

AGRICULTURAL COMMODITIES PROJECTIONS FOR THE DEVELOPING ASIAN COUNTRIES*

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I. Scope of the Study

1. Commodities

The agricultural commodities selected for these projections are the main primary food crops in the Asian countries, of which rice, wheat, maize, and other minor cereals, sugar-cane, sugar (both centrifugal and noncentrifugal), the main sources of vegetable oil (such as palm-kernel, palm-oil, groundnuts, cottonseed, sesame-seed, copra, etc.), tea, natural rubber, jute, and other hard fibres are representative.

However, this thesis is limited to the projection of "cereals," as is mentioned in the footnote below.

One of the special features of the Committee's study is that the projected commodities are divided into more subheadings than in the FAO projections.¹ Major cereals, for instance, have been subdivided into rice and wheat, and minor cereals into maize, sorghum, millet, barley, and other miscellaneous

* This is a part of a larger attempt to draw "the Long-Term Projections for Asian Developing Economies," which was carried out by the Research Department for Economic Growth of the Institute of Asian Economic Affairs, Tokyo, during the period of the fiscal years 1962-63 and 1963-64. In this paper, the author intends to elucidate the methods of determining the agricultural commodities projections and to indicate the significance of these projected values. But this paper should be defined as drawing an outline of demand and production projections of "cereals," an area in which the writer was most concerned. As for details of the projections as a whole, the reader should refer to the original abridged report of the Agricultural Committee of the Department, which was published in July, 1964. In this paper, however, as a result of the author's re-examination of the Committee's report, some of these projections have been modified, particularly the projected values of Thailand and the agricultural projections for India.

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However, any statement or view expressed in this paper should not necessarily be regarded as reflecting the opinion of the Committee or its members.

¹ *Agricultural Commodities-Projections for 1970*, FAO, May, 1962.

cereals. However, projections were also based on a summarized group of both major and minor cereals.

2. Countries

The following 18 countries in the ECAFE Area¹ were selected: Brunei, Burma, Cambodia, Ceylon, China (Taiwan), Hongkong, India, Indonesia, the Republic of Korea, Laos, Malaya, Singapore, North Borneo, Pakistan, the Philippines, the Republic of Viet-Nam, Thailand and Sarawak. Whilst the Sino-Soviet area was not included in the scope of this study, it is felt that these countries will have a great impact upon the demand-supply position of some major agricultural commodities (for instance, rice) of the world.

3. Period for Projections

Projections are set for 1970, and they cover the period of ten years between 1961 and 1970. These projections have been based on an analysis of results achieved in the ten years between 1951 and 1960 as a rule, but, where additional data have been available, sometimes between 1948 and 1960 or between 1948 and 1962.

Special attention had to be given to the statistical data of those countries that were involved in hostilities or being rehabilitated during these periods. In some cases, attempts were made to obtain statistics from prewar times, say, covering the period from 1934 to 1938. Unfortunately, however, figures available for Asian countries are not sufficient to meet purposes of this kind.

II. Methods used in Projections²

1. Methods used in Production Projections

(1) In principle, production of the agricultural products was projected by estimating the area and yield per unit of area for 1970, by means of the least-square method on the basis of statistical data for 1960's. In order to select out the sample years for extrapolating the past trend of yield and area, special care was taken, and the agricultural situation analysed country by country.

As for suitable types of function for estimating a production trend, straight line, exponentials and others were examined,³ and two types of function, $y=a+bt$ and $y=ab^t$ were mostly utilized, where y implies production area or yield per unit of area (or output), t , the number of years, and a , b parameters.

(2) Statistical information is obtained mainly from *FAO Production Year Book*, and to reinforce the former, the original statistics issued by those coun-

¹ The "area" or "region" in this thesis means these selected countries.

² As for the trade of major commodities, the projections were undertaken by the Trade Committee of our Department, and the summary of the trade projections is expected to be published in a forthcoming number of the Journal.

³ $y=a+b$ $ty=ab^t$ $y=ab^t$ $y=a+bc^t$ $y=a+bt+ct^2+dt^3$

tries, where more detailed ones were available, were also used.

(3) It is true that a set of production factors such as irrigated area, area sown with improved seeds, fertilized or manured, etc., are needed in order to project production. However, the limited availability of statistics concerning these factors forced us to select out of them only the above-mentioned two factors, "area" and "yield" per unit of area, taking other factors into consideration by modifying the parameters in trend functions.

(4) In the choice of the function, great care was given to the degree of correlation and the specific conditions of agriculture in each country. In this determination, the following were given special consideration:

- (i) In the case of some promising agricultural products in countries with a rapid agricultural improvement, mostly in recent years, special care was given to the key-factors and the expected impact upon future output (for example, maize and rice in Thailand).
- (ii) The maximum capacity of production, transportation, shipment, and port facilities.
- (iii) The basic outline of agricultural policy and targets of agricultural development plans and ratio of their achievement in each country.

2. Methods used in Demand Projections

For demand-analysis of the selected commodities, the following three methods were employed:

- (1) Regression analysis, where the explanatory variable was the value of per capita GNP.¹
- (2) Trend-analysis of per capita consumption of each commodity.
- (3) To multiply per capita consumption at the base year by the projected population at 1970, where the level of per capita consumption of a given

¹ As for some non-food commodities (for example, natural rubber), it was found to be improper to use GNP as an explanatory variable in regression analysis of demand, and in reality, the regression coefficient proved unsatisfactory. However, some significant value of a regression coefficient could be obtained by applying the aggregate income of the industrial sector as an explanatory variable for such countries as India that has more developing industry than other developing countries in the area. We also examined disposal income, personal expenditures, etc. as explanatory variables for demand-analysis, but, finally, GNP was chosen as being a more dependable index from the viewpoint of reliability of statistics.

It should be noted, therefore, that the income elasticity which was derived from our regression-analysis, using per capita GNP as an explanatory variable, is not the so-called "income elasticity" as estimated through household expenditures, but "GNP elasticity," and an elasticity coefficient reflecting the combined effect of income and other factors which are related to income (GNP in this case) in the past and also during the projected period.

