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## THE NATURE OF AGRICULTURE'S CONTRIBUTIONS TO ECONOMIC DEVELOPMENT†

### I. INTRODUCTION

In the burgeoning literature on economic development there has been considerable discussion of the relative importance of agricultural vs. industrial development. Few attempts have been made, however, to examine in detail the nature of agriculture's contributions to the process of economic growth. In particular, it seems desirable to consider more fully the inter-relationships between agricultural and industrial expansion and the extent to which agricultural development is complementary to over-all economic growth.

Expansion of agricultural output requires increased inputs, and in that sense necessarily competes with other sectors of the economy. Historical experience and theoretical considerations suggest, however, that the optimum approach to increasing farm output and productivity in an underdeveloped country is likely to entail only modest demands on the critically scarce resources indispensable for industrial development.

Since the emphasis in the present paper is on the nature of agriculture's contributions to economic advance, only a brief statement is given here of the reasons underlying the assertion that farm output and productivity can and should be increased by methods that make very limited demands on resources of high opportunity cost which are essential for industrial expansion.<sup>1</sup> In virtually all underdeveloped economies agriculture is an existing industry of major proportions. On the order of 40 to 60 per cent of the national income is produced in agriculture, and some 50 to 80 per cent of the labor force is engaged in agricultural production (11, pp. 94-97, 193; 26, pp. 45-47). Although large quantities

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† An attempt to present a general statement of agriculture's contributions to economic development is a hazardous undertaking. If we have succeeded in making a contribution to consideration of this complex and important question, it is largely due to the valuable criticisms and suggestions that have been directed at successive drafts of this paper. Discussion of early versions of the article with David Bell, W. Arthur Lewis, Kazushi Ohkawa, William O. Jones, and Helen C. Farnsworth was especially valuable in clarifying our ideas and organization. We are indebted to M. K. Bennett for his final editing of the manuscript which has added clarity and led to needed qualification of some of our generalizations. The authors are, of course, solely responsible for the faults that remain.

<sup>1</sup> The argument is sketched in an earlier article on "Agricultural Productivity and Economic Development in Japan" (21) and is presented in more detail in a paper on "Agricultural Development and Economic Transformation: Japan, Taiwan, and Denmark" (20).

of labor and land are committed to agriculture, these resources are being used at low levels of productivity. Frequently, the amounts of available capital in the form of draft animals and small tools and equipment are also substantial relative to the total stock of capital. The low levels of productivity that characterize the use of resources currently available in agriculture is due largely to the lack of certain complementary inputs of a technical, educational, and institutional nature.

Under these circumstances, though more in densely than in sparsely populated regions, the most practical and economical approach to increasing farm output and productivity lies in enhancing the efficiency of the existing agricultural economy by introducing various technological innovations within the framework of the existing labor-intensive methods of production and with a minimum of capital investment. The large quantities of land and labor already being used in agriculture are characterized by low opportunity cost. There are obviously strict limits on the extent to which available agricultural land resources can be used to further industrial development. Agricultural labor can, in general, be expected to have low opportunity cost for some time since lack of capital prevents rapid absorption of labor by the expanding non-agricultural sectors. This argument is based in part on the validity of Engel's Law interpreted in relation to the increase of incomes over time. Since the demand for food does not rise as rapidly as the growth of income, the demand for the aggregate of goods and services produced by the non-agricultural sectors of the economy expands more rapidly than the increase in demand for agricultural products. Historically, a secular decline of the agricultural sector seems to have been a universal feature of the process of economic growth at least beyond the earliest stages. The essential characteristics of this phenomenon have been summarized succinctly by Kuznets: "when modern economic growth does occur, it is the combination of the marked rise in productivity of labor in the agricultural sector, with the secular limits on the demand for its products that results in such a sharp and uniform reduction of the agricultural sector in the labor force" (26, p. 60).

The historical experience of Japan and Taiwan, to mention two interesting and pertinent examples, demonstrates the substantial potential that exists for raising farm output and productivity by techniques that rely mainly on the use of resources that have low opportunity cost. Agricultural development in these countries made only minimal demands on the critically scarce resources such as investible funds, foreign exchange, and high calibre entrepreneurial talent which are indispensable for industrial development.

Labor productivity in Japanese agriculture seems to have approximately doubled over a span of thirty years, comparing farm output and labor inputs during the years 1881-90 with the decade 1911-20. Studies of agricultural change during that period indicate very clearly that the overwhelmingly important factors responsible for the growth in productivity were: (1) agricultural research leading to the development and selection of higher-yielding varieties of rice and other major crops; (2) increased application of fertilizers; and (3) activities that facilitated wide use of the most productive plant varieties and of improved farm practices. There was little change in the organization or cost structure of Japan's agriculture during this period; cash and other non-labor costs were some 15 per cent of the gross value of production at the beginning of the period, and were still only about 20 per cent at the end (21, pp. 498-513; 34; and 20).

The increase of labor productivity in agriculture in Taiwan was even larger—something like 130 to 160 per cent over the 30-year span between the decade 1901-10 and the 1930's.<sup>2</sup> Here also the gains in productivity were largely the result of technological advance. An extraordinary threefold expansion of sugar yields and nearly a twelvefold increase of output were conspicuous elements in the increase in agricultural productivity registered in Taiwan. It will be recalled that this was primarily an export crop and that the first three or four decades of the present century were a period of spectacular progress in breeding higher-yielding varieties of sugar cane; particularly noteworthy were the POJ varieties developed in Java but shortly introduced in Taiwan. Increase of crop area, largely through extending the area of double cropping, and expansion of irrigation appear to have been more important in Taiwan than in Japan during the periods considered; development in those directions in Japan was already fairly advanced by the 1880's (20, pp. 95-97). Agricultural investment thus appears to have been a somewhat more important factor in Taiwan than in Japan, but to a large extent it was direct, non-monetary investment (20).

The expenditures for agricultural research, extension-type activities, and other "developmental services" that were of such strategic importance in Japan and Taiwan were very modest, particularly in relation to the large increments in output that were attained. The conclusion is inescapable that the returns accruing to this type of investment were exceedingly high. Outlays for fertilizer increased rapidly and were substantial. This represented a resource demand that was competitive with industrial expansion since it required foreign exchange and, in the case of Japan, the erection of fertilizer plants. But the returns obtainable were very large relative to the cost of the additional fertilizer inputs. There is, in general, a high degree of complementarity among various agricultural inputs, and fertilizers are a conspicuous example. The work of the plant breeders in Japan and Taiwan was largely directed at developing varieties characterized by a strong response to increased applications of fertilizer; the gains achieved were the result of the joint advance in varietal improvement and in raising the level of soil fertility. Changes in cultural practices, such as an increase in plant density, were also needed to realize the full potential of new varieties.

The implications of the secular decline of agriculture and the process of economic transformation are examined further in section III in considering agriculture's role in relation to capital formation. It is well to anticipate, however, that the distinction between resources of high and low opportunity cost that has been stressed is most clearly applicable and significant in countries of high rural population density, such as Java, India, or Egypt. In the concluding section, brief consideration is given to the extent to which the argument requires modification in relation to the extensive areas of tropical Africa and South America where rural populations are sparse.

