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ECONOMIC GROWTH AND THE CONTRIBUTION OF
AGRICULTURE: NOTES ON MEASUREMENT

I

WE deal here with the economic growth of nations since the late eighteenth or early nineteenth century. This limitation allows us to specify most clearly the distinctive aspects of modern economic growth that should be measured.

The aspect most easily perceived and most commonly measured is the aggregative. In fact, the usual definition of economic growth—a sustained increase in a nation's total and *per caput* product, most often accompanied by a sustained and significant rise in population—stresses this aspect. 'Sustained' means persisting over a long period and not in the nature of a cyclical or otherwise short-term expansion. 'Increase' means more than a formal mathematical requirement, in that it could not be satisfied by a rate of one-millionth of 1 per cent. per century. In the eighteen to twenty-four nations that may be said to have experienced modern economic growth, product *per caput* grew at rates ranging from well above 10 to close to 30 per cent. per decade, and total product at rates ranging from 15 to over 40 per cent. per decade; and, with some striking exceptions, population grew at rates ranging from 8 to 20 per cent. per decade.¹ A rate of 10 per cent. per decade means doubling in somewhat over 70 years; of 20 per cent. in less than 40 years; of 30 per cent. in less than 30 years; of 40 per cent. in about 20 years. With modern economic growth extending over a century in many of the developed nations, the rise sustained in total and *per caput* product was of a magnitude rarely if ever reached in the past.

The second interesting aspect is the structural. The significant characteristics of the rises associated with modern growth are the large and rapid shifts that occur in the structure of an economy—in the relative importance of various industries, regions, classes of economic units distinguished by form of organization, economic classes, commodity groups in final output and so on. The frequent

¹ See my *Six Lectures on Economic Growth* (The Free Press of Glencoe, Ill., 1959), pp. 19–28.

references to modern economic growth as 'industrialization' and to its important constituent elements in terms such as 'urbanization' and 'mechanization', clearly indicate these structural aspects; while even slight acquaintance with the literature on economic growth reveals that the main burden of the analysis is not on the aggregative but on the structural characteristics. The measures usually provided are the familiar distributions of product, capital and labour among industrial sectors; among regions; between the private and the public sectors, and by further divisions within each; and among various socio-economic groups.

The third aspect is the international. We distinguish this aspect in order to stress the facts that, except for the single pioneer nation, all nations participating in modern economic growth view the prospects initially as the task of adopting (and adapting) potentials already demonstrated elsewhere in the world; that no nation can grow in an international vacuum; and that the process of a nation's growth involves a pattern of sequential interrelations with others—more developed and less developed. In a sense, then, the modern economic growth of any one nation is a process of shifting from the underdeveloped to the developed group, utilizing the appropriate channels of international trade, finance and communications in general. Although this whole process of borrowing the knowledge and resources that are indispensable in a nation's modern economic growth cannot be measured, a wide variety of statistical data on foreign trade, foreign capital movements and international migrations have been assembled. Hence the view of the changing *domestic* structure of a nation's economy in its process of growth can be supplemented by a view of the sequential pattern of the economic flows between it and the rest of the world.¹

The three aspects are clearly interrelated. The rise in *per caput* product, essential to the aggregative view of economic growth, in and of itself means a shift in consumption and savings patterns and thus contributes to the shift in the industrial and other structures of the economy. On the other hand, it is the utilization of the technological potential of modern times through the development of new industries

¹ The importance of this aspect is not denied by the experience of the Communist countries. Initially they also borrowed extensively and imported considerably from abroad—which is natural, since they were follower nations. That these ties with other nations have not continued to grow as they did with the more freely organized societies is but another case of changes in the pattern of economic growth as we move from the pioneer nation, to the first and then the more removed (in time and in character of historical antecedents) follower nations.

and new methods of production—which means structural shifts—that permits a rise in product *per caput*. And the aggregative growth and certain structural shifts provide the surpluses for international trade and capital movements; while the latter, bringing the benefits of international division of labour, are in turn conducive to the greater aggregative growth of the participating nations and thus to greater structural shifts within them. This close association is hardly surprising, since a nation's modern economic growth may be described as the utilization of domestic and international division of labour, under conditions of changing technology, to increase *per caput* product of a growing population.

Given this interrelation, it is often impossible to specify the contribution of a single industrial sector, say agriculture, to each aspect of economic growth. Nor is it particularly illuminating to do so. For if a sector contributes directly to the growth of product per worker, it indirectly contributes to structural shifts and greater international division of labour; if a sector contributes directly to foreign trade, it indirectly contributes to growth of product *per caput* and to structural shifts within the country. It would seem preferable to consider the contribution of agriculture to economic growth jointly in all three aspects of the process, and then examine the various ways in which such a contribution may be rendered. Some of these ways bear more directly on aggregative aspects of growth than on the structural; others bear more directly upon the structural or international than upon the aggregative. But each has some bearing on all three related aspects of economic growth.

