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THE CHANGING IMPORTANCE OF LAND AS A FACTOR OF PRODUCTION IN FARMING

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IN few fields are ideas more subtly and enduringly enslaved by some defunct economist than in the role attributed to land as a factor of production in agriculture. Notable amongst efforts to free us from the shackles of old ideas are the writings of T. W. Schultz.[1] One of the first agricultural economists to graduate from the tool-using to the tool-making class, Schultz developed a comprehensive body of theory to explain the effects of economic progress upon agricultural factors. In so doing he has demonstrated the breakdown of classical economic theory as a description of the real world and has shown how thinking on many aspects of economic growth is still needlessly befogged by its lingering influence.

Other implications of land's declining relative importance as a factor of production are explored by Breimyer[2] and a description of the impact of technological advance as a substitute for land is given by Heady.[3] So elegant and penetrating are these various discussions of our topic that they raise the question whether I can add anything that is not pure pastiche. My paper falls into four necessarily tiny parts. First, I review briefly the reasons for the changing role of land in agriculture. Secondly, I discuss some of the diverse forms in which discredited ideas about land still permeate our thinking on agricultural and general economic policy. The third section of the paper examines the importance of land as a factor, viewed from the standpoint of the individual farm. Finally, I indulge momentarily in some speculation about the future role of land under conditions of rapid growth in world population.

[1] For his most rounded but by no means earliest discussion of land's declining importance and of the influence of our intellectual heritage on ideas about land see T. W. Schultz, *The Economic Organization of Agriculture*, New York, McGraw Hill, 1953, chap. 8, pp. 125–45 and 'Land in Economic Growth', chap. 2 in Land Economics Institute, *Modern Land Policy*, Urbana, University of Illinois Press, 1960, pp. 17–39.

[2] H. F. Breimyer, 'The Three Economics of Agriculture', *Journal of Farm Economics*, vol. xliv, no. 3 (Aug. 1962), pp. 679–99.

[3] E. O. Heady, 'Need for Land and Resource Adjustment', chap. 1 in Iowa State University Center for Agricultural and Economic Adjustment, *Dynamics of Land Use: Needed Adjustment*, Ames, Iowa State University Press, 1961, pp. 1–26.

Reduced Importance of Land in Agriculture

Land is, of course, still no less important in the sense that agriculture is a land-based industry; algae culture and hydroponics are not yet a practical process for feeding the world. In other words, other factors are not perfect substitutes for land. However, in developed countries such as the United States of America and Australia, the proportions between land and other factors have changed substantially since 1920. Technological change, defined by Stout and Ruttan[1] as 'a change in the parameters of a production function resulting directly from the use of new knowledge' is regarded as the basic cause of this shift.[2] Factor proportions have thus changed at the optimum combination and there has been not merely a change in input combinations deriving from reduced capital rationing or other movements towards the efficiency frontier for agriculture.

Some observers have tended to discount the importance of the technological revolution in American agriculture and have ascribed part of the gains in output to farming at a higher level becoming profitable as a result of the more favourable price-cost relationships and reduced price uncertainty under government price supports. For example, Strong pointed out at the Mysore Conference that facile talk of 'technological explosions' can divert attention from the fact that 'the supply response has been to an assured high price, regardless of market, in fact under circumstances which take all but the climatic risks out of farming'.[3] However, so far as experience in the last four decades in North America and Oceania is concerned, few, I suspect, will adhere to a neo-classical view, which ascribes increased output per acre largely to increased quantities of inputs (using the term inputs here as not including new techniques and improvements in the quality of the labour force).[4] Wantrup[5] is perhaps more cautious than most when he claims that evidence in the United

[1] T. T. Stout and V. W. Ruttan, 'Regional Patterns of Technological Change in American Agriculture', *Journal of Farm Economics* (May 1958), p. 197, vol. xl, no. 2.

[2] See Marion Clawson, R. Burnell Held, and Charles H. Stoddard, *Land For The Future*, Baltimore, John Hopkins Press, 1960, p. 198.

[3] T. H. Strong, 'Using Economic Research in Policy Making', *Proceedings of the Tenth International Conference of Agricultural Economists*, Mysore, 1958, p. 225.

[4] This is not meant to imply that investments in research and in health and education cannot appropriately be regarded as inputs (especially for aggregate production functions and long-term supply functions). Schultz has suggested that this is necessary in his paper 'Reflections on Agricultural Production, Output and Supply', *Journal of Farm Economics*, vol. xxxviii, no. 3 (Aug. 1956), pp. 748–62.

[5] S. V. Ciriacy-Wantrup, *Conceptual Problems in Projecting the Demand For Land and Water*, Giannini Foundation Paper no. 176, University of California, Berkeley, 1959, p. 21. (Reprinted in *Modern Land Policy*.)

