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Agricultural Growth – Formulation, Evaluation and Policy Consequences

INTRODUCTION

Most of the world's population still lives in countries that are largely rural, and the development of such countries is of general interest. The development of a rural economy is largely related to the development of its agricultural sector. The agricultural sector is not isolated; it is interdependent with the rest of the economy through the factor and product markets, and changes in such markets affect all major sources. This interdependence must be taken into account when important policy questions and measures are considered and evaluated. Specifically, the effects of changes in resource endowment and in supply of final or intermediate products (for instance, due to foreign aid) cannot be limited to one sector, and the feedback cannot be ignored. That, of course, also holds true with respect to price policies, changes in technologies, and any other important measures.

In order to be able to assess the consequences of development policies, it is necessary to understand the process of growth. The distinction between the two concepts is made here in order to emphasize that the concept of development implies some intervention in the process of economic growth. Intervention is generally motivated by the desire to achieve targets, such as higher rates of growth or improvement in the distribution of income or consumption, and it will result in altering the process of growth. A full understanding of these results requires evaluating them within a dynamic framework which allows comparison of the growth paths that will occur under different intervention measures in any given economy.

There are various models that deal with sectoral growth in the context of general equilibrium. However, much of the discussion on economic growth is inspired by stylized facts. The casual observer can easily discover that while the style has remained fairly constant over a long period of time, the facts vary greatly over time and space. Thus, it is suggested that more insight can be gained by concentrating on the facts. This is the

* I am indebted to George M. Kuznets for commenting on an earlier draft.

theme of the approach discussed in this paper. We start by stating the current views on the sources of growth and thereby establish two points. First, that capital accumulation may be more prominent in growth generation than is usually considered and second that improving resource allocation may contribute greatly to growth, as explained in the section devoted to that subject. Intersectoral factor mobility is given analytical prominence as an essential element in the construction of a proper growth model. The various components of this analysis are then drawn together to sketch the framework guiding the research centered at IFPRI. The whole subject of growth is sometimes viewed ambivalently by researchers and policy makers. Some reflections on this point conclude the paper.

SOURCES OF GROWTH AND SOME IMPLICATIONS

An increase in output per caput is achieved by an increase in the ratio of resources to population and by improving the resource utilization. At present, in most countries, aside from population, the resources that are accumulated are aggregated into one variable, capital. There are different forms of capital and in various discussions it is useful to distinguish between some forms and particularly between physical and human capital. However, the common feature of the various forms of capital is that they are financed by sacrificing present consumption and consequently the value of capital formation in any year is simply the value of the sacrificed consumption. The relevance of this basic point will become clear below.

The improvement in the utilization of resources is referred to as technical change. As with capital, there are various forms of technical change. For some purposes they can be aggregated. A common form of aggregation is to consider the marginal affect of technical change on output which leads to the measurement of technical change as a residual.[1]

One of the most important subjects related to our understanding of economic growth is the quantification of the contribution of the two sources, capital accumulation and technical change, to economic growth. Such a quantification may be viewed as an empirical question, but not a very simple one. If the two components are assumed to be independent, it turns out that the direct contribution of capital accumulation to growth is small relative to that of the residual technical change.[2] Taking it at face value, this result is somewhat unsatisfactory for it does not explain why some countries and some periods are blessed with a large residual technical change whereas others are not. It is more tempting to disaggregate the residual technical change to some postulated sources. This is basically the position taken by writers like Jorgenson and Griliches (1967), and Dennison (1974). One postulated source is the improvement in the qualities of inputs. Improvement in the quality of labour is attributed largely to an increase in the amount of human capital embedded in labour. Human capital is generated by schooling, training, health etc.[3]

The works of Schultz (1960, 1961) and Becker (1962), established the prominence of education in the production of human capital. Once variables that contribute to productivity, such as education or research, are identified, they can be introduced explicitly into the production function. This was the approach of Griliches in his work on the Productivity Growth of US Agriculture. [Griliches, 1963, 1964]. The introduction of such variables into the production functions indicate that they are important and as such, they provide an explanation for sources of growth. In as much as this identification of source of growth is important, it should be emphasized that increasing the level of these variables requires resources. This is basically suggested in the name "human capital". Consequently, the degree to which these sources of growth can be exploited by any given country is limited by the amount of savings which the country can generate, domestically and from abroad.