Special care was taken with the demand-analysis of agricultural commodities, especially non-food commodities, from the viewpoint of price effect and substitutes, consumers' preferences and their tastes. However, price-analysis could not be used this time, mainly owing to the unavailability of statistics for this kind of work in the ECAFE region.

commodity is assumed "constant" up to 1970.

3. Demand Projections for Cereals

(1) Attempts were made to allow for substitution between superior cereals (rice and wheat in case of ECAFE region) and inferior cereals (other minor cereals), so that another separate demand projections for total cereals unit as "all cereals" could be prepared, after the projections for each commodity were over, in order to examine the total projected value of each cereal from another viewpoint. The basic methods employed for demand projections of "cereals as a whole" (all cereals) were the same three that have already been explained in the preceding section.

(2) The demand-analysis of minor cereals was very difficult, mostly owing to the more serious shortcomings of available statistics and in many cases it was impossible to obtain satisfactory results through the separate analysis of minor cereals and major cereals. Therefore, the following method was adopted for the purpose of examining the value of each cereal obtained through separate projection: The per capita (or aggregate) demand for minor cereals equals the per capita (or aggregate) demand for "all cereals" minus that of the major cereals.

This, it is believed, also gave the estimates a significant value.

4. Methods of Regression-Analysis used in Demand Projections

(1) As for cereals, the regression-analysis in these demand projections was performed through correlation-analysis between per capita GNP and per capita consumption of the commodities, by applying time-series data. The analysis of regression, through time-series data, should be reviewed by or supplemented by cross-section analysis based upon, for instance, household expenditure data. This seems necessary, especially in case of the Southeast Asian countries, for the following reasons:

- (i) The shortcomings of reliable time-series statistics.
- (ii) The growth-rate of per capita GNP in many of the ECAFE countries, during the projected term, being very low or even negligible in some cases.
- (iii) The equation forms applicable to our demand-analysis not including either such variables or parameters to make possible an analysis of the effect of those factors other than "income."

Time, however, did not permit the completion of sufficient cross-section analysis.

(2) Demand Functions for Regression-Analysis

Analysis was based on the following equation forms, after reference to the studies conducted by other organizations that were considered appropriate.¹

¹ E.g., L. M. Goreux, "Income and Food Consumption," *Monthly Bulletin of Agricultural Economics and Statistics*, Vol. IX, No. 10, FAO, Oct., 1960. Do., "Economic Growth and Commodities Projections," *Monthly Bulletin of Agricultural Economics*, Vol. X, Nos. 7/8, FAO, Jul./Aug., 1961. NCAER, *Long-Term Demand for and Supply of Selected Agricultural*

(1) $Y = a + bx$	$\eta = \frac{bx}{Y}$
(2) $\log Y = a + b \log x$	$\eta = b$
(3) $Y = a + b \log x$	$\eta = \frac{b}{Y}$
(4) $Y = a - \frac{b}{x}$	$\eta = \frac{b}{ax - b}$
(5) $\log Y = a - \frac{b}{x}$	$\eta = \frac{b}{x}$
(6) $\log Y = a - \frac{b}{x} - c \log x$	$\eta = \frac{b}{x} - c$

x , Y and η refer respectively to per capita GNP, per capita consumption (apparent) and elasticity coefficient during the base period (mainly in 1960). a , b , and c are parameters.

Out of the above demand functions, (1), (2) and (3) were chosen as being the most suitable for the demand-analysis wherein time-series data of per capita consumption of a given commodity and per capita GNP were applied, after taking into consideration the fitting of demand curves, the economic structure of the countries, etc. The parameters of these three demand functions were computed by electronic computers, by commodity, and the estimated values were carefully examined mainly in the light of regression coefficients.

The results obtained through this method were also reviewed, and modified, where necessary, by making an analysis of the possible ceiling of production capacity, the possible saturation point of consumption, the extrapolation of the past trend of per capita consumption of a given commodity, and adjusting linear or non-linear equations.

5. Trend-Analysis of Per Capita Consumption

(1) As has been mentioned before, an analysis of the past trends of per capita consumption for each commodity (or aggregate consumption in case of such countries as Brunei and Sarawak where no population data were available separately) was also made. The cyclical fluctuations of the time-series data were adjusted by taking a three-year average.

(2) In case the consumption level was considered not to change or change only negligibly, the average consumptions of the most recent years (mostly, three-year averages) were multiplied by the projected population to estimate the aggregate demand for 1970.

(3) Equation Forms Employed for Trend-Analysis of Demand

The extrapolations of the past trends of per capita demand of the commodities were used, together with regression-analysis of per capita (or aggregate) demand, and both linear and curvilinear equation forms applied, the same ones that were employed for the trend-analysis of production. In this case,

Commodities, place India, 1962.

The equation forms (5) and (6) were worked out in *Agricultural Commodities-Projections for 1970*, FAO, May, 1962.

however, a straight line equation ($Y=a+bt$) produced a good match. It is interesting to note that, in many cases, the values projected by extrapolations of the past trends of per capita (or aggregate) demand, which were simpler than regression-analysis, were found to be more appropriate, or very probable, than the values projected through the latter, up to 1970 at earliest, probably because of the shortcoming of available consumption data applied for demand functions.

6. Problems of Statistical Data for Demand Projections

(1) Statistics of GNP and Population

For statistics of GNP¹ and population² in the 1950's and in the year 1970, we used the data prepared by the Institute. The GNP values of the countries were expressed in three forms: high, low and medium assumption. As the result, the projected values of demand were originally also indicated in those different forms. However, our production projections were performed mainly on the basis of the extrapolation of the past trends, that is, on the basis of the "lower assumption" in those countries where a rapid agricultural development is expected before 1970, and as for the regression-analysis of demand, the projected values were based on low income assumption, after examining all the values projected on the above three kinds of GNP, were used.

(2) Problems of Consumption Data

Much painstaking work was required to obtain from many sources correct consumption data regarding the selected commodities for the demand projections. In the production projections, the statistics of *FAO Production Year Books* for every year were used and these were supplemented by the original statistics for each country analysed, whenever any shortcomings—for instance, insufficiency in time-series sequences of data—were discovered.