<sup>2</sup> This estimate is based on an index of physical output in calorie equivalent described in 20. Shifts from low- to high-value crops (or vice versa) were relatively unimportant in Taiwan during this period, and there appears to have been only a modest change in the relationship between gross and net value of farm output. Hence, it seems reasonable to suppose that the increase in value productivity was also on the order of 130 to 160 per cent. In Japan, the increase in labor productivity in agriculture between 1881-90 and 1911-20 was a little over 100 per cent on the basis of estimates of the net income produced in agriculture and a little less than 100 per cent according to the increase in physical output (20).

## II. THE GROWTH OF DEMAND FOR AGRICULTURAL PRODUCTS

The most obvious contribution of agriculture to economic development is in providing the enlarged supplies required to satisfy the rising demand for food. The prime determinants of this growth in demand are the rates of increase in population and in per capita incomes. Only a part of higher incomes will be devoted to expenditure on food, so the influence of a rise in per capita incomes depends on the income elasticity, which for present purposes can be defined simply as the proportionate increase in demand for food associated with a one per cent increase in income. The annual rate of increase in demand is thus given by  $D = p + \eta g$ , where  $p$  and  $g$  are the rate of growth of population and per capita income and  $\eta$  is the income elasticity of demand for agricultural products (32).<sup>8</sup> Demand in this instance refers to the (real) value of food purchased plus the reservation demand for items produced by a family for its own consumption, an element that may be of some importance even for urban residents in under-developed countries. Among the factors other than growth of population and per capita incomes that may influence the demand for food, changes in consumer preferences may be of appreciable importance where population groups are becoming familiar with new foods; the rise in bread consumption in tropical Africa, for example, seems to be a function of urbanization and acculturation as well as a rise in incomes *per se*.

*Population growth.*—One of the striking uniformities in the modernization of a country is the population upsurge that occurs when death rates fall from perhaps 35 to 45 per thousand toward the level of about 10 per thousand which characterizes the economically advanced nations. This decline is mainly a result of improved sanitation, public health measures to control infectious diseases, general improvements in medical care, and improvements in nutrition and midwifery. At present, international borrowing of knowledge and techniques in the public health field is so important that there is only a weak relationship between the spread of these measures and growth of per capita income. Moreover, the decline in mortality is often both substantial and abrupt, owing to recent discoveries such as DDT, the sulpha drugs, and penicillin, which have markedly increased the effectiveness of public health and sanitation measures. Without exception, birth rates have fallen much more slowly than death rates. Apart from the exceptionally high rate of growth in the United States, where immigration was an important factor, none of the presently developed countries witnessed annual rates of growth in excess of 1.4 per cent (10, p. 2). Taiwan showed the effects of widespread and systematic introduction of public health measures at an unusually early date, the rate of natural increase rising above 2 per cent during the 1920's (2, p. 13). Ceylon perhaps is the most conspicuous example of rapid reduction in death rates. Largely as a result of the control of malaria, mortality fell from 19.8 per thousand in 1946 to below 10 in 1956; and since birth rates declined much less, the rate of natural increase rose from not quite 2 per cent to 2.6 per cent in a decade. Since the end of World War II it has become increasingly common for rates of population growth of 1½ to 2½ or even 3 per cent to characterize a developing economy.

<sup>8</sup> The equation omits a second order term that is of negligible importance, particularly in view of the margin of uncertainty that necessarily characterizes estimates of income elasticity and rates of increase of population and income.

*Income elasticity of demand for food.*—The increase in demand for food in response to the growth of income in underdeveloped countries is significantly higher than in the economically advanced nations. Examination of the evidence bearing on the income elasticity of demand for food in underdeveloped countries, as measured by value, suggests that it is on the order of 0.6 or higher, compared with figures of perhaps 0.2 or 0.3 in high-income nations. These approximations relate to income elasticity with respect to food expenditure measured at the farm level, the concept most relevant to assessing the growth of demand for agricultural products.<sup>4</sup> Precision cannot be claimed for these figures because of the various difficulties involved in estimating income elasticity of demand even in countries where statistical data are of high quality and abundant. Knowledge of secular trends in food consumption and of differences in diet patterns between high- and low-income countries provides strong collateral evidence for the assertion that the income elasticity of demand for food is much higher in the low-income countries.

The increase in food expenditure with growth of income, not only in developed but also in underdeveloped countries, is mainly a result of shifts from less to more expensive foods rather than increased intake of food calories.<sup>5</sup> The rise in consumer outlays for food in underdeveloped countries is partly a result of substitution of more expensive but preferred starchy staples such as rice and wheat for cheaper foods such as maize or millets and sorghums. To a greater extent, however, it is likely to reflect a decline in the "starchy staple ratio," i.e., the percentage of total calories derived from cereals and root crops which M. K. Bennett has shown to be closely correlated with the level of national income (3, pp. 213-22; see also 14, pp. 214-15, and 12, pp. 244-47). In low-income countries these cheap starchy foods provide from 60 to 85 per cent of the total calorie intake, in contrast with a level of 25 to 40 per cent in economically advanced countries where the starchy staples have been displaced by increased consumption of the more expensive foods with relatively high income elasticities—meat and dairy

<sup>4</sup> Inter-country comparisons of income elasticity based on cross-section data are presented in 14 and 19. Also suggestive is the fact that the estimated income elasticity of demand for edible agricultural products in Japan, based on time series data, declined from 0.6 for the period 1878-1921 to 0.2 for the years 1922-37 (31, p. 122). Estimates of income elasticity of food expenditure in India are summarized in 8, pp. 124-27. The high figures for the United States, above 0.6, obtained by Houthakker on the basis of cross-section data from the 1950 urban consumption surveys are puzzling. They are certainly not indicative of the income elasticity of demand for the farm-produced component of food purchases. Miss Burk has estimated the income elasticity of demand for food in the United States at about 0.2 for the periods 1924-41 and 1948-57, using both a farm value-weighted index (farm-produced foods only) and a retail value-weighted index (consumption of all food). Using a "structural index" based on cross-section data for consumption at home from the 1955 Survey of Household Food Consumption, but using farm commodity equivalents and farm prices, she estimates the income elasticity for all urbanization categories at 0.12 for "use of farm foods—all sources" and 0.24 for purchased food only (5). Daly has estimated the income elasticity of demand for food at the farm level in the United States at less than 0.15, using time series data but a different technique (9). Marketing and processing services account for about 60 per cent of the retail value of foods purchased in the United States. Correlation between income level and the services component produces an upward bias in estimates of income elasticity based on cross-section data for the United States (unless adjusted as in Miss Burk's computation). This factor is undoubtedly much less important in cross-section estimates for underdeveloped countries since the processing, packaging, and marketing components incorporated in the foods purchased at retail are relatively insignificant; the services are less elaborate and wage costs much lower.