It may be useful to elaborate further on this point. The technology available to the economy at any given point in time consists of a distribution of techniques which, among other things vary in their capital intensities.[4] It is possible that more than one technique can be employed simultaneously. As the overall capital labour ratio in the economy increases there is a shift from the low to the high capital–labour techniques.[5] This intuitive result has very far reaching implications. It is applicable to human capital as well as to physical capital and it is applicable in both ways. Not only that accumulation results in capital intensive activities but also further use of capital (human and physical) intensive activities requires capital accumulation. Thus it is not sufficient to list for a country the portfolio of promising investments. The country should have the means for the implementation of this portfolio. To make the argument more concrete, reference can be made to the green revolution where the planting of the high yielding varieties had to be combined with other inputs as well as knowledge generated in schools, by extension service and by experiment stations. All these have somehow to be financed.

Another source of growth is the interindustry shift of resources (Kuznets, 1946). Such a shift results from a decision by firms and individuals. As it constitutes an important element of our discussion, we devote the next section to a discussion of some aspects of the micro foundations of resource allocation.

ALLOCATION OF RESOURCES

Competitive conditions require that the prices of a homogeneous factor be equal in all alternative uses. In most economies agricultural wages are lower than non-agricultural wages and therefore a competitive condition is violated. The phenomenon is not transitory; it endures for a long period of time, which can be measured in terms of decades and centuries. However, eventually the gap in sectoral wages diminishes and finally it

disappears. Two implications can be drawn from this observation: (1) There are forces in the economy that act in the direction of equating factor prices; (2) The process of resource allocation requires real time. The fact that a response to market prices may not be immediate and requires time for completion is not new and it constitutes the corner stone of distributed lag analysis.

In general, economic analysis of resource allocation which allows for lagged response to economic stimuli treats the time pattern of the response as exogenous to the economic system. Such a treatment has no justification; it may be misleading in that it distorts our views with respect to the operation of the economic system. The very same considerations that have led to the introduction of lagged response can also be used to argue that the path of resource allocation is an endogenous variable, that is a variable whose value at any time is determined within the economic system. This position is taken here with respect to the formulation of the agricultural growth model. However, it is also relevant for the study of the various attributes of the product supply and factor demand at lower levels of aggregation, such as firms or industries.[6]

Generally, models of distributed lags assume that a response of the economic units to a change in the exogenous variables is completed within several periods (usually years). The speed of the response is represented by the coefficient of adjustment. The coefficient of adjustment is given exogenously and the economic analysis becomes largely an interesting statistical exercise in estimation. This observation applies to models assuming constant as well as variable coefficients of adjustment. The latter are determined by fitting a flexible polynomial scheme to the data. It is done in order to capture complex response patterns that cannot be captured by a constant coeffient of adjustment models. However, it should be indicated that allowing for a more detailed description of the response path, when this path is endogenous, has its drawbacks. Different economic conditions may generate very different adjustment paths. An attempt to approximate one such path by another may result in considerable error. Yet, with a variety of technical procedures, some of which are very imaginative, this is essentially the practice in many of the empirical studies, dealing with resource allocation.