II

In considering the contribution of agriculture, or for that matter of any sector, to the economic growth of a country, we must first recognize an element of ambiguity. Since any sector is part of an interdependent system represented by the country's economy, what a sector does is not fully attributable or credited to it but is contingent upon what happens in the other sectors (and perhaps also outside the country). Thus, even if we deal with net product originating in, or contributed by, a sector, deducting the purchases or contributions from others and limiting the total to the product of the factors attached to that sector, the magnitude and movement of the net product so measured still depend upon the rest of the economy; and its product may perhaps be more correctly described as the

result of the activities of the economy whose particular *locus* is the given sector—rather than as a contribution of the given sector fully creditable to it as if it were outside the economy and offering something to the latter. But so long as we keep the semantic caution in mind, and remember that the capacity of a sector to ‘contribute’ depends not upon the sector alone, no harm is done by retaining this familiar expression.

The first type of contribution of agriculture to the economic growth of a nation is that constituted by growth of product within the sector itself. An increase in the net output of agriculture, in and of itself, represents a rise in the product of the country—since the latter is the sum of the increases in the net products of the several sectors. This type, which we may call the product contribution, can be briefly examined—as a contribution first to the growth of *total* net or gross product, and second to the growth of product *per caput*.

We begin with a simple algebraic notation and refer to ‘product’, since the formal conclusions are the same for product gross of capital consumption (gross national product, and corresponding gross product originating in the sector) or net of it (net national product, and corresponding net product originating in the sector).

Designate:

P_a —product of agriculture (*A* sector).

P_b —product of all other sectors (non-*A* sector).

P —total product = $P_a + P_b$

δP —increment in total product—aggregate growth.

r_a —rate of growth of P_a so that $P_a^1 = P_a^0 (1 + r_a)$, the superscripts referring to time.

r_b —rate of growth of P_b so that $P_b^1 = P_b^0 (1 + r_b)$.

Then,
$$\delta P = P_a r_a + P_b r_b. \quad (1)$$

And the equation for the share of the growth of agricultural product in the growth of total product is:

$$\frac{P_a r_a}{\delta P} = \frac{1}{1 + \left(\frac{P_b}{P_a} \times r_b \right)}. \quad (2)$$

Thus, if at the initial point of time, the share of agriculture in countrywide product is 60 per cent.—which is about the highest for an underdeveloped country¹—and if over the next decade the rate of

¹ See my paper on ‘Industrial Distribution on National Product and Labor Force’, *Economic Development and Cultural Change*, vol. v, no. 4, supplement, July 1957, table 3, p. 10.

growth of the non- A sector (r_b) is four times as high as that of the A sector (r_a), the product contribution of agriculture to the growth of total product will be 1 divided by $(1+0.67 \times 4)$, or about a quarter. At the end of that decade the initial share of agriculture in total product will be less than 60 per cent., and if r_b/r_a remains four, the following decade will witness a product contribution of agriculture to growth of total product smaller than a quarter.¹

Several conclusions can be derived from equation (2). Firstly, so long as the rate of growth of the non- A sector is higher than that of agriculture, all other conditions being equal, the proportional contribution of agriculture to the growth of total product will decline. The only component in equation (2) that might prevent such a decline is the ratio r_b/r_a : a decline in it might counteract the effect of the rise in P_b/P_a . Secondly, if r_b/r_a rises, i.e. if the rate of growth of the non-agricultural sector is increasingly higher than that of agriculture, the decline in the share of agriculture in the growth of total product would be even greater. Thirdly, if we assume that the rate of growth of countrywide product is *constant* over time (only a few countries showed acceleration in the long-term movement), and if r_b/r_a is over 1, i.e. if the rate of growth of the non-agricultural sector is higher than the rate of growth of agriculture, then either r_b , or r_a , or both, must decline over time. For if they remain constant, the increasing weight of P_b (enjoying a higher rate of growth) will make for an *acceleration* in the rate of growth of total product.

¹ There is a direct relation between the ratio of rates of growth of product in the non- A and A sectors (r_b/r_a) and the movement of the ratio of the product of the A sector to the total. This can be expressed by the following equation:

$$\frac{(1+r_b)}{(1+r_a)} = \frac{P_a^0}{P_b^0} \left(\frac{P^1}{P^0} - 1 \right). \quad (3)$$

Thus, if at time point 0, the first ratio in the right-hand side of equation (3) is 1.5, meaning that the shares of the A sector and the non- A sector in total product are 60 and 40 per cent. respectively; and if over the next decade the share of the A sector drops to 55 per cent., the value on the right-hand side becomes 1.5 $(1/0.55 - 1)$ or 1.23. Then, if the rate of growth for agriculture is 10 per cent. per decade, $(1+r_a)$ becomes 1.10; and $(1+r_b)$ becomes 1.35; and the rate of growth for the non- A sector 35 per cent. per decade, or 3.5 times as high as that for the A sector. When the share of agriculture drops from 30 to 25 per cent., the right-hand side of equation (3) becomes:

$$\frac{0.30(4-1)}{0.70} \text{ or } 1.29;$$

and if $(1+r_a)$ is still 1.10, $(1+r_b)$ becomes 1.42, yielding a rate of growth 4.2 times as high as that for agriculture. Likewise, if we lower the rate of growth in agriculture, and set $(1+r_a)$, at, say, 1.05, under the conditions illustrated above, $(1+r_b)$ becomes 1.29 and 1.35 respectively, yielding rates of growth for the non- A sector six or seven times as high as those for the A sector.