States during the last fifty years does not give unqualified support to either the modern (technology-stressing) view, or the classical view (stressing traditional inputs and diminishing returns). Nevertheless, one must agree with him that the analytical methods used and interpretation of data for the U.S.A. are by no means unassailable. Many of the studies use residual imputation techniques in estimating distributive shares of factors. In others curve-fitting methods give results of little structural or predictive significance.[1] There may well be wider divergence of views about the magnitude of contributions of technological advances to future increased agricultural output, which can be counted on towards feeding an increased world population during the next four or five decades.

The Tyranny of Old Ideas

The half-life of ideas on land is exceptionally long and the pollution of the policy arena with outmoded but stubborn ideas remains high, nearly a century after their parent theories were discarded. Beneath many current ideas on agricultural policy and on economic development generally lie strong influences of the theoretical framework constructed by Ricardo and the other classical economists. In Ricardo's vision of economic growth, land occupied a central position as the ultimate limiting factor. Land was treated as fixed in supply, being defined to fit this premise as the original and indestructible powers of the soil. As population growth called for the use of successively less fertile land in agricultural production, secularly diminishing returns to other factors of production would inevitably ensue. Landowners would be enriched as rents for agricultural land absorbed an increasing share of national product and the return to capital would be driven down to zero, at which point no further inducement to investment would exist and the stationary state would have been reached. Like most economic theories, Ricardo's description of the process of economic growth and its gloomy outcome, had ideological objectives. The emergence of the stationary state could be deferred, he held, by the repeal of the Corn Laws. This dismantling of trade barriers would enable the limit to economic growth to be postponed at least for as long as the vast lands of the New World were being brought into production as a source of cheaper food.

[1] For a criticism of the fitting of aggregate production functions to non-experimental data, see G. G. Judge, 'Discussion: Estimates of the Aggregate Agricultural Production Function from Cross-Sectional Data', *Journal of Farm Economics*, vol. xlv, no. 2 (May 1963), pp. 429–32.

Even when the Ricardian theory of rent was replaced by a theory of distribution, in which the distributive share of land was explained by reasoning no different from that for other factors, the notion of secularly diminishing returns against land continued to dominate the thinking of many economists and even more the thinking of practical men. Schultz[1] has noted that even as late as 1920 Marshall remained a victim of his own ancestral piety. Moreover, these hand-me-down ideas pertaining to land continue to exert a strong influence today over thinking on many economic issues. Schultz mentions, as examples, Colin Clark's ill-fated predictions for 1960 and the widespread tendency among 'economic developers' to start with a pre-conception that agriculture can contribute little or nothing to economic growth in the less fully developed countries because of its well-known propensity for bringing diminishing returns into play. We could all doubtless add to these examples from our own experience. Without any effort on my part to collect them, several choice specimens turned up in my own recent reading. They are perhaps worth displaying in order to illustrate the degree to which the corollaries of a bygone theory, clearly inadequate to explain events in the real world, still pervade and debilitate our thinking in a multitude of ways.

Not long ago one of Australia's leading general economists argued that, since the amount of exploitable natural resources was ultimately limited, any very substantial increases in population would necessarily be detrimental to average productivity and levels of living in Australia. In order to meet the food needs of a growing population, he claimed, it would be necessary for primary producers to resort to lands of progressively lower fertility, giving rise to lower average productivity in agriculture.[2] This was a popular dogma in my own undergraduate days. We used to be told that Australia's capacity to support population was limited by her vast arid lands. The limit was estimated at fourteen million people. Recently I encountered this old friend in America where a television programme explained that Australia's population capacity was no more than twenty-five million because of the large proportion of the land area made up of arid wastes. Such is the durability of ideas that perhaps when Australia has upwards of 100 million prosperous inhabitants, land will still be regarded there as condemning the country to a very restricted future.

[1] T. W. Schultz, 'Land in Economic Growth', op. cit., p. 22.

[2] P. H. Karmel, 'The Economic Effects of Immigration' in *Australia and the Migrant*, Australian Institute of Political Science, Melbourne, Angus and Robertson, 1953.

Another example of the hold which outmoded concepts and frames of reference continue to exercise over our thinking is provided in a recent U.S.D.A. publication.[1] The author concludes that North America is emerging as the breadbasket of the world. 'Agricultural production potential is now concentrated in North America' as Western Europe lacks land, and other regions lack either one or more essential inputs or suitable institutional conditions. Not only is this view of Europe's lack of agricultural potential inconsistent with recent concern in the United States over the likely output-expanding effects of the European Common Agricultural Policy; it rests on a vision of limited substitution possibilities for land and capital which is sharply at variance with the facts of rural life in Northern America during the last four decades.