<sup>5</sup> A very crude indication of the income elasticity of demand for food with respect to quantity measured in calories is provided by inter-country comparisons of per capita calorie intake in relation to income. By this approach the FAO has estimated that the income elasticity of demand for calories is 0.1 or less except for countries near the bottom of the income scale (14, pp. 88-89).

products and fruits and vegetables.<sup>6</sup> Since the starchy staple ratio in high-income countries is already low there is less scope and urge to shift from cheap food-stuffs toward more expensive sources of food calories.

*Inflationary impact of food shortages.*—The annual rate of increase of demand for food in an underdeveloped country can easily exceed 3 per cent, a formidable rate of growth in agricultural output to be achieved by an underdeveloped country.<sup>7</sup> The annual increase in net agricultural output in Japan between the 1880's and the decade 1911-20 appears to have been only about 2 per cent; this was the period of most rapid increase in agricultural production, and Japan is cited with good reason as a country in which an impressive increase in agricultural productivity made a significant contribution to over-all economic growth. It is also to be noted that the growth of demand for marketed supplies will be a good deal more rapid than the total increase, owing to the increase of population in cities and mining and industrial centers dependent upon purchased food.

Failure to expand food supplies in pace with the growth of demand can seriously impede economic growth. Professor Lewis takes such a serious view of the adverse effects on economic development of food shortages and rising prices that he has asserted that "failure of peasant agriculture to increase its productivity has probably been the chief reason holding down the expansion of the industrial sector in most of the underdeveloped countries of the world" (28, p. 23). It is, of course, debatable whether a stagnant agricultural sector has been the most important single factor, but there are compelling reasons why insufficient expansions of farm output is likely to lead to a rise in food prices and act as a brake on economic development.

Very little evidence is at hand concerning the responsiveness of the demand for food to a change in food prices in underdeveloped countries. The price elasticity of demand for individual foodstuffs is probably higher than in economically advanced countries. At least with important items, the pressure to substitute is strong when relative prices change.<sup>8</sup> With respect to the price elasticity of demand for "all food" there is a presumption that the reverse is true, at least in the case of an increase in food prices. Since cheap starchy staple foods—cereals and root crops—provide something like 60 to 85 per cent of the total calorie intake in low-income countries, there is relatively limited scope for offsetting a rise in food prices by shifting from expensive to less costly foods. There is obviously no substitute for calories. Because of the pressure to resist a reduction in calorie intake, it seems likely that the price elasticity with respect to the total amount of food demanded is close to 0.

The inflationary impact of a rise in food prices is particularly severe in un-

<sup>6</sup> Meat and dairy products are inherently more expensive than the starchy staples; the agricultural resources required to produce 1,000 calories are substantially greater because of the large loss of "primary calories" when grain or root crops are fed to animals instead of being used for direct human consumption. The high water content and perishability of fruits and vegetables make them costly sources of food calories. Sugar and fats, which have also tended to displace starchy staples, are not necessarily more expensive sources of calories.

<sup>7</sup> Rates of increase of population and per capita incomes of 2 per cent per annum and an income elasticity of 0.6 give a value of 3.2 per cent for D in Ohkawa's demand equation.

<sup>8</sup> See, for example, one instance that has been summarized by W. O. Jones (22, pp. 117-19). Sharp increases in the prices of staple foods other than maize (which was subject to government controls) led to drastic changes in the importance of different staples in the diets of workers in Kampala, Uganda between September 1952 and September of the following year.

derdeveloped countries because food purchases bulk so large in total household expenditures. Urban budget studies in a number of underdeveloped countries indicate that on the order of 50-60 per cent of total consumption expenditure is devoted to food compared with 20 to 30 per cent in the high-income countries.<sup>9</sup> Exceedingly low price elasticity of demand for food, together with its dominant position as a wage good in underdeveloped countries, means that even a moderate growth of demand ahead of supply will cause sharp price rises leading to political discontent and pressure on wage rates with consequent adverse effects on industrial profits, investment, and economic growth.

Since the economic and political repercussions of a considerable rise in food prices are so unfavorable, domestic food shortages are likely to be countered by expanded food imports to the extent that foreign exchange or credits are available. Even if this response is restricted by import or foreign exchange controls, political pressures will be strong to provide sufficient food imports to hold down food prices. It is, of course, reasonable to rely on imports to even out fluctuations in domestic supplies; and in some instances it may be economic even as a long-term policy to follow the pattern of Britain in the period since repeal of the Corn Laws and obtain enlarged food supplies largely through expanded food imports. This solution is obviously not possible on a world-wide basis, and there are considerations that suggest that for many countries it is likely to be a questionable solution.

Foreign exchange is usually a critically scarce resource required for imports of machinery and other requisites for industrial development that cannot be produced domestically; and demand for such items can be expected to increase as development proceeds. "The real choice," as Chenery has expressed it, "is then between expanding exports and expanding production for home consumption" (7, p. 67).<sup>10</sup> This problem of "import substitution" is a difficult one because it is unlikely that the comparative advantage of imports vs. domestic production in the future is accurately indicated by a comparison of present prices translated at the existing exchange rate. These considerations clearly do not justify the adoption of autarchic policies with respect to food imports. But recognition of the critical and increasing need for foreign exchange, and the difficulties likely to be encountered in expanding exports, underscores the potentially high returns to measures to increase agricultural productivity and output, especially when this can be achieved largely through the use of resources of low opportunity cost. This is a presumption, not a certainty. It does not alter the fact that there are cogent reasons for maintaining price competition between domestic and imported foodstuffs, and it is frequently advantageous to import certain foodstuffs which cannot be produced efficiently, wheat in tropical regions being an important example. For some underdeveloped countries with very limited tax resources, it is arguable that a duty should be levied for revenue purposes on certain

<sup>9</sup> The unweighted arithmetic average of food expenditure as a percentage of total expenditure according to budget surveys in 20 African cities is 63 per cent. Estimates based on the Fourth Round of the National Sample Survey in India (1952) indicates that 55 per cent of total household expenditure in urban areas and 67 per cent in rural areas is devoted to food (8, p. 125; see also 11, pp. 101-102 and p. 194).

<sup>10</sup> To the extent that United States agricultural surpluses are made available on favorable terms the statement calls for qualification, India being a conspicuous case in point. There remains, however, a question whether such windfall supplies will be available on a continuing basis.

imported foods with consequent biasing of the structure of relative prices in favor of local products.

A number of underdeveloped countries have reacted to the social and economic problems resulting from food shortages and high prices by instituting price controls, compulsory food collection, and rationing. It is understandable that considerations of social equity would prompt such action in a low-income country, but from the standpoint of economic development the consequences of continuing food distribution controls for an extended period are almost entirely unfavorable. In the first place, to the extent that food rationing and price controls are effective, they simply transfer the pressure resulting from increased purchasing power to other parts of the economy or toward imports, so that the inflationary impact impinges on resources that are scarcer than those required for expanded agricultural output. Moreover, the effort to operate such controls ties up administrators and agricultural specialists in a control function that is not only of uncertain value but usually ineffective as well. Even in relation to the interests of the lowest-income groups that are theoretically benefited most by a program of direct controls, it seems certain that much higher returns can be obtained by using the available administrative talent for a well conceived program of agricultural development directed at increasing output rather than controlling its distribution. It is also important to note that distribution controls frequently impede the growth of a commercially oriented agriculture and discourage expansion of specialized production in areas of high potential (39, pp. 121-26).

