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THE DETERMINATION OF ECONOMIC HOLDINGS FOR SETTLEMENT: A NEW APPROACH*

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INTRODUCTION

The success of settlement schemes depend upon the degree of attention paid to the multifarious factors involved in settlement planning. Lewis (1954) identifies some of these factors as (*a*) choosing the right place, (*b*) choosing the right settlers, (*c*) physical preparation of the site before the settlers arrive, (*d*) acreage per settler, (*e*) conditions of tenure, (*f*) settlers' capital and (*g*) organization of group activities. The problem which we consider important to examine in this paper is the thorny issue confronting settlement planners, of determining the appropriate sizes of holdings to be allotted to the settlers. The neglect of this aspect has often led to the wasteful use of scarce national resources. The lack of any formal analytical procedure in such a determination and the recourse of planners to rule of thumb measures have largely contributed to this situation. The object of this paper is to demonstrate the usefulness of an analytical procedure (Parametric Linear Programming) which is well suited to handle the multi-dimensional aspects involved in determining appropriate holdings to be given to the prospective settlers. The procedure is demonstrated in the context of settlement objectives and other considerations of operational significance in Sri Lanka. However, the methodology and implications of the analysis would be of wider application and interest to settlement planners in general who are faced with the problem of determining the appropriate sizes of holdings to be given to the prospective settlers.

CONCEPTS AND DEFINITIONS

The concept of an economic holding is ambiguous and varies according to the objectives and assumptions adopted. Therefore, it follows that an economic unit based on one definition will not be consistent with another. Hence it would be necessary at the outset to discuss the objectives and assumptions which would be relevant in such a determination. Mellor (1966) defines two criteria for determining the acreage to be allotted to the settlers Firstly, the productivity of the land resource and secondly, the level of living to be presented to the peasants. Lewis (1954) is of the opinion that the size of farm should be set by the level of living. According to official thinking in

* This study was conducted at Wye College (University of London) in connection with the work on the author's Ph.D. thesis on "A Study of Economic Resource Use and Production Possibilities on Settlement Schemes in Sri Lanka."

The analysis was conducted on the London University C. D. C. 6600 Computer, using the Linear Programming Package—L.P. Farm—J. P. G. Webster, Wye College (University of London), 1973.

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the past in Sri Lanka, a holding was considered to be economic if it satisfied an employment criterion, an amount of land cultivable by means of unaided efforts of a peasant family; an income criterion, as it provided an adequate livelihood for a peasant family; and finally a very vague criterion, of an extent of land sufficient for a peasant and his family (Andrawewa, 1965). Economic considerations and particularly the maximization of production should be dominant when land is developed and alienated. Although these aspects had been neglected in the past, it is gratifying to note that such considerations pervade the current thinking on land settlement. In the Mahaveli River Diversion Project[1] which is by far the most extensive land developement and settlement project being undertaken, the objectives are defined as the optimum utilization of basic resources of land, labour and capital, bearing in mind that land and capital are scarce national resources and that labour is an abundant resource (Mahaveli Development Board, 1972). The goals of optimum production and maximum employment are indeed appropriate in the context of the economic and social conditions prevailing in the country. Another objective proposed for future settlement is that the income potential of an ordinary settler should be sufficient to offset the attraction of an urban white-collar income of Rs. 500 per month. Indeed a subsistence level of living or an average level of living would no longer be attractive to the prospective settlers particularly the educated unemployed. In short, farm allotments based on nutritional standards or minimum living conditions are no longer tenable in view of the expectations of job seekers.

Having set out the objectives of settlement, it would also be imperative to specify the other variables which enter the calculus in the determination of optimal holdings to be allotted to the settlers. Amongst these, the size of families, farming system, level of technology and the level of mechanization are the most significant.

The practice in the past has been to determine a holding for an average family. While this might be a convenient way of dealing with the problem, insistence on exact and uniform allotments would invariably lead to an inefficient use of both land and labour resources. The size of family affects the determination of optimum holdings through its influence on the labour force available for farming and the level of income required to support a farm family. Therefore, an uniform size of holding would be unsatisfactory from the point of view of efficient resource use. Ideally the aim should be to provide holdings to meet the requirements of a wide range of family sizes. However, both from the point of view of administrative manageability and purposes of this analysis it is considered expedient to consider only a few representative family sizes. In fact, only three family sizes representing hypothetical large (8 members), medium (6 members) and small (4 members)[2] families have been adopted for the analysis (see Appendix Table 1).

