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THE RELATIVE INCIDENCE ON AGRICULTURISTS AND ON OTHER GROUPS OF THE BENEFITS RESULTING FROM TECHNICAL CHANGE IN AGRICULTURE

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AGRICULTURE presents a combination of systems so diverse that any statement which is true of one part is rarely if ever true of the whole. Since the intention here is to make a statement which is thought to be valid only for farming in a certain range of countries, it will be useful to begin by explaining why others are omitted.

The title invites us to assume that an advance in agricultural technique has taken place, and sets the question, Who gains most? Tacitly it is implied that the gain is divided, and that at least in some conditions the major share may not go to agriculture. However, there appear to be two important types of agricultural system or situation in which the farmers would reap by far the greater part of the benefit arising from their own technical progress.

At one extreme there is the system of subsistence farming which prevails over much of the populous belt of Asia, together with large zones in Africa and South and Central America, especially where there is no effective commercial transport. The numbers concerned are possibly more than half the world's farm population. They produce in order to eat, and when they produce more they consume more. An advance in their technique will raise their standards before it does anything else. Without hesitation it may be laid down that the first stage in improving their lot is to enable them to learn more about farming, and that although ultimately others may profit, substantially the whole gain will at first accrue to themselves.

At the other extreme are the farming communities which already are so efficient that they command much of the international market. In a free-trade expansionist world the further enhancement of their efficiency,[1] relatively to that of agriculture elsewhere, would bring

[1] Increased 'efficiency' means, throughout, the capacity to produce a larger volume of output from a given volume of resources, and is assumed to accompany the 'technical change' indicated in the title.

them gain, and this would be particularly true of areas producing protein foods, for which the demand is moderately elastic. Australia and New Zealand are the outstanding examples, but they are mentioned here primarily to illustrate and emphasize the reason for not discussing countries similarly placed. To include them would in fact be to introduce a special case; generalizations based on it would be liable to mislead, for the gain of such countries is at least partly at the expense of agriculture where the rise in efficiency has been less rapid.

In order to have a definite economic setting it is proposed to confine attention to States resembling those of the North Atlantic zone. The geographic spread intended is somewhat wider than that ordinarily associated with this zone and would include, for instance, Finland, Sweden, and Switzerland. It will be assumed for the analysis that the territory comprised is a closed system.

A distinguishing feature of this area is the preponderance of industry, on which agriculture depends for most of its market and income. Subsistence farming is by no means negligible in some regions, but in general the system is one of exchange; the greater part of the farmer's income is received in cash, and the cash is derived either from sales, mainly to industry, or from government subsidy.

All the countries, with one possible exception, have been alike in another respect. In the exchange between agriculture and industry the income received by agriculture has been relatively low per head at all times except during war and periods of food scarcity caused by war. For the United Kingdom it is possible to carry back to 1867 estimates of income per man-unit of farmers and their farm-working relatives, after excluding the return to property. The resulting 'farmer's incentive income'[1] per man-unit can be compared with the corresponding 'incentive income' of all non-farm producers, to give what may be described as the 'incentive income ratio'. During the most prosperous period of the Golden Age this ratio appears to have been slightly over 80 per cent.[2] In the later almost continuous depression, 1879–96, it fell, according to our estimates, to an average of about 40 per cent. Just before the outbreak of the First World War there was a recovery to over 50 per cent. The level was much the

[1] Sometimes called the farmer's 'labour income' though it includes the return to management and to the function of entrepreneur. 'Incentive income' is considered to be the category of income most suitable for use when the comparison is with either industrial wages or the income of industrial entrepreneurs whose receipts are earned with the aid of a proportion of property differing substantially from that required in farming.

[2] These figures have been broadly adjusted for differences in urban and rural retail prices and exceed the estimates in the appended Tables. Self-supplies are included in the farm income.

same in the twenties and early thirties; but with the aid of a series of most comprehensive measures the Government succeeded in bringing it to an average of about 80 per cent. in the last five years before the Second World War.

TABLE I

Incentive Income Ratios[1]

	Farmers and Relatives			*Non-farm Producers*			
	Aggregate incentive income per an. (1)	*Numbers engaged in farm work: man-units* (2)	*Incentive income per man-year* (3)	*Aggregate incentive income per an.* (4)	*Numbers: man-units* (5)	*Incentive income per man-year* (6)	*Ratio* (3) : (6) (7)
United States	*$mn.*	000	$	*$mn.*	000	$	%
1910–14	3,128	9,160	341	22,282	26,294	847	40
1922–6	4,641	8,518	545	52,136	32,323	1,613	34
1927–31	4,711	8,347	564	55,299	34,795	1,589	35
1932–6	3,912	8,571	456	33,663	30,279	1,112	41
1937–40	4,326	8,148	531	50,116	34,594	1,449	37
United Kingdom	*£mn.*	000	£	*£mn.*	000	£	%
1867–73	42·1	811·3	51·9	632·8	9,267·8	68·3	76
1874–8	37·9	870·6	43·5	714·6	9,909·6	72·1	60
1879–96	26·3	930·7	28·3	849·5	11,222·2	75·7	37
1897–1914	41·3	932·3	44·3	1,365·9	14,117·0	96·8	46
1923–32	44·4	477·5	93·0	2,957·5	15,436·4	191·6	49
1933–8	69·7	460·1	151·5	3,330·7	16,569·7	201·0	75

Sources: United States: see ch. xii, *Agriculture and Industry: Relative Income. United Kingdom:* papers in *Journal of Proceedings of the Agricultural Economics Society*, 1952–3, *Journal of Agricultural Economics*, 1954, and *Statistical Journal*, 1955.