A different view on the matter was expressed in two articles dealing with the response of a competitive firm [Mundlak 1966, 1967]. This view can be put forward in a way that will serve the subsequent discussion. As Glenn Johnson emphasized [Johnson, 1956, 1958], at any given point in time the economic unit, firm or farm in our case, possesses various assets yielding positive quasi rents whose capitalized values are above the market prices of the assets. The firm therefore finds it profitable to continue using the assets. Quasi rents are derived from the services that those assets render in production. That means that the production plans of the firm are based on the utilization of such assets and the response of the firm to prices and to price variations depend on the level of such assets. The analysis is generalized directly to other commitments or

contractual arrangements in which the firm is engaged. In short, the response of the firm is affected by some fixed factors and as such it is a short run response. Applying it to agriculture, and specifically to farm systems based on family labour, labour can be included among the fixed factors. We return to this problem below. Technically, what this means is that strictly speaking the level of the fixed factors should be included in the short run response functions. But since all economic observations are at best generated by short run equilibrium (rather than long run), it follows that the fixed variables should be included in all the response functions. The evaluation of the quasi rents of such contractual arrangements and consequently the changes that take place in their stocks depend on the firm's views or expectations with respect to the economic environment and specifically with respect to prices. As those change, changes take place in the level of the fixed inputs. It is then necessary to express the behavioural equations for the fixed factors in terms of the relevant prices and the level and nature of the existing commitments.

This approach leads to a recursive system describing the behaviour of the firm in terms of factor demand equations, each equation expressed in terms of the relevant prices and the factors of production which can be considered as fixed over the time domain pertinent to the particular decision. Specifically, when applied to investment, investment is not expressed as a function of outputs, as the flexible accelerator formulation suggests. Instead, it is expressed as a function of prices and rates of returns. This is the essence of the analysis. It deals with a competitive firm with decreasing returns to scale, for otherwise there is no profit maximization solution. The analysis is easily generalized to a non-competitive firm with constant returns to scale or to a competitive firm whose output is determined exogenously and whose domain is optimization is cost minimization.[7]

Before concluding this section it should be indicated that there is another topic which is pertinent to the discussion of resource allocation in agriculture and related empirical analysis. Economic analysis is based on the assumption of profit maximization by the firms. As much as profits are desired they need not be the only criterion for the firm's behaviour. Other considerations such as uncertainty, the leisure component of various activities are also taken into account. Thus it is possible to consider a utility function of the firm in which profits are one of the arguments but not the only one. The firm seeks to maximize utility rather than profits. The optimal solution depends on the utility function and it can be expected to be different from the profit maximization solution [Mundlak, 1971]. The solution of course depends on prices and its behaviour in prices is discussed elsewhere [Mundlak and Volcani, 1973]. Two conclusions of this analysis are pertinent for our discussion. First, under such formulation a consistent discrepancy can be found between the value marginal productivities and factor prices. Such discrepancies may vary among various activities. Second, other things being equal, the partial response of quantities to price variations should be of the same sign as that obtained under profit maximization.

INTERSECTORAL FACTOR MOBILITY

As indicated above, at any point in time there may be factor price differences in the economy. At the sectoral level, except for very mature economies, agricultural wages are lower than non-agricultural wages. Also differences may exist in the rates of return on capital. The direction of the differences in the rates of return is not necessarily the same as that of wages although it is usually believed to be so. Such a belief may serve as an explanation for the widely held idea that agriculture should finance growth. This idea has led to government intervention which has taken various forms in different countries.

Two questions immediately arise: first, why are there differences in factor prices and second what are their consequences. As we deal with a dynamic system, the reasons and the consequences are somewhat related. Wage differences are caused by a differential growth in the excess demand for labour in the two sectors. The demand for factors is derived from a demand for the final product which by itself is subject to differential growth. It is well known that the income elasticity of the agricultural product is less than unity, and therefore the income elasticity of the non-agricultural product is larger than unity. Consequently, the income effect of growth calls for a larger expansion of the non-agricultural sector.[8] In addition to the income effect there is also a price effect which tends to increase the relative price of the labour intensive product. That generates a substitution effect in demand which supplements the income effect on differential growth. It then emerges that there is an overall tendency for a faster development of the non-agricultural sector which affects the demand for labour. However, the demand for labour need not change at the same rate as that of the product demand. As capital accumulates there is a tendency for a substitution of capital for labour. That takes place in both sectors, which implies not only that agriculture expands at a lower rate, as compared to the other sector, but that its demand for labour expands at an even lower rate. If the natural rate of growth of the labour force (assuming a constant rate of participation) is the same in both sectors, we find that this process generates excess supply of labour in agriculture.

