton	607.1	6.06	Price of cotton (raw), other than linters. (263.1)
Henequen		2.30	Same as sisal.
Jute	230.5	2.30	(264.0)
Sisal	230.6	2.30	Price of sisal and other agave fibers and their wastes. (265.4)
Rubber	674.5	6.74	Price of natural rubber and similar natural gums. (231.1)

Source: FAO, *Trade Yearbook 1965,* Rome, 1966.

Table D-5. Commodities classified according to different price categories used for the construction of price weights

Farm-gate price	Wholesale price	Retail price	Export price	Import price	Others
Wheat			(Wheat)	(Wheat)	
Rice	Barley	Nuts (unshelled)	Banana	Dates	Rye
Maize	Potatoes	Vegetables	Olive	Cocoa	Oats
Millet	Cottonseed	Mutton	Sunflower seed	Abaca	Buckwheat
Sorghum	Copra	Poultry	Citrus fruits	Flax	Mixed grain
Pulses (all)	Linseed	Eggs		Sisal	Sweet potatoes
Ground nuts	Rapeseed			Henequen	Cassava
Sesame seed	Sugar cane				Other fresh fruits
Cotton	Sugar beets				Fruits (unspecified)
Jute	Coffee				Soybeans
Tobacco	Tea				Palm kernel
	Hemp				Beef & veal
	Cocoon				Pork
	Wool (greasy basis)				
	Rubber				
	Milk				

Table D-6. Estimation procedures of India price weights based on farm-gate prices, 1957-62 averages *

Commodity	1957-62 average, producers' price		1957-58 and 60-62 av. producers' price		States for which price data are used
	U.S. dollars per metric ton	Wheat relative (W_I)	U.S. dollars per metric ton	Wheat relative (W_I)	
Wheat	414.0	1.00	414.5	1.00	Andra Pradesh (A.P.), Bihar, Madhya Pradesh (M.P.), Mysore, Punjab, Rajastan, Uttar Pradesh (U.P.).
Rice†	389.8	0.94			A.P., Assam, Bihar, Kerala, M.P., Madras, Mysore, Punjab, Rajastan, U.P., West Bengal.
Maize			321.3	0.78	A.P., Bihar, M.P., Punjab, Rajastan, U.P.
Millet (Baira)			358.7	0.87	A.P., Bihar, M.P., Madras, Mysore, Punjab, Rajastan, U.P.
Sorghum (Jowar)	336.0	0.81			A.P., M.P., Madras, Mysore, Punjab, Rajastan, U.P.
Pulses (Gram)			346.4	0.84	A.P., Bihar, M.P., Mysore, Punjab, Rajastan, U.P.
Ground nuts	500.9	1.21			A.P., Bihar, M.P., Mysore, Punjab, Rajastan, U.P.
Sesame			857.4	2.07	A.P., M.P., Mysore, Rajastan, U.P.
Cotton	900.0	2.17			A.P., M.P., Mysore, Punjab, U.P.
Jute	798.4	1.93			Assam, Bihar, West Bengal.
Tobacco			1,921.1	4.63	A.P., Bihar, Mysore, U.P.

*National average prices were calculated as the averages of state average prices using quantities of production by states as weights.

†In cases where prices are in terms of milled rice, the paddy prices were estimated using a conversion factor, 0.67.

Sources:

State average prices: India, Ministry of Food and Agriculture, *Economic Survey of Indian Agriculture, 1959/60, 1963/64, and 1964/65; Agricultural Price in India 1960.*

Quantities of production by states: India, Ministry of Food and Agriculture, *Estimates of Area and Production of Principal Crops in India 1959/60 and 1960/61;* Central Statistical Organization, Department of Statistics, *Statistical Abstract of Indian Union Series 8-12,* 1959-1965.