A similar calculation for the United States can be carried back to 1910. A consistently low figure of about 40 per cent. is to be recorded for the whole period before 1939, except during the phase of war-induced scarcity. In Canada there was wider fluctuation but approximately the same low average between 1926 and 1938. For certain other countries estimates have been made of the farmer's incentive

[1] The series in this Table and in Table II include income in kind, but the inclusive amounts have not been adjusted for the differences between rural and urban retail prices. For the United Kingdom an approximate adjustment may be made by the addition of 4 or 5 per cent. in the inter-war period and 11 per cent. before 1914. The addition is larger for the United States, being as much as 13 per cent. at the beginning of the Second World War. See Nathan Koffsky, in *Studies in Income and Wealth*, vol. xi, National Bureau of Economic Research, New York, and *Agriculture and Industry: Relative Income*, ch. xv on 'Relative Retail Prices'.

income per man-unit, but it has not been possible to obtain comparable figures of non-farm incentive income. The incentive income

TABLE II

Wage Ratios[1]

*United Kingdom**

	%		%
1850–4	43	1900–4	47
1855–9	45	1905–9	49
1860–4	47	1910–14	49
1865–9	46	1915–18	48–50
1870–4	48	1919–23	49
1875–9	50	1924–8	50
1880–4	50	1929–33	52
1885–9	51	1934–8	53
1890–4	48	1939–43	65
1895–9	48	1944–7	75

United States†

	%		%
1910–14	41	1930–4	21
1915–19	41	1935–9	27
1920–4	32	1940–4	35
1925–9	28	1945–7	46

* *Agriculture:* Contract wage, including the cash value of wages in kind, of ordinary male workers for a full week without overtime.

Industry: Average of contract wages for a full week without overtime, of male manual workers in fourteen industrial trades included in Bowley's Index.

† *Agriculture:* Average annual earnings, i.e. aggregate annual income, including wages in kind, of farm labour (*Net Farm Income and Parity Report 1943*, p. 26; and *Farm Income Situation July–Aug., 1949*, p. 16), divided by the number of hired farm workers (*Historical Statistics of the U.S., 1789–1945*, p. 97, col. 63) reduced to man-equivalents. The series of hired farm workers (after 1945) was extrapolated with the aid of figures in *Agricultural Statistics*, 1950, p. 584.

Industry: Average annual earnings per man-equivalent in non-farm industries.

Source: 1910–26: *Historical Statistics of the U.S., 1789–1945*, p. 68, col. 135; 1929–47: Non-farm wage-bill divided by the number of full-time employees (both derived from series in *National Income Supplement* to *Survey of Current Business*, July 1947, pp. 36 and 38; and *Survey of Current Business*, July 1949, pp. 21 and 36). Other years by interpolation.

ratios have therefore been broadly gauged from subsidiary data on relative income including the return to property, and from relative wages.[2] In 1938 the highest ratio was to be found in France, and it was probably over 75 per cent. The range from 60 to 75 per cent.

[1] See footnote to Table I, p. 136.

[2] The estimates are based on material published in *Agriculture and Industry: Relative Income*, Macmillan, 1956.

included Denmark and Germany and possibly Hungary. A central group with ratios below 60 per cent. comprised Sweden, Finland, and probably Italy, and below this were the Netherlands, Turkey, and Eire, with probably Norway, Bulgaria, and Portugal. The average for the whole area could not have been as high as 60 per cent.

It is in relation to this situation that the question stated at the beginning is to be reset. If there were an advance in agricultural technique in these countries, leading to a general rise in farming efficiency, would the ratio rise, or would it be still further depressed?

The answer clearly depends on the way in which the forces set in motion by the rise in efficiency would link up with, and possibly modify, the economic forces which have produced the ratio of less than 60 per cent.; and the first stage in the answer is to analyse and describe these forces.

In view of the long period for which this relative income position has lasted it seems probable that the factors affecting the ratio form a specific system, operating in accordance with some association of economic laws. In addition to the data already given, series of farm and non-farm wages for the United Kingdom and Sweden confirm that a low wages-ratio has prevailed for about a hundred years. Adam Smith reported that in his day farm income throughout Europe was poor by comparison with industrial income and that in Great Britain the position had been even more adverse to agriculture a century earlier, that is, in the seventeenth century. When this historical evidence is coupled with the most up-to-date information from the United Nations, showing that agricultural income is reverting to the low relative levels of pre-war days, it may justly be concluded that the phenomenon of income disparity is inherent in agriculture's economic structure and situation. Since the *resultant* of the economic forces affecting income in agriculture is enduringly different from the corresponding resultant for industry, the forces themselves must be different in nature or strength, or in their mutual relationship. What, then, are the chief points of difference?

There appear to be five elements in the economic situation of agriculture which, because of their manner of interaction, may be regarded as constituting an unusual, if not unique, system. Individually, they appear to be generally accepted as reflecting the true position, though in some cases confirmation in terms of actual measurement may be difficult. They are:

1. The low income-elasticity of the demand for farm produce.

2. A significant degree of flexibility[1] in the expansion of the supply.
3. The low price-elasticity of the demand.
4. Virtually complete short-period inflexibility of supply at times when demand is contracting.
5. The low supply price of agricultural man-power.

As just noted, the special feature of these conditions is the way in which they are interrelated. The first, the low income-elasticity of the demand, would be of little account were it not that the supply of farm produce is flexible enough to overtake the demand when the market is expanding at the rate ordinarily attained. Both the demand and the supply may grow slowly by comparison with the corresponding expansion in the rest of enterprise, but it is their mutual relative movement that is significant. As a rule the supply expands rapidly enough to give rise to a surplus of farm produce at an early stage at any time when supply in the economy as a whole is overtaking demand.