*Export and industrial crops.*—Particularly in the early stages of economic growth, the development or expansion of agricultural exports is likely to be a relatively easy and economical means of increasing incomes and augmenting foreign exchange earnings. Similarly, some of the early and most promising opportunities for expanding manufacturing lie in textiles, the crushing of oilseeds, and other industries that depend upon agricultural raw materials.

A profitable export crop can often be fitted into an existing cropping system; the capital requirements for such innovations are relatively modest and depend to a considerable extent on direct, non-monetary investment by farmers. Given favorable natural conditions and political stability, it is possible to attract foreign investment for plantation production of agricultural export crops that are demanding in their requirements for technology and capital. There is a reasonable expectation that the new crops and techniques will come to be adopted by local cultivators; the growth of production of rubber by small holders in Malaya and Indonesia is pertinent (44, pp. 76-79). Development of production of export crops has the further advantage of catering to an existing market. Even though aggregate demand for many agricultural exports is inelastic, an individual country that accounts for only a fraction of world exports faces a fairly elastic demand schedule, considerably more elastic than the demand for food crops for the domestic market. Hence, substantial expansion of export production is often a rational policy even though the world supply-demand situation for a commodity may be unfavorable. There is, of course, the risk that substantial expansion of exports of a commodity in a number of countries may lead to a serious decline in the price of a primary commodity for which the price and income elasticities are low.

It is well known that export crops have frequently been important in generating increased incomes and foreign exchange earnings. Uganda may be cited as an extreme example; exports of coffee and cotton account for some 85 per cent of the value of all exports and, still more striking, close to 50 per cent of the country's cash income. This is extreme, but examples of considerable dependence on agricultural exports can be easily multiplied. Wickizer has summarized export data for eight important tropical crops for the years 1955-57; for five out of eight, the leading exporter depends on a single crop for more than 50 per cent of its foreign exchange earnings (44, p. 56):

Commodity	Leading exporter	Per cent of country's exports by value
Sugar	Cuba	71
Bananas	Ecuador	53
Cocoa	Ghana	64
Coffee	Brazil	63
Rubber	Malaya-Singapore	53

Heavy reliance on export proceeds from one or a few crops obviously makes an economy vulnerable to fluctuations in world prices, but opportunities for diversification are likely to be meagre for a country at an early stage of development. To a considerable extent the flexibility of a diversified economy is one of the rewards of development. For this and for more basic reasons, it is argued in section III that a transformation of the occupational and output structure of an economy is an essential condition for self-sustaining, cumulative development. Of more immediate importance, however, is the fact that the expansion of incomes and foreign exchange earnings by introducing or enlarging the production of promising export crops can and should play a strategic role in promoting economic growth in many underdeveloped countries.

*Increased food supplies and health and productivity.*—Knowledge of food intake and of human nutritional requirements is too imprecise to permit accurate assessment of the extent or seriousness of malnutrition or calorie shortage in underdeveloped countries. Global claims that "malnutrition and actual hunger is the lot of at least two-thirds of mankind" cannot be supported by evidence.<sup>11</sup> Study of a considerable number of nutritional surveys of sample population groups, the most reliable type of evidence available, suggests that both calorie shortage and serious malnutrition are limited to a relatively small though appreciable fraction of the world's population. The marked differences in conditions in different countries, and regions within a country, cast strong doubt on broad generalizations with respect to nutritional status. According to our reading of the available evidence—admittedly incomplete and often difficult to interpret—it would be a mistake to expect the widespread and substantial improvement in productivity as a result of improved diets that is sometimes claimed. It is not denied, however, that in a good many areas significant gains in health can be expected; the contribution of improved nutrition to the lowering of infant mortality rates is likely to be especially notable.

<sup>11</sup> The quoted phrase is from Lord John Boyd-Orr (4, p. 11). See Bennett's appraisal of Orr's assertion (3, pp. 189-200) and the discussion by Farnsworth (15, pp. 4-11). The articles by Scrimshaw (38) and Hegsted (17) are good, brief statements by competent nutritionists with experience in underdeveloped regions.

In some of the underdeveloped regions there are rural groups with a pattern of life characterized by spasmodic bouts of intensive work followed by prolonged periods of very low activity. Calorie intake is low when physical activity is low, and participation in a modern money economy involving sustained work means an increase in calorie requirements. Of more general nutritional significance is the enlarged consumption of vegetables and fruits, meat, and dairy products that generally results from an increase in per capita incomes. These commodities are often termed "protective foods" since they are good sources of the vitamins and high-quality protein that are not generously provided by a diet consisting predominantly of the starchy staple foods.<sup>12</sup>

On the other hand, rising incomes and the process of urbanization typically lead to other dietary changes that represent deterioration from the nutritional point of view. A shift toward consumption of more highly milled grain products means reduced availability of the B vitamins; and higher consumption of sugar and soft drinks is at the expense of foods that provide essential nutrients as well as calories. The shift from native beer or wine to commercial beer or spirits means a loss of vitamin C and the B vitamins that are available in significant quantities in the unfiltered traditional beverages.

The changes in diet composition that represent improvement in nutritional quality are likely to be more important, but this is neither certain nor universal. Attention to nutritional education and measures such as encouraging or requiring parboiling or under-milling of rice and enrichment of wheat flour may be equally important, especially as short-term measures.

### III. AGRICULTURE IN RELATION TO CAPITAL FORMATION

It is widely recognized that the process of economic development involves a transformation of the structure of an economy such that agriculture accounts for a diminishing share of national income and the labor force. A closely related requirement for development is not so generally recognized. For reasons developed in this section, it is likely to be essential for agriculture to make a net contribution to the capital requirements for industrial expansion and for overhead investment, especially during the earlier stages of economic growth.

