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Working Paper

## Technological Change and Rural-to-Urban Migration of Labour: A Micro-Economic Causal Relationship in the Context of Less Developed Economies

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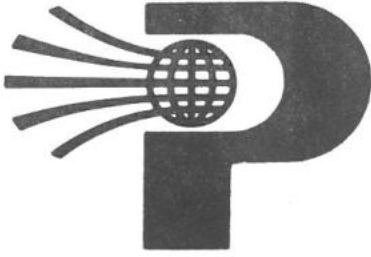


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TECHNOLOGICAL CHANGE AND RURAL-TO-URBAN  
MIGRATION OF LABOUR: A MICRO-ECONOMIC  
CAUSAL RELATIONSHIP IN THE CONTEXT OF  
LESS DEVELOPED ECONOMIES

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## PREFACE

The purpose of this paper is to suggest a new line of analysis of rural-to-urban migration of labour - RUMOL - in less developed economies.<sup>1</sup>

The general impetus for making the suggestion originates in the opinion that a single model cannot at the same time be specific enough to explain much variability and general enough to cover many diverse - in kind, not in degree - situations; the trade-off between these two is strong. The "same" rural-to-urban migration phenomenon can derive from completely different aspirations, rationales and decision rules. In different contexts - e.g. stages in economic development - (internal) objectives and constraints simply interchange (not to mention the different sets of institutional and sociocultural constraints). In one context, rural-to-urban migration decisions may ensue from maximization of expected income subject to a non-linear risk constraint; in another - from minimization of risk subject to an income constraint. Likewise, the nature - even in the pure traditional economic sense - of the entities which produce this "same" phenomenon is again diverse. There is a world of difference between the allocative problems (the production factors endowment) facing a firm, a family (a household) and a farm family-firm and there is a world of analytical difference too between the "economic behaviour" of each of the latter units - according to the extent to which it is determined within or outside the monetary market framework. Such differences are bound to be reflected in differences in the migration behaviour of these units.

The sooner it is understood and accepted that a general comprehensive micro-economic model of rural-to-urban migration cannot do much beyond producing the proposition that "X migrates ("voluntarily") from A to B because B is, in some sense, "better" for X than A" - the earlier would migration research be freed from the grip of "the best as the enemy of the good". Many good migration models are compatible - and necessary.<sup>2</sup>

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<sup>1</sup> *The objective here is to present the general outline of the argument and to list the basic relationships. Work on a rigorous exposition of these ideas is currently underway in the Employment and Development Department of the International Labour Office.*

<sup>2</sup> *This differs from the view expressed in a recent comprehensive report (U.N. Department of Economic and Social Affairs The Determinants and Consequences of Population Trends: New Summary of Findings on Interaction of Demographic Economic and Social Factors Population Studies No. 50 Vol. I (New York, 1973) chapter 6: "Population distribution, internal migration and urbanization"). After reviewing a large number of "migration theories" it is concluded - p. 211 - that "the greatest challenge to migration theorists is the organization of all hypothetically relevant factors into one coherent theoretical framework". (Emphasis added). Taking just one more recent example: "the tendency to migrate from the countryside to the towns [is] so pervasive that before analyzing it in purely African terms, one should try to find a global explanation*

...Continued



Not only is it, however, presumptuous to aim to develop a general model of rural-to-urban migration; it could also be harmful since, as is often the case, the model - that is, a model which is too general - acts as a source of inspiration for policy measures geared at dealing with migratory aspects which if at all, can only partially be explained by that model.

These general comments hold particularly for the case of rural-to-urban migration of labour - RUMOL - in the less developed economies - that sub-category of migration adhered to in the present paper.

The object of the paper in fact falls short of producing another model of migration. It does not even aim at explaining or predicting all RUMOL nor all reasons<sup>3</sup> for that RUMOL which takes place in less developed economies. Positively expressed, the purpose is to achieve a better understanding of the decision-making process and the causal relationship which elicit a major part of RUMOL.

The specific impetus for the present study is two-fold; firstly, the magnitude of the RUMOL phenomenon in the less developed economies and the general concern (justified or not) which "it" (-symptoms it represents and consequences it entails) has brought about and secondly, a certain disillusionment with the capacity of the existing body of migration theory to provide satisfactory insights into the micro-economics of the phenomenon (its behavioural characteristics) and to offer a sound basis for policy intervention.