Further, the surplus would be of much less effect if *either* the third *or* the fourth condition were inoperative, that is, if the price-elasticity of the demand were such that the surplus would be quickly absorbed by the market when prices fell, or, alternatively, if farmers could contract supply in response to a fall in prices. It is the association of inelasticity of demand with inflexibility of supply which causes the surplus to remain as a persistent weight or blanket over the market.

Finally, *in the long run* supply would contract, were it not that the supply price of agricultural man-power is extremely low. As a fairly general rule it may be said that no man who has been born into agriculture and has inherited his father's farm will abandon it unless he is driven out by bankruptcy or infirmity. But this alone would not prevent fairly rapid contraction, since farmers die or become physically unfit or retire for other cogent reasons at the rate of about 3 per cent. per annum. It is because new-comers are willing to take their place at a low rate of return that contraction in agriculture is delayed. Indeed it is difficult to find any instance whatever of substantial short-term or long-term contraction of farm output in any nation.

When an increase in efficiency, implying greater productivity, is superimposed on these five factors, the short-term effects are cer-

[1] The term 'flexibility' is used to introduce a time element and to denote a low or high rate of expansion in response to a growing demand.

tainly adverse to agriculture. There is, of course, no material effect on either the income-elasticity or the price-elasticity of the demand. But owing to the immediate pressure towards increase in supply, there is greater flexibility of supply in expansion, and less flexibility in contraction. In other words, the surplus of farm produce arises earlier and is caused to be more persistent.

Even when the whole surplus has been disposed of, this implies no improvement in income, for the less-than-unity price-elasticity of demand signifies that a smaller gross revenue is realized from the larger volume of output.

Before the conclusion to which this reasoning leads is given definitively, it is perhaps desirable to state the initial question in alternative forms. By technical change in agriculture may be meant a new burst in efficiency, followed by a phase of slowing down, so that whatever long-term forces were previously operating might return in full strength. Alternatively, the meaning implied might be a permanently higher rate of increase of efficiency.

In the first case, although the initial effects would be adverse to agriculture, in due course the return to farmers per head would be determined again mainly by the supply price of entrants into farming. Since fewer entrants would be required in the new condition of increased efficiency, the marginal supply price might be lower, and the incentive income ratio might remain for some time below the previous level; but the change would be slight and possibly not permanent.

In the second case the so-called short-term effects would be ever-recurring. There would be no time for adjustments to be made to one rise in efficiency before another followed, yielding a new surplus and a new depressing influence on farm income. Just as a jet-plane's speed is determined by a sequence of short-term explosions, so the effect on farm income of the sequence of bursts of increasing efficiency would be virtually the only *active* influence to consider. This influence would necessarily operate in relation to the more static or passive conditions of demand; and from the supply side the extent of the decline in farm income would still be limited by the possibility of an increasing exodus from agriculture of the factors of production—not only the human factor, but also land and capital. Nevertheless, within the environment of these conditions of demand and supply, the perpetual change in farming efficiency would be the essentially active determinant. And the more rapid the rate of rise in efficiency, the lower, other things being equal, would be the ratio of farm to non-farm income.

Accompanying Changes

In practice, however, other things do not remain equal. *Industrial* efficiency in the North Atlantic countries has increased enormously in the past, and it is most improbable that in any foreseeable future agricultural productivity will improve without a similar change in industry. The rate of progress in British industry in the second half of the nineteenth century was such that the terms of trade between industry and agriculture moved appreciably in favour of agriculture; and the general trend has continued though there have been fluctuations around the trend. It may be emphasized that the reference here is to the terms of trade between the two branches of the domestic economy. A different result is obtained when attention is confined to internationally traded produce. In the exchange of all U.K. exports for imports—a high proportion of food being comprised in imports —the advantage moved fairly steadily and extensively in favour of the United Kingdom from about 1856 to 1933. Thereafter the movement was reversed.

Another relevant factor is that every rise in agricultural efficiency per man not associated with a proportionate increase in consumption tends to bring about a contraction in numbers engaged.[1] A decline in numbers means that the absolute excess of man-power in farming areas will diminish and will be absorbed more readily into the comparatively large and growing industry. This, in turn, will tend to raise the supply price of man-power in agriculture, though there may be some offset through greater competition of new-comers seeking entry into the limited field of occupation on the land.

Moreover, the supply price of the human agent in agriculture may rise for independent reasons. In some of the North Atlantic countries, though not in all, there seems to have been a tendency since the late war for farming to lose its appeal, especially to women, on account of the isolation of the life and the greater range of interests in cities.

It would be a prohibitively large task to pursue the consequences arising from changes of the kind indicated—that is, changes which ordinarily accompany, without necessarily arising from, an advance in agricultural technique. Perhaps it will be acceptable to conclude with a number of statements which, it may again be mentioned, refer only to countries typified by the North Atlantic area.

1. An improvement in the technique of agricultural production

[1] Reduced hours or concealed unemployment may, alternatively, result. The reduction of hours of work may be regarded as one of the non-monetary benefits accruing to agriculturists—an example of a considerable range of psychic gains from technical progress, not elsewhere considered in this paper.

cannot be regarded as, in itself, a means of raising the relative cash income of farmers.

2. Farmers may benefit from such improvement in so far as it enhances the quality, amount, or variety, of their self-supplies. But the greater part of the advantage of any marked acceleration in the rise of efficiency on the land is likely to accrue, in the short period, to industry. In the long run, if there is a slowing down in the rate of improvement, the benefits will again be shared between agriculture and industry according to laws and conditions such as are indicated in the five points outlined earlier. Whatever ratio of income prevailed before the rise in efficiency is likely to emerge again, subject to the effects of 'accompanying changes' such as may influence the supply price of manpower in agriculture.