1. Costing approximately Rs. 7000 million and phased over the next three decades. 1 Pound Sterling = Rs. 24.00.
2. Hereinafter referred to as Groups A, B, and C for convenience.

The level of income considered desirable for the prospective settlers was noted as Rs. 500 per month. Clearly, this level of income would be inadequate for all the three family units assumed in the analysis. Since there is no objective basis on which suitable income levels could be defined for each group it has been decided to weigh them on the basis of domestic expenditures observed in a field study (Amerasinghe, 1974) for peasant farm families of similar size. On this basis, the desired income levels for the three groups are Rs. 1,000, Rs. 700 and Rs. 500 respectively. Considereng the fact that the average urban wage in Sri Lanka is Rs. 453 per month (Department of Census and Statistics, 1971), these income levels are indeed attractive.

It is not only important for the allotments to generate a level of income sufficient to offset the attraction of urban whitecollar jobs, but it is also imperative that they should be able to maximize the use of available factors of production particularly farm labour. The provision of a satisfactory level of employment to those settled should be an important goal of settlement policy. The concept of full employment is complex and the definitons adopted have differed widely. For instance, a full working year has been defined by Rodenstein-Rodan (1957) as 290 days, Islam (1964) as 270 days, Raj (1958) as 300 days and Cho (1963) as 280 days. Since there is no consensus regarding the definition of a full working year, the one used by the Employment Mission to Sri Lanka of a working year comprising 240 man-days (International Labour Office, 1971) has been adopted in this study. This low figure of employment is acceptable in view of the widespread overt unemployment prevalent in the country at the present time. Moreover, since an attractive income objective has been defined, the lower employment level cannot be considered too objectionable.

The location and farming system also have an important bearing on the appropriate holding size, since the income potential of the holdings are related to these variables. In this instance since all future settlements are envisaged within one ecological zone, namely, the Dry Zone, the importance of location can be assumed constant. However, within this ecological zone, given the availability of irrigation, it is feasible to have a number of farming systems. In the past, the allocation of land has been in terms of lowland[3] and highland[4] allotments. It is the contention of the author based on empirical evidence and other observations (Amerasinghe, 1974), that this policy has contributed to the under-utilization of resources in the past. Due to the lack of proper motivation and also the attitudes of peasant farmers towards traditional paddy cultivation vis-a-vis irrigated highland cultivation, it is felt that only irrigated lowland or only irrigated highland should be provided if the past experience of under-utilized resources is not to be repeated (Amerasinghe and Wijaypala, 1972). However, since recent thinking amongst policy-makers regarding the allotment of traditional mixed farms has been

3. Irrigable paddy land.
4. Unirrigable land where rain-fed agriculture could be practised.

indecisive (Mahaveli Development Board, 1972), this alternative has also been examined.

The size of holding to be allotted would also depend on the level of mechanization. In this analysis the levels of mechanization operative in peasant farming at present, are considered relevant. In the case of the paddy farms, draught power is assumed to be supplied by bullocks or tractors,. And for the irrigated food crop farms, the use of hand tools or tractors are assumed. While in the case of mixed farms, the power assumed is a combination of buffalo ploughed paddy fields and hand labour cultivated food crop farms vis-a-vis tractorised farms. Only selective or partial mechanization of the farms are considered in all cases. In the food crop farms this entails only the tractorisation of the preparatory tillage operation, while in the case of paddy farming it also includes threshing.

THE MODEL

It is clear from the foregoing that an analytical procedure with the ability to accommodate a complex objective function and optimize the use of available farm resources would be necessary in the determination of economic holdings for settlement. Linear Programming (LP) is well suited for this purpose and could generate optimal solutions satisfying these many requirements. It is not proposed to discuss the assumptions and limitations of this analytical tool *per se*, which are well documented. However, the specific assumptions, mathematical formulation of the analytical model and method of analysis are discussed.

(*a*) *Assumptions*

(*i*) The settlers are assumed to maximize farm incomes under the three farming systems referred to.

(*ii*) The farmers cultivate under the specified levels of technology and no immediate changes are assumed. The technical input-output information is based on the data from the Dry Zone Agricultural Station at Maha Illupallama, which have been suitably modified with regard to technical feasibility and net revenues based on the author's field experiences during the cropping year 1971-72 at the Minipe Settlement Scheme in Sri Lanka. Single value expectations of average prices and average input-output relations have been assumed.