Some closely related dogmas surround other natural resources, especially water. Like land, water is a good that can be produced at a price and as Headley and Ruttan[2] show existing substitution possibilities among input categories are 'clearly inconsistent with an approach which regards a specific level of irrigation development as essential to continued expansion of farm output'.

Moreover, is it not possible that the failure of efforts to develop satisfactory land classifications owes something to the implication, in classical theory, that land can be uniquely ranked by the quality of its fertility services? John D. Black's paper[3] pointing out that there is no marginal or submarginal land, *only marginal and submarginal uses of land*, was an attempt to free thinking on agricultural adjustment from this further link with the classical economists.

It is tempting to search for traces of fallout from old ideas on land in the development of ambitions for territorial conquest during the last century and a half. Ricardo urged free trade as the means of staving off the dismal climax to the process of economic growth. To others enlargement of one's land base may well have appeared a better alternative. I must leave to the historians, however, the task of assessing the extent to which the classical economists' views on land may have disrupted peace in the past or may still do so in the future. This, is not the only reason to deplore the tendency of some general

[1] L. R. Brown, *Man, Land and Food. Looking Ahead at World Food Needs*, United States Department of Agriculture, Economic Research Service, Foreign Agricultural Economic Report no. 11 (Nov. 1963), p. 132.

[2] J. C. Headley and V. W. Ruttan, 'Regional Differences in the Impact of Irrigation on Farm Output', in E. N. Castle and S. C. Smith (eds.) *Economics and Public Policy in Water Resource Development*, Ames, Iowa State University Press (forthcoming).

[3] John D. Black, 'Notes on "Poor Land" and "Submarginal Land" ', *Journal of Farm Economics*, vol. iv, no. 2 (May 1945) pp. 1–35.

economists to urge the relevance of classical economics for the problems of the under-developed countries today. The existence of Malthusian conditions in these countries (in the sense of pressure of population upon the means of subsistence) is in no way an indication that the economic models of Malthus and Ricardo provide a suitable framework for approaching their problems.

Importance of Land for the Individual Farm

Perhaps one of the characteristics of land which has helped maintain a specialized field of land economics (despite the protestations of production economists at a discipline based ostensibly on a single factor of production) is that access to or control of other factors has often been vested in the ownership of agricultural land. Land has been a preferred security for farm credit. In many forms of tenure, land ownership confers the right to make the major decisions affecting the farm business. Along with the bundle of rights to the use of land go quite frequently rights of access to product or factor markets. In view of the declining relative importance of land in agriculture one might ask whether the preservation of institutions giving such special powers and privileges to land ownership is appropriate. In some types of farming, as Breimyer[1] observes, control of variable non-farm inputs and possession of technical know-how have already superseded land ownership as the major instrument of management control, with very far-reaching implications for the organization of agriculture.

Despite the widening possibilities for factor substitution, land resources controlled by individual farmers have important implications for the efficiency of their operations. Full realization of scale economies in cropping enterprises often requires farm enlargement and consolidation. The adoption of new farm technology, as Scofield suggests, has been a strong factor influencing the demand for land in sizeable areas of country.[2] Some other types of farming, however, are becoming less directly land-based. This is clearly so in the livestock industries. Livestock production in North America has already moved far towards a factory-type operation for conversion of feedstuffs to broiler chickens, eggs, pigs, and lot-fed cattle. There has been some trend in the same direction in other economically advanced regions.

[1] H. F. Breimyer, op. cit.

[2] W. H. Scofield, 'Prevailing Land Market Forces', *Journal of Farm Economics*, vol. xxxix, no. 5 (Dec. 1957), pp. 1500–10.

Future Importance of Land

While agricultural production is not currently pressing against the supply of land in the economically developed countries, what of the long run future? Whether land will at some time to come become sharply limiting depends partly on factors governing the growth of demand, especially population growth, and partly on the pace and form of future technological progress. Technological advances affect the demand for land services in various ways. Some innovations in agriculture are neutral in their impact, increasing the ratio of yields to inputs of all resources in like proportions. More frequently, however, technological improvements will result in differential changes in the parameters for various inputs in the production function. Some developments in farm machinery have had relatively little effect on land requirements per unit of output. On the other hand, the initial saving of land involved in the substitution of mechanical for animal power was substantial and other machinery advances have had major land-saving effects especially where they enabled more timely operations and better conservation of sub-soil moisture in dryland farming. Mechanized land clearing methods have also greatly reduced costs at the extensive margin in sizeable areas such as the brigalow lands of Australia. Moreover, many of the other major technological advances in recent decades (such as synthetic organic insecticides and herbicides, hybrid corn, better fertilizers, and the correction of minor element deficiencies in soils, improved breeds for more efficient conversion of feedstuffs by livestock) have been strongly land-saving in their impact.