Let us turn now from the product contribution of agriculture to the growth of countrywide product *per caput*, or rather per worker—a more meaningful unit for sectoral analysis.

Designate (in addition to the notation above):

L_a = workers in the A sector.

L_b = workers in all other sectors.

L = all workers = $L_a + L_b$.

R = rate of growth of product per worker (same in both the A and non- A sectors).

Then, we have the following expression for the change in total product per worker:

$$\frac{P^1}{L^1} - \frac{P^0}{L^0} = \left(\frac{P_a^1}{L_a} - \frac{P_a^0}{L_a^0} \right) \left(\frac{L_a^1}{L^1} \right) + \left(\frac{P_b^1}{L_b} - \frac{P_b^0}{L_b^0} \right) \left(\frac{L_b^1}{L^1} \right) + \left(\frac{P_b^0}{L_b} - \frac{P_a^0}{L_a^0} \right) \left(\frac{L_b^1}{L^1} - \frac{L_b^0}{L^0} \right). \quad (4)$$

Equation (4) tells us that the increment in a country's aggregate product per worker is the sum of: (a) the increment in product per worker in the A sector, weighted by the share of the A sector in labour force *at the end* of the period; (b) the increment in product per worker in the non- A sector, weighted by the share of the non- A sector in labour force *at the end* of the period; (c) the *change* in the share of the non- A sector in the labour force (usually a rise) during the period, weighted by the difference between product per worker in the non- A and A sectors at the beginning of the period.

If we assume that P_b/L_b is larger than P_a/L_a , which is usually the case, and set the ratio for time 0 at 2; and if we assume further that products per worker in the A sector and in the non- A sector grow at about the same rate—not an unreasonable assumption in the light of records for the developed countries—equation (4) can be simplified to:

$$\frac{P^1}{L^1} - \frac{P^0}{L^0} = \frac{P_a^0}{L_a^0} [(L_a^1/L^1)R + (L_b^1/L^1)2R + (L_b^1/L^1 - L_b^0/L^0)], \quad (5)$$

Thus, if the initial share of the labour force in agriculture is as high as 75 per cent., product per worker in agriculture only half of that in the non-agricultural sectors, the rate of growth in product per worker per decade (for both sectors) 20 per cent., and the share of labour force in the non-agricultural sector increases 5 percentage points per decade—a not unreasonable figure—the right-hand side of equation (5) for the first decade becomes

$$\frac{P_a^0}{L_a^0} [(0.70)0.20 + (0.30)0.40 + 0.50].$$

The first component (*a*) of the right-hand side of both equations (4) and (5) is clearly a measure of the contribution of agriculture to the growth of countrywide product per worker; while the second component (*b*) is clearly a measure of the contribution of the non-*A* sector. But what about the third component (*c*), the effect of the shift in the percentage distribution of the labour force from the *A* to the non-*A* sector? It is in this connexion that the ambiguity of the term 'contribution' emerges. In one sense it is a contribution of the *A* sector, since the latter provides additional labour force to the non-*A* sector; and as will be seen below, the internal migration involved in this shift must be quite large in the process of modern economic growth. In another sense the shift is a contribution of the non-*A* sector, since the latter provides the essential employment opportunities to the labour moving from the *A* sector. The allocation of this joint contribution to the *A* and non-*A* sectors is clearly a matter of judgement. If we divide it equally between the two, the proportional contribution of agriculture to the countrywide growth of *per caput* product becomes in the example above $(0.14 + 0.025)/0.31$, or somewhat over one-half.

On the assumptions underlying equation (5), and however we allocate the third component, some general statements can be made as to the level and movements of the proportional contribution of agriculture to additions to countrywide product per worker. Firstly, this proportional contribution will be larger, the larger the terminal share of agriculture in the country's labour force, and the higher the ratio of product per worker in agriculture to that in the non-*A* sector. And, if we permit the rate of growth of product per worker in the *A* and non-*A* sectors to differ, the proportional contribution of the *A* sector will be larger, the higher the ratio of the rate of growth of product per worker in the *A* sector to that in the non-*A* sector. Secondly, in so far as in the course of economic growth the share of agriculture in the labour force declines, there will be a continuous decline in the proportional contribution of agriculture to the growth in countrywide product per worker—unless the rate of growth of product per worker in the non-*A* sector falls behind the rate of growth of product in the *A* sector—which is unlikely. Thirdly, if we assume that the countrywide product per worker grows at a constant percentage rate, the continuous shift of the labour force from the *A* sector with its lower product per worker to the non-*A* sector with its higher product per worker *must* be accompanied by a decline in the

rate of growth of product per worker in the *A* sector, or in the non-*A* sector, or in both. The slight damping influence of the third component—the absolute rise in the share of the non-*A* sector in the labour force—may be disregarded, since its weight is likely to be small. The parallelism of these conclusions to those derived for the proportional contribution of agriculture to growth of total product is obvious.