*Secular decline of agriculture and economic transformation.*—Economic development is a complex process that has revealed many different historical patterns. Nevertheless, secular decline in the relative importance of the agricultural sector has been a universal feature of economic development defined as substantial improvement in per capita income levels. Dovring's analysis of long-term changes in the composition of the labor force in a number of countries indicates that there has normally been an increase in the absolute numbers employed in agriculture during the early phase of industrialization, but a decline in absolute

<sup>12</sup> Many nutritionists regard insufficient protein intake—in quantity and quality—as the most pervasive nutritional problem in underdeveloped countries. Meat and dairy products provide protein of excellent quality; but a protein intake of good quality can also be obtained, and at considerably lower cost, from a suitable combination of vegetable foods, soybeans, peanuts, and other legumes being especially valuable in supplementing cereal proteins (see 13, pp. 21-31). Josué de Castro claims that a diet high in animal protein contributes to low fertility; but nearly all professional nutritionists would concur in the view expressed by Ancel Keys that de Castro's argument (that chronic hunger, particularly hunger for protein, increases sexual drives and birth rates) "is replete with error" and "simply not defensible" (24, pp. 38-39).

as well as relative numbers at a later stage (10). This is to be expected, he notes, on the basis of a simple mathematical relationship. The rate of increase in the percentage share of non-agricultural employment in the total labor force of a country will be equal to the difference between the growth rates of the non-agricultural labor force and the total labor force. Although this difference, which Dovring terms the "coefficient of differential growth," determines the rate of change in sector proportions, the numerical reduction of the agricultural labor force will also depend on how heavily the non-agricultural sector weighs in the total labor force. Thus, as he points out, a coefficient of differential growth of 1 per cent (associated, for example, with an increase in the non-agricultural labor force of 3 per cent per annum and a 2 per cent rate of increase in total labor force) might mean an increase in non-agricultural employment from 20 to 20.2 per cent at an early stage of development but an increase of from 50 to 50.5 per cent in a country where non-agricultural employment already accounted for a substantial share of the labor force.

What are the reasons for this structural transformation of a developing economy? The two most basic factors have already been mentioned: (1) an income elasticity of demand for food considerably less than one, and (2) the scope that exists for increasing agricultural productivity which permits substantial expansion of output with a constant or declining farm labor force.<sup>13</sup> "Put in its simplest terms, the crux of the problem is this: In a country with a highly productive agriculture each farm family produces enough to feed itself and some ten to twenty non-farm families as well. But if this is to be possible there must be ten to twenty non-farm families to feed" (11, p. 126).

Since production for export caters to a world market it is to be expected that the relative decline of the agricultural sector will not proceed as rapidly or as far in countries that have a marked comparative advantage in the exportation of agricultural products. It was emphasized in section II that enlarged exports of farm products often make a positive contribution to development in generating increased incomes and foreign exchange earnings. It is important to recognize, however, that even countries particularly well suited by their resource endowment and historical circumstances to emerge as major agricultural exporters can be expected to witness a decline in the relative and, eventually, absolute share of agriculture if they achieve a substantial increase in the level of per capita income. In Denmark and New Zealand, conspicuous examples of countries that have benefited greatly from their role as leading agricultural exporters, less than 20 per cent of the labor force is presently engaged in agriculture. Thus historical experience, as well as some of the inter-relationships considered below, seems to indicate that cumulative economic growth requires expansion of manufacturing and other components of the non-agricultural sector, not merely a change in the product mix available for consumption which might be obtainable up to a point by means of international trade.

*The two-sector classical growth model.*—The inter-relationships between agriculture and general economic growth can be brought out most clearly in terms

<sup>13</sup> In addition to the various editions of Colin Clark's *Conditions of Economic Progress*, see E. M. Ojala, *Agriculture and Economic Progress* (London, 1952); T. W. Schultz, *The Economic Organization of Agriculture* (New York, 1953); and M. Latil, *L'évolution du Revenu Agricole* (Paris, 1956).

of Professor Lewis's version of the classical growth model which assumes that there is a surplus of manpower in agriculture; and the non-agricultural sectors are regarded as the dynamic element which absorbs this surplus of manpower. More precisely, the distinction made in this two-sector model is not between agriculture and non-agriculture but between a "subsistence" or "traditional" sector and a "capitalist" sector. The capitalist sector is defined as "the sector of the economy where labour is employed for wages for profit-making purposes," and it is further characterized by the use of reproducible capital (28, p. 8; 27, p. 146). The balance of the economy comprises the traditional or subsistence sector which is using virtually no reproducible capital and is characterized by very low output per head.

Since the supply of labor available in this traditional sector is assumed to be effectively "unlimited," the transfer of manpower to the capitalist sector is limited by the demand for labor which in turn is limited by the rate of capital accumulation. Shortages of skilled labor may, of course, be a serious problem in a developing economy, but it is only a "quasi-bottleneck" in the sense that it can be dealt with if funds are available for training programs. The real bottlenecks to expansion in the model are the availability of capital and natural resources.

Within the capitalist sector available supplies of capital will be combined with labor only up to the point where the marginal product of labor is equal to the going wage. The wage rate in the capitalist sector can best be thought of as being determined by the *average* product per man in the traditional sector plus a margin, although it may also be influenced by conventional views of the minimum required for subsistence, by trade union pressure, or other factors. A substantial fraction of profits will be re-invested so that there will be cumulative expansion of employment in the capitalist sector until the surplus of labor in the traditional sector disappears. Lewis tersely summarizes his two-sector model as follows (28, p. 3n):

Most countries in the early stages of economic development have not one economy but two—a high wage economy (mines, plantations, factories, large-scale transport, etc.) and a low earnings economy (family farms, handicraft workers, domestic servants, petty traders, casual labourers, etc.). As development occurs, labour transfers from the low earnings to the high wage economy. It is of little consequence whether persons moving out of the low earnings economy have been in "disguised unemployment," or whether their marginal product has been zero, negative, or merely small. All that the analysis requires is that the supply willing to move at the current wage rate should greatly exceed the demand.

Clearly, the crucial assumption in this two-sector model is that the rural population is so large relative to the capital and natural resources available that labor shortages and rising labor costs will not be a deterrent to expansion of the capitalist sector. "When capital catches up with labour supply," as Lewis phrases it, the two-sector model is no longer relevant. "Classical economics ceases to apply; we are in the world of neo-classical economics, where all the factors of production are scarce, in the sense that their supply is inelastic" (28, p. 26). In reality, of course, the transition is gradual, not abrupt. Existence of a labor surplus in the

traditional sector is a relative concept, and a reduction in the degree to which labor is "surplus" is likely to raise average product per worker in agriculture and real wages in the capitalist sector.

Lewis's two-sector model is obviously akin to the notion of "rural underemployment" or "disguised unemployment." It differs from the extreme version of the disguised unemployment argument in including the proviso that the workers remaining in agriculture could sustain output because they would be able and willing to work harder (27, p. 141). It seems to us that this proviso can be further broadened in line with the potentialities that exist for expanding farm output and productivity by methods that make only minimal demands on capital and other scarce resources. That is to say, the validity of the two-sector model does not appear to be seriously impaired if the remaining farm labor force can supply the "required" output by working harder and by introducing technological improvements such as higher-yielding varieties, increased use of fertilizers, and simple improvements in farm implements.

The notion of a "required" increase in farm output is obviously not intended in any rigorous way. Since the price elasticity of demand for "all food" is apparently extremely low, the value productivity of investment for expansion of food crops for domestic consumption will tend to be very high in a situation of scarcity and high prices, but will decline sharply as a result of reduced prices if food supplies increase more rapidly than the expansion of demand. This characteristic of the demand for food also suggests that the magnitude of the effort to enlarge food production should be guided by estimates of the prospective growth of demand. Projections of the growth of aggregate demand for food and for major commodities cannot be made with precision, but useful approximations are possible in the light of prospective changes in population, income levels, and food consumption patterns. Historical experience in other areas and studies of food purchases by income class can throw some light on probable changes in food consumption, although the conclusions can only be suggestive and need to be guided as much by judgment as by statistical analysis.