The very validity of a number of dominant assumptions of many of the current popular lines of analysis is questionable. First, there is the question of the identity of the decision-making entity. It is surprising how rare it is assumed to be the family, how often it is the migrant himself. If consumptive behaviour, labour supply and the allocation of time and other economic activities carried out by individuals in developed economies are recognized largely unexplained unless analyzed within the context of a family or a household utility framework, the argument for a different orientation in the context of a developing economy, particularly when the rural element is prevalent, is somewhat odd. The special nature of the rural farm-family-firm and the complex but identifiable and strong income and production (e.g. sharing) links among its members render it largely meaningless to study the behaviour of individuals outside the family context.

Moreover, different families (small farmers vis-a-vis landless labourers) are most unlikely to maximize the same, narrowly defined, utility function and a given family need not maximize the same utility

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footnote No. 2 continued...

(emphasis added). M. Boserup in Nurul Islam (ed.) *Agricultural Policy in Developing Countries*, Proceedings of a conference held by the International Economic Association in Bad Godesberg, West Germany (London 1974) p. 310.

<sup>3</sup> The study may indeed be interpreted to focus on a cardinal element in RUMOL causality, at least as significant as other reasons usually referred to, while (if implicitly) other elements are held constant.

function at different stages of its life cycle<sup>4</sup> e.g. when its income needs, levels of assets etc. are substantially different.

The usual assumption concerning the nature of the maximand is also critical. Agents (i.e. migrants) are assumed to be guided by a wish to maximize expected income. Inter alia, this leads to the widely accepted proposition that the greater the expected inter-sectoral income differential the greater RUMOL is likely to be. Firstly, this imposes a linear relationship on a non-linear world. Surely, given push (pull) intensities which determine the lower end (upper end) of the income differential, the elasticity of RUMOL with respect to different pull (push) intensities that respectively keep the differential constant is not, itself, constant; different propensities of RUMOL would be provoked by equal absolute (or relative) successive income differentials. If the expected utility from income is the maximand then, if the function is concave (convex) given changes around the lower limit of a given income differential are, for example, of greater (smaller) utility value than equal changes around the upper limit of the differential. (Think of the extreme case where in state A the relative differential is  $(Y_u - Y_r)Y_r^{-1} = \alpha$  where  $Y_r < Y_s < Y_u$ ,  $Y_r, Y_u, Y_s$  representing rural, urban and subsistence incomes respectively whereas in state B,  $\alpha$  is between say  $\beta Y_u, \beta Y_r$  such that  $\beta Y_u > \beta Y_r > Y_s$ ). But furthermore, a single argument (- income) utility function is hardly acceptable; at least one further argument has to be incorporated i.e. labour effort and at the minimum this should be done at the theoretical stage of the analysis of RUMOL. In a slightly different terminology, both income level and the supply price of labour should enter into the maximand.

In addition, the existing lines of analysis appear to miss more than they hit. Why does the great majority of rural families fail to expel migrants? What determines the timing of migration? Is it, indeed, only the urban signal? These and other questions would not be dwelled upon here - with the exception of one issue which seems to be of particular importance as it is related to a distorted interpretation common to many migration studies.

RUMOL is often found to take place in spite of "high" over-all rate of urban unemployment (but is rational in accordance with the maximization of the expected income hypothesis). Consequently it worsens the urban unemployment situation. Rural-to-urban migrants are thus blamed for encumbering the urban economy with a heavy unemployment burden which, in turn, could be largely removed if the migration flow is to be stemmed.

The evidence on which this scenario is based now looks - to say

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<sup>4</sup> For example, the pattern of risk-bearing may be different for different ages (e.g. maximization by older families maybe subject to a constraint of a smaller variance of the expected wage stream); rates of pure time preference and the price of leisure may be age-variant; maximands at a given stage may depend on optimal values of previous maximizations; arguments in the maximized function e.g. leisure and consumption goods may, at different ages, be of variable degrees of substitutability; external restrictions and market conditions may differentially determine various constraints e.g. the capacity to borrow; and so on.

the least - far from being conclusive. A large body of recent findings<sup>5</sup> suggests that (a) the urban unemployment rate among migrants is lower than the urban unemployment rate among the non-migrants<sup>6</sup>, (b) since usually migrants compose not more than half of the urban population and labour force, rural-to-urban migrants less than half<sup>7</sup>, most unemployed in absolute terms are not rural-to-urban migrants (e.g. better educated urban natives).