Table D-7. Estimation procedures of India price weights based on wholesale prices, supplemented by retail prices, 1957-62 averages

Commodity	Market	Standard	Retail prices: Rupee per metric ton	Retail prices: Wheat relative (W_I)	Explanation of estimation procedures
Wheat	Hapur	F. A. Q.	464	1.00	Simple averages of 1957-1962.
Barley	Hapur	F. A. Q.	319	0.69	Simple averages of 1957-1962.
Potatoes	Kanpur	Desi	271	0.58	Simple averages of 1957-1962.
Copra	Cochin	F. A. Q.	1,437	3.10	Simple averages of 1957-1962.
Linseed	Calcutta	Small Grain	696	1.50	Simple averages of 1957-1962.
Rapeseed	Calcutta	Bold Kanpur	884	1.91	Simple averages of 1957-1962.
Sugar cane					Original data in raw sugar basis were converted to cane and beet basis by multiplying 0.05 and 0.07 respectively: assuming extraction rates 0.10 for cane and 0.14 for beet; value added ratio 0.50.
Sugar, raw	(Kanpur)	(D-29 ex-factory)	(966)	(2.08) 0.10	
Sugar, beet				0.15	
Coffee	Coimbatore	Arabica Cherry flat	3,811	8.21	4-year averages of 1957, 1958, 1961, and 1962.
Tea	Calcutta	Plain B.P.	4,120	8.88	
Hemp	Calcutta	Raw Sann Hemp loose	790	1.70	
Cocoon (raw silk)	(Bangalore)	(Charka first)	(63,490)	(18.88)	Original data in raw silk basis were converted to cocoon basis by multiplying by 0.138.
Wool	Bombay	Raw Joria, White Chaitri	6,767	14.58	
Rubber	Kottayam	RMA IX R.S.S.	3,314	7.14	
Milk	Delhi	F.A.Q.	563	1.21	
Mutton	Bombay		2,318	5.00	Wholesale price available only for 1962. Estimated 1957-62 average wholesale price by multiplying 1957-62 average retail price by the ratio of wholesale price to retail price in 1962.
Poultry	Bombay	Chickens	1,381	2.98	Procedures same as for mutton. Original data in bird basis converted to meat basis assuming 1 chicken = 0.9 k.g.
Eggs	Bombay		2,434	5.24	Converted by assuming 1,000 eggs = 53.5 k.g.
Vegetables	Madras		610	1.31	Procedures same as for mutton. Simple average prices of peas, tomato, okra, and onion.
Nuts, unshelled	Bombay		2,427	5.23	Procedures same as for mutton. Simple averprices of cashew, almond, and walnuts.
Cottonseed	Bombay		362	0.78	

Sources: Central Statistical Organization, Government of India; *Statistical Abstract of the Indian Union 1965;* New Delhi, 1966.
Ministry of Food, Agriculture, Community Development & Co-operation, *Agricultural Situation in India,* Mar. 1957, Mar. 1962.

Table D-8. Estimation procedures of India price weights based on import prices, 1959-62 averages

Commodity	Import prices: U.S. dollars per metric ton	Import prices: Wheat relative (W_I)	Explanation of estimation procedures (values inside of parentheses are SITC numbers)
Wheat	86.6	1.00	1959-1962 average producers price.
Abaca	356.6	4.12	(265.5)
Sisal, Henequen	208.7	2.41	(265.4)
Cocoa	533.5	6.16	(72.1)
Dates	288.4	3.33	(52.0)
Flax	542.0	6.27	(265.1)

Source: FAO, *Trade Yearbook 1965,* Rome, 1966.

Table D-9. Estimation procedures of India price weights based on export prices, 1959-62 averages

Commodity	Export prices		Explanation of estimation procedures (values inside of parentheses are SITC numbers)
	U.S. dollars per metric tons	Wheat relative (W_I)	
Wheat	96.6	1.00	1959-1962 average wholesale price.
Banana	61. 2	0.63	(51.3)
Olive (oil)	(544.1)	1.13 (5.63)	Original data in olive oil basis converted to olive basis by assuming an extraction rate 0.20. (421.5)
Sunflower seed	107.1	1.11	(221.8)
Citrus fruits	135.2	1.40	Average price of orange, lemon, and other citrus fruits. (51.1) (51.2) (51.2)

Source: FAO, *Trade Yearbook 1965,* Rome, 1966.