Pressures for standing room from growing populations are unlikely to cut significantly into the land supply for agriculture. There will undoubtedly be some encroachment on cropping lands by urban sprawl and vehicular expressways but the fact that only 2 per cent. of the land area in the United States is at present occupied by cities helps to keep this in perspective.

Speculation about the future output of technological progress is a hazardous exercise but there seems little reason for expecting a restoration of land's importance to result from a future slackening in the rate at which land-saving innovations become available. It is possible, of course, that the surge of technological change during the last four or five decades reflects a long cycle in the flow of scientific and technical developments. The historical tendency for major innovations to be clustered in time, which has been made the basis of theories explaining fluctuations in the levels of economic activity,

may mean we can expect to encounter a period in which nature is more niggardly in giving up its secrets. However, a more plausible hypothesis seems to be that the more rapid technological change of recent decades is simply a result of greater inputs in scientific research and technical improvements.

A. MÄKI, *University of Helsinki, Finland*

It has rarely been more difficult for me to get a grasp of the point at issue than when I cogitated over Professor Lewis's introduction of this subject and the opinions he advanced. This may be because he works at almost the opposite side of the globe, where conditions differ greatly from those familiar to me. Another reason, perhaps, is that he views the question primarily from the standpoint of political economy, while the branch of economics represented by me is concerned first and foremost with private economy which is touched upon only briefly, in his introduction.

It is probably because of the geographical difference that I regard the importance of land as a production factor as quite different in the European conditions, in which the population is large per unit of area and where unutilized land is relatively scarce, from what it is in Australia where there is very much land relative to the population. The latter difference between us again explains why I do not regard land as a factor of production in the sense in which the term is used in political economy to differentiate it from other property and production factors called capital by political economists. There is no difference of principle in private economy between land and other factors of production. A farmer invests capital, by which I mean here abstract purchasing power, and buys a farm which includes land, land improvement, buildings, and agricultural machines and tools. It is impossible and quite unnecessary to try to distinguish between the original land in its natural condition and the property represented by agricultural land in its present shape. In addition to capital, the farmer in most cases makes use of his own labour and that of his family. Thus, there are actually only two factors of production: capital and the labour input of the entrepreneurial family. And even of these two, the latter may be completely lacking.

When Professor Lewis's paper is considered from this standpoint it is difficult to understand the importance that he still attaches to the theories of Ricardo and other classical economists or, more correctly, to what extent he believes these theories to be regarded as important and topical by several present-day economists. He speaks of the tyranny of old ideas and goes so far as to urge historians to 'assess the

extent to which the classical economists' views on land may have disrupted peace in the past or may still do so in the future'. As I am not sufficiently familiar with conditions elsewhere, I cannot comment on the general attitude adopted to the theories of Ricardo and other classical economists. The significance of these theories is very small or nil today, at any rate in the conditions with which I am familiar, and I do not understand the necessity for any reference to them, for example, in practical agricultural policy which has gained great importance in almost every country. Classical economists must be given every credit for initiating the development of theories, for clarifying concepts, and evolving a terminology, but with the theory of land rent in the form in which it was introduced by Ricardo, I have never been able to agree. When a farmer invests capital in agriculture he also expects to derive a return which is called rent. The question of how this rent is distributed between the different parts of property is largely a matter of deliberation, but I would like to suggest that the yield gained should be divided between all parts of the property. Hence, land rent, to use this old term, arises practically always, and not only in the cases mentioned by Ricardo.

Another classical theory mentioned by Professor Lewis is the law of diminishing returns. I was not entirely clear how he interprets this law. However, according to the elements of agricultural chemistry and, thus, also to agricultural economics, when a factor of production, for example, fertilizer, is added to the soil a certain marginal output will be obtained initially, but subsequent input units will give a successively smaller marginal output until a point is reached at which the output fails to grow any further. This phenomenon is customarily termed the law of diminishing returns, and numerous experiments and practical experience have proved that it is still valid.

As regards the principal question of this paper, the changing importance of land, I want to view it, too, only from the point of view of private economy. As stated by the speaker, land is an essential factor of production in crop husbandry, is largely so in livestock husbandry, and in some degree in all productive activity. Grain can hardly be produced profitably independently of the area of land, and the production of animal fodder also requires a considerable area of land. Although artificial fodders enter the picture in these modern times, it is difficult at this stage to imagine that domestic animals will take to artificial fodder alone to satisfy their energy requirements. As soil is indispensable in plant production and is available only in a limited degree, I do not understand fully that land may be 'a good

that can be produced at a price'. How could this be possible, for example, in Europe on a large scale? There are still considerable reserves of land in the world, but if the population grows explosively I fear that mankind must begin to study Malthus's classical theory again.