3. The need for technical progress on the land is not lessened by any of these considerations. Government measures for redressing the income balance between agriculture and industry might be devised in such a way as to accompany, and be associated with, a programme for increasing agricultural efficiency.[1]

4. Finally, there is the consideration emphasized by Colin Clark in the first edition of *The Conditions of Economic Progress*. Technical progress in agriculture releases man-power to supply a greater abundance of manufactured goods and professional services, the cheapening of which gives a higher purchasing power to all cash incomes, including those of agriculturists. In the long run, an advance in agricultural technique implies, unquestionably, a rise in the *absolute* well-being of farmers.

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Recently, when reading two sermons, I became convinced that the consequences of technical improvements can be looked upon in an enormous variety of ways. These two sermons were given in England. Both of them made reference to projects for emitting new artificial moons or at visiting our old natural moon. In an industrial town, a Methodist prepared his congregation for bringing Christianity to the inhabitants of other planets, while in a village where people are still bothered with cleaning oil lamps, the priest expressed a hope

[1] The analysis throughout has assumed no change in government policies, as the discussion of public action was not implicit in the title. Some suggestions as to principles for guiding policy in regard to the ratio are given in *Agriculture and Industry: Relative Income*, but the scope for generalization is limited in view of the great differences in economic structure between the various distinct branches of agriculture.

that the competent authorities, after having succeeded in the fantastic adventure of landing on the moon, would try to accomplish the gigantic task of extending electricity a few miles farther into the British countryside.

To begin with, I am going to follow the Methodist, not with an equally high missionary enthusiasm, perhaps, but with the purpose of extending your vision, if not to other planets, at least to a part of our earth which for many of us is not much more easily accessible. Later on I will deal with the exhortation of the village priest.

Mr. Bellerby's paper was deliberately confined to North America and the central and western parts of Europe. During the period it covers, the economic order predominating in the North Atlantic area had far-reaching and even decisive influence on the forces affecting the market and competition. Now, I should like to supplement his argument by considering other types of economic order for which the paper was not designed. I have in mind not only an economic setting characterized by subsistence farming, but even more an economic order realized in the countries east of the North Atlantic area. In these countries a central planning authority decides which technical changes are to be performed and who should benefit from them. Such an authority may give a greater weight either to industry or to agriculture, either to investment or to consumption. It will not leave the development to the market.

In the western parts of the northern hemisphere governments at all times have influenced the spread of technical improvements and the distribution of the resulting increases of income. During the last few decades, they have refined and strengthened their influence in many ways. They vary in their attitude to a policy of *dirigisme*, but they seem to agree in not being willing to abolish the forces of the market and competition altogether.

Before explaining the results of technical progress in agriculture under the economic order familiar to us, we should think of the results which come from technical progress generally, whether in agriculture, in industry, in transport or in other branches of our economic life. Under the forces of the market no entrepreneur or special group can permanently appropriate to itself the benefits of technical improvements. Competition requires that individuals, to use Adam Smith's term, be guided as by an invisible hand to realize the advantages of others and the best for the community when aiming at their own profits. Only when competition is suppressed, for example by monopolies, can others be excluded for a long period

from the benefits of technical progress. It is only during a period of transition that economic gains will remain in the hands of those who have carried out technical improvements.

For the last two centuries technical progress has been very strong in non-agricultural pursuits, and it is questionable whether this fact is sufficiently taken into account. Overwhelmingly, the non agricultural sector is less hampered by the law of diminishing returns and is able to progress technically more rapidly than can the very best agriculturists. Consequently, in industry conditions are favourable again and again for over-proportional rises in income.

Under the forces of the market, this difference leads to what Max Sering thirty years ago named the law of rising exchange values of agricultural products. He discovered this law by using the model and method of Johann Heinrich v. Thünen. It is confirmed by the improvement in the terms of trade between agriculture and industry on the British domestic market. Similar improvements can be observed in other European countries. The new approach of Mr. Bellerby's paper raises the question whether at present the basic conditions have changed essentially.

According to today's paper there has been a permanent though varying disparity between the incentive incomes in agriculture and in industry in the North Atlantic area. I wonder if the important differences between various periods of the past and present, between more or less well-to-do and industrialized countries, between growing and stable populations, between leading and backward farmers, between different degrees of governmental influence on prices, have been taken into account as much as they should be. And, indeed, the definition of incentive income does not allow far-reaching conclusions, for it excludes the returns to agricultural property, as well as those which flow from non-agricultural sources, such as savings or pensions. It also excludes agricultural wages which, with the increasing mobility of the workers, rise nearer and nearer to industrial wages. The absolute and relative increases of agricultural wages are as much consequences as causes of technical improvements.

I am doubtful, therefore, whether the five elements in the economic situation of agriculture that Mr. Bellerby mentions have been valid throughout the last ninety or hundred years in all North Atlantic countries—and more important, whether they are peculiar to agriculture alone.

Particularly I should like to deal with his fifth element, the low supply price of agricultural man-power. The decisive cause of this undeniable fact is the important role of family holdings. But in this,

agriculture is not unique. Unfortunately, we possess hardly any reliable figures of income in non-agricultural family units, for example, the earnings of artisans or small tradesmen. But from some observations we may conclude that the disparity between them and industrial incomes and wages is probably as great as it is for agriculturists.

Now, what are the consequences of my reflections? A considerable proportion of the benefits of technical achievements in agriculture goes to other groups. Agriculturists do share some of the benefits of technical improvements in industry, mining, or transport, but it is only in a lesser degree that farmers and their families take part in the general rise of the gross domestic product. Even so, they are not the only group living under such unfavourable conditions.