APPENDIX E. QUANTITIES OF AGRICULTURAL OUTPUT, 1957-1962 AVERAGES

Data of the quantities of individual agricultural commodities produced minus agricultural intermediate products for 1957-62 (table E-1) were taken from sources shown in table E-2. In principle, the quantities of agricultural intermediate products to be deducted were taken from FAO, *Food Balance Sheets 1957-59 Average and 1960-62 Average.* Imported feed grains are included in the quantities of agricultural intermediate products.

1. Grains

Problems in enumerating grain output data are: (a) how to estimate output and intermediate input of feed grains which do not appear in *Food Balance Sheets* and (b) how to classify unspecified grains.

The first problem involves millet, sorghum, rye, maize, and oats. In cases where these grains do not appear in *Food Balance Sheets,* we estimated the quantities of these grains fed to livestock as the total available supply (= domestic production + import − export). In FAO, *Trade Yearbook,* from which export and import data were collected, millet and sorghum are not enumerated. We assumed that "cereals, n.e.s." in *Trade Yearbook* consisted of millet and sorghum and distributed half of "cereals, n.e.s." to millet and the other half to sorghum.

The second problem concerns the treatment of "other cereals" in the *Food Balance Sheets.* We distributed the "other cereals" among millet, sorghum, rye, maize, and oats by the ratios of these grains in the total available supply in physical weights.

We enumerated rice in the rough rice basis. Data in terms of husked (brown) rice or milled rice were converted into rough rice terms using the conversion factors shown in table E-3.

2. Fruits

Fruits are grouped into citrus fruits and other fresh fruits. Bananas and dates are treated separately. Citrus fruits include oranges, grapefruit, and lemons. Other fresh fruits include apples, pears, plums and prunes, cherries, peaches, apricots, figs, pineapple, and fresh grapes (including grapes for wine). These data were collected from FAO, *Production Yearbook.* These do not cover all fruits, however. Therefore, we made a check by the *Food Balance Sheets.* We aggregated all fruits including processed fruits (using conversion factors: dried times 4 = fresh; canned times 1.2 = fresh; juice times 1.6 = fresh) in the *Food Balance Sheets* and adapted the figures from the *Food Balance Sheets* in case these figures exceed the figures obtained from the *Production Yearbook.*

3. Livestock products

In the construction of price weights, we adapted a convention that the total value of livestock is attributed to meat. Therefore, we do not include hide, skin, and tallow in our aggregation.

Milk includes milk of cows, goats, sheep, and buffalo. Only milk fed to livestock in the form of whole milk is deducted as an intermediate product. Poultry includes chickens, ducks, geese, and turkeys.

4. Feed not deducted

Because of the lack of information and/or incomparability of data, the following feed items were not deducted from output: (a) oilseed cakes, (b) sugar beets and sugar cane, and (c) skim milk.

Table E-1. Quantities of agricultural output minus agricultural intermediate products (1957-62 average)