To the effect of capital accumulation on differential growth we have to add the effect of technical change. This is more complex in view of the various possibilities which exist. To simplify the exposition we assume that technical change is Hicks' neutral, and of equal rate, in both sectors. Under this assumption, only the income effect exists and it augments the effect of capital accumulation considered above.

The excess supply of agricultural labour generated by the process described above tends to press down agricultural wages while the excess demand in the non-agricultural sector tends to raise wages in that sector. This analysis can be further complicated in various ways but there is no need to do so for the purpose on hand. A similar analysis applies to the rates of return on capital, with only one exception: the accumulation of

capital results in a decline in the rate of returns relative to wages and consequently in a factor substitution effect leading to an increase in the demand for capital in both sectors. However, the net effect depends also on the sectoral elasticities of substitution.

Unless the elasticity of substitution in agriculture is large relative to that of the non-agricultural sector, the factor substitution effect will not change the final conclusion of a tendency toward a faster growth in demand for capital in the non-agricultural sector. Whether or not this development leads to excess demand depends also on the generation of sectoral savings. The sectoral savings behaviour has not been sufficiently investigated. However, other things being equal, the permanent income hypothesis might suggest higher savings rates in agriculture since agricultural income is subject to wider fluctuations. This is also supported by some evidence. In any case, higher savings rates in agriculture are in line with the generation of excess supply of capital in agriculture.

In a comparatively static model economy excess supply is automatically corrected by a proper change in prices. Such a correction does not require any time since time does not appear in the analysis either explicitly or implicitly. This is a missing link that has to be added to a model which pretends to explain actual data. This is also what has to be done here in order to trace the consequences of factor price differences. The basic premise is that factors move from a sector of low returns to that of high returns. Thus, there is a continuous off farm migration which comes to a halt only when the wage gap properly measured, disappears. The time rate of migration is postulated to depend on the wage differential itself as well as on the relative size of the two sectors and some additional variables. The dependence of the migration on the wage differential and the size of the sectors makes migration, and thereby labour allocation, an endogenous variable within the system. The larger is the gap, the larger is the rate of migration. Such an approach was applied to cross country, to time series data for Japan and for Argentina.[9] The empirical analysis provides quantitative results for the coefficients in question, all in line with the expected direction. The implication of this approach is that the size of the sectoral labour force at any given point in time is equal to the labour force in the previous period plus the natural rate of growth less migration (migration being negative for the receiving sector).

A somewhat similar approach is taken with respect to capital, except that here only the new savings are allowed to move between sectors. For a closed economy without a government we define an inter-sectoral flow of savings which is equal to the difference between the savings generated within the sector and the investment in the sector. The flow of savings is assumed to depend on the ratio of the sectoral rates of returns.[10] Consequently, the change in the sectoral stock of capital is endogenous within the system. The question is how is such a system postulated to operate. This is taken up in the next section.

A FRAMEWORK FOR SECTORAL GROWTH

We have argued at some length that at any given point in time the intersectoral resource allocation in the economy is pretty much determined. This feature has to be incorporated into the model which should explain the behaviour of the system over time. Consequently, the supply conditions at any point in time are rather simple. The resource allocation and the technology determine the sectoral outputs. Outputs are distributed, in a closed economy without government, between consumption and investment. Demand equations for the final products and for the investment goods together with the fixed supplies determine the product price ratio for that period, simultaneously with the distribution of the various products among the various uses. Given the technology and sectoral resource allocation, factor shadow prices are determined and they in turn determine the flow of resources from a sector of low returns to a sector of high returns. The resource flow, together with population growth and capital accumulation, determine the availability of resources to the two sectors in the next period. Adding the effects of changes in technology, the outputs in the next period are determined and the process repeats itself.