The main problem of today's topic is whether the forces which have led to a disparity of agricultural income have become stronger. It may be that technical improvements today in many industries lead not to lower product prices but to higher wages. If that be so, the question remains whether with the growing mobility of workers, such a state of affairs can last long. If farmers were to abstain from technical progress, however, their situation would by no means become better; it would deteriorate considerably. A farmer in Denmark whose splendid performances we were admiring on our way to this Conference gave us a very modest and sensible answer: 'If we are less efficient we must go', meaning that he would have to yield to competition.

Yesterday, M. Cépède drew our attention to the different effects of various technical improvements in agriculture. All of them are indispensable for modern farmers if they are to withstand competition and keep in step with the standard of living of the industrial population. Here I see the most convincing argument for the need for technical progress on the land which was the third of Mr. Bellerby's statements at the end of his paper. No doubt, the first statement, that technical improvement is not in itself a means of raising agricultural cash income, is also true.

If I now turn to the village priest, it will not do for villages or regions that are still without sufficient technical equipment to appeal to the competent authorities to provide for electricity or aqueducts. Backward villages and regions are to be found in many countries, as in Germany. Investigations we have made since 1951 into the living conditions of small farmers make it clear that a decisive pre-condition for better living lies in the rural population's becoming willing and able to acquire technical knowledge. In many cases the elementary

schools are to be improved in order eventually to bring electricity, motor power, fertilizers, or aqueducts into the proper hands.

Let me conclude with a few remarks to which I attribute special importance. First, a disparity of income calculated by the income per man-unit can be compensated to a high degree when several earners live in one household. Here we have one of the explanations of the strength of the family farm. Second, money income is not the only determinant. This is a point on which the Presidential Address laid stress, and which also accords with Mr. Morales's and Mr. Colon-Torres's papers. Particularly in family farms, some *imponderabilia* are esteemed, consciously or unconsciously, worth more than money. Such are opportunity to till the soil independent of employers, family life, a rural home, and the feeling of working for the children in the tradition of the ancestors. Such is also the satisfaction derived from technical improvements performed under one's own responsibility, or from a well-seeded field, a successful harvest, or a carefully bred, well-grown, and efficiently fed animal. The strength of these *imponderabilia* varies. Recently we have observed in many places that they are getting weaker, but they will always be important. We should not spoil the inner satisfaction that the farming population feels on account of these things by showing them that other people earn and spend more money. On the other hand, as my late friend and colleague, W. Bucken of the University of Freiburg, used to teach us, these *imponderabilia* are to be honoured only in so far as they are valuable and give real happiness to the people concerned. We should not try to compel them to be happy; still less should we force them into what fanatics and ideologists may regard as happiness.

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Mr. Bellerby rightly concludes that in an economy such as exists in the North Atlantic zone the primary impact of technological change on farm income will be to reduce aggregate gross market receipts. Expansion of output when demand is stable and inelastic will result in a relatively greater change in price than in volume of sales. This fact helps to account for the consistently low income of farm people relative to the average income of other groups in the economy. A relatively slow increase in demand is related to the low income elasticity for food; and since aggregate demand for food is also inelastic in respect to price, an adverse income situation develops for farm people.

However, in this type of economy many parts or areas of agriculture have greatly increased their real level of living in a condition of technological change; and the next problem is to outline the conditions under which farm incomes have increased, both relatively and absolutely. These conditions appear to be a considerable increase in output per man associated with a rapid expansion in the use of capital equipment and heavy migration of excess or under-employed labour resources out of agriculture. Our data clearly show that this transition has occurred in the most efficient and highest income areas in North American and European agriculture. This result depends on the ability or the capacity of the industrial economy to employ the people who migrate out of agriculture and on the mobility of the farm population or their ability to migrate to new types of employment. Under such conditions of industrial expansion, of labour mobility, and of capital accumulation in agriculture, technological innovations in agriculture will result in higher farm incomes; and the two general benefits to society are an expansion of agricultural output and an increase in the industrial labour force derived from agriculture.

Another effect of increased technology and labour-saving devices in this type of economy is a greater participation of farm people in off-farm employment. To illustrate, out of the 5·3 million farm operator families listed by the U.S. Census, fewer than 40 per cent. are dependent solely on their own farming activities.[1] Approximately one-third of the 5·3 million families, or about 1·6 million, received more income from non-agricultural sources in 1950 than they did from the sale of farm products. These proportions do not vary widely among different sections of the country or among the classes of farms of different sizes. Thus in 1950 in the United States about 42 per cent. of the farmers in the north were solely dependent on agriculture as compared with 36 per cent. in the south and 31 per cent. in the west. About 24 per cent. in the north received more income from sources outside agriculture than from farming, as compared with 35 per cent. in the south and 36 per cent. in the west. The range by income class in the 'completely dependent' category was from 31 per cent. in the middle income classes (from $3,000 to $7,000 net income) to 40 per cent. for those with $10,000 or more net income. About 38 per cent. of the farm families with $2,000 to $7,000

[1] Louis J. Ducoff, 'Classification of the Agricultural Population in the United States', *Journal of Farm Economics*, Aug. 1955, pp. 511–23; data based on unpublished records of the 1950 U.S. Censuses of Population and Agriculture compiled in a matching study made co-operatively by the Bureau of the Census and the Department of Agriculture.

net income received the major part of their incomes from non-agricultural sources, whereas about one-quarter of the farm families in the highest and lowest income brackets were so situated.