Commodity	Country										
	Argentina	Australia	Austria	Belgium & Luxemburg	Brazil	Canada	Ceylon	Chile	Colombia	Denmark	Finland
Wheat	5,017	5,222	498	743	578	8,914	−2	1,046	119	247	212
Rice, rough	175	114	0	−3	4,327	0	765	90	433	0	0
Rye	124	0	332	−51	15	116	0	7	0	190	92
Barley	375	766	−47	−88	22	1,378	0	38	67	199	74
Oats	308	304	28	−48	16	21	0	16	0	57	56
Maize	2,268	27	−281	−432	2,794	−566	9	3	665	−135	−29
Millet	163	24	−5	0	−4	0	25	0	−1	0	0
Sorghum	340	24	−5	0	−4	0	0	0	−1	0	0
Buckwheat	0	0	0	0	0	0	0	0	0	0	0
Mixed grain	0	0	0	−464	0	55	0	0	0	−215	0
Potatoes	1,357	517	1,067	1,432	714	1,597	0	658	436	931	543
Sweet potatoes	341	7	0	0	964	0	41	0	160	0	0
Cassava	130	0	0	0	14,662	0	220	0	692	0	0
Pulses, all	51	13	3	16	1,561	45	6	104	84	26	2
Nuts, all	5	0	5	0	55	0	0	3	6	0	0
Vegetable	1,003	694	499	843	608	1,198	432	669	205	363	77
Citrus fruit	791	203	0	0	1,933	0	0	92	40	0	0
Dates	0	0	0	0	0	0	0	0	0	0	0
Banana	18	116	0	0	5,119	0	0	0	430	0	0
Other fresh fruit	3,240	1,895	1,051	346	1,869	703	0	867	404	276	63
Fruit, unspecified	0	0	0	0	0	0	83	0	0	0	0
Cotton seed	227	4	0	0	961	0	2	0	113	0	0
Copra	0	0	0	0	0	0	223	0	2	0	0
Ground nuts	292	12	0	0	403	0	0	0	0	0	0
Linseed	716	17	0	17	32	477	0	5	0	1	0
Sesame seed	0	0	0	0	0	0	6	0	20	0	0
Soybeans	6	0	0	0	218	173	0	0	16	0	0
Olive	46	1	0	0	0	0	0	20	0	0	0
Palm kernels	0	0	0	0	104	0	0	0	0	0	0
Rapeseed	0	0	8	0	0	182	0	31	0	19	10
Sunflower seed	643	2	1	0	0	11	0	42	0	0	0
Sugar cane	9,773	10,151	0	0	55,006	0	115	0	14,559	0	0
Sugar beets	0	0	1,719	2,450	0	1,033	0	365	0	1,920	330
Cocoa	0	0	0	0	163	0	3	0	14	0	0
Coffee	0	0	0	0	1,892	0	0	0	465	0	0
Tea	7	0	0	0	1	0	195	0	0	0	0
Abaca	0	0	0	0	0	0	0	0	0	0	0
Cotton	121	2	0	0	504	0	1	0	59	0	0
Flax	1	1	0	31	0	0	0	0	0	0	0
Hemp	0	0	0	0	0	0	0	4	0	0	0
Henequen	0	0	0	0	0	0	0	0	0	0	0
Jute	0	0	0	0	38	0	0	0	0	0	0
Sisal	0	0	0	0	43	0	0	0	0	0	0
Cocoon	0	0	0	0	1	0	0	0	0	0	0
Wool, greasy	185	733	1	1	27	4	0	22	0	0	0
Tobacco	41	11	1	3	159	88	4	7	34	0	0
Rubber	0	0	0	0	22	0	99	0	0	0	0
Beef & veal	2,256	812	149	208	1,389	710	20	120	382	240	70
Pork	180	111	251	246	507	461	1	33	67	594	62
Mutton & lamb	174	554	4	2	41	15	2	28	5	1	2
Poultry	36	45	18	56	136	287	2	2	22	53	2
Milk	4,517	6,391	2,370	3,696	4,924	8,229	115	778	1,985	5,135	3,310
Eggs	171	129	68	163	257	297	10	31	45	132	40

Table E-1. (continued)