This is not to suggest that it is either possible or desirable to avoid appreciable fluctuations in the agricultural price level and still larger variations in the prices of individual commodities. Indeed, such variations play an increasingly valuable role in calling forth desirable changes in the composition of farm output and in the intensity of application of agricultural inputs.

Viewing development as a process of cumulative expansion of the capitalist sector and absorption of surplus labor from the traditional sector underscores the significance of the distinction made in section I between resources of high and of low opportunity cost. So long as the conditions of the classical growth model are relevant, factor proportions and productivities will and should be different in the two sectors and a different calculus is applicable to allocation decisions. This is, of course, the rationale underlying the assertion that output and productivity of traditional agriculture should be increased primarily by enhancing the efficiency of labor and other resources that are already present in large quantities and which are difficult to transfer. Hence, the strategic importance of "developmental services" such as agricultural research and extension-type activities that can lead to substantial increments of output at modest cost—and which

make only limited demands on the resources of high opportunity cost that are required for the expansion of the capitalist sector.

*Economic transformation and capital accumulation.*—Recognition of the importance of expanding the capitalist sector and transforming the structure of a nation's economy brings into bold relief the exceedingly difficult problem faced by an underdeveloped country in mobilizing the capital required for an "adequate" level of investment. Not only is capital required for the creation and expansion of manufacturing and mining enterprises, but also for overhead investment in transportation, power supply, and communications. Additional needs arise because of the capital and recurrent expenditure required to expand education and other essential governmental services, including the "developmental services" stressed above.

There are, moreover, considerations that argue for a determined and fairly large-scale effort to initiate and sustain growth in the manufacturing sector. Most persuasive are the arguments which apply when there are important external economies because of the high degree of interdependence of some types of industrial activities. Chenery's attempt to give an indication of the quantitative importance of some types of external economies provides a measure of support for the view that in making certain industrial investment decisions it is advantageous to undertake inter-related activities together and on an adequate scale (6, p. 114). Hirschman makes a closely related point in emphasizing the desirability of promoting development sequences that have important backward and forward "linkage effects" in the sense that the launching of one enterprise induces decisions to launch related enterprises (18, pp. 100-119).

In sharp contrast with the substantial requirements for investment and for expanding the level of government expenditure, the supply of savings and the tax base are small in an underdeveloped economy. The low level of incomes is an important reason for the restricted supply of savings, but the small size of the capitalist sector is probably even more important. Past experience seems to provide substantial support for Lewis's view that re-investment of profits is the chief source of capital formation. Hence a small capitalist sector implies a very low rate of savings and investment. With regard to the small tax base, it is to be noted that heavy taxation of the emerging manufacturing industry is likely to retard the expansion of this important component of the capitalist sector. Indeed, there are frequently cogent reasons for granting tax exemption to certain manufacturing activities because of the special obstacles that confront new industrial enterprises in an economy that has not achieved much progress toward industrialization.

*Agriculture as a source of capital.*—In an underdeveloped country that is seriously trying to achieve economic progress, the requirements for investible funds and government revenue seem certain to outstrip the supply except in those countries which have large earnings from petroleum or mineral exports or particularly favorable access to foreign capital. The sheer size of the agricultural sector in an underdeveloped economy points to its importance as a potential source of capital for over-all economic growth. During the early stages of economic growth this presumption is particularly strong since re-investment of profits cannot be an important source of capital accumulation when the capitalist sector is only a small segment of the economy. Furthermore, since there is scope

for raising productivity in agriculture by rather moderate capital outlays, the volume of saving and of capital formation financed by the agricultural sector can be increased without reducing the low consumption levels characteristic of the farm population of an underdeveloped country.

Although the possibility exists, political, institutional, and economic problems often make it difficult to translate this increased potential for saving and capital accumulation into an actual increase in investment. Increased agricultural productivity may be reflected in either (a) reduced agricultural prices, (b) a reduction of agricultural inputs, (c) increased farm receipts, or, most likely, (d) a combination of these effects. This cataloguing of the possible effects of increasing productivity in agriculture suggests the major channels by which agricultural development can facilitate capital formation in the modern or capitalist sector.

It has been suggested above that stable or reduced agricultural prices can facilitate capital accumulation by preventing deterioration or even improving the terms of trade on which the industrial sector obtains food and other agricultural products. In the long run, shrinkage of the farm labor force represents the major agricultural input which falls as productivity rises, but that is a slow process depending on capital accumulation and expansion of the capitalist sector.

Before turning to the possibilities of securing a flow of capital out of agriculture, it is well to consider ways in which the resource requirements of the agricultural sector can be minimized. Emphasis has already been placed on the desirability of developing agriculture by methods that make only minimal demands on resources such as investible funds, foreign exchange, and high-calibre entrepreneurial talent, these being indispensable for expansion of the capitalist sector and therefore of high opportunity cost. Accordingly, it has been argued that priority should be given to raising agricultural productivity by technological improvements promoted by appropriate "developmental services" and by direct, non-monetary investment by farm operators. Likewise, it is desirable for the capital requirements for agricultural expansion, including increased outlays for fertilizers, to be financed as much as possible out of increased farm receipts that may accrue with the increase of productivity and output.

Somewhat less obvious are the possibilities of minimizing tax requirements for education and other services provided for the agricultural sector by means of levying school fees, charges for land registration, etc. Quite apart from the political difficulties that may limit action in this direction, careful judgment is also required to determine those instances in which it is *not* desirable directly to link services rendered with a charge to defray all or part of the cost. For example, in the case of a well established export crop, it may be sound policy to cover part of the cost of research and extension activities related to that crop by levying a tax on the product. But in general, the cost of agricultural research and extension should be borne by general tax revenue. Many farmers are likely not to be able or willing to pay for such services because of insufficient income or insufficient awareness of their value. More basic, however, is the fact that the social returns from increased agricultural productivity are usually much larger than the private benefits that can be appropriated by individual producers since innovations are quickly generalized and much of the benefit redounds to consumers in the form of lower prices.

Historically, land taxes have probably been the major means by which agri-

culture has contributed to the capital requirements for general economic development. In the Soviet Union, however, compulsory collection of grain at artificially low prices was the principal device used to siphon off the increase of output originating in agriculture to facilitate the forced-march development of the nation's industry.<sup>14</sup> In Communist China, the program of organizing the farm population into rural communes seems to be aimed not only at extracting the maximum possible surplus of capital from the countryside, but a maximum labor effort as well. In both instances, drastic reorganization of the farm economy was brought about through coercion supported by an all-pervasive effort to shape individual attitudes and behavior to conform to the national goal of achieving the most rapid possible rate of capital accumulation and increase of gross national product.

In societies that value individual freedom and place limits on the coercive powers of government, the problem is more difficult. It is, therefore, by no means surprising that there has been great variation in the extent to which countries have made use of the opportunity afforded by an increase in agricultural productivity to finance over-all economic development.