Attempts were also made to obtain consumption data from FAO statistics. However, the number of selected countries in the ECAFE region and of time-series samples of consumption data were still inadequate in the food balance sheets officially published by FAO.³ In view of these facts, agricultural commodities balance sheets⁴ were worked out consisting of "production," "trade" and "apparent consumption" of all the commodities in the ECAFE nations from 1948 to 1960, by utilizing the statistical data of *FAO Production Year Books* and *Trade Year Books*.

With this information, it was possible to deduce the time-series figures of apparent consumption of the selected commodities over the past ten years,

1. Refer to "Aggregate Economic Projections for the Developing Asian Countries" by A. Onishi in this journal.

2. See Table 1.

3. "Food Balance Sheets—1952-54 Average," FAO, 1957. "Food Balance Sheets—1954-56 Average," FAO, 1958. "Food Supply Time Series," FAO, 1958. *FAO Production Year Book*, 1951-1961.

4. "Agricultural Commodities Balance Sheets in Southeast Asian Countries—1948-1960," Research Materials No. 49, Tokyo, the Institute of Asian Economic Affairs, 1963.

but this "apparent consumption" is only a rough estimate, for it excludes allowances for "net human consumption" such as changes in stock, use for seeds, feeds and manufacture, and wastage.¹ Another difficulty met with is due to the overlapping of the various kinds of statistical years (crop year and trade year) adopted in FAO Year Books, the total value of all the agricultural products in a given year in a country, for instance, does not always coincide with GNP or income in the agricultural sector, or some part of them, in the same year.

In spite of this, however, data concerning agricultural commodities obtained from FAO statistics, together with the food balance sheets of FAO, and of the governments of each country, were consolidated. By using these kinds of information, taken together, it was possible to reduce the possibility of error to a minimum.

7. Problems that Remain to be Solved in Future Studies

- (1) The effect of change in consumption patterns and income distribution on demand.
- (2) The independent analysis of export- and import-demand for major commodities.
- (3) The analysis of value elasticity, together with amount elasticity.
- (4) A more detailed study of substitution in demand.
- (5) Price effect upon demand.
- (6) Cross-section analysis, including international comparisons, based upon detailed household expenditure data.
- (7) Separate demand-analysis in urban and rural areas.
- (8) Improvement in consumption data, especially from the viewpoint of time-series sequence.
- (9) Nutritional projections.

III. Review of Commodities Projections

1. Rice

The area under consideration constitutes one of the principal production areas of rice in the world. Around 93 per cent of the world rice cultivation area is situated in the Asian region (including Mainland China). 75 per cent of output in the world is directed to domestic consumption in Asia, and the total export is only about 3 per cent of the production, 6 to 7 million tons. Since the end of World War II, the weight of rice in world trade has dropped.

The yield per unit of area has surpassed the level of long-term stagnation in the prewar days, despite the postwar use of marginal inferior land due to the fact that almost all the land suitable for rice production has been cultivated. This fact demonstrates that much effort has been made for agricultural investment and technical improvements. As countries where the effect upon production by increase in yield has exceeded that by land extension, we can point out China (Taiwan), Malaya, India, Burma, and Japan. Japan

¹ The extraction-rate of them used here was about 10-12.5%.

and China (Taiwan), where the room for land extension is extremely restricted, are dependent on the increase of yield per unit of cultivation area for output increase. India has endeavoured both to increase yield and to expand cultivation areas. In Malaya, despite the abundance of arable land, the growth of yield is remarkable.

Although rice production in Asia showed an increase in excess of a population increase for 10 years in the 1950's, as of 1960, the quantity of rice consumption per head of population has barely reached the prewar level, that is, a level at which a bare minimum subsistence is possible. Accordingly, a rise in the level of income expected in future will increase consumption per head and bring about the transfer of inferior cereals to rice, thus to expand the demand for rice in large measure. The strong preference for rice in this area will strengthen this tendency.

In the region as a whole, there was a surplus of rice (milled equivalent) of about 360,000 tons in the base-year 1960 (1958-60 average), but there will be a shortage of about 5.9 million tons in 1970. The major exporters of rice in 1960 were Burma, Thailand, Cambodia and the Republic of Viet-Nam, which had exportable surpluses of about 3.2 million tons, and these four exporting countries will have increased exportable surplus of 6 million tons in 1970. China (Taiwan), the Republic of Korea, and Laos, where demand balanced rice production with some surplus, will be degraded into rice-deficit countries of about 100,000 to 150,000 tons.

The countries that will be confronted with a large rice shortage in 1970 are India (-3.6 million tons), Pakistan (-2.2 million tons), and Indonesia (-3.3 million tons), some 9 million tons in total, though their deficits in 1960 (1958-60 average) were 478,000, and 216,000 and 750,000 tons respectively, and only 1.4 million tons in total.

In other main rice-deficit countries such as the Philippines, Hongkong, Malaya and Singapore, and Ceylon, shortages will become more acute up to 1970, except for the Philippines, where production is catching up with demand. These countries with rice shortages are now making every effort to increase rice production through economic planning, with ambitious targets. However, the projections show that the rates of production growth are not only lower than planned, but are also lower than the growth-rate of demand of this cereal.

2. Wheat

It can be said that, in the area as a whole, wheat is a less important foodstuff than rice, mainly because of the crop-pattern based upon the natural conditions and the traditional preferences in diet among the population. Most of the production (e.g. 99% of 1958-60 average) of and demand (96% of 1958-60 average) for wheat are concentrated in India and Pakistan.

In the area, there was about a 3.6 million ton shortage of wheat in 1950, with a 4.9 million ton shortage in 1960. However, this shortage of wheat will increase in the 1960's and will be about 10.3 million tons in 1970. The

main countries deficient of wheat in 1970 will be India (-6.5 million tons) and Pakistan (-2.8 million tons). China (Taiwan) and the Republic of Korea will meet their deficits of 600,000 tons and 360,000 tons respectively. The rate of growth of wheat production both in India and Pakistan during the 1960's will be lower than planned, and during this period the increase in the demand for wheat will be greater than production, so that India and Pakistan will be confronted with wheat shortages. The Third Five-Year Plan of India (1961-62~65-66) is intending to increase the yields from 700 to 925 pounds per acre (from 785kg to 1,037kg per hectare) and to achieve wheat production of 15 million tons in the final year.