The terms "urban" and "rural" which are not specifically defined can initially be taken to mean what is generally implied by their use in the majority of rural-to-urban migration studies (the relevant criterion referring normally not only to specific quantitative notions but also to the type of economic activity or employment)<sup>8</sup> though, in fact, in the present paper, migration from only a sub-sector of the rural sector - the farm sector - is scrutinized. (The apparent link with earlier remarks is that the usual rural-urban sectoral breakdown is too crude to serve as a useful framework for a satisfactory analysis of RUMOL's causality. Some further division is necessary which, in turn, will generate a set of "RUMOL models" each being relevant to a different section or group of rural units). What is implied by "migration" and "labour" will become clear as the analysis proceeds.

Finally, it should be explained why paying explicit and special attention to "the case of the small farmer" is found to be necessary. It is almost a matter of definition (a) that in most less developed economies, when grouping is done according to some broad economic characteristics, the largest single group, usually in a sense of absolute majority too, are small self-employed farmers (to be defined as) having access to sufficient land to provide subsistence income to their families and very limited access to productive services; (b) that the bulk of the poor are concentrated in rural areas and (c) that the largest component

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<sup>5</sup> See ILO, Department of Employment and Development, report on "Rural-to-urban migration and major economic issues: findings of surveys and empirical studies 1965-1975" (in preparation).

<sup>6</sup> It is odd to assume, although this is usually the case, that migrants are concerned primarily with the over-all urban unemployment rate. The chief concern of an engineer prior to migration would probably and normally be the employment prospects as an engineer at the destination; likewise for a teacher, a carpenter or a farm migrant. Thus RUMOL is pursued in face of a relatively low, relevant rate of urban unemployment and higher real urban incomes.

<sup>7</sup> This holds even when within the urban-to-urban group of migrants account is taken of migrants whose previous residence was rural.

<sup>8</sup> Definitions do however vary from country to country so that consequently, reference to a locality as urban in a general context has to accept prevailing definitions despite their diversity. Furthermore, even in a given country different definitions may best suit different purposes (such as those of economic planning, administrative reform etc.). To the extent that definitions are based on few criteria rather than on a "composite index formed of many items" including reference to the number and type of functions which the locality can or do exercise, they are necessarily crude simplification. The main criteria are lower size limit,

of these poor are such small farmers.<sup>9</sup>

It is by now well recognized that a quick eradication of absolute and relative poverty in less developed economies is not feasible, (large scale transfers of income being politically unlikely) and so it becomes particularly crucial fully to trace and understand the decision-making mechanism behind the revealed actions of small farmers so as to make it possible to enunciate alternative development strategies for increasing their income and welfare. To the extent that RUMOL largely originates in such families (rather than in the landless - and this is, to take just one recent comprehensive study, a conclusion reached by John Connell (et al.) "Migration from rural areas: the evidence from village studies", Institute of Development Studies at the University of Sussex, Discussion paper No. 39, January 1974), the understanding of its causality and implications for these families is essential. Not before then can feasible instruments of both desirable and effective policy intervention be designed and activated - with RUMOL linked trade-offs, complementarities and linkages being also fully considered and properly accounted for. Indeed, from the point of view of the design of development strategies, the role - and usefulness of such an analysis of RUMOL does not lie in it proving the need for policy measures aimed (say) at increasing "rural end incomes" given (say) that the reduction of RUMOL is a socially desirable target but, rather, in its capacity to single out those policy weapons which, although belonging to the group of income increasing policy weapons, are likely to be the most effective ones in meeting that target. (If critical characteristics of the RUMOL phenomenon identified by the analysis happen to be directly amenable to policy measures, the analysis is particularly useful. Such is believed to be the case in the present paper).

The paper is divided into two parts, each of which into two sections. In Section 1 of Part I the basic argument is presented. In a summary form it runs as follows. The decision-making unit is defined - a family enterprise producing food on its own small-holding. Over a specific time span, the "net utility maximizing family" is shown to observe a reduction in its

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footnote No. 8 continued . . . . .