(*iii*) The production alternatives examined are those which are currently found on the peasant farms. In the case of the paddy farms, four activities have been identified for the *Maha* and *Yala* cultivation seasons. They have been differentiated on the basis of their yield potential *i.e.*, whether high-yielding (HVY) or traditional low yielding varie-

ties (TV); their age to reach maturity, *i.e.*, long aged (L) or short aged (S); method of preparatory tillage, *i.e.*, mechanized (T) or buffalo ploughed (B); whether transplanted (T) or broadcast sown (B); and finally whether planted in the *Maha* (M) or *Yala* season (Y). In the case of food crop farming, the activities considered are those which are currently cultivated by the peasant farmers and also some others which are feasible under the prevailing management levels. While in the case of the mixed crop farms, combinations of activities in the other two farming systems have been assumed.

No livestock farming has been considered due to the lack of adequate data and also its low attractiveness conditioned by socio-cultural taboos.

(*iv*) Production capital is not considered a constraint as it is assumed that the settlement authorities would ensure the availability of adequate credit for the settlers to adopt improved levels of farming.

(*v*) Farmers operate within the farm resources specified. In the case of family labour, the availability of family labour has been calculated on the basis of work days available per month and the number of adult equivalents available for farming. The labour force available for each family group is reported in Appendix Table 2. The availability of hired labour was assumed at the rate of 50 man-days per month to supplement the family labour in each group in some versions of the analytical model, to explore income and employment possibilities and to observe its impact on the optimum size of holding.

(*vi*) No rotational husbandry constraints have been built into the models as there is no official information in this regard. Therefore, the intensity of cultivation for the highland food crop farms and mixed farms, are assumed at a lower level. Only single cropping has been assumed, when in fact multiple cropping possibilities exist.

(*vii*) Irrigation water and draught power are assumed to be available. In the use of the former, it is assumed that each holding will be provided adequately, while in the case of the latter it is assumed that ample facilities are available for hiring.

(*viii*) It is assumed that farmers are efficient managers and are able to reach the levels of technology specified.

(*b*) *Specification*

The analytical model could be mathematically expressed as :

Maximize: $Z = P_1X_1 + P_2X_2 + \ldots\ldots + P_nX_n$

Subject to: $A_i^L \geqslant a_{i1}X_1 + a_{i2}X_2 + \ldots\ldots + a_{in}X_n$

$$A_i^H \geqslant a_{i1}X_1 + a_{i2}X_2 + \ldots\ldots + a_{in}X_n$$

$$L_i^F \geqslant a_{i1}X_1 + a_{i2}X_2 + \ldots\ldots + a_{in}X_n - L_i^H$$

$$L_i^H \geqslant a_{i1}X_1 + a_{i2}X_2 + \ldots\ldots + a_{in}X_n + L_i^H$$

$$I_i \leqslant a_{i1}X_1 + a_{i1}X_2 + \ldots\ldots + a_{in}X_n$$

$$E_i \leqslant \Sigma\, a_{ij}X_j$$

$$K_j \geqslant 0 \text{ for all } j$$

where, Z is the total net returns to the fixed resources of the farm.

P_j is the net returns per unit of real activity.

A_i^L is the available irrigated lowland per farm.

A_i^H is the available irrigated highland per farm.

L_i^F and L_i^H are the available family and hired labour respectively for farming on a monthly basis.

I_i is the minimum income level which should be satisfied for the respective family size-group.

E_i is the minimum employment level which should be satisfied for the respective family size-group.

X_i are the crop activities.

a_{ij} is the input-output coefficients of the ith resource and the jth activity.

The negative L_i^H indicates the possibility of hiring labour on a monthly basis to supplement the monthly family labour supply, while positive L_i^H indicates its use.

(c) Analytical Procedure

The method of analysis involves the examination of models for all the three farming systems for each family group and the different assumptions of mechanization and hired labour possibilities mentioned earlier. The land resource variable in each case is then parameterised through a range of farm units which are considered sufficient to satisfy the income and employment objectives specified. Different versions of the analytical model are analysed under the assumptions of employing only family labour and family labour supplemented with hired labour and mechanized and non-mechanized possibilities. The minimum income and employment requirements are relaxed in some versions of the model when the solutions have been found to be infeasible, with the object of examining the income and employment possibilities.[5]

5. The basic LP models containing relevant technical data for each of the farming systems under the different mechanization assumptions are not reproduced here for want of space. The interested reader may write to the author directly.