However, it seems improbable that India will achieve this plan target under the present conditions of its agriculture, and both yields and area are likely to continue to grow only at lower rates of growth as at present.

In West Pakistan wheat is a staple food, but the import of wheat by Pakistan, which amounted to about 850,000 tons on 1958-60 average, will have to be increased, unless production increases at a minimum annual compound rate of more than 4%, or, otherwise, some alternate foodstuffs will have to be obtained.

The Republic of Korea, suffering the stagnation of agricultural production resulting from the Korean War, has increased production since 1953, but it is still far from self-sufficiency and will also be obliged to increase the imports, mainly, of wheat and barley up to 1970.

3. Miscellaneous Cereals (excluding Maize)

The importance of miscellaneous or minor cereals such as millet, sorghum, barley, oat, rye, etc.) in international trade is rather slight, but together with major cereals (rice and wheat) they are vital self-consuming foodstuffs in the Asian developing countries, and both classes of cereals substitute for each other.

Both the production and consumption of minor cereals in the area are, as in the case of wheat, considerably concentrated in two countries, India and Pakistan, where a large part of the population still live on the millet (*bajra* and *ragi*), sorghum (*jowar*) and other available minor cereals. And the ratio of minor cereals for human consumption to the total production of all cereals is very significant in these countries,¹ though their yield per hectare

¹ The Ratio of Major and Minor Cereals to All Cereals (1958-60 average).

Commodity	India		Pakistan	
	Production	Consumption	Production	Consumption
Rice (milled equivalent)	51%	48%	66%	63%
Wheat	14	19	26	30
Maize	6	5	3	3
Other minor cereals (millet, sorghum and barley)	29	28	5	4
Total	100	100	100	100

Source: Based on data in *FAO Production Year Book, 1961*.

is lower than the major cereals, rice and wheat.¹

This means that the land is not sufficiently prepared for cultivating the major cereals, and results in the underdevelopment of their agricultural investments. There will be no significant change in this situation before 1970.

In 1960, there was a shortage of minor cereals of about 157,000 tons in the region as a whole, but the year 1970 will see a surplus of 780,000 tons. India, which had a deficit of minor cereals amounting to 30,000 tons in 1960, will obtain a surplus of 750,000 tons in 1970, and Pakistan, where the demand for and production of minor cereals barely balanced in 1960, will have a surplus of 60,000 tons in 1970, though these surpluses of minor cereals may not actually show as such, inasmuch as their balances of all cereals in 1970 are largely deficient as shown below.

4. Maize

The supply of maize to the world markets is dependent upon the four major exporters, U.S.A., the Argentine, South Africa, and Thailand, while this cereal is mainly bought by the five major advanced countries—U.K., Japan, Federal Republic of Germany, Italy, and Holland. It can be said that this trade-pattern of maize will not change significantly before 1970. Higher income levels in some countries may possibly bring about improved diets and a development of the livestock industry, which may bring some other countries into the picture as new importers or exporters.

So far, in the area, maize has long been a self-consuming minor cereal, but, owing to the rapidly increasing demand for maize as feeding-stuff in Japan and Italy in recent years, the production of this cereal has also increased remarkably.

In the ECAFE area, demand for and production of maize will be almost balanced on the point of about 12 million tons with a possible surplus of 400,000 tons in 1970, and Thailand will have a significant amount of exportable surplus, while there will be a deficit of 1.5 million tons in the case of India.

It is really surprising to see how rapidly the production of maize in Thailand has increased since about the end of 1950's, with an annual compound rate of growth of 31% in this decade.

However, the population lives on rice in Thailand and the domestic consumption of maize has been negligible so far, and most of the maize produced in the country should be exportable. It should be remembered, therefore, that the increase-rate of maize production in Thailand will largely depend upon the import policy of Japan, its important customer, on the one hand, and, upon the capacity of transportation, warehousing, and harbour facilities of this country, on the other.

¹ The yield per hectare of minor cereals (millet and sorghum) in the Far East is 450kg based on 1959/60—61/62 average, while those of rice (paddy) and wheat are 1,750kg and 880kg respectively. (Calculated from the data of *FAO Production Year Book, 1962.*)

According to the projections which take in the above factors, the production and exportable surplus of Thai maize will be about 1.3 million tons and 1.2 million tons in 1970 respectively, or about four times those of 1959.

It is also interesting to note that Indonesia will have a surplus of 480,000 tons in 1970, though it had none in 1960. However, this will not provide an exportable surplus, as Indonesia is projected to have a significant shortage of all cereals in 1970.

5. All Cereals

To sum up the general situation and outlook for these cereals in the area as a whole, there was a production of 114.3 million tons and demand of 118.7 million tons in 1960, with a shortage of 4.4 million tons. In 1970, however, the production will be 156.4 million tons, with an annual compound rate of growth of 2.9% in the 1960's, while the demand will be 171.5 million tons, with annual compound rate of growth of 3.4% in the 1960's, with the result that the area will face a shortage of 1.5 million tons.

The four countries that will have surplus of cereals in 1970 are: Burma (+1.9 million tons), Thailand (+3.6 million tons), the Republic of Viet-Nam (+1.4 million tons) and Cambodia (0.5 million tons).

All other countries will have deficiencies. There will be serious shortages in 1970 in the three countries—Pakistan (−4.9 million tons), India (−10.9 million tons), and Indonesia (−2.8 million tons).

Other major cereal deficit countries will be the Republic of Korea (−0.55 million tons), China (Taiwan) (−0.76 million tons), Ceylon (−0.75 million tons), Malaya and Singapore (−0.74 million tons), and Hongkong (−0.67 million tons).