These rather simple schemes could be applied to the empirical long-term records on product, labour force and product per worker—in total and for the two sectors separately—for a number of countries, and with the product valued at constant prices to eliminate the effect of price changes. Such statistical analysis would probably show in countries with a high rate of economic growth, with respect to overall aggregates and consequent structural shifts, a rapid decline in the proportional contribution of agriculture—from a quarter or more of the growth of total product and a half or more of the growth of *per caput* product, to a few percentage points. It must be remembered that currently the share of agriculture in both product and labour force in many developed countries is well below 20 per cent. The analysis of the statistical evidence might also reveal more about the time pattern of the movements. But to present such an analysis in adequate detail would transcend the limits of the paper; and we prefer to devote the rest of the discussion to other somewhat less obvious and perhaps less familiar types of contribution of agriculture to a country's modern economic growth.

III

A given sector makes a contribution to an economy when it provides opportunities for other sectors to emerge, or for the economy as a whole to participate in international trade and other international economic flows. We designate this contribution the market type because the given sector provides such opportunities by offering part of its product on either domestic or foreign markets in exchange for goods produced by the other sectors, at home or abroad.

Thus in the case of agriculture, we can envisage two contrasting situations. In one, agriculture engages 100 units of labour force to turn out 1,000 units of product without any purchases from other sectors, and thus in complete independence of the country's production processes. In another, agriculture engages 80 units of labour force and still turns out 1,000 units of product—but does so by purchasing

200 units of fertilizers, &c., provided by 20 units of the country's labour force. In both cases, the net output of the economy, with the same labour force, is the same—1,000 units of final goods. But in the second case we have market transactions and diversification of the structure of production.

The example is unrealistic, for the division of labour in the second case would, usually, result in an appreciably higher product per worker. Indeed, this rise is the very reason for the reduction in the economic independence of a sector and its engagement in trade with other sectors at home or abroad. But the illustration does emphasize the contribution of changes in a sector to the significant element in economic growth of diversification of structure—the intensification of the internal and international division of labour. These changes are important in and of themselves—apart from the contribution that they make to growth in total or *per caput* product.

Thus agriculture makes a market contribution to economic growth by (a) purchasing some production items from other sectors at home or abroad; (b) selling some of its product, not only to pay for the purchases listed under (a) but also to purchase consumer goods from other sectors or from abroad, or to dispose of the product in any way other than consumption within the sector. In all these ways, agriculture makes it feasible for other sectors in the economy to emerge and grow and for international flows to develop; just as these other sectors and the international flows make it feasible for the agricultural sector to operate more efficiently as a producing unit and use its product more effectively as a consuming unit.

In this connexion, some familiar trends in agriculture in countries that have experienced modern economic growth come easily to mind. There is first the spread of modern technology to agriculture proper: chemical fertilizers, machinery and mechanical power replaced extensively means of production originating within agriculture itself (such as natural fertilizers, draught animals and hand-made tools). The need to purchase these new production goods from other sectors meant an increasing 'marketization' of the production process within agriculture; and it is reflected in the increasing proportion that purchases from other sectors constitute of the product of agriculture—gross of all production expenses. To cite an easily available statistical example: in the United States of America the *net* farm income in 1910 amounted to slightly less than 80 per cent. of *gross* farm income; whereas in 1950 it was less than 70 per cent. (both totals are in constant prices, and are

five-year averages centred on the years cited).¹ Thus the proportion of outside purchases (including capital consumption) rose over the forty years from about 20 to about 30 per cent. of the gross product.

The proportion of gross income accounted for by purchases from other sectors is clearly a crude and incomplete measure of the marketization of the production process in agriculture. We treat all agriculture here as one sector, disregarding the network of market transactions within agriculture—transactions which presumably grow in absolute and *proportional* volume as agriculture becomes more specialized and diversified in the course of economic growth. A more complete measure would be based on records of outside purchases at each farm—making it independent of arbitrary definitions of a sector. But so long as we understand what is involved in the marketization of the production process in agriculture, we need not dwell upon its measurement.

There is another question, however, viz. how to measure the 'contribution' to economic growth. The measure just discussed is a gauge of relative importance of purchases from outside to the gross product of a sector—not of their proportional contribution to a country's economic growth. We need here to define the aspect of the latter to which we think marketization contributes—over and above its indirect contribution to total and *per caput* product.