RESULTS

The examination of the LP models assuming different labour availabilities, *i.e.*, family labour only and family labour supplemented by hired labour for the three different farming systems and levels of mechanization discussed, entailed the analysis of twelve models. Since the results of the twelve models and the parametric variations (120 LP solutions) would be too numerous to report, only a summary of the relevant results is presented (Tables I and II). In addition to the appropriate holdings determined, it will be also necessary to consider a suitable unit to be allotted as a homestead based on administrative costs and institutional factors. Due to the lack of data in this connection an objective analysis has not be undertaken. However, a homestead varying between one-half and three-fourths of an acre is considered sufficient to satisfy the purpose of a traditional village home garden of providing vegetables and other day to day culinary requirements.

(*a*) *Paddy Farms*

It is assumed in this analysis that it is feasible to double crop the paddy land available. Income and employment possibilities are explored by parameterising the land variable through 1—10 acres. The results indicate that the appropriate sizes of paddy farms which could be recommended for the three family size-groups A, B and C are 6.0, 4.0 and 3.0 acres respectively (Table II), when the availability of hired labour is assumed. It is clear that these holdings satisfy the employment criterion specified in Appendix Table 1 under both mechanized and non-mechanized assumptions. On these farm units, the income criterion is not satisfied in the case of groups B and C with only family labour use (Table I). It is necessary in the case of these two groups for the proviso of hiring labour to be operative as the family units are small and the seasonal demands for paddy cultivation exceed the family labour supply. On hiring labour, the desired income levels can be achieved. The results also indicate that selective mechanization of paddy farms lowers farm incomes and displaces labour, while the possibility of hiring labour enhances the income and employment generating potential of paddy farms on each of the holding sizes examined.

(*b*) *Highland Food Crop Farms*

The results indicate that under the assumption of employing only family labour and non-mechanization of the farms, that the specified income levels for all the three family groups are achievable but not the employment criterion for the largest group by a small amount (Table I). When the possibility of mechanization is examined it is clear that selective mechanization is both income and employment destroying and that the specified criteria cannot be satisfied

TABLE I—APPROPRIATE FARM ALLOTMENTS FOR SETTLEMENT (FARMING ONLY WITH FAMILY LABOUR)

Family group	Non-mechanized				Mechanized			
	Farm size (acres)		Income (Rs.)	Employment (man-days)	Farm size (acres)		Income (Rs.)	Employment (man-days)
1. Paddy farms								
A ..	6.0		12,137.27	769.58	7.0		12,867.00	807.28
B ..	5.0		8,354.74	541.03	5.0		8,194.98	517.22
C ..	3.0		5,012.85	324.52	3.0		4,916.99	310.33
2. Highland food crop farms								
A ..	4.5		14,868.00	715.79	4.5		1,102.55	520.84
B ..	3.75		10,757.64	525.62	3.0		6,939.09	333.01
C ..	2.25		6,454.59	315.57	2.25		4,163.46	199.81
3. Mixed farms	Low-land	High-land			Low-land	High-land		
A ..	4.0	3.0	14,832.00	799.38	4.0	3.0	14,374.00	737.43
B ..	3.0	2.25	10,564.52	569.09	3.0	2.25	10,406.36	495.27
C ..	2.0	1.5	6,510.14	368.27	2.0	1.5	6,250.00	335.42

On investigating the income and employment possibilities under the assumption of hiring labour, it is clear that both income and employment possibilities are enhanced. The appropriate size of holdings could be recommended as 3.75, 3.0 and 2.25 acres respectively for the three family groups A, B and C (Table II). The income criterion is satisfied in all the three cases but the employment requirement is met only in the case of group C. Under the assumption of mechanization and hiring labour possibilities, the income and employment potentials of the farms improved. Although the income criterion specified is achievable, the employment criterion is not satisfied in the case of groups A and B. However, it is felt that these shortcomings could be overlooked, in view of the fact that only single cropping is assumed. Considering the possibilities of double and even multiple cropping on the holdings since irrigation facilities are available, these limitations could be overcome without much difficulty.