It would have been interesting to see examples and numerical data illustrating the change which Professor Lewis considers to be occurring in the importance of land. I understood him to suggest that its importance is diminishing in comparison with other factors of production. I cannot concur with this view without a more thorough study, for quite clearly there are factors influencing the trend quite differently. Professor Lewis says that in developed countries such as the United States of America and Australia, the proportions between land and the other factors have changed substantially since 1920. I am not familiar with conditions in Australia, but I recently read Professor Earl Heady's article of 1963 in the publication, *The Management Input in Agriculture*, in which he gives the fluctuations in work, land, and capital as percentages of total annual inputs of agriculture for the period 1910–60. The proportion of work has diminished from 74·6 to 30·1 per cent., the share of capital has increased correspondingly from 16·7 to 61·4 per cent., but the share of land has remained almost unchanged at 8·0 to 9·6. This percentage was 8·5 in 1960. The total of inputs has increased by 21·3 per cent. since 1910. These figures conflict with Professor Lewis's opinion. I assume, without going into the matter more thoroughly, that development in Europe has followed similar lines to those mentioned by Professor Heady and that probably no essential changes have occurred in the importance of land. Heady himself considers that the numerical data he provides illustrate the development all over the world.

Professor Lewis also touched upon the point that agricultural land is being used increasingly for other purposes. It may be that this question is not yet of universal significance, but it can be seen in my own country in the far North that considerable areas of agricultural land located in more favourable climatic conditions are used every year for roads, residential and industrial building, and other purposes. This means that the centre of gravity of agriculture is gradually moving to more and more unfavourable conditions. This naturally tends to raise agricultural production costs. The drawbacks of this development could be alleviated through national planning, and this is a point which merits greater attention than it receives at present.

SAWAENG KULTHONGKHAM, *Ministry of Agriculture, Thailand*

It is fortunate that members having problems in agricultural economics can turn to this great organization for help and valuable consultation. The Association has had a long life, and certainly has accomplished great things in the task of bringing the well-being of farmers up to the level of other occupations. There is a long way still to go. Many millions of farmers all over the world are still poor. Many have no opportunity to exchange political views, nor to have access to social affairs. There have been rich and poor for centuries, but modern means of communication enable us to recognize them. It is the task of all of us in this Association to supply scientific knowledge of farm production and distribution to farmers so that, in due time, their poverty may be eradicated. I am sure that our organization can make, and is willing to make, a great commitment to that end. The methods for doing so, particularly in developing countries like mine, are basic for discussion at this meeting, and since the land is the basic factor effecting the income of farmers, both problems should be discussed together.

Professor Lewis's thoughtful paper has dealt with what he describes as the declining importance of land in present-day agriculture. Few persons, I believe, will contest the statement in so far as the word importance may be used here in the sense of the magnitude of its contribution. It is an accomplished fact which needs no elaboration. In view of the declining relative importance of land, Professor Lewis poses an interesting question: the appropriateness of the preservation of institutions giving special powers and privileges to landownership. I quite agree with him when he says that land has been a preferred security for farm credit. Yet recent trends, especially in the field of supervised farm credit, indicate that the managerial ability of the farmers has emerged as an alternative to land in credit procurement. The right to make major business decisions, formerly almost entirely vested in landownership, has also been transferred to the tenants in many countries where land-reform laws have been enacted. These developments together with those cited in the paper certainly reveal the slackening of economic power attached to landownership. Against this background, the question of the appropriateness of the preservation of institutions for giving special powers and privileges to landownership appears to be academic rather than pressing.

If I understand it correctly, I think that Professor Lewis's discussion of outmoded but stubborn ideas is a fair statement of what is the

crucial issue in land economics today. I like particularly his warning that the existence of Malthusian conditions in developing countries is in no way an indication that the economic models of Malthus and Ricardo provide a suitable framework for approaching these problems. Coming from that area myself, I am very much concerned with the type of blunder which arises from preoccupation with an apparent situation without regard to the process. So far as developed countries are concerned, I share Professor Lewis's view that there seems to be little reason for expecting a restoration of land's importance. I agree that speculation about the future output of technological progress is a hazardous exercise. The future role of land in the developing and overpopulated countries in South-east Asia, however, is not difficult to predict. There the land input of most farms has already reached its minimum, and many factors are now operating against further reduction. Among the more important of these are: land reform movements and related government programmes, increased geographical and occupational mobility, higher educational attainment, and the rising expectation among the farm population. These, together with other factors, are more than enough to offset the pressure of rapid growth of population. Last but not least, I wish to say that I look forward to the happiest day of my life when researchers in agricultural economics discover a method to enable poor farmers to earn incomes and status equal to those of other occupations.