The aspect is clearly development of sectors other than agriculture; and this could be measured by comparing the non-agricultural sectors in the country providing production goods to agriculture with all the non-agricultural sectors. In other words, the percentage of the growth in output of all non-agricultural sectors (including the transportation and other facilities involved), accounted for by the fertilizer, agricultural machinery and other plants that provide the production goods to agriculture, would measure the proportional contribution which marketization of the production process in agriculture made to the industrialization aspects of economic growth within the country. What the facts in the situation are I am in no position to state, but a realistic illustration may suggest the order of magnitude. Assume that the proportion of purchases from other sectors to *gross* product of agriculture increased in the process of growth from 10 to 30 per cent.; which, in percentages of *net* product, meant a shift from 11 to 43 per cent. Assume further that at the initial point of time the

¹ See Alvin Tostlebe, *Capital in Agriculture: its formation and financing since 1870*, National Bureau of Economic Research, New York, 1957, table 20, p. 101.

proportion of net income from agriculture to net national product was 60 per cent., and declined to 15 per cent. at the end. Purchases by agriculture from other sectors (gross) were therefore 6.6 per cent. of net national product at the initial point of time and less than 6.5 per cent. at the end point; and if we reduce this proportion by a fifth to allow for the difference between gross and net content ('net' representing returns to factors), we have roughly 5.3 per cent. of net national product represented by industries whose only function is to supply producers' goods to agriculture. The percentage works out at 13 and 6 per cent. respectively ($5.3/40$ and $5.3/85$) of the net product of all non-agricultural industries. Marketization of the agricultural production process thus accounted for a significant but declining fraction of the 'industrialized' sectors and of the structural aspect of economic growth.

We turn now to the increase in the proportion of agricultural *net* product which is not consumed within the producing farm or agriculture proper but is sold on the markets in which agriculture trades with other sectors of the economy or abroad. This trend is largely due to a rise in net product per worker within agriculture combined with the low secular income elasticity of the demand for agricultural consumer goods, but it may also reflect technical progress that reduces cost and facilitates transportation and trade over wide areas. The contribution to economic growth here is the release of a larger proportion of the *net* product of agriculture as a basis for demand for consumer goods (or, to a more limited extent, of producer goods) from other sectors in the economy and from foreign countries.

Some suggestion of the magnitude of such marketization of the net product of agriculture can be made on two alternative assumptions, both disregarding the minor fraction of the net product that may be saved (rather than consumed). On the first assumption, the per worker (or *per caput*) consumption of agricultural net product is the same in both the *A* and non-*A* sectors, despite the large difference in their total income *per caput*. On this assumption, if we begin with a share of the *A* sector in net national product of 60 per cent. and in the labour force of 75 per cent., per worker or *per caput* consumption of agricultural net product throughout the economy will be 0.6 (in percentages of net national product); the consumption by the agricultural population of its own product will be 75 per cent. multiplied by 0.6, or 45 per cent. of net national product; and their consumption of other goods will be 15 per cent. (i.e. 60 per cent. of

total net product minus 45 per cent. represented by agricultural product). If we also assume that all the non-agricultural final product goes through the market, the total marketed net product is 55 per cent. of net national product, of which 15 per cent. is agricultural final product. The contribution of agriculture to total marketed net product is then slightly over a quarter; and it is clear that as the shares of agriculture in national product and in labour force decline, its proportional contribution to the growing marketed net product will decline. Thus when the share of agriculture in the national product is down to 15 per cent., and in the labour force correspondingly down to 26.1 per cent. (to preserve a ratio of product per worker in the non-*A* sector to that in the *A* sector of 2 to 1), the marketed portion of agricultural net product will, on the assumptions stated, be 11.1 per cent. of national product; the total marketed portion will be 96.1 per cent. (i.e. 85 per cent. non-agricultural output plus 11.1 per cent. agricultural); and the proportional contribution of agricultural marketings to total will be about a ninth rather than over a quarter.

An alternative assumption would be that the distribution of final consumption (which, disregarding savings or capital formation, we equate to net national product) between agricultural and non-agricultural products—for both agricultural and non-agricultural populations—is the same and in fact is shown by the shares of agriculture and of other sectors in the countrywide total of net product. Thus, at the initial point of time, with the share of agriculture in the net national product of 60 per cent., the agricultural population would consume only 60 per cent. of its net income in the form of agricultural products; and trade the remainder, i.e. 24 per cent. of net national product, to the people dependent upon the non-agricultural sectors. The total marketed product would be 64 per cent. of net national product (40 per cent. represented by non-agricultural output, all marketed; and 24 per cent. by the marketed, agricultural output); and agriculture's contribution to it will be 24 out of 64, or close to four-tenths. On this assumption, when the share of agriculture in national product drops to 50 per cent., half of the agricultural output would be traded, i.e. 25 per cent. of total product—a slightly higher percentage than in the first instance, but a lower share of the total marketed output (which will be 75 per cent.).

Which assumption is the more realistic would have to be determined by empirical study; and the actual behaviour of agricultural and non-agricultural producers and consumers may fall within the range

suggested by the two assumptions. However, the main points to be noted are suggested under either assumption. Firstly, at the initial point of time, when agriculture accounts for a large share of the net output of the economy, the extent to which such product is traded with the other sectors has a major bearing upon the width of the economic base which these other sectors may enjoy. If, for simplicity's sake, we think of a closed economy, any difficulty in increasing the marketable surplus of agricultural product will restrict the growth base of the other sectors. Secondly, once growth occurs and is accompanied by a decline in the shares of agriculture in both product and labour force, the increased productivity per worker in agriculture reflected in these trends assures an increasing proportion of marketed agricultural net product and at the same time a decreasing proportional contribution of such marketings to the total product of the economy. In short, the market contribution of agriculture to a country's economic growth, strategic in the early periods of growth, must, in the nature of the case, diminish in relative weight once growth has proceeded apace.