However, in view of transportation capacity and shortages of foreign currency holdings in the countries concerned, it will not be possible to treat these large food-shortages as import demands, and, what is more, the effective demand will be restrained by the amount of available supply.

If the amount of per capita consumption of cereals remains as it was in the base-year (1958–60 average), the shortages of cereals for 1970 would be not more than present levels, and, as seen in Table 5, it would also be possible for some of the countries deficient of cereals to achieve self-sufficiency in food, without importing cereals. It should not be forgotten, however, that the hard reality of food-shortage will remain as a potential demand in this case, even if it is not revealed as import demand.

Now if the per capita consumption of cereals remains at the level of the base-year (1958–60 average), Ceylon will have a smaller deficit in 1970 than in the base-year.

However, the shortage of cereals would still be more in Pakistan, Indonesia, China (Taiwan), the Republic of Korea, Malaya and Singapore, and Hongkong.

India will achieve self-sufficiency in cereals in 1970, or the final year of the Fourth Five-Year Plan, which was planned to be completed in 1965–66,

the final year of the Third Five-Year Plan.¹

It should be remembered that our production projections were based mainly upon the trend-analysis of the 1950's, that are mostly lower than the planned targets in the countries concerned. If those planned targets of cereals could be achieved successfully up to 1970, the shortage of cereals would possibly be reduced to a remarkable extent. In such a case only, the demand for and production of cereals in the area would reach a balancing-point, without leaving any serious potential shortage of cereals.

Another factor, which will mitigate the possible aggravation of the food situation in the future, is the increase in production and increased popularity of such substitutes as pulses, starchy-root crops, animal- and fishery-products. The pulses are important self-consuming food-crops in India and Pakistan, and the same is true with cassava, a starchy root, in case of Indonesia, though we could not extend the projections to the above commodities this time. It will hardly be expected, however, that the countries in these areas can achieve, before 1970, increased production of those substituting food-crops and of the animal-and fishery-products having minor importance as foodstuffs at present, to such an extent as would bring about a drastic change in their long-established dietary customs.

IV. Some Policy Implications of the Projections

The increase in demand for food-crops (cereals) in the developing Asian countries will largely be over the increase in production even on low assumption of income growth. It can be said that the production targets of foodstuffs and other major agricultural commodities in the economic plannings of Asian countries generally seem very optimistic with such an exception as Thailand.

It can be recognized, therefore, that the greatest bottleneck in the economic growth of those developing Asian nations is the food problem.

The export of primary products, which occupied the attention of member-countries in the UN Conference on Trade and Development in 1964, will be subjected to much more severe international competition. Even if the measures for more favourable duties on the part of the import countries should promote trade in these commodities, the possible amount of foreign currency to be earned by it will not be sufficient for executing the economic planning expected, in view of the production capacity and exportable surplus in the future.

If the food-shortage becomes more serious in the future as our study

¹ As for the projections of cereals in India, the statistical analysis was made in detail using the original statistics of India in the author's report, "Agricultural Commodities Projections in India—with Special Reference to Self-Sufficiency of Food" (in Japanese), for the Kantō District Meeting of the Japan Society of International Economics (April 4, 1964). In this work, the total production of all cereals in India is given as about 88.0~90.0 million tons in 1970. These estimates are almost equal to those of the Agricultural Committee of the Institute, using FAO statistics on an all-India base.

shows, the amount of foreign currency necessary for importing food-crops will inevitably increase, and accordingly the import of capital goods required for economic development planning should be reduced. This will further widen the disparity of economic growth between South and North. Since the economic growth in most of the developing Asian countries depends on a solution of the food problem, the countries concerned, especially those countries with food deficiencies, should first make every effort to increase agricultural production to such a point as will exceed the increased demand caused by population growth.

Secondly, it is necessary for them to promote the export of primary products as a direct measure for earning foreign currency, and to bolster import-substitute industries and the domestic market as an indirect measure to save foreign currency. Together with their own efforts, the developing Asian countries concerned should exert themselves to obtain as much foreign aid, including technical aid, as possible. Technical aid is essential for making full use of imported capital goods, establishing import-substitute industries and improving the agricultural productivity of the developing countries. It is necessary for these countries to guard against boycotting such foreign techniques as are more advanced than their own, merely because of short-sighted nationalism or prejudice.

It is very important for the policies of the developing countries to be considered integrally, from the viewpoint of long-term economic growth and the international division of industries. The economic development of the area as a whole is a vital problem for achieving economic prosperity not only of the developing Asian countries but also of Japan, which is the sole exception of a highly industrialized country in the area, and we expect to study this problem under the next fiscal year project, "The Possibility and Conditions for Economic Integration among the Asian Countries."

Table 1. POPULATION PROJECTIONS FOR THE DEVELOPING ASIAN COUNTRIES

(Estimated by the Research Dept. for Economic Growth, the Institute)

(Unit: 1,000 persons)

Country	1960	1965	1970	1975	1980
British Borneo	1,283	1,455	1,675	1,951	2,292
Burma	20,662	22,607	24,926	27,707	31,065
Cambodia	4,952	5,652	6,480	7,470	8,672
Ceylon	9,896	11,371	13,111	15,204	17,698
China (Taiwan)	10,612	12,577	14,867	17,705	21,314
Malaya (Federation of)	6,909	8,158	9,706	11,687	14,206
Hongkong	2,983	...	...	...	...
India	432,567	481,263	540,155	609,317	690,795
Indonesia	92,600	102,464	113,328	125,937	141,407
Korea (Republic of)	24,665	28,090	32,110	36,788	42,340
Laos	1,805	2,001	2,242	2,524	2,868
Pakistan	92,727	103,924	116,857	131,462	147,494
Philippines	27,792	32,372	37,940	44,743	53,108
Singapore	1,634	1,931	2,290	2,771	3,397
Thailand	26,258	30,000	34,390	39,640	46,037
Viet-Nam (Republic of)	14,100	15,728	17,501	19,353	21,486