Commodity	Country											
	France	Germany	Greece	India	Ireland	Israel	Italy	Japan	Libya	Mauritius	Mexico	Netherlands
Wheat	7,852	2,488	1,540	9,408	305	33	7,625	1,027	22	0	1,194	152
Rice, rough	77	−3	66	44,448	0	1	680	15,282	0	0	272	−12
Rye	69	1,685	18	0	0	−4	7	−21	0	0	0	−178
Barley	1,212	220	−6	1,702	156	0	−278	1,407	28	0	11	−188
Oats	−13	−108	1	0	27	0	−98	18	0	0	17	−178
Maize	291	−590	14	3,595	−81	0	796	−1,148	0	0	3,975	−1,090
Millet	−15	−47	0	7,175	0	−91	0	−88	0	0	0	0
Sorghum	−15	−47	0	8,464	0	−91	0	0	0	0	0	0
Buckwheat	0	0	0	0	0	0	0	37	1	0	0	0
Mixed grain	21	−114	14	0	0	0	0	0	0	0	0	−555
Potatoes	6,279	9,826	382	2,174	794	82	2,502	2,714	16	4	233	2,870
Sweet potatoes	0	0	0	1,062	0	0	0	4,788	0	1	92	0
Cassava	0	0	0	1,819	0	0	0	0	0	1	0	0
Pulses, all	53	9	88	9,961	5	2	290	347	3	0	669	77
Nuts, all	97	0	41	0	0	0	446	0	9	0	50	0
Vegetable	7,334	2,291	1,178	1,413	431	269	8,392	9,171	73	18	583	1,683
Citrus fruit	2	0	287	0	0	570	1,262	1,008	16	0	894	0
Dates	0	0	0	0	0	1	1	0	28	0	7	0
Banana	0	0	0	2,147	0	35	0	0	0	0	307	0
Other fresh fruit	12,782	3,213	1,966	0	28	194	13,093	2,524	21	0	1,136	626
Fruit, unspecified	0	0	0	8,247	0	0	0	0	0	19	0	0
Cotton seed	0	0	134	1,679	0	16	11	0	0	0	824	0
Copra	0	0	0	245	0	0	0	0	0	2	174	0
Ground nuts	0	0	0	4,183	0	9	0	110	5	1	80	0
Linseed	40	0	1	385	0	0	7	4	0	0	17	19
Sesame seed	0	0	8	393	0	1	1	5	0	0	131	0
Soybeans	0	0	0	0	0	0	0	387	0	0	0	0
Olive	5	0	645	0	0	12	1,871	0	28	0	4	0
Palm kernels	0	0	0	0	0	0	0	0	11	0	23	0
Rapeseed	139	73	0	1,154	0	0	10	267	0	0	7	10
Sunflower seed	9	0	3	0	0	3	6	0	0	0	0	0
Sugar cane	0	0	0	86,062	0	0	0	285	0	4,230	19,330	0
Sugar beets	11,373	10,320	49	0	887	162	7,601	1,009	0	0	0	3,542
Cocoa	0	0	0	0	0	0	0	0	0	0	20	0
Coffee	0	0	0	52	0	0	0	0	0	0	125	0
Tea	0	0	0	331	0	0	0	71	0	1	0	0
Abaca	0	0	0	0	0	0	0	0	0	0	0	0
Cotton	0	0	71	844	0	10	7	0	0	0	462	0
Flax	41	0	0	0	0	0	1	7	0	0	0	26
Hemp	2	0	0	75	0	0	16	2	0	0	0	0
Henequen	0	0	0	0	0	0	0	0	0	0	143	0
Jute	0	0	0	894	0	0	0	1	0	0	0	0
Sisal	0	0	0	0	0	0	0	0	0	0	0	0
Cocoon	0	0	1	21	0	0	7	114	0	0	0	0
Wool, greasy	24	4	11	32	11	0	13	3	2	0	6	1
Tobacco	47	15	82	294	0	2	66	125	1	1	67	0
Rubber	0	0	0	26	0	0	0	0	0	0	1	0
Beef & veal	1,451	907	26	155	204	11	523	138	2	1	321	222
Pork	1,167	1,540	25	24	98	0	276	193	0	0	140	334
Mutton & lamb	125	18	73	327	38	2	39	3	5	0	19	8
Poultry	406	98	17	80	19	60	154	64	1	0	80	69
Milk	18,081	17,176	849	20,022	2,329	307	8,080	1,807	24	20	2,925	6,437
Eggs	495	423	52	96	47	58	367	540	2	1	200	326

Table E-1. (continued)