Japan is perhaps the clearest example of a country where an increase in agricultural productivity contributed significantly to the financing of economic development. Although Japan of the late 19th and early 20th century was far from being a democratic society, the government of that period was also far from wielding totalitarian powers.<sup>15</sup> Real national income produced in agriculture doubled between the decades 1881-90 and 1911-20, during which time the population gainfully employed in agriculture declined by close to 10 per cent. The growth of total national income was even more rapid, a three-fold increase over the same period. Agriculture contributed over 50 per cent of total national income in the earlier period, close to 40 per cent in the 1911-20 decade, and the increase in income in agriculture accounted for some 35 per cent of the total increase.

The special significance of agriculture's role in relation to capital formation in Japan may be inferred from these additional considerations: (1) as pointed out above, the increase in agricultural output was obtained with very moderate government investments in research, agricultural education, and extension-type activities, and with only a moderate increase in purchased inputs; (2) the improvement in the levels of living of the farm population was substantially less than the increase in agricultural productivity, so that much of the increase in national product originating in agriculture was available for urban consumption and for capital accumulation;<sup>16</sup> and (3) a considerable part of the increase in productivity in agriculture was siphoned off by heavy land taxes and other levies on agriculture that contributed largely to government expenditures to promote industrialization.

<sup>14</sup> See 21, pp. 508-10, for a brief discussion and citations relative to the Soviet case.

<sup>15</sup> For an excellent analysis of the democratic forces at work in Japan in the decades following the Meiji Restoration, the reasons for their failure, and for the success of the extremist, militaristic groups in the 1930's, see 37.

<sup>16</sup> This point is clearly at odds with the familiar argument that increased rural incomes resulting from rising farm productivity represents a valuable stimulus to industrial expansion. The latter argument seems most persuasive in relation to products whose manufacture is characterized by economies of scale, so that additional demand is needed to push total demand over a critical threshold.

Tax statistics show that the land tax accounted for 86 per cent of the tax revenue of the national government in the fiscal year 1875/76, 45 per cent of the tax revenue of the General Account in 1893/94, and 22 per cent of the total tax yield in 1906/07, the tax yield in that year being some seven times higher than the tax revenue of the national government in 1875/76 (21, pp. 501-05). Excise taxes and profits of the government's distribution monopolies, which also bore heavily on the farm population, were an increasingly significant source of tax revenue, being more important than the Land Tax after 1900. On the basis of estimates of the division of the total tax burden between agriculture and non-agriculture by Seiji Tsunematsu, it appears that agriculture's share of taxes exceeded 80 per cent as late as 1893-97 and was still above 50 per cent during the years 1913-17 (20). The significance of the tax revenues obtained from agriculture is suggested by the active role the Japanese government played in fostering development by constructing "model factories," subsidizing the creation of a merchant marine and shipbuilding industry, and by strategic investment in overhead capital including railroads, education, and research. Some notion of the quantitative importance of government's role in investment is provided by Rosovsky's estimates of investment in Japan. His data indicate that government investment, excluding military investment, rarely fell below 30 per cent of total investment and exceeded 50 per cent throughout the period 1895-1910 (36, pp. 354-57).

This heavy reliance on agricultural taxation seems to have been a conscious policy of the Meiji leaders, a policy which the economic historian Takao Tsuchiya has rationalized in these terms: "The urgent necessity of protecting and fostering other industries compelled the government to impose a heavy land tax on the agricultural population to obtain the wherewithal to carry out industrial development programs" (30, p. 4).

The role that agriculture has played and is playing in India and Pakistan appears to be strikingly different and gives rise to doubts whether capital accumulation and economic growth will proceed at a "satisfactory" pace. The information available suggests that agriculture's contribution to tax revenue has declined considerably during the postwar period despite the stress that has been placed on promoting economic development. Agriculture has been exempt from general income tax, and the revenue from land taxes has not increased nearly as much as agricultural and other prices. Wald reports that in the seven so-called Part A states in India, land revenues increased only 50 per cent between 1938/39 and 1951/52 while the index of wholesale prices of major agricultural commodities increased 550 per cent during the same period. Land revenues in India provided only 9 per cent of the combined receipts of the central government and states or provinces in 1954, and the comparable figure for Pakistan in 1952 was

On the other hand, if the capital requirements for developing infrastructure and capital goods or export industries are large relative to the amount of capital that can be mobilized, demand is unlikely to be a limiting factor to investment. This condition, we believe, prevailed in Japan during the period 1880-1920, but whether it will be true of a particular nation depends not only on economic factors such as the size of the market, but also on political decisions relative to the pace of development. Developments in Japan during the 1920's suggest that a low level of consumer purchasing power may have been a more important factor limiting expansion of the capitalist sector than lack of investible funds. A tentative examination of the evidence suggests, however, that deflationary policies and an over-valued exchange rate were probably mainly responsible for a marked retardation in the expansion of employment in the capitalist sector in Japan during the years 1920-32 (20).

only 5 per cent. In the prewar year 1939 land revenues contributed something over 20 per cent of total tax revenue (42, pp. 44n, 54, 61-63).

In certain other countries, the agricultural sector has contributed largely to governmental revenue. Although the yield from the land tax in Burma declined from 40 per cent of total government revenue prewar to 5 per cent in 1952, this was offset by the fact that profits of the state agricultural marketing board have provided about two-fifths of the government's revenue from all sources (42, p. 63). Export taxes and allocations from marketing board surpluses have been a major source of development funds in several African countries, particularly Ghana and Uganda.<sup>17</sup>

Although the political difficulties of taxing the agricultural sector are formidable, other obstacles stem from inertia, from some unfortunate characteristics of existing tax schemes, and from a failure to appreciate fully the strategic role that agriculture can and should play in contributing to the capital requirements of economic development. Failure to appreciate agriculture's potential contribution to development is understandable, for in many traditional societies rural taxation was essentially a levy or tribute to support sumptuous living and the construction of monuments by a royal court and nobility. Similarly, a tendency for nationalist leaders to associate land taxation with colonial exploitation has sometimes produced a reaction which led to de-emphasizing or even eliminating taxation of farm land as a significant source of governmental revenue. Indonesia seems to be a conspicuous case in point (35, p. 571).

Although many would differ in emphasis, most economists would doubtless agree with Lewis's conclusion that: "The central problem in the theory of economic growth is to understand the process by which a community is converted from being a 5 per cent to a 12 per cent saver—with all the changes in attitudes, institutions and in techniques which accompany this conversion" (29, pp. 225-26). Since agriculture in underdeveloped countries typically contributes some 40 to 60 per cent of the national income, the presumption is strong indeed that the transition from a level of saving and investment spelling stagnation to one permitting a tolerable rate of economic growth cannot be achieved unless agriculture makes a significant net contribution to capital formation in the expanding sectors. In his highly provocative analysis of factors bearing on "the pace of development," R. F. Kahn reaches similar conclusions. His answer to the question of political feasibility is one that deserves to be pondered: "Governments are judged not only by their failure to introduce unpopular measures but also by their failure to achieve results. If one is looking at all far ahead it is not timidity which appears to offer a safeguard against political upheaval" (23, p. 198).