Table 2. PROJECTED AGGREGATE DEMAND FOR AND PRODUCTION

Country	Production—paddy equivalent (milled equivalent) ¹⁾			Annual Compound Rate of Growth	
	1950	1960	1970	1950's	1960's
	Burma	5,219.0 (3,543.7)	6,753.0 (4,585.3)	8,080.0 (5,494.4)	2.6	1.7
Cambodia	1,261.0 (807.0)	1,382.0 (884.5)	1,760.0 (1,144.0)	0.9	2.2
Ceylon	310.0 (210.8)	801.0 (544.7)	1,555.0 (1,057.4)	10.0	6.2
Malaya (Fed. of & Singapore)	637.0 (410.3)	856.0 (539.3)	1,449.0 (965.9)	3.0	5.4
India	33,560.0 (22,820.0)	48,271.0 (32,824.3)	69,192.0 (47,050.6)	3.7	3.3
Indonesia	9,257.0 (6,294.8)	12,407.0 (8,436.8)	14,454.0 (9,829.0)	3.0	1.4
Korea (Republic of)	3,061.0 (2,234.5)	3,212.0 (2,344.8)	4,136.0 (3,019.3)	0.5	2.3
Pakistan	12,580.0 (8,554.4)	14,168.0 (9,634.2)	16,587.0 (11,279.2)	1.2	1.4
Philippines	2,620.0 (1,703.0)	3,710.0 (2,411.5)	5,306.0 (3,449.0)	3.5	3.0
China (Taiwan)	1,640.0 (1,148.0)	2,437.0 (1,642.9)	2,941.0 (2,058.7)	3.6	2.1
Thailand ²⁾	6,766.7 (4,398.4)	7,365.0 (4,787.3)	10,900.0 (7,085.0)	0.8	3.6
Viet-Nam (Republic of)	...	4,802.0 (3,073.0)	7,862.0 (5,110.3)	...	4.7
North Borneo	43.2 (28.2)	67.0 (43.6)	95.8 (62.3)	4.5	3.3
Sarawak	...	99.0 (64.4)	100.0 (65.0)	...	0.1
Brunei	6.3 (4.1)	2.5 (1.6)	7.0 (4.6)	-9.0	10.0
Laos	544.0 (353.6)	524.0 (340.6)	612.5 (398.0)	-0.03	1.4
Hongkong	—	—	—	...	...
Total	77,505.3 (52,502.6)	106,766.5 (72,159.1)	145,037.3 (98,072.7)	3.2	2.8
	(Excluding Sarawak and South Viet-Nam)				

(II) Wheat

Burma	4.0	8.0	29.3	7.2	12.5
China (Taiwan)	16.0	43.0	97.4	10.4	7.7
India	5,952.0	9,392.3	15,070.0	4.7	4.4
Korea (Republic of)	94.0	125.3	191.7	2.9	3.9
Pakistan	3,862.0	3,818.0	4,608.7	-0.1	1.7
Total	9,928.0	13,386.6	19,997.1	3.0	3.7

Notes: 1. The figures in parentheses are "milled equivalent."

2. The original projected values were modified here, with the change in total

OF SELECTED AGRICULTURAL COMMODITIES (Rice and Wheat)

(1,000 M/T)

Demand—Milled Equivalent			Annual Compound Rate of Growth		Balance		
1950	1960	1970	1950's	1960's	1950	1960	1970
2,334.7	2,968.0	3,617.3	2.4	1.8	1,209.0	1,617.3	1,877.1
...	649.9	863.0	...	2.6	...	234.6	281.0
...	1,066.9	1,808.2	...	4.9	...	-522.2	-750.8
869.3	1,057.9	1,708.5	2.0	4.4	-468.0	-518.6	-742.6
23,539.7	33,301.8	50,690.3	3.5	3.9	-718.9	-477.5	-3,639.7
6,543.2	9,185.8	13,123.4	3.5	3.3	-248.4	-749.0	-3,294.4
...	2,335.9	3,124.3	...	2.7	...	8.9	-105.0
8,526.8	9,850.1	13,463.2	1.4	2.9	27.6	-215.9	-2,184.4
1,781.3	2,486.5	3,509.5	3.4	3.2	-78.3	-75.0	-60.5
984.0	1,519.3	2,206.7	4.4	3.5	164.0	123.6	-148.0
2,900.1	3,554.0	4,622.6	2.1	2.5	1,498.3	1,233.3	2,422.4
...	2,940.0	3,728.0	...	2.2	...	133.3	1,382.3
28.2	56.4	132.9	7.2	8.1	-9.9	-12.8	-70.6
75.2	131.6	178.7	5.8	2.8	...	-67.2	-113.7
4.1	7.4	10.5	6.1	3.2	0	-5.8	-5.9
...	330.3	500.0	...	3.8	...	10.3	-102.0
144.8	354.4	670.0	9.4	6.0	-144.8	-354.4	-670.4
...	71,796.2	103,997.5	...	3.4	...	362.9	-5,924.8
14.6	46.2	57.5	12.2	2.0	-10.6	-38.2	-28.2
48.0	267.0	700.0	18.7	10.1	-32.0	-224.0	-602.7
7,666.3	12,917.0	21,599.3	5.3	4.8	-1,714.3	-3,524.7	-6,529.3
...	414.8	554.9	...	2.7	...	-289.5	-363.2
3,817.7	4,672.0	7,370.0	2.0	4.2	44.3	-854.0	-2,761.3
11,546.6	18,317.0	30,281.7	...	4.7	...	-4,930.4	-10,284.6

(Excluding the Republic of Korea)

value accordingly.

Table 3. PROJECTED AGGREGATE DEMAND FOR AND PRODUCTION
(Maize and Other)

Country	Production			Annual Compound Rate of Growth	
	1950	1960	1970	1950's	1960's
	India	1,943.0	3,828.0	5,050.0	7.0	2.6
Indonesia	2,217.0	2,404.0	3,408.0	0.8	3.2
Pakistan	394.0	454.0	643.0	1.4	3.2
Philippines	667.0	1,130.0	1,608.0	5.4	3.3
Thailand	23.0	348.3	1,315.0	31.2	14.2
Burma	28.0	25.0	45.5	-1.1	5.6
Ceylon	7.0	8.0	11.9	1.4	3.7
Korea (Republic of)	...	14.7	16.4	...	1.0
China (Taiwan)	7.0	16.6	25.3	9.0	3.9
Cambodia	41.0	103.0	235.6	9.6	7.8
North Borneo	3.0	1.0	2.6	-10.4	9.1
Viet-Nam (Republic of)	...	28.0	30.0	...	0.6
Laos	...	12.0	14.0	...	1.4
Total	5,330.0 ¹⁾	8,372.6	12,405.3	...	3.6

Note: 1. The total excludes the countries where data were not available.