Commodity	Country									
	New Zealand	Norway	Pakistan	Paraguay	Peru	Philippines	Portugal	South Africa	Spain	Surinam
Wheat	46	–32	3,521	9	128	0	563	678	3,785	0
Rice, rough	0	0	13,546	18	303	3,471	156	5	421	70
Rye	0	1	0	0	0	0	137	1	214	0
Barley	42	10	124	0	144	0	14	5	8	0
Oats	11	13	0	0	0	0	–1	18	47	0
Maize	1	–68	428	94	249	814	335	2,814	–27	1
Millet	0	0	242	0	0	0	0	–32	0	0
Sorghum	0	0	266	0	0	0	0	–32	0	0
Buckwheat	0	0	0	0	0	0	0	0	0	0
Mixed grain	0	72	0	0	0	0	0	0	–4	0
Potatoes	156	511	379	4	939	8	843	241	3,876	0
Sweet Potatoes	5	0	0	70	128	731	0	31	0	0
Cassava	0	0	0	528	309	372	0	0	0	2
Pulses, all	19	0	600	23	93	37	62	54	327	0
Nuts, all	0	0	0	0	0	0	56	0	664	5
Vegetable	180	151	1,523	45	852	882	969	652	4,400	2
Citrus fruit	6	0	15	144	267	49	126	385	1,537	16
Dates	0	0	64	0	0	0	0	0	10	0
Banana	0	0	871	142	0	403	0	57	295	3
Other fresh fruit	121	122	0	24	551	662	1,870	1,080	5,383	0
Fruit, unspecified	0	0	2,245	0	0	0	0	0	0	0
Cotton seed	0	0	625	19	208	1	0	13	143	0
Copra	0	0	0	0	0	1,227	0	0	0	0
Ground nuts	0	0	20	0	0	19	0	169	0	0
Linseed	6	0	13	0	0	0	0	0	7	0
Sesame seed	0	0	31	0	0	0	0	0	0	0
Soybeans	0	0	0	0	0	0	0	0	0	0
Olive	0	0	0	0	7	0	563	0	1,892	0
Palm kernels	0	0	0	9	0	0	0	0	0	1
Rapeseed	0	0	324	0	0	0	0	0	0	0
Sunflower seed	0	0	0	0	0	0	0	92	2	0
Sugar cane	0	0	17,147	586	7,135	11,354	0	8,582	338	118
Sugar beets	0	0	0	0	0	0	0	0	3,498	0
Cocoa	0	0	0	0	5	3	0	0	0	0
Coffee	0	0	0	2	30	26	0	0	0	0
Tea	0	0	24	0	1	0	0	0	0	0
Abaca	0	0	0	0	0	109	0	0	0	0
Cotton	0	0	313	10	127	1	0	17	72	0
Flax	0	0	0	0	0	0	0	0	8	0
Hemp	0	0	10	0	0	0	0	0	11	0
Henequen	0	0	0	0	0	0	0	0	0	0
Jute	0	0	1,087	0	1	0	0	0	3	0
Sisal	0	0	0	0	0	0	0	2	0	0
Cocoon	0	0	0	0	0	0	0	0	1	0
Wool, greasy	258	4	16	0	10	0	11	136	34	0
Tobacco	3	0	93	12	4	61	0	29	28	0
Rubber	0	0	0	0	30	3	0	0	0	0
Beef & veal	258	53	258	70	72	42	40	314	154	1
Pork	40	54	0	5	33	151	63	54	237	0
Mutton & lamb	418	15	81	1	32	2	19	111	106	0
Poultry	5	3	0	9	11	30	8	21	83	3
Milk	5,347	1,525	6,091	78	503	7	430	2,403	2,492	6
Eggs	38	31	32	1	8	87	27	59	187	1

Table E-1. (continued)