(c) *Mixed Farms*

It is clear that both income and employment criteria can be satisfied with the mixed farming system examined under the specified labour supply and mechanization assumptions (Tables I and II). In the case of group A, a holding consisting of 4.0 acres lowland and 3.0 acres highland is found to be adequate to satisfy the income and employment criteria specified. While holdings of 3.0 acres lowland and 2.25 acres highland for group B and 2.0 acres lowland and 1.5 acres highland for group C are found to be sufficient to meet the income and employment objectives. It is imperative to note that these holdings have been determined under the assumption of single cropping and that a great potential exists in these holdings both for increasing farm incomes and employment by double and multiple cropping. It is interesting to note that the impact of selective mechanization which was observed to be both income and employment destroying under the specialised

TABLE II—APPROPRIATE FARM ALLOTMENTS FOR SETTLEMENT

(FARMING WITH FAMILY AND HIRED LABOUR)

Family group	Non-mechanized					Mechanized				
	Farm size (acres)	Income (Rs.)	Employment (man-days)			Farm size (acres)	Income (Rs.)	Employment (man-days)		
			Family labour	Hired labour	Total			Family labour	Hired labour	Total
1. Paddy farms										
A ..	6.0	13,849.54	803.64	104.04	907.68	6.0	13,267.09	750.77	105.37	856.14
B	4.0	9,376.86	517.76	102.92	620.68	4.0	8,977.33	482.56	104.33	586.89
C	3.0	6,838.38	357.90	120.36	478.26	3.0	6,576.90	315.54	115.80	431.34
2. Highland food crop farms										
A	3.75	12,390.00	612.51	—	612.51	4.5	14,002.07	585.00	102.43	687.43
B	3.0	9,899.00	471.07	2.70	473.77	3.0	9,417.00	349.00	50.00	399.00
C	2.25	7,322.63	329.47	25.25	354.72	2.25	6,944.63	268.86	63.75	332.61
3. Mixed farms										
	Low-land	High-land				Low-land	High-land			
A	4.0	3.0	14,832.00	799.38	—	799.38	4.0	3.0	14,374.00	737.43	—	737.43
B	3.0	2.25	11,030.68	593.67	20.74	614.41	3.0	2.25	10,710.61	504.81	15.53	520.43
C	2.0	1.5	7,289.69	266.84	28.07	394.91	2.0	1.5	7,091.07	324.31	21.32	345.63

farming systems examined was found to have a favourable impact under the mixed farming system, particularly on the larger holdings and with limited labour supply (groups B and C). This is indeed an interesting result which warrants further investigation regarding the possible beneficial effects of selective mechanization.

LIMITATIONS

The analytical procedure demonstrated has its limitations and it is imperative to be aware of these before any final recommendations could be made. An obvious limitation of the method is its static nature. It was assumed in the analysis that technology, resource supplies and the specified income and employment criteria remain fixed in time. Clearly, this is a serious limitation as land settlement involves long-term planning. However, it might be argued that some of these long-term considerations could be accommodated within the LP framework outlined above by making suitable adjustments. For example, in the above analysis for the food crop and mixed farms, only single cropping has been assumed, although more intensive farming capable of generating higher incomes and employment were feasible. Also the future developments in technology were assumed to be land augmenting and therefore capable of cushioning some of the demands which could arise subsequently with regard to income and employment, following the changes in land-man ratios. Other dynamic aspects such as cash flows and enhanced production possibilities have not been considered in the above analysis. The lack of suitable information on these matters precluded such considerations.

Labour supplies were assumed fixed and the specification of labour on a monthly basis implied that farm tasks could be performed any time within the course of the month. While this assumption is not very critical in the context of irrigated agriculture, it cannot be wholly accepted as satisfactory due to the other uncertainties operative in the production environment. However, the short answer to this problem is, better data, whereby a more thorough specification of the model would be possible. Labour supplies and requirements being more precisely defined could help substantially in overcoming limitations regarding the timeliness of operations.

Another limitation of the analysis was that the objective of employment did not consider the possibilities of seasonal under-employment during the year. In the analysis, only the total number of employment days per farm was considered relevant. Clearly, this may not be entirely satisfactory. This could, however, be easily built into the model by specifying minimum employment constraints to enable a more even distribution of work throughout the year. This was neglected in the analysis as employment *per se* was not the only objective considered important. Moreover, since the income levels specified were attractive this requirement was overlooked.

The analytical models could also be criticised on the assumptions of single value expectations of prices and technical input-output data. Clearly,

any normative analysis would be prone to the same limitation. However, LP has the advantage of lending itself to sensitivity analysis which could partly overcome the problem of uncertainties. If the relevant range of price variations are known, a thorough investigation could be made and policy decisions taken on the basis of the stability of the plans.

The assumption that the potential settlers would be profit maximizers could also be criticised. While this might be considered unrealistic in the peasant farming context, it could be argued that this should be a relevant objective in land settlement where vast expenditures are often incurred by the governments of developing countries.