The dynamics of the economy is formulated in terms of a period analysis. The length of the period is determined by a practical matter, by the period of national accounting, which is generally a year. The question is to what extent does the length of the period matter and, specifically, if the period were made very short, say a day, would the behaviour of the economy become closer to that of a competitive economy? The length of the period matters in the same way that it matters in distributed lag analysis [Mundlak, 1961b]. The shorter is the period of analysis, the lower is the rate of adjustment which in our case implies lower migration and flow rates. Thus as the period of analysis approaches zero, the limiting case of this economy diverges from the competitive economy. The economy approaches that of a competitive economy when the period of analysis becomes very long, say a century. But such an analysis, while it may be of interest to future historians, is of no present concern. However, it should be indicated that the higher are the rates of adjustment, the faster will the factor price gaps tend to disappear and therefore, it would require less time for the economy to converge to a competitive economy.

As the time path of the endogenous variables depends, among other things, on the rate of intersectoral factor allocation, the path itself is endogenous in the system. In order to compute the path, the system is expressed as difference equations and a solution is obtained for the various rates of growth in terms of the various parameters which are estimated empirically. The solutions are data specific and the growth scenarios depend on the initial values of the exogenous variables and the parameters.

This model was applied to the Japanese data [Mundlak, 1979]. The model is extended to cover foreign trade and the extended model is being

fitted to Argentinian data. The model is further extended to include government and this version will be fitted to Mexican data.[11]

Fitting the model to the data implies a selection of values for the various parameters in question and then generating the time path of the various endogenous variables of interest. The computed time path is compared with the actual data. If the discrepancy is large, some values of the parameters are changed and the computation is repeated. Thus, the criterion is that of a good fit for several equations. The criterion could be made more rigid leading to an optimization technique. We have not gone this far yet since the main problem is that we allow for a change of parameters over time and none of the standard optimization techniques accommodates such a situation. The basic idea is that there is no need to assume that the parameters in question are constant throughout the period, as the standard econometric models do. Once we allow for variable parameters we face a very rich set of possibilities. This is an interesting problem by itself, but beyond the scope of the present discussion.

Once the model is fitted to the data, it is possible to raise various questions. The technical questions are clear. For instance, it is possible to examine the sensitivity of the fit to changes in the parameters and thereby gain a "feel" for the quality of the final estimates of the parameters used in the analysis. A different set of questions to be asked is that of "if–then" questions. That is, deriving scenarios under hypothetical conditions. Several such scenarios were derived with respect to the Japanese economy of which we mention one. It is customary to think that agriculture played an important role in the financing of Japanese economic growth. To examine this hypothesis, the growth of the Japanese economy was simulated under the constraint of no flow of savings from agriculture to the non-agricultural sector. The resulting growth path did not differ a great deal from the basic fit. Thus, the use of a complete model for testing the hypothesis does not support it. On the other hand, a similar computation with respect to labour migration indicates that if labour were not allowed to migrate from agriculture, the development of the economy would have been greatly affected. The calculations start with 1905. Such findings have far reaching policy implications. Specifically, one should question the use of government policies of taxing agriculture in order to finance the non-agricultural sector. We have quoted here only one aspect of this policy and there are other unfavourable aspects which augment the above implications. A recent criticism of such policies evaluated against the background of the Indian experiences were expressed by Mellor [Mellor, 1976].

Finally, the model can be used for examining the consequences of various policies. This is done by generating growth paths under the constraints imposed by the policies. One question that we have ignored thus far is the question of distribution. This question can be handled at various levels. At the technical level it can be easily incorporated into the model. It is also possible to trace the effect of various variables on

distribution. Such a treatment is far too broad to be pursued here. However, there is a broader aspect to this issue that is related not only to economic analysis but also to economic policy which we overview in the next section.