Commodity	Country									
	Sweden	Switzerland	Syria	Taiwan	Turkey	United Arab Republic	United Kingdom	United States	Venezuela	Yugoslavia
Wheat	568	197	894	41	5,788	1,268	1,019	29,763	109	2,276
Rice, rough	0	−1	1	2,341	166	1,413	0	2,376	83	19
Rye	91	27	0	0	518	0	13	396	0	−230
Barley	79	−198	381	0	188	37	515	3,861	0	71
Oats	47	−101	0	0	18	0	99	883	0	24
Maize	−47	−75	5	8	420	1,582	−2,987	17,669	423	1,768
Millet	−18	−13	38	4	6	554	−226	0	0	−12
Sorghum	−18	−13	0	3	9	−5	−226	−1,926	0	−21
Buckwheat	0	0	0	0	0	0	0	1	0	0
Mixed grain	17	−7	0	0	29	0	0	0	0	40
Potatoes	991	478	28	5	1,176	241	4,905	9,602	87	1,688
Sweet potatoes	0	0	0	1,434	0	74	0	629	18	0
Cassava	0	0	0	96	0	0	0	0	260	0
Pulses, all	13	−1	85	17	331	275	24	875	64	165
Nuts, all	0	5	3	0	212	0	4	194	0	33
Vegetable	216	284	210	749	3,359	2,624	2,774	14,736	109	1,170
Citrus fruit	0	0	6	52	307	351	0	6,932	56	1
Dates	0	0	0	0	0	389	0	21	0	0
Banana	0	0	0	114	0	56	0	3	868	0
Other fresh fruit	363	1,055	694	207	6,468	986	720	10,393	485	2,241
Fruit, unspecified	0	0	0	0	0	0	0	0	0	0
Cotton seed	0	0	194	2	330	818	0	5,050	14	5
Copra	0	0	0	0	0	0	0	0	10	0
Ground nuts	0	0	7	93	11	33	0	738	0	0
Linseed	2	0	0	0	21	8	0	717	0	1
Sesame seed	0	0	5	4	45	17	0	3	21	1
Soybeans	5	0	0	44	0	0	0	15,900	0	13
Olive	0	0	59	2	267	8	0	45	0	20
Palm kernels	0	0	0	0	0	0	0	0	0	0
Rapeseed	139	9	0	5	3	0	0	2	0	6
Sunflower seed	0	0	0	0	100	0	0	0	0	111
Sugar cane	0	0	2	7,104	0	4,322	0	15,317	2,829	0
Sugar beets	1,910	235	79	0	3,000	0	5,801	15,127	0	1,970
Cocoa	0	0	0	0	0	0	0	0	14	0
Coffee	0	0	0	0	0	0	0	5	53	0
Tea	0	0	0	16	5	0	0	0	0	0
Abaca	0	0	0	0	0	0	0	0	0	0
Cotton	0	0	115	1	191	430	0	2,921	8	2
Flax	2	0	0	1	5	6	1	0	0	4
Hemp	1	0	2	0	13	0	0	0	0	40
Henequen	0	0	0	0	0	0	0	0	0	0
Jute	0	0	0	16	0	0	0	0	0	0
Sisal	0	0	0	1	0	0	0	0	8	0
Cocoon	0	0	0	0	2	0	0	0	0	0
Wool, greasy	0	1	9	0	44	3	56	140	0	14
Tobacco	0	2	7	18	114	0	0	871	8	37
Rubber	0	0	0	0	0	0	0	0	0	0
Beef & veal	134	101	9	4	80	173	843	7,101	116	177
Pork	220	125	0	193	0	1	694	5,068	24	236
Mutton & lamb	1	3	24	1	85	40	236	345	1	59
Poultry	14	5	3	29	34	51	272	3,806	19	65
Milk	3,843	2,683	135	5	4,035	1,141	11,311	55,103	440	2,307
Eggs	95	29	8	19	52	31	745	3,624	12	72

Table E-2. Sources of data by commodities

FAO: Food Balance Sheet, 1957-59, 1960-62	FAO: Production Yearbook 1960-65		FAO: Production Yearbook 1960-65 FAO: Trade Yearbook 1960-65
Buckwheat	Abaca	Mutton & lambs	Barley
Cassava	Banana	Olive	Maize
Eggs	Beef & veal	Palm kernels	Millet
Ground nuts	Cocoa	Pork	Oats
Nuts, unshelled	Cocoon	Poultry	Rye
Potato	Coffee	Rapeseed	Sorghum
Pulses, all	Copra	Rubber	
Mixed grain	Cotton	Sesame seed	
Rice	Cottonseed	Sisal	
Sweet potato	Dates	Soybeans	
Vegetables	Flax	Sugar beet	
Wheat	Hemp	Sugar cane	
	Henequen	Sunflower seed	
	Jute	Tea	
	Linseed	Tobacco	
	Milk	Wool, greasy basis	

Table E-3. Conversion factors of rice

	Paddy to husked, brown rice	Paddy to milled rice
Taiwan	0.78	
Spain		0.62
France	0.75	
Israel		0.65
Italy	0.80	
Japan	0.80	
Netherlands		0.65
Philippines		0.65
South Africa		0.65
Turkey		0.60
USA		0.69
Yugoslavia		0.65
Others		0.65

Primarily based on FAO, *Technical Conversion Factors for Agricultural Commodities,* Rome, 1960.