(II) Minor Cereals (Millet, Sorghum, Barley, Rye, and Oats)

Burma	...	30.0	38.0	...	2.2	
India	M	6,093.0	7,421.7	8,841.4	2.0	1.7
	S	5,487.0	8,739.0	12,134.4	4.8	3.0
	B	2,386.0	2,574.7	3,223.3	0.8	2.1
Total		13,966.0	18,735.4	24,199.1	3.0	2.4
Korea (Republic of)	M	114.0	56.3	67.2	-6.8	1.6
	S	14.3	6.0	8.2	-8.3	2.9
	R	26.0	24.3	30.0	-0.7	1.9
	B	619.0	784.3	934.0	2.4	1.6
	O	—	—	3.0	...	...
Total		773.3	870.9	1,042.5	1.2	1.7
Pakistan	M	368.0	314.3	255.0	-1.6	-1.9
	S	226.0	223.7	202.0	-0.1	-0.9
	B	158.0	154.3	179.0	-0.3	1.4
Total		752.0	692.3	636.0	-0.8	-0.8
Ceylon	M	12.3	19.0	24.8	4.4	2.4
China (Taiwan)	M+S	5.7	8.0	12.0	3.8	3.4
Grand Total		15,509.3	20,355.6	25,952.4	...	2.3

(Excluding Burma)

OF SELECTION AGRICULTURAL COMMODITIES
 Minor Cereals)

(1,000 M/T)

Demand			Annual Com- pound Rate of Growth		Balance		
1950	1960	1970			1950	1960	1970
			1950's	1960's			
2,084.3	3,899.4	6,573.6	6.5	4.9	-141.3	-71.4	-1,523.6
2,199.4	2,404.0	2,927.0	0.9	1.8	17.6	0	481.0
394.0	454.0	639.2	1.4	3.2	0	0	3.8
672.3	1,107.0	1,564.5	5.1	3.2	-5.3	23.0	43.5
23.3	43.5	100.4	6.4	7.9	-0.3	304.8	1,214.6
...	30.0	45.0	...	3.8	...	-5.0	0.5
6.7	8.0	15.9	1.8	6.4	0.3	0	-4.0
0.7	24.3	47.9	52.5	6.4	...	-9.6	-31.5
6.7	17.5	35.6	10.6	6.7	0.3	-0.9	-10.3
...	—	—	...	...	...	103.0	235.6
3.0	3.2	4.4	0.6	2.9	0	-2.2	-1.8
...	32.1	40.3	...	2.1	...	-4.1	-10.3
...	12.0	14.0	...	1.4	...	0	0
5,390.4 ¹⁾	8,035.0	12,007.8	...	3.7	...	337.6	397.5
...	30.0	30.0	...	0	...	0	-8.0
14,412.7	18,766.4	23,450.0	2.7	2.3	-446.7	-31.0	749.1
} ... }	77.1						
25.7	24.3						
...	898.6						
...	1,000.0	1,089.4	...	1.0	...	-129.1	-46.9
} 600.3 }	534.8						
158.3	154.5						
758.6	689.3	572.8	-1.0	-1.7	-6.1	3.0	63.2
13.3	19.1	22.8	3.7	1.6	-1.0	-0.1	2.0
5.7	8.2	12.0	3.7	3.5	0	-0.2	0
...	20,513.0	25,177.0	...	1.9	...	-157.4	775.4

Table 4. PROJECTED AGGREGATE DEMAND FOR AND PRODUCTION

Country	Production				
	1950	1960	1970	Annual Compound Rate of Growth	
				1950's	1960's
Brunei	4.1	1.6	4.6	-9.0	10.0
Burma	3,575.7	4,648.3	5,607.2	2.7	1.7
Cambodia	848.0	987.5	1,379.6	1.5	3.1
Ceylon	230.1	571.7	1,094.1	9.5	6.1
China (Taiwan)	1,176.7	1,710.5	2,193.4	3.8	2.3
Hongkong	—	—	—	...	...
India	44,681.8	64,780.0	91,369.7	3.8	3.1
Indonesia	8,511.8	10,840.8	13,237.0	2.4	1.8
Korea (Republic of)	3,101.8	3,355.7	4,269.9	0.8	2.2
Laos	353.6	352.6	412.0	-0.03	1.4
Malaya (Fed. of) & Singapore	401.3	539.3	965.9	3.0	5.4
North Borneo	31.2	44.6	64.9	3.6	3.5
Pakistan	13,562.4	14,598.5	17,166.9	0.7	1.5
Philippines	2,370.0	3,541.5	5,057.0	4.1	3.3
Viet-Nam (Republic of)	...	3,101.3	5,140.3	...	4.7
Thailand ¹⁾	4,421.4	5,135.6	8,400.0	1.5	4.5
Sarawak	...	64.4	65.0	...	0.1
Total	83,269.9	114,273.9	156,427.5	...	2.9

(Excluding Sarawak and South Viet-Nam)

Note: 1. The original projected values were modified here, with the change in total