An important hypothesis, partially tested at the present time, is that the degree to which farm people will participate in off-farm employment—either on a part-time basis for those partially employed on the farm, or on a full-time basis for members of the family not employed on the farm—is a function of their proximity to industry, of the available transportation facilities, and of the state of technology on the farm. Thus average income of farm people is considerably higher in the areas closer to centres of industry in both the United States and Europe, where supply prices for labour are high, than it is in outlying relatively undeveloped areas, where supply prices for agricultural labour are lower. A corollary hypothesis is that farm people will migrate from agricultural to industrial employment more rapidly in industrialized areas than in undeveloped areas and the relative incidence of farm technological advance will be to improve the income of farm people more rapidly in areas close to industry than in the outlying areas. These hypotheses assume equivalent grades of land in the developed and undeveloped areas, since the effects of the fertility of agricultural land is a major factor in a production response.

An important inference arising out of these hypotheses—or perhaps an additional hypothesis—is that the greatest gain in technological change will occur to farmers through the development of industries interspersed among rural areas. The effect of such an integration of industrial employment opportunities with agricultural labour resources is to raise the supply price for labour. In many communities in Europe and North America farm people can change employment rather easily, sometimes without changing their residence. In these communities and in other situations where a high degree of labour mobility has been achieved, the net incomes of farm people frequently exceed those earned in industry. Thus farm incomes are not inherently lower than industrial incomes. Good general education is of course necessary to create the desired degree of mobility, but improvement of that kind does not appear to be sufficient to solve the low-income problem in many of the lower income communities.

Mr. Bellerby referred briefly to the highly efficient agriculture dominating the world market and the largely subsistence agriculture of undeveloped areas. He states that the further enhancement of the efficiency of the most efficient areas relative to agriculture elsewhere

would bring them gain, and this would be particularly true of the areas producing protein foods for which the demand is moderately elastic. This is true so long as the technological advance is restricted to areas that supply only some given fraction of the world market and so long as the technological change affects only those commodities not highly inelastic in demand. In fact, in such cases technological progress is a prime essential for further growth of the export economy, as many of us have seen in our visit to some of the European countries. On the other hand, the widespread adoption of of new technologies in wheat production, for example, has reduced the man-hours required and has resulted in an expansion of output under the given conditions. Government policy, of course, has intervened to maintain price, and huge surpluses have developed in the major exporting nations. A major part of the benefit resulting from these technologies eventually will flow from these more efficient producers to the consumers in importing as well as exporting countries. As aggregate output of agriculture increases, the benefits tend to become world wide.

In regard to subsistence agriculture where there are no commercial transport facilities, Mr. Bellerby is correct in stating that the first impact will be restricted to raising consumption levels of people on the land. The condition of no commercial transport is probably too limiting to apply to half the world's population. Be that as it may, these effects can be the first steps in an industrial revolution. As excess labour is developed, greater demands are created for transport facilities and supporting industrial opportunities. Whether these will develop or not depends on how well the abilities of the people are organized, on how fully education and the opportunities to learn new techniques are developed, and on what capital is available to meet the requirements of further development. Here the emphasis on people and their culture seems particularly appropriate and the economist must seek more help from other disciplines in appraising relative incidence and in seeking to organize for further technological growth and development.

In general, in an exchange economy, increases in farm output brought about by technological change will shift the terms of trade against agriculture, if other conditions remain unchanged. An improvement in the relative level of income in agriculture requires expansion in other parts of the economy, including the secondary and tertiary industries. By a process of balanced development of employment opportunities in industry as well as in agriculture, agriculturists will participate in the benefits of technological progress.

L. HJELM, *College of Agriculture, Uppsala, Sweden*

I shall give some figures on Swedish conditions during the last fifteen years—figures which partly emphasize Mr. Bellerby's statements but which also give another picture. During this period, an important improvement in agricultural productivity has taken place. Total production has increased about 10 per cent. while labour consumption has decreased about 30 per cent. From this it follows that the gross production per man-hour has increased about 55 per cent. If these results are reduced by the increased input of fertilizers, concentrates, &c., a net production increase per man hour of about 35 per cent. is obtained.

Of interest is the effect of this improvement in productivity upon farmers' incomes and product prices—that is the indirect effect upon the income of other occupational groups. Swedish farmers' pre-war incomes lagged considerably behind the incomes of other occupational groups; at the end of the thirties, the lag for rationally managed family farms is estimated at between 20 and 25 per cent. As in many other countries, this led to a government price policy to adjust income distribution. In Sweden these measures were introduced during the great agricultural crisis at the beginning of the thirties. Since the immediate pre-war years, a significant improvement in the real income of agriculturists has taken place. An increase of 120 per cent. has been calculated for farm labourers from 1939 to 1954. During the corresponding period industrial workers had an average increase of 85 per cent. The increase of farmers' incomes was not so favourable in percentage terms as was the farm labourers'. In this case yearly variations due to yield fluctuations and so on must be taken into consideration. Besides, income changes vary for different farm sizes. On the whole, the present working income on rationally managed farms of about 20 ha. of arable land is on the same level as the wages of industrial workers.

This levelling has been caused both by price policy and productivity improvement. According to a study I have made on income development in Swedish agriculture since before the war, I find that about two-thirds of the real income increase of farmers and farm labourers is connected with a rise in productivity. About one-third depends on the relative rise in agricultural product prices compared with the prices of productive resources. The large rise in real income of farmers and farm labourers during the last fifteen years is thus due in large part to improved techniques in various enterprises. It is possible also that the present price policy has to some extent accele-

rated technical development. In the first place, the policy has been linked with a rationalization programme especially concerned with the consolidation of small farms. And secondly, it is probable that fixed guaranteed prices in themselves have encouraged long-term improvements. Farmers are now more willing to risk investing capital and to take long-term measures.