It might also be pointed out that the analysis did not provide a means of determining the exact holding size. This was considered unnecessary due to the uncertainties involved in peasant farming which would render such an exact specification dubious. It was considered more useful to obtain an insight into the income and employment absorption capacities of a large number of farm holdings, from which an appropriate one could be selected. This would in particular enable a large number of subjective definitions in relation to income and full employment to be evaluated. However, it could be stated that an exact size of holding could be determined by specifying equality constraints in the models.

CONCLUSIONS

It is evident that LP could provide a useful analytical framework for determining the appropriate size of holdings for land settlement. It is also clear that such a determination depends upon the objectives of settlement, size of family units, farming systems and the levels of technology including the level of mechanization. And that a correct specification of the technological, social and economic elements would be imperative to derive conclusions of operational significance. Although certain limitations were noted in the above procedure, it is alleged that these stem from a lack of appropriate data and well defined concepts, particularly with regard to objectives. These problems are in no way insuperable as they depend largely on the planning authorities. The main virtues of the analytical procedure are its ability to accommodate the multifarious factors involved within a simplified mathematical model, the wide range of alternatives it could provide and methodological simplicity. Therefore, provided the necessary data are available, a suitable procedure exists which could provide empirical information on which firm policy decisions could be made regarding the appropriate sizes of allotments to be given to the potential settlers and the densities of settlement. The fact that the data requirements for this analytical procedure do not greatly exceed other farm planning procedures which might be employed for settlement planning, further strengthens the potential role of LP as a pragmatic tool for settlement planning.

APPENDIX

TABLE 1—INCOME AND EMPLOYMENT CRITERIA

Group	Family size		Desired income level (Rs. per annum)	Desired employment level (man-days per annum)
	No. of members	Adult male equivalents		
A	8.0	3.0	12,000	720
B	6.0	2.0	8,400	480
C	4.0	1.0	6,000	240

TABLE 2—FAMILY LABOUR AVAILABLE FOR FARMING

(*man-days*)

Month	Work days* per month	Group A (4 adult equivalents)	Group B (2.5 adult equivalents)	Group C (1.5 adult equivalent)
October	26.0	104.0	65.0	39.0
November	25.0	100.0	62.5	37.5
December	26.0	104.0	65.0	39.0
January	26.0	104.0	65.0	39.0
February	23.0	92.0	57.5	34.5
March	26.0	104.0	65.0	39.0
April	20.0	80.0	50.0	30.0
May	23.0	92.0	57.5	34.5
June	22.0	88.0	55.0	23.0
July	26.0	104.0	65.0	39.0
August	25.0	100.0	62.5	37.5
September	25.0	100.0	62.5	37.5

*On the basis of field observations (Amerasinghe, 1974) family labour available for farming has been calculated as the product of work days per month and adult equivalents in each family group.

REFERENCES

Nihal Amerasinghe : A Study of Economic Resource Use and Production Possibilities on Settlement Schemes in Sri Lanka, Ph.D. Thesis, University of London, 1974 (unpublished).

A. B. Andrawewa, "Some Thoughts on the Economic Size of Production Holdings in Traditional Agriculture," *Ceylon Journal of History and Social Studies*, Vol. 8, No. 1, 1965.

Y. S. Cho : Disguised Unemployment in Underdeveloped Areas, University of California Press, Los Angeles, U.S.A., 1963.

Department of Census and Statistics : Socio-Economic Survey of Ceylon 1969-70, Department of Census and Statistics, Government of Ceylon, 1971.

International Labour Office : A Report on a Programme of Action for Sri Lanka, "Matching Employment Opportunities with Expectations," ILO, Geneva, 1971.

W. A. Lewis, "Thoughts on Land Settlement," *Journal of Agricultural Economics*, Vol. 11, 1954.

Mahaveli Development Board : Mahaveli Development Board, Paper No. 51, Colombo, 1972 (mimeo.).

J. W. Mellor: The Economics of Agricultural Development, Cornell University Press, Ithaca, U.S.A., 1966.

K. N. Raj, "Employment and Underemployment in the Indian Economy," *Economic Development and Cultural Change*, Vol. 7, No. 3, 1958.

P. Rodenstein-Rodan, "Disguised Unemployment and Underemployment in Agriculture," *Monthly Bulletin of Agricultural Economics and Statistics*, Vol. 6, Nos. 7-8, July—August, 1957, F.A.O Rome.