The same conclusion is suggested by the third aspect of the market contribution of agriculture: that bearing upon the type of trading partner with whom market relations are established. The market contribution to economic growth will be the greater the higher the growth-inducing power of the trading partners whose co-operation via the market is being secured. The same volume of purchases by agriculture from a host of village carpenters, blacksmiths, &c., and from a factory that produces agricultural machinery by advanced methods, will have different impacts on the growth not only of the non-agricultural sectors of the economy but also of agriculture itself.

It is in this connexion that the contribution of agriculture to exports assumes strategic importance, since in most countries modern economic growth is a matter of following the pattern set by the nations that have already experienced this process; and it is exceedingly important for a follower nation to trade with the more advanced countries which can provide it with the tools of modern technology. Even with allowance for capital imports, a country in the early stages of economic growth that cannot itself produce, even at high cost, the tools of modern technology, must be able to offer the more advanced countries a *quid pro quo*. It can do this only with products in which it has a comparative advantage; and in the nature of the case this advantage

is likely to lie in natural resources rather than in skills. Since agriculture, after mining, is the sector in which natural endowments have greatest weight, it is hardly a surprise that in the initial stages of growth of many presently developed countries, agriculture was a major source of exports and that the resulting command over the resources of the more developed countries played a strategic role in facilitating modern economic growth. It is also apparent that, as economic growth continued, the advantage with respect to products affected by natural resource endowments might recede relative to that resulting from economies of scale and accumulation of skills in other sectors. Consequently, in addition to the reduction in the weight of agriculture in the total output of a country, there may be an even greater reduction in its share of exports. Thus the market contribution of agriculture, this time in specific connexion with the capacity of a country through international trade to tap the resources of the more advanced units, is likely to be large in the initial stages of growth (unless the mineral resources are sufficiently great to make agricultural exports less strategic) and bound to decline as economic growth takes hold in a country. While any detailed analysis of the relations touched upon here would raise difficult questions concerning the phasing of this process of building economic growth on trade with the more advanced countries, the substance of the contribution is clear and the measures, in terms of shares of exports and feasible imports of capital goods, are obvious without further discussion.

IV

The third type of contribution by a sector to economic growth occurs when there is a transfer or loan of resources from the given sector to others. Thus if agriculture itself grows, it makes a product contribution; if it trades with others, it renders a market contribution; if it transfers resources to other sectors, these resources being productive factors, it makes a factor contribution.

The resources being transferred are either capital, or rather funds for financing acquisition of material capital, or labour. In the case of the former, two different types of transfer may occur. In the first there is a compulsory transfer from agriculture for the benefit of other sectors; and this is ordinarily done through taxation of a kind in which the burden on agriculture is far greater than the services rendered by government to agriculture (including an adequate share of overhead government expenses), the residue being spent by government for the

benefit of other sectors. To illustrate, the government may use a tax on agriculture as its only revenue, and expend it all either on a subsidy to some manufacturing industry (thus in fact providing capital funds for the latter), or use it all in the construction of some public utility. To be sure, both the factory and the public utility contribute to growth within agriculture proper; but the direct contribution to economic growth is to the non-agricultural sectors, and this flow, originating in the agricultural sector, is not covered in its product or market contribution.

The measurement of such forced contributions of agriculture to economic growth is not easy; the incidence of some indirect taxes is difficult to ascertain and the allocation of government expenditures in terms of benefits to agriculture and to economic growth elsewhere is far from simple. But this factor contribution by agriculture was clearly quite large in the early phases of economic growth in some countries. Thus in Japan in the last two decades of the nineteenth century the land tax was over 80 per cent. of central government taxation, and the direct tax ratio to income produced was between 12 and 22 per cent. in agriculture, compared with from 2 to 3 per cent. in the non-agricultural sectors.¹ Forced extraction of surplus from agriculture by taxation, confiscation and other measures also probably financed a considerable part of industrialization in the Soviet Union. Indeed, one of the crucial problems of modern economic growth is how to extract from the product of agriculture a surplus for the financing of capital formation necessary for industrial growth without at the same time blighting the growth of agriculture, under conditions where no easy *quid pro quo* for such surplus is available within the country. It is only the open economy, with access to the markets of the more highly developed countries, both for goods and for capital loans, that can minimize this painful task of initial capital accumulation.

The other form of capital transfer is, of course, lending, or the utilization of savings originating in the agricultural sector in financing the growth of the non-agricultural sectors. Provided that we have data both on savings and capital formation, both in agriculture and in other sectors of the economy, there is no problem in measuring the extent to which savings originating in agriculture contribute to the

¹ See Kazushi Okhawa and Henry Rosovsky, 'The Role of Agriculture in Modern Japanese Economic Development', in *City and Village in Japan, Economic Development and Cultural Change*, vol. ix, no. 1, part ii, October 1960, tables 14 and 15, pp. 61 and 62.

financing of capital formation elsewhere in the economy. But no such data are at hand for my purposes, and we are forced to speculate on the magnitudes involved.