I. KATCHURO, *Institute of Agricultural Economics, Minsk, U.S.S.R.*

In his report Dr. Lewis enumerated interesting data on the influence of land improvement upon agricultural production.

I wish to share with you our experience of land improvement in Byelorussia and its influence on agricultural production. In the Byelorussian S.S.R. land improvement is a basic way of increasing agricultural production in an intensive way. In Byelorussia there are 7 million hectares of marshy lands or 34 per cent. of the territory. In certain areas marshy lands amount to 60 per cent. In those areas the proportion of land per agricultural worker is 0·5 hectares and gross revenue is 2·6 times less than in regions where there are no swamps, for where there are marshes intensive production is impeded.

After the Revolution land improvement began. The Government and peasants were interested in this. In 1925 64,000 hectares were drained and by 1941 drained areas reached 276,000 hectares. Out of that area, 180,000 hectares were devoted to intensive agriculture.

During the war many drainage works were destroyed and the damage involved was equivalent to 30 million roubles.

After the war, drainage began again and every year 150,000–200,000 hectares of marshes are drained. On 1 January 1963 the entire area of reclaimed land was 885,000 hectares. Out of this, 767,000 hectares are used in agriculture. According to the state plan, by 1970 1·5 million hectares will have been drained. Improvement and drainage plays an important part in agricultural production.

In the three Poleski districts, in 1962 three-quarters of the total production came from drained areas. Drainage is connected with large capital investment; the Government and the kolkhoz devoted 248 million roubles or 300 roubles per hectare of drained land to this work. This cost is recovered in 1–2 years on the best farms. In these good farms the net revenue per hectare is 200–300 roubles. Capital investment is best recovered from hemp, sugar beet, potatoes, maize, and other cereals. The best farms devote 50 per cent. of their area to these crops.

The harvest in drained lands is as follows: grain 2,500–3,000 kg. per hectare, potatoes 2,500–3,000 kg. per hectare, beet (root) 3,000–4,000 kg. per hectare, green maize 4,000–5,000 kg., and hemp 800–1,000 kg.

Experience in Byelorussia shows that drainage of marshy areas can be used effectively in agriculture.

V. Koulikov, *Tashkent, U.S.S.R.*

Irrigation plays a great part in raising the level of agricultural production. Through irrigation land productivity increases more than sevenfold. Capital investment for irrigation is recovered in 1½–2 years.

Up to the Revolution there were 560,000 hectares under irrigation in Central Asia and Russia imported 720,000 tons of cotton. In order to import cotton for the needs of the country, the Government paid out annually 700 million golden roubles. From 1870 to 1917, 330 million hectares of new land were brought under irrigation. This is less than 35,000 hectares annually. For the country it was necessary to solve the problem of production of its own cotton. This was solved in the years 1929–32.

Last year in the U.S.S.R. 5,210,000 tons of cotton were produced. This is the result of great capital investment on the part of the Government, directed towards increased production in the irrigated lands of Central Asia. In the years 1928–32 1·6 milliard roubles were devoted to irrigation. From 1964 to 1970 it is planned to invest more than 30 milliard roubles and it is intended to bring 1·6 million hectares under irrigation.

The national revenue of the Central Asian Republics on the basis

of intensification of irrigation, complex mechanization, and chemical fertilizers, has been more than doubled.

Government capital investment deeply alters agricultural production, increases soil productivity, and brings in larger crops. Work is rendered easier and the necessary conditions for the improvement of the material and cultural well-being of agricultural workers are established.

T. YAJIMA, *Hokkaido University, Japan*

My knowledge of the history of economic doctrines makes me hesitate, or rather forbids me, to attribute the so-called theory of declining importance of land to Dr. Schultz, because I remember that Karl Marx, for example, pointed out almost the same thing more than a century ago. I believe there is no argument about this so far as macro-economic observation is concerned. However the story is different if seen from the micro-economic point of view. The reasons are (1) that land is still the biggest and the most important item in the farm inventory, (2) that other items of farm inputs, their quality as well as quantity, are basically influenced and determined by land, by its amount as well as its quality, (3) that rent, in the sense of an economic category, especially differential rent, is increasing tremendously in many countries including Japan, and that farm organization is now compelled to readjust itself in compliance with the enhanced rent. This is what is generally called intensification of farming. Therefore, I must say that the importance of land is not declining so far as the individual farm is concerned.

V. STIPETIC, *University of Zagreb, Yugoslavia*

I accept Professor Lewis's view that technological changes are the basic cause of the reduced importance of land in agriculture. The battle against the tyranny of old ideas, especially against the theoretical existence of the so-called secular tendency of diminishing returns to land, is a field in which we agricultural economists ought to work much harder in future. Practical agricultural policy should be freed from the faulty heritage of the past. It seems necessary that we should deal more with the decline of land rents in contemporary agriculture, an aspect which was somewhat neglected by Professor Lewis.