As I have just mentioned, income growth has not been similar among the various groups of farms. The most important rise in farmers' working income is found in the plains of south Sweden and in north Sweden—that is in the best and worst agricultural regions. In the latter the improvement is due above all to the relatively large forest areas and to forestry's favourable economic situation during the last fifteen years.

Comparing different sizes of farms, small farms (2–10 ha.) have been lagging, while the largest are doing better. This is due to the differing opportunities for rationalization; it has not been possible to mechanize so much on small as on large farms. However, prices have developed more favourably for small farms owing to a differential in subsidies in their favour. Therefore, on large farms productivity improvements have influenced income development more than on small and average-sized farms. On small farms profitability has risen thanks to improved price relations between products and resources.

J. MILHAU, *Faculty of Law, and National School of Agriculture, Montpellier, France*

Today's papers suggest two interrelated observations. First, that technical progress should lead to the organization of agricultural markets. Some speakers have spoken with enthusiasm about technical progress in agriculture and have told us that this progress will continue unremittingly. But the majority of speakers have expressed fears about unemployment and social disorders which technical progress may bring in its train. In reality, the problem is the age-old one of Man face to face with Machine.

The Machine says to Man: 'I come to free you. I ease the burden of your work.'

Man replies: 'You are turning me out of my workshop and my fields. You are reducing me to unemployment and want.'

The Machine answers: 'I shall give you back, increased a hundredfold, the income and the work which I am taking temporarily from you today.'

This last reply is no doubt true for other industries, but it is very debatable for agriculture. The demand for industrial goods is in

general elastic; the reduction in prices as a consequence of technical progress permits an enormous development in consumption.

The demand for agricultural products, on the contrary, is in most cases inelastic. An increase in production—whether as a result of good climatic conditions or of technical progress—brings about a reduction in selling price which is greater than the reduction in unit cost. Consequently, a good harvest often brings low receipts and this phenomenon, known as King's law, is at the root of the Malthusian policies so often practised by nations. We conclude, therefore, that technical progress can have a very serious economic effect on agriculture because of the inelasticity of agricultural markets; and also that the organization of these markets—both nationally and internationally—is a necessity in order that we may not again have the distressing sight of humanity destroying its agricultural riches while so many of its members starve.

Secondly, technical progress implies co-operative development. Technical progress often takes the form of more intricate and costly machinery, and also of a more complex organization of the farm. One may ask if the small family farm can adapt itself to these new conditions. We believe that such an adaptation is possible through co-operation. The French system provides an interesting example. There are three groups of peasant associations, each forming a three-storied structure combining local, regional, and national levels. First, there is the Mutualité Agricole which is an exclusive farmers' mutual insurance society, insuring against the principal technical risks (fire, livestock mortality, accident, hail and tempest). It has at least one million members and the total premiums exceed 11 milliards of francs (approx. £11,000,000). When the different social services (insurance and assistance) were extended to agriculture it was the Mutualité Agricole, already a powerful organization, which was entrusted with the enforcement of the existing legislation. It provides for social security and also family allowances in agriculture.

The second group is that of mutual farm credit, which is also co-operatively organized, and which has freed the French peasant from usury. Today it provides for the financing and modernizing of farms, through the mobilization of farmers' savings.

The third group which is increasing rapidly, is made up of co-operatives of all types (machinery, processing, supplies, sales, &c.).

In this way in our country small family farms can adapt themselves to the demands of technical progress.

We might say, briefly, that co-operatives are to agriculture what the concentration of factories is to industry; and this brings us back

to our earlier conclusion that the agricultural world and the industrial world are totally different and are not commensurate.

Economic and sociological laws are perhaps universal like the laws of gravity; but as gravity has different effects as bodies fall through air or through water, so economic and sociological laws result in different consequences in the agricultural and industrial worlds. If such a conclusion is valid, it justifies a conference such as this one.

G. MINDERHOUD, *Landbouwhoogeschool, Wageningen, The Netherlands*

Both Mr. Bellerby and Professor von Dietze used alternatively the words 'agriculturists' and 'farmers'. This might cause some confusion as these words are not identical in meaning. I should hold that farmers, farm workers (employees), and landlords are all agriculturists.

On a further point, I think it was Professor Halcrow, who hit the nail on the head. If one or a small number of farmers raise their standard of farming, they will receive the benefits because, either they will obtain higher yields at the same or lower costs than other farmers, or they will lower their costs of production for existing yields. If, however, all farmers in a certain area adopt higher standards of farming, the benefits may accrue either to the farm workers who are able to force higher wages or to the landlords who will receive higher rents. Furthermore, if all farmers over a large area improve their standards of farming, prices of agricultural products will drop, and the consumers will receive the benefits resulting from this general technical improvement. As we are all consumers, in the long run the whole community will receive the benefits.

J. KLATZMANN, *National Institute of Statistics and of Economic Studies, Paris, France*

Mr. Bellerby has observed that one of the reasons for the decrease in farmers' incomes, when production increases owing to technical progress, is the low elasticity of demand for agricultural products. I think this question deserves some attention. When the relationship between variations in supply and variations in price, is mentioned, it is not generally stated from what standpoint it is being considered. In reality, there is not *one* elasticity of demand but several, corresponding to different stages in the marketing process. Often when speaking of elasticity, one thinks of the relation between variations in quantity and in price at the consumer stage. It is said that demand is inelastic when, for example, supply increases by 10 per cent. and retail prices fall by 15 per cent. But this relation between the variation in price

and the variation in quantity is almost of necessity different at the production stage. If one considers the different categories of cost which occur between production and consumption, it is clear that they have a variable effect and, in particular, that certain costs which exist in all marketing processes lead to the elasticity of demand at the production stage being less than that at the retail stage. Let us suppose that the supply of a certain product increases by 10 per cent. If the retail price decreases by 15 per cent., one may be fairly certain that the production price will fall by more than 15 per cent. There are even cases where the elasticity is greater than one at the consumer stage and less than one at the production stage. That is to say, when the volume produced increases, consumers' expenditure increases, while at the same time producers' receipts decrease.