In such speculation the following general points must be taken into account. In the initial phases of growth the share of agriculture in total national product is large, but the *per caput* income in the *A* sector is distinctly lower than that in the non-*A* sector. Hence the share of domestic savings originating in agriculture is a function of the share of agriculture in total income, the lower level of real income in agriculture than in the other sectors, and the relative propensity to save of the agricultural population and of other groups in the economy. To assay these three variables would necessitate much empirical study. But to make the discussion more meaningful let us begin with a share of the *A* sector in income of 60 per cent., in labour force of 75 per cent.; and assume that savings amount to 5 per cent. of the *A* sector income, which on a *per caput* basis is only half of the income in the non-*A* sector, compared with a 10 per cent. savings rate for the non-*A* sector. Total domestic savings would then amount to 7 per cent. of national income, 4 per cent. originating in the non-*A* sector and 3 per cent. in the *A* sector.

The flow of savings out of the *A* sector to finance capital formation elsewhere would depend largely upon the relative needs of these sectors for capital, which needs are reflected in differential rates of return (all other conditions being abstracted from). Perhaps the incremental capital-output ratios might suggest how much capital is needed to secure additional output. The data for recent years indicate that in all but the most fully developed countries the incremental capital-output ratios for the *A* sector, while higher than those for manufacturing, are not too different from the countrywide ratios and hence from those for the non-*A* sector as a whole.¹ If this situation can be assumed to hold for the early phases of economic growth, the allocation of savings depends largely upon the relative rates of growth of the *A* and non-*A* sectors, reflecting differences in long-term demand for additions to their product. Hence, whether or not there will be a flow of savings from the *A* sector to finance capital formation in the non-*A* sector will be revealed by a comparison of two fractions: the first is the ratio of additions to product of the *A* sector to additions to the

¹ See my paper 'Capital Formation Proportions: International Comparisons for Recent Years', *Economic Development and Cultural Change*, vol. viii, no. 4, part ii, July 1960, table 15, p. 64.

total product of the economy—already discussed under the product contribution of agriculture, and expressible as $P_a r_a / (P_a r_a + P_b r_b)$; the other fraction is the ratio of savings originating in agriculture to all savings originating in the economy, which can be written as $s_a / (s_a + s_b)$. Now if we assume, in addition, that the net savings rate is 7 per cent., that national product grows at a rate of 3 per cent. per year (or 34.4 per cent. per decade), implying an incremental capital-output ratio of 2.3 to 1; and that the rate of growth of the product of the non-*A* sector is four times that of the product of the *A* sector, the *needed* capital formation in the *A* sector will be only 27 per cent. of total capital formation needed;¹ whereas savings originating in agriculture are 43 per cent. of total savings. There will therefore be a flow of savings originating in the *A* sector into capital formation in the non-*A* sector, accounting for 16 out of 73, or somewhat less than a quarter of the latter.

The example is purely illustrative; and the discussion is designed only to bring out the variables that would have to be measured in empirical study. The rate of growth of the product of the non-*A* sector might well be more than four times that of the *A* sector. The incremental capital-output ratio for the *A* sector might well be distinctly lower than, rather than equal to, the capital-output ratio for the non-*A* sector—in some countries in some periods agricultural output could be increased significantly with little or no capital investment. If these two contingencies were to materialize, the flow of savings from agriculture to finance capital formation elsewhere would be relatively larger than is suggested in the illustration. On the other hand, we are dealing with domestic savings alone, disregarding financing from abroad—capital imports that were quite important in the early phases of growth of several countries, such as Canada, Australia and Scandinavia. But this is a matter with which Professor Cairncross's paper is to deal at length.

We may now turn to the third type of factor contribution made by agriculture to the economic growth of a country—the provision of labour. While this shift of labour from the *A* to the non-*A* sectors in the process of modern economic growth has become quite familiar,

¹ This can be calculated from the equation: $(0.60)r + (0.40)4r = 3.0$. r , the rate of growth for the *A* sector, is then 1.364 per cent., that for the non-*A* sector four times as high, or 5.456 per cent. Multiplying the former by 0.60 yields the increment of the product of the *A* sector, or 0.818; multiplying the latter by 0.40 yields the increment of the product of the non-*A* sector, or 2.182; and the ratio of the increment in the *A* sector to increment in total product, and, on the assumption used, of the capital needs of the *A* sector to total capital needs, is then 0.818/3, or 27 per cent.

the magnitude of the migration and of the factor contribution involved may not have been given the attention that it deserves.

To begin with, we must stress the fact that through the periods under discussion and in almost all the countries, the crude (and refined) birth-rates of the agricultural populations were distinctly higher than those of the non-agricultural; whereas the death-rates were at least equal, if not lower, for the agricultural.¹ This means that the rate of natural increase was very much higher for the agricultural than for the non-agricultural population; and consequently for the agricultural than for the non-agricultural labour force.