*Population aspects.*—One final consideration bears on the importance of struc-

<sup>17</sup> The high tax yields in these instances have been partly a result of inertia in that they have been in considerable measure a consequence of rising world prices and an increase in value rather than physical productivity. This is not the place to discuss the pros and cons of export taxes and marketing board surpluses as devices for stabilization or for mobilizing funds for development. Excessively heavy taxation can, of course, "kill the goose that lays the golden eggs," as Nurkse and others believe to have been true of Argentina's policies during the decade following World War II. Moreover, arguments for mobilizing funds by taxing the agricultural sector are not convincing if they result in spendthrift government policies and large expenditures on "public consumption goods" as Walker and Ehrlich judge to have been the case in Uganda (43).

tural transformation as an essential feature of the process of economic growth. Because of the population upsurge that follows the introduction of even a modicum of modern public health measures, it will usually be exceedingly difficult to achieve a substantial increase in per capita incomes unless the sharp decline in death rates is paralleled by a decline in birth rates.

Past experience indicates that structural transformation of an economy together with the accompanying urbanization, increase of incomes, spread of education, and change in attitudes, incentives, and knowledge are necessary conditions for a reduction in birth rates. The possibility exists that direct measures to encourage the reduction of birth rates can be effective in the absence of major changes in the economic and social structure. We are aware of no evidence, however, that provides a basis for believing that such direct measures can by themselves lead to a sufficient reduction of average family size to bring about a leveling off of rapid rates of population growth.<sup>18</sup> Admittedly there are still some underdeveloped countries where sparseness rather than density of population is an obstacle to development. But with the rapid rates of natural increase that have become so common during the period since World War II, there is mounting evidence to suggest that in many countries gains in total output may be absorbed to a large extent in simply maintaining increased numbers with very little improvement in per capita incomes.<sup>19</sup> The historic role of economic and social transformation in contributing to a lowering of birth rates is likely to be highly significant even though its impact may be reinforced and accelerated by more direct measures.

#### IV. CONCLUSIONS

Something must now be said about the over-simplification involved in the general view of agriculture's contributions to economic growth that has been presented here. The specific resource configuration in a country, or region, obviously has great bearing on its agricultural potential and heavily influences the general priorities as well as the details of development.

Since Professor Lewis's version of the classical growth model has been invoked to clarify some of the inter-relationships between agricultural and industrial development, a crucial question is the extent to which the propositions advanced are relevant only to countries with dense rural populations. The nature and extent of the modifications in the two-sector analysis that would be called for in the case of the sparsely populated regions of tropical Africa and South America

<sup>18</sup> Japan's experience is of interest in this regard. Crude birth rates declined slowly from 36.1 per 1,000 in 1920 to 32.4 in 1930 and 29.4 in 1940. Between 1950 and 1955 there was an abrupt decline in the birth rate from 28.1 to 19.3, a decline that seems to have been influenced substantially by widespread resort to abortion which was legalized by the Eugenics Protection Law which became effective in 1949 (41, pp. 269, 311). Since Japan had already witnessed substantial economic and social transformation by 1920, these changes are not particularly relevant to the situation in presently underdeveloped countries. More pertinent to the possible effectiveness of direct measures in rural areas is an experiment carried out by a group of doctors in three Japanese villages. Education to overcome the traditional "Kodakara" concept (that children are the greatest wealth of a family and of a country) and provision of information concerning contraceptive methods (and free contraceptive supplies) led to a decline in the birth rate in these villages from 29.6 to 14.6 per thousand in the third year and 13.6 in the seventh year (25).

<sup>19</sup> The study by Coale and Hoover of *Population Growth and Economic Development in Low-Income Countries* (8) presents a careful and persuasive argument that continuation of present high fertility rates in India will significantly restrict the gains in per capita income that are likely to be attained.

do not seem to have been worked out; and we have not undertaken that task in this paper. It is obvious that mechanization will tend to become economic at an earlier stage if there is a scarcity of labor in the countryside. Whether a relatively sparse rural population will in fact result in inadequate agricultural output or labor shortages and rising wages that deter expansion of the capitalist sector will depend on many factors. Clearly, one crucial factor is the rate of capital formation and expansion of employment in the non-agricultural sectors. Another is the rate of population growth which will influence both the demand for farm output and the supply of labor forthcoming for agriculture and industry. Highly pertinent also are the prospects for developing production of profitable export crops. If land is abundant and there is good potential for enlarging output of export crops, the assumption of surplus labor in agriculture would appear to be highly inappropriate. In British East Africa, for example, recruitment of labor for work on plantations or in industry is commonly alleged to be difficult by those who undertake it.

It is also well to recall that many of the presently underdeveloped countries face special problems because of the limited understanding of the problems of technological improvement with tropical soil and climatic conditions. Extensive research has been carried out with respect to a limited range of commercial export crops, but relatively little attention has been given to the basic food crops. This problem is conspicuously important in tropical Africa where answers are yet to be found for many of the technical and economic problems of developing more productive farming systems as an alternative to the traditional shifting cultivation. There are even indications that in some areas unresolved technical problems in the use of mechanical equipment under tropical conditions is a more important obstacle to mechanization than the economic questions of availability and allocation of funds for the purchase of machinery.

Despite these and other qualifications, we believe that the analysis offered here of the nature of agriculture's contributions to economic development has considerable relevance even for underdeveloped areas where the rural population is fairly sparse. The analysis would have suggested, for example, that large-scale settlement and mechanization schemes such as the Niger Agricultural Project at Mokwa in Nigeria, aimed primarily at increased production of local food crops, represented a highly questionable use of scarce resources. The failure of such projects is not surprising. On the other hand, the notable success of the Gezira Scheme in the Sudan is not hard to explain. The scheme was oriented toward the production of a high-value export crop, long-staple cotton. The Gezira lies in an arid zone where crop production is risky and yields meagre without large-scale irrigation facilities; alternative approaches to agricultural development and other productive employment for the labor force drawn to the scheme were largely ruled out by technical considerations.<sup>20</sup>

Of the wide relevance of certain of the conclusions that have been suggested there can be little doubt. Failure to pay proper heed to increasing agricultural output and productivity is likely to jeopardize over-all economic development. Even though the distinction between resources of high and low opportunity cost

<sup>20</sup> For authoritative discussions of the two projects mentioned see 1 and 16.

may be less applicable in areas of sparse rural population, it remains advantageous to realize the potential that exists for enhancing the productivity of the existing agricultural industry by technological innovations. This in turn points up the high returns obtainable from intelligent efforts to strengthen "developmental services" such as agricultural research and extension programs, particularly when these are combined with increases in conventional inputs such as fertilizers and insecticides. Finally, the proposition that a "satisfactory" rate of growth depends on agriculture making a net contribution to the capital requirements for industrial expansion would appear to apply to most late-developing economies.

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