SOME REFLECTIONS ON GROWTH AND DISTRIBUTION

The process of economic growth increases the sustained stream of output per caput of a country and thereby facilitates an expansion of consumption per caput. As such it should be viewed favourably, independently of the income level or distribution of the country. This is not always the case. Measures leading to growth are sometimes judged by their effects on distribution as some discussions of the consequences of the green revolution demonstrate. Such a discussion is naturally of interest and has some policy consequences. Yet, attempts to judge steps leading to economic growth solely or largely by their effect on distribution may be very costly in terms of both growth and distribution. This statement should be viewed within an historical perspective. High variance and skewed income distributions are at least as old as recorded history. On the other hand economic growth is a relatively recent phenomenon.[12] It immediately follows that inequality of income distribution cannot be attributed to economic growth, nor for that matter can it be said that inequality necessarily leads to growth.

One may puzzle why the discussion on distribution has been linked to that of growth. Two possibilities come immediately to mind. First, growth expands income, and perhaps it is implicitly assumed that it is easier to affect the distribution of new income than that of existing income. Second, the increasing interest of international agencies that have the ability to affect domestic policies and to link their own views of desirable distribution to the economic assistance that they offer. Also, there is some convenience in assuming that poverty should be largely alleviated through the redistribution of new income since it diverts attention from the consideration of redistribution of the present wealth or income flow. Poverty exists in many countries whose average income can be considered to be above subsistence. If a high premium is placed on the elimination of poverty, through redistribution, there is no need to wait for economic growth to take place.

The purpose of bringing this argument in here is not to point at inconsistent thinking but rather to emphasize that in view of the historical record, the problem of distribution is apparently not as simple as it is sometimes viewed. Inequality in distribution and poverty have existed in countries and periods which are otherwise very different in many other dimensions. Whether or not the reasons for such a phenomenon are fully understood, it is clear that economic growth generates rents in the economic system. However, generation of rents is not specific to economic growth. Any change in the physical, economic, political or

social environment which affects economic variables generates rents, positive to some and negative to others. No economic system can be sheltered from changes which generate rents and it is therefore not very productive to concentrate our attention on searching for such shelters. What distinguishes economic growth is not the generation of rents but the openings of new opportunities and important among them are the opportunities which are opened up for labour previously employed in low productivity activities.

Arguments are sometimes posed relating the distribution to the welfare of the low income group. In essence the claim states that it is better to be poor in a poor country than to be poor in a rich country. This claim may seem logical but not necessarily in line with the evidence. In recent years about one million Mexican workers cross the border annually to join the US labour market. This is a choice of people to be relatively poor in a rich country. At the same time, no movement of labour is recorded in the opposite direction, that is, there is no movement of poor people who chose to be poor in a poor country. What seems to matter here is the immediate improvement and the prospects for economically better future which dominate any other considerations. These of course are the elements which are generated by economic growth. The revealed preference of the people whose well being we seek is clear and strong.

Sometimes there is a reluctance to deal with economic growth professionally on the ground that there are some pressing short run problems to be solved and it is therefore a luxury to deal with long run problems such as growth. Such an argument could be understood if economic activities were completely separable and independent over periods, so that the level of activity to day were completely independent of the decisions taken in the past. As this is not the case, decisions taken today do affect the future and it is therefore indeed important to be able to assess their effects. It is a luxury not to do it and luxury cannot be afforded when the income is low.

To conclude, it should be emphasized that the purpose of the foregoing comments is not to minimize the importance of distribution. The purpose is to indicate that if distribution is to be improved and poverty is to be alleviated, it is better to be done by means which achieve this objective. Improvement of the conditions of the poor today at the expense of the poor of tomorrow does not seem to be an appropriate solution. But this appears to be the essence of policies which suppress growth.

NOTES

[1] The term marginal is used here to imply that resources are held constant. This meaning of the residual measure is often overlooked by its critics.

[2] For more details see the discussion by Kennedy and Thirwall (1972).

[3] Cf. Schultz (1979).

[4] The capital labour ratios which minimize cost.

[5] Cf. Danin and Mundlak (1979).