The orders of magnitude can now be suggested. At the initial point of time, when the share of the *A* sector in the labour force was 75 per cent., we may set the crude birth-rate for the agricultural population at about 40 per 1,000, with that for the non-agricultural at about 27 (the ratio of the former to the latter being roughly 1.5). If we set the crude death-rates at 20 per 1,000 for both groups, the rate of natural increase for the two sectors, for population and hence for the labour force (with some lag), will be 20 and 7 per 1,000, respectively. Thus the rate of growth of the agricultural labour force, owing to its rate of natural increase, is almost three times that of the non-agricultural. Incidentally, on these assumptions the rate of natural increase for total population, i.e. the countrywide rate, works out at 16.75 per thousand.

Consider now the internal migration of the labour force that would be required over a decade for the share of the *A* sector in the labour force to decline from 75 to 70 per cent., under the assumption of a closed population (i.e. no international migration). Over that decade, total labour force would rise from 100 to 118.23, labour force in the *A* sector would rise from 75 to 91.425, and that in the non-*A* sector from 25 to 26.805. To secure a 70-30 apportionment, the 91.425 in the *A* sector would have to be reduced by internal migration to 82.761—a migration out of the *A* sector of roughly 8.7 per cent. of the countrywide initial labour force, or over 9 per cent. of the labour

¹ See a summary discussion in United Nations, *The Determinants and Consequences of Population Trends*, New York, 1953, p. 62, on urban-rural differentials in mortality, and pp. 85-86 on urban-rural differentials in fertility. For more recent discussion of these differentials in fertility see the papers by Gwendolyn Johnson (pp. 36-72) and by Clyde Kiser (pp. 77-113), in Universities-National Bureau Committee on Economic Research, *Demographic and Economic Change in Developed Countries*, Princeton University Press, 1960; and the paper by T. Lynn Smith, 'The Reproduction Rate in Latin America: Levels, Differentials and Trends', *Population Studies*, vol. xii, no. 1, July 1958, pp. 1-17.

force that *would* have been in the *A* sector at the end of the decade if not for internal migration.

This transfer of workers from the *A* to the non-*A* sector means a sizeable capital contribution because each migrant is of working age and represents some investment in past rearing and training to maturity. What is the magnitude of this investment in human beings? Let us assume that every worker migrating from the *A* sector embodies outlays on rearing, education and training equal to ten times the current product per worker in the *A* sector (this is a rough ratio, based on an average prior year's outlay of about six-tenths of the current *per caput* income multiplied by 17, the age assumed at transfer). If, then, in each year of the decade something like 1.01 per cent. of the labour force in the *A* sector moves to the non-*A* sector (the difference between a rate of natural increase of 2 per cent. and 0.89 per cent. required by the conditions of the illustrative example), we have a transfer embodying outlays equal to 10.1 per cent. of the total income of the *A* sector. This, in the first interval, would be 10.1 per cent. of 60, or over 6 per cent. of total national product; but the addition to the factor endowment of the non-*A* sector is over 25 per cent. of its current product (10.1 as per cent. of 40).

The figures in the illustration could be modified in the light of empirical data, but they are realistic enough for us to draw some plausible conclusions. Firstly, if we accept the interpretation of internal migration as a transfer of capital invested in human beings, this factor contribution of the *A* sector to the growth of the non-*A* sectors must have been quite large in the early and even later phases of modern economic growth—since internal migration of the labour force was from the *A* to the non-*A* sectors and sizeable. In the illustration, the value of the transfer was estimated at over 6 per cent. of total current income; and it would have been easier, without violating the rules of plausibility, to raise this percentage significantly than to lower it. Yet under the assumptions of the illustration, total net savings in the economy were not more than 7 per cent. of national income. And, granting that the 'contribution' in question depends upon the employment capacity of the non-*A* sector, we could still argue that the internal migration of labour from agriculture represents a large transfer of valuable resources to the non-*A* sectors and a large contribution to the country's economic growth. This conclusion has several implications, not the least of which is that the kind of investment in human beings that is, and can be, made in the *A* sector

determines the quality of an important part of the labour force in, and hence of its contribution to the growth of, the non-*A* sector.

Secondly, if the share of the *A* sector in the labour force and the relative magnitude of labour transfers from it decline, there is bound to be a decline even in the absolute value of the factor transfers thus made; and most certainly in its proportion to the stock of labour already available in the non-*A* sector. After a while, although it may be fairly late in the course of modern economic development, the absolute numbers of workers in the *A* sector decline; and transfers that may be a large fraction of the current labour force in agriculture would mean only minor fractional additions to the labour force outside the agriculture, and for the country as a whole.

Finally, it need hardly be pointed out that what is true of internal migration applies to the international movement of labour which through the nineteenth and early twentieth centuries assisted a number of rapidly developing countries. This migration was most often from the agricultural sector in one country to the non-*A* sector in another, and in that sense was similar to what we have been discussing—except that the factor contribution was to the economic growth of another country. At some time this may have had a curious effect on internal migration within the recipient country, impeding internal migration from at least some parts of the domestic *A* sector. But these aspects of the factor contribution of the *A* sector, while of great interest, would take us into an analysis of the growth process for different groups of countries that would be too detailed for treatment here.