Table 5. ALTERNATIVE DEMAND

Country	Production			Demand	
	1960 (1958-60 Average)	1970	Annual Compound Rate of Growth 1960's	1960	1970
				(1958-60 Average)	I
Brunei	1.6	4.6	10.0	7.4	10.5
Burma	4,648.3	5,607.2	1.7	3,074.2	3,749.8
Cambodia	987.5	1,379.6	3.1	649.9	863.0
Ceylon	571.7	1,094.1	6.1	1,094.0	1,846.9
China (Taiwan)	1,710.5	2,193.4	2.3	1,812.0	2,954.3
Hongkong	—	—	...	354.4	670.4
India	64,780.0	91,369.7	3.1	68,884.6	102,313.2
Indonesia	10,840.8	13,237.0	1.8	11,589.8	16,050.4
Korea (Republic of)	3,355.7	4,269.9	2.2	3,775.0	4,816.5
Laos	352.6	412.0	1.4	342.3	514.0
Malaya (Fed. of) & Singapore	539.3	965.9	5.4	1,057.9	1,708.5
North Borneo	44.6	64.9	3.5	59.6	137.3
Pakistan	14,598.5	17,166.9	1.5	15,665.4	22,045.2
Philippines	3,541.5	5,057.0	3.3	3,593.5	5,074.0
Viet-Nam (Public of)	3,101.3	5,140.3	4.7	2,972.1	3,768.3
Thailand	5,135.6	8,400.0	4.5	3,597.5	4,763.0
Sarawak	64.4	65.0	0.1	131.6	178.7
Total	114,273.9	156,427.5	2.9	118,661.2	171,464.0

Note: 1. The projections based on regression- or trend-analysis as explained in chapter 3
 2. The projections on the assumption that the amount of per capita consump-

OF SELECTED AGRICULTURAL COMMODITIES (All Cereals) (1,000 M/T)

Demand			Balance				
1950	1960	1970	Annual Compound Rate of Growth		1950	1960	1970
			1950's	1960's			
4.1	7.4	10.5	6.1	3.2	0	-5.8	-5.9
2,349.3	3,074.2	3,749.8	2.7	1.8	1,226.4	1,574.1	1,857.4
...	649.9	863.0	...	2.6	...	337.6	516.6
...	1,094.0	1,846.9	...	4.9	...	-522.3	-752.8
1,044.4	1,812.0	2,954.3	5.7	4.5	132.3	-101.5	-760.9
144.8	354.4	670.4	9.4	6.0	-144.8	-354.4	-670.4
47,703.0	68,884.6	102,313.2	3.7	3.6	-3,021.2	-4,104.6	-10,943.5
8,742.6	11,589.8	16,050.4	2.9	3.0	-230.8	-749.0	-2,813.4
...	3,775.0	4,816.5	...	2.2	...	-419.3	-546.6
...	342.3	514.0	...	3.8	...	10.3	-102.0
869.3	1,057.9	1,708.5	2.0	4.4	-468.0	-518.6	-742.6
31.2	59.6	137.3	6.7	7.9	0	-15.0	-72.4
13,497.1	15,665.4	22,045.2	1.5	3.2	65.3	-1,066.9	-4,878.3
2,453.6	3,593.5	5,074.0	3.9	3.2	-83.6	-52.0	-17.0
...	2,972.1	3,768.3	...	2.2	...	129.2	1,372.0
2,923.4	3,597.5	4,763.0	2.1	2.6	1,498.0	1,538.1	3,637.0
75.2	131.6	178.7	5.8	2.8	...	-67.2	-113.7
...	118,661.2	171,464.0	...	3.4	...	-4,387.3	-15,036.5

value accordingly.

PROJECTIONS OF ALL CEREALS (1,000 M/T)

II	Annual Compound Rate of Growth		1960	Balance		
	1960's			1960	1970	
	I	II			I	II
...	3.2	...	-5.8	-5.9	...	
3,696.2	1.8	1.7	1,574.1	1,857.4	1,911.0	
832.6	2.6	2.3	337.6	516.6	547.0	
1,484.4	4.9	2.8	-522.3	-752.8	-390.3	
2,632.5	4.5	3.5	-101.5	-760.9	-439.1	
592.6	6.0	4.8	-354.4	-670.4	-592.6	
86,694.9	3.6	2.1	-4,104.6	-10,943.5	4,674.8	
14,554.7	3.0	2.1	-749.0	-2,813.4	-1,317.7	
4,801.0	2.2	2.2	-419.3	-546.6	-531.1	
450.8	3.8	2.5	10.3	-102.0	-38.8	
1,641.1	4.4	4.1	-518.6	-742.6	-675.2	
82.4	7.9	3.0	-15.0	-72.4	-17.5	
20,114.6	3.2	2.3	-1,066.9	-4,878.3	-2,947.7	
5,065.4	3.2	3.1	-52.0	-17.0	-8.4	
3,769.7	2.2	2.2	129.2	1,372.0	1,370.6	
4,721.1	2.6	2.5	1,538.1	3,637.0	3,678.9	
...	2.8	...	-67.2	-113.7	...	
...	3.4	...	-4,387.3	-15,036.5	...	

of this thesis.

tion of all cereals in the base-year (1958-60 average) will be constant up to 1970.

ERRATA

(Volume II)

No. 1

P. 1	L. 14	<i>for</i>	Philippinese	<i>read</i>	Philippines
P. 1	L. 14		Takaigawa		Takigawa

No. 2

P. 123	L. 20	UNESOC	UNESCO
P. 123	L. 25	Politics	<i>Politics</i>
P. 148	L. 25	$GS=S$	$GS=s$
P. 148	L. 31	(S)	(s)
P. 223	L. 9	<i>elective</i>	<i>effective</i>
P. 227	L. 27	nationality	rationality

No. 3

P. 252	L. 3	1962	1926
P. 258	L. 30	$A_0(K)_{a_1}(L)_{a_2}e^{at}$	$A_0(K)^{a_1}(L)^{a_2}e^{at}$
P. 259	L. 11	Y_{D^t}	Y_{D_t}
P. 259	L. 21	Y_{D^t}	Y_{D_t}
P. 259	L. 23	Y_{D^t}	Y_{D_t}
P. 259	L. 28	$K(Y_{D^t} - Y_{D^0})$	$K(Y_{D_t} - Y_{D_0})$
P. 260	L. 27	ΔM	ΔM
P. 272	L. 32	$y = a + bt$	$y = a + bt$
P. 272	L. 41	$y = a + b$	$y = a + bt$
P. 272	L. 41	$ty = abc^t$	$y = abc^t$