I do not need to quote many data to support the view that a new technology in agriculture has caused a decline in land rents throughout the world. For example, in the United Kingdom land rents declined from 24 per cent. of the total income from agriculture in the 1870's to only 4 per cent. in the 1950's. A tendency of more or less

the same order may be observed in the United States as well as in Western Europe and Japan. It exists also in less-developed countries, but in a much milder form. The present fight for land reform, to a very great extent, is a fight for reductions in, or total abolition of land rents. There, agriculture remains within the traditional backward framework of old technology. So, if land rents tend to decline in those countries, we may say that it is a result more of a deterioration of the terms of trade for agricultural products on world markets and from land reform, than of the application of new technology in agriculture.

It is extremely important to explain theoretically how and why the introduction of new technology tends to lower land rents in the long run. The usual explanation, that it just reflects a declining role of land as a factor of production, seems to be merely a tautology without deep theoretical significance. According to my investigations, which were published a couple of years ago, the answers ought to be sought in three different but connected sectors, namely: (1) in the tendency towards capital-intensive agriculture which is equalizing capital employed per person in manufacturing and in agriculture, (2) in the fact that higher yields per acre enable society to get food from land of better quality. Marginal and sub-marginal land has been going out of production. As a result, there is an immediate fall in differential land rents throughout agriculture. For example, one could mention the case of Western Europe where in the past fifty years about eight million hectares of the poorest arable land have gone out of production. (3) In the introduction of new technology which has reduced the differences in soil fertility. This also works in the direction of lowering land rents.

I would emphasize again that the theoretical approach to falling land rents has to be observed from the point of view of price levels, the institutional set-up and the economic impact of new technology in agriculture, all of which create falling land rents.

A. B. Lewis, *The Agricultural Development Council, New York, U.S.A.*

There are two crucial points which should at least be mentioned. Since 1930, at various times I have been engaged in or concerned with projects for the economic classification of agricultural land, first at Cornell University in New York State, and later in China, many parts of the United States, Puerto Rico, Costa Rica, and, very recently, Japan and Taiwan. A project is under way at the Taiwan Provincial Chung Hsing University, under the supervision of Professor Shison C. Lee, one of our members here, which is intended

to provide an economic land classification map of the entire island. In these studies, land areas have been classified according to the opportunity which the land offers to a farmer to earn an income and to accumulate capital. In many studies farm business data have been collected for large numbers of farms, and the performance of farms in different land classes has been compared.

Through these studies we have been able to identify two main groups of land factors affecting agriculture. First, there are the so-called regional factors—mainly climate and land–water relationships —which largely determine the kind of crop and livestock enterprises that farmers can best adopt. As technological progress occurs and farmers learn how to employ effectively an increasing variety and volume of costly inputs in production, we observe that particular types of enterprise become more and more specialized in places where the regional land characteristics are most favourable to them. Farmers cannot risk investing large sums in agricultural inputs per acre or per animal in areas where the regional characteristics of the land are less favourable, though we know that formerly, when development was far less advanced, many enterprises were more or less generalized over many regions.

The second major group of land factors, mainly soil and topographic, largely determine the degree of success of farm families in producing the crop and livestock products whose choice is dictated to them by the regional factors. On the basis of the second group of land factors, agricultural regions are subclassified into economic land classes. So influential are the soil and topographic factors that, as is well known, the technological development of agriculture in many regions, as in the eastern U.S.A., has resulted in the widespread abandonment of lands whose unfavourable soil and topographic features give them a low capacity to yield a return to increased inputs. At the same time, total production, obtained on a much smaller area of land of better soil and topographic characteristics and a higher capacity to yield a return for inputs, has steadily risen.

In summary, as agricultural technology advances, farmers must and do choose with increasing care the basic land resources on which they conduct their enterprises. As previously noted in this discussion by Professor Yajima, land is not a mere input in production. It is the thing into which, or on to which, the inputs are put, and its nature determines the amount and the nature of both the inputs that are invested in agriculture and the farm capital that can be accumulated on the land. In view of the findings of our studies, to which I would gladly provide references, there seems to be ample evidence that, as

agricultural technology improves and the volume and value of inputs increase, land becomes steadily more important as a factor in production.