I apologize for making these assertions without giving any proofs, but it would take up too much time to do so. I should add that the results of theoretical work are confirmed by the few measurements one can make in practice. To conclude, the elasticity of demand, which the producer observes in the market where he sells his goods, is generally lower than the elasticity of demand at the final stage of marketing, even though this latter elasticity might not be very high.

Now a few words on another question which deserves to be discussed at greater length. All the speakers have emphasized the small average income per man in agriculture compared with the average income in other occupations. Firstly, are the figures valid? I think that in many cases they are debatable. Secondly, what is the meaning of this comparison between the average income per man in agriculture and that per man in non-agricultural occupations, which include all types from the unskilled workman to the internationally famous surgeon? What is the meaning of averages obtained in this way? I am not saying this in criticism of the conclusions of other speakers. I am convinced that similar work is generally less well paid in agriculture than in other industries. But even if I agree with this conclusion, I think that the comparison between the two figures, *average* income per head in agriculture and *average* income per head in other occupations, is of only limited interest.

W. MACKENZIE, *Department of Political Economy, University of Alberta, Edmonton, Alberta, Canada*

I was particularly interested in Mr. Bellerby's paper, because I have made somewhat similar calculations for Canada. My conclusions are much the same as his in so far as my figures show exactly what his do. But I wonder whether we are right in assuming from that that the

position between agriculture and the rest of the economy is a chronic one of lower incomes in agriculture. Dr. Halcrow touched upon the fact that many workers engaged in agriculture obtained part of their incomes elsewhere. There is also the problem that many of those listed as working in agriculture are casual workers. Now I know enough of Mr. Bellerby's work to know that he has considered seriously the importance of both these points. But just to illustrate the weakness of the material with which we must work in drawing such comparisons, I would cite a recent paper in the *Canadian Journal of Economics and Political Science*.[1] A colleague of mine produced a result for Canada over the period 1942–51, which showed agricultural incomes to be 47 per cent. of the incomes in the non-agricultural sector. However his figures do not allow for off-farm work and the casualness of labour. From an examination of the data I am led to believe that agriculture does not necessarily have incomes chronically so much lower than those in the non-agricultural sector, and that perhaps we should look into the figures and statistics with which we must work and spend a great deal of time refining the material. In Canada, at least, the evidence, particularly in the prairies, leads us to believe that our figures must be somewhat exaggerated.

J. R. Bellerby (*in reply*)

Professor von Dietze, Professor Halcrow, and later speakers have indicated ways in which the farmer himself must realize some absolute gain from the improvement of his methods, and it seems to me that it would be very valuable, by way of a follow-up of this discussion, to make a list of the particular methods which would most effectively produce that kind of result. One of the suggestions was that the benefit of any improvement goes to the farmer when there is an accompanying exodus of labour from agriculture. This is particularly true where output is unchanged, as when some forms of mechanization are undertaken. The list of measures giving this result might be extended through the addition of many which benefit the farmer through improving his self-supplies.

Professor Minderhoud's comment, I think, calls for an acknowledgement from me that it modifies the conclusions in the direction of the expectation that greater absolute gain will accrue to the agricultural community when efficiency rises in agriculture. He points out that farm products form a large part of the consumption of all farm people including wage-earners, and that they all gain

[1] W. J. Anderson, 'Productivity of labour in Canadian Agriculture', *The Canadian Journal of Economic and Political Science*, vol. 21, No. 2, 1955, pp. 228–36.

whenever food in general is produced more economically and sold at lower relative prices. The gain is in respect not only of self-supplies but also of food brought by farm people from shops, which may represent as much as half the family budget.

Though I agree with this and other comments, I still feel that the answer in my paper to the specific question, Who gains *most* from agricultural improvements? can be maintained. In essence the answer is that, in the long run, the division of the benefit between the farm and non-farm community will be according to the five factors which at all times determine the share of income received by agriculture; and of these the most important is the supply price of agricultural man-power—or the supply price at the margin of entry or exit. Demand factors are important partly as determining where the margin will be.

Whether the supply price of man-power in agriculture has risen to a new high level permanently is something on which I think I should like to delay an opinion for some time. The latest figures of relative farm income given in United Nations reports show an ominous trend, as though many countries were on the way back to the bad old days; and I should feel that there would be most ground for optimism if all policies were inspired by pessimism—that is, by the belief that the supply price of man-power in the world's agriculture is still low—though I should agree that there is evidence of a rise in some countries.

Just one other matter, and that is the question of the value of the statistics from which the ratio of round about 55 to 60 per cent. is derived. That of course depends not only on the aggregates of income, as to whether they have been estimated satisfactorily, but also on the assessments of the numbers in agriculture. These are based mainly on census figures, the assumption being that when an individual registers himself as a farmer, but nevertheless spends, say, one-third of his time outside agriculture, this is balanced by the exclusion of others who spend one-third of their time in agriculture and register themselves as belonging to another occupation. I think Mr. Mackenzie would agree that if the aggregate of farm income is raised by including farmers' earnings from outside agriculture, the aggregate should in compensation be reduced by the amount of the income from agriculture earned by people not registered as farmers. The amount would be difficult to assess in countries where caterers, retailers, jam-makers, and others carry on farming as an adjunct to their main business, but the figure might be considerable enough to justify inquiry.