[6] For surveys of distributed lags which also provide some perspective of the dominant

methods see Griliches (1967), Nerlove (1971) and Sims (1974).

[7] This point is sometimes misunderstood. For instance Jorgenson [1974, p. 362] writes: "While such a model would be appropriate under decreasing returns, the empirical evidence we have reviewed supports an assumption of constant returns. For this description of technology Mundlak's distributed lags investment model is inappropriate". An earlier statement reads that "Our overall conclusion is that . . . the degree of returns to scale can be taken to equal unity" (Ibid., p. 360). This statement is more in line with the findings reviewed by Jorgenson. It also accommodates decreasing returns. However, this is a marginal point. The main point is that his statement is based on inadequate evidence. In his paper, he reviewed aggregate production functions whereas the model specifies the function of an individual firm, whose managerial capacity is held constant. The production function of the firm can assumed to be of constant returns to scale in all inputs, including management or entreprenurial capacity. It is less than unity with constant management [Mundlak, 1961a]. Thus doubling the level of management, other things being equal, is likely to result in doubling all inputs and output. Consequently, when dealing with aggregate industry data, and these are the data reviewed by Jorgenson, it is not surprising to find constant returns even though the behaviour of a given firm is subject to decreasing returns since his managerial capacity is fixed. The degree of returns of the industry production function depends to a large extent on the elasticity of the supply function of entreprenurial capacity. Other things being equal, the more elastic this function is, the larger is the tendency for observing constant returns to scale. This is also the justification for using constant returns production function for describing the technological conditions at the sectoral level which is implicit in the discussion below.

[8] For the importance of the income and some other effects, see Schultz (1945).

[9] Chapters 2 and 3 (with Strauss) in [Mundlak, 1979] and a yet unpublished work with Cavallo, D. on Argentina.

[10] This is true whether the flow equation is expressed directly in terms of the differential returns as is the case in the work of Mundlak and Strauss, in (Mundlak, 1979, Ch. 4), or if it is derived from the savings and investment equations, as is the case in the yet unpublished work of Cavallo and Mundlak on Argentina.

[11] The work on Mexico is carried out jointly with Aspe, P. and Triguero, I.

[12] See Kuznets, 1973. Actually, it would be more accurate to talk of modern economic growth as Kuznets does.

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DISCUSSION OPENING – FERNANDO C. PERES

In opening the discussion, Fernando Peres felt that more was needed to be known about the tests of validity of the models proposed. The functional format of these models suggested a method of trial and error. This may be acceptable but we need to know more about the qualifications concerning the model. A Monte-Carlo convergence technique might be used here.

The trade-off between growth and distribution might have been presented in other terms. The implication of the paper was that those in favour of improving income distribution are against growth if such growth is suspected of causing maldistribution. But alternative kinds of growth are possible and it is necessary to find ways of achieving growth while at the same time improving income distribution.

GENERAL DISCUSSION – RAPPORTEUR: CLARK EDWARDS

In the general discussion the point was made that in applying such a model as Mundlak's to Japan, attention must be given to phases of growth. Three development phases can be distinguished in Japan's growth; Mundlak's model pertains to phase II. During phase I, however, the flow of savings from agriculture to non-agriculture was significant.

It was also pointed out that the Mundlak model relied upon capital

accumulation and technology as its two sources of growth. There were several other sources of growth which are relevant to the problem which Mundlak seeks to solve. If the market for farm products is inelastic and agricultural growth is induced by the accumulation of capital and the adoption of new technology, farm income is likely to fall as output rises. This will inhibit growth. In this case, growth will be stimulated instead by expanding the size of the market both at home and abroad. Spatial systems determining growth, such as improved transportation and access to markets, were not considered by Mundlak. Neither did he consider the role of institution building in agricultural growth.

In reply to the opener's comments, Dr Mundlak said that he did not consider the actual testing of his model to be important. He was concerned to find models which seemed to explain history and which had numerical solutions.

Participants in the discussion included Kazushi Ohkawa and Clark Edwards.