R. P. SINHA, *University of Manchester, U.K.*

I accept Professor Lewis's basic thesis that with technological innovation the importance of land will decline. But as the pace of technological innovation is likely to be very slow in many densely populated countries there is still a case for co-ordinated planning and economy in the use of land. My most fundamental disagreement with Professor Lewis is where he emphatically deplores the tendency of some general economists to urge the relevance of classical economics for the problems of the under-developed countries today, and arrives at the conclusion that the Malthus and Ricardo models do not provide a suitable framework for approaching these problems. He has failed to produce any convincing arguments on this point. One could agree to disagree on the policy implications of the Ricardian thesis, or the classical thesis as a whole, but the model itself and the mechanics of development, in so far as the distribution of income and capital formation are concerned, can be applied to underdeveloped countries. Professor Lewis's thesis is woven around the idea that technological progress shifts the production possibility curve upwards. This possibility was not ignored by Ricardo. With the time at my disposal I cannot go into the details of the classical theory of development, but I will describe a situation which seems to be very nearly Ricardian in essence, if not in detail. In many developing countries, the rising demand for food has increased the food prices and consequently the 'rent' in the Ricardian sense. This surplus, as Ricardo foresaw, is not necessarily devoted by large landowners (I am not talking of small peasant farmers) to developmental purposes. So, any transference of income in terms of higher prices to this group retards capital formation. Most of it is spent either on luxuries or on speculation in land. Now that in many underdeveloped countries (India being typical) land reforms have fixed a ceiling on land holding, these big landowners enter the food-grains market as speculators. This tends to keep food prices high. Many of these landed interests have strong political backing, so counter measures are seldom effective. Ricardo hinted at the possibility of a clash between the interests of such land-holders and the national interests.

As an analytical tool, I should think that the classical system (in which I would include Adam Smith, Ricardo, Malthus, Mill, and

Marx) produced the most comprehensive theory of development in the last two hundred years. The theory is simplified but hardly redundant. The truth does not lie in extremes. Some of the assumptions made by the classical economists regarding the developing economies of the eighteenth and nineteenth centuries may not be valid for the developing economies of the twentieth century, yet the theory may offer some insight into the problems of developing economies. Instead of discarding the assumptions I would prefer to qualify or modify them.

J. N. Lewis (*in reply*)

Although my discussants have not pulled any punches, they have been kinder to me than one rather disconcerting critic who looked over my paper before the meeting. He concluded the whole paper was based on a man of straw but advised me to let it be. 'If you start correcting it now', he said, 'you will have nothing left!'

Professor Mäki and I approach the topic from basically different viewpoints. I am concerned primarily with the political economy of agriculture, although I have included a brief section on the importance of land to individual farmers. He finds the relative neglect of the micro- or farm-level problems a weakness of my paper, but within the limit of three thousand words it was bound to reflect an uneven coverage. Perhaps I did devote a disproportionate space to the tyranny of old ideas concerning land. But I found this fascinating and certainly not without major implications for public policy in land development and many other fields. I was not aware, when I started, how completely Schultz had anticipated me.

We seem to be somewhat at cross purposes over diminishing returns. Rejection of the doctrine of secularly diminishing returns of other factors against land does not imply any challenge to the law of diminishing returns to single factors, other inputs being constant. Unless one defines land in terms only of its spatial aspects, it can be produced, like water and other resources, at a price. The Netherlands land reclamation programme is a good example of this. Professors Kulikov and Katchuro, have given further instances, during the discussion, in the reclamation of marshland and irrigation developments in the U.S.S.R.

Dr. Yajima claims that Marx anticipated the ideas propounded by Schultz concerning land's decline in relative importance. I do not know to what extent, if at all, Marx freed himself of the classical economists' belief in an inevitable enrichment of the rentier class.

But one can assert in fairness that Schultz was the first to develop a comprehensive body of theory, giving a more satisfactory explanation of the economic relations between agriculture and the rest of the economy than that given by classical theory. Schultz readily acknowledges his debt to John Stuart Mill and the other classical economists, and probably could not have made his contribution if he had not been so steeped in their writings.

One speaker mentioned the rise of land values in Japan and suggested this was inconsistent with the view that the relative importance of land was declining. Rising land values in themselves do nothing to disprove Schultz's hypothesis, and in any case are not surprising in a country which supports rice at about four times the world price level.

Dr. A. B. Lewis put my case rather better than I did, before advancing the contention that deteriorating terms of trade for primary producing countries account for much of the failure of returns to land to increase in relative terms. I agree with him that they are part of the story but, of course, technological advances in turn account for much of the deterioration in the terms of trade of under-developed countries. I do not think that under-developed countries should become obsessed with the terms of trade which do not afford a good measure of the gains from trade. If they proceed (as at the recent U.N. Conference on Trade and Development) on the basis that the pressing thing to do to facilitate their economic development is first to improve the terms of trade, turned against them largely by unfair actions of industrial countries, they could well be led to support inappropriate programmes serving actually to constrain their rate of development or to channel it along unsound lines.