*normally in the range of 2000 to 5000, density and prevalence of non-agricultural activities ( - percentage of "economically active population" which are engaged in agriculture is less than some stated maximum e.g. one third). It is the joint application of these three which generally produces a more satisfactory borderline.*

*For a summary review of some of the related difficulties and the suggested solutions see, for example, "Statistical definitions of urban population and their uses in applied demography", United Nations, Department of Economic and Social Affairs Demographic Yearbook 1972 (New York, 1973), pp. 5-12.*

<sup>9</sup> Hollis Chenery (et al.) *Redistribution with Growth: Policies to Improve Income Distribution in Developing Countries in the Context of Economic Growth - a Joint Study by the World Bank's Development Research Center and the Institute of Development Studies, University of Sussex* (London 1974) pp. 19-20.

welfare as measured in net utility terms. An impetus to change technology is generated but this is subjected to a set of internal and external conditions. The absence of smoothly functioning market structures and appropriate institutional (as well as non-institutional) arrangements implies that the internal constraints, which arise from the prevalence of production risks and low level of (absolute and per family member) surplus, are not alleviated by external factors. It is precisely the easing of these constraints which is a precondition for carrying out the technological change and it is RUMOL which facilitates this via its dual role in the accumulation of surplus and, through diversification, in the control of the level of risk.

In Section 2 of Part I some complementary reflections are added.

Part II consists of an examination of the relationship between RUMOL - which is "privately" desirable - and the alternative social welfare criteria likely to prevail. In the light of some specific social welfare criteria, replacement of RUMOL by alternative catalysts for transforming technology may appear desirable. The conditions for such a substitution are closely examined. This elicits some explicit policy implications. The discussion in Part II also lays bare the usually implicit but highly specific conditions which should pertain for RUMOL to be a socially inadmissible act.

There are two appendices. The first refers to the issue of a land augmenting technological change.

The second appendix confronts some fundamental elements of the analysis of Part I with some evidence. The scrutiny of available evidence in order to enlist its support also by-produce some important methodological implications concerning the generation of "desirable" evidence - that is from the point of view of the issues under review in the present paper. Both aspects are reported on.

PART I

UTILITY MAXIMIZATION, TECHNOLOGICAL TRANSFORMATION,  
SURPLUS ACCUMULATION AND RISK-BEARING - THE ORIGIN AND  
ROLE OF MIGRATION

SECTION 1  
THE BASIC ARGUMENT

A. The Set-Up

Consider first an individual who is the sole beneficiary of the fruits of his labour. Assume that his ordinal utility function is  $U = U(F,L)$  for  $F, L \geq 0$  both assumed homogeneous where  $F$ -food and  $L$ -labour being the only sources of "utility" and "disutility" respectively. To ease the analysis add an independence assumption and then additive separability to get

$$U = U_1(F) - U_2(L) \text{ with } \frac{dU_1}{dF} > 0, \quad \frac{d^2U_1}{d^2F} < 0, \quad \frac{dU_2}{dL} < 0, \quad \frac{d^2U_2}{d^2L} > 0. \text{ Assume a}$$

strictly concave production function  $F=F(L,\theta)$  with a given stock of land.<sup>1</sup> It is easy to show that if the individual's desire is to maximize net utility - that is the difference, given the level of labour input, between the utility (from food) and the disutility (from effort) levels - then, a stable equilibrium will exist<sup>2</sup> of which the respective labour input will be designated the "equilibrium labour input". Diagrammatically this is represented in Figure 1.

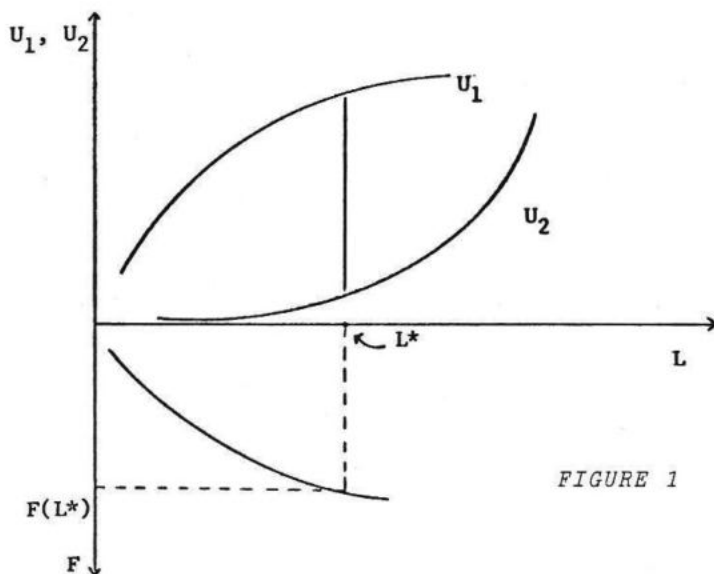


FIGURE 1

<sup>1</sup> This could jointly or, to some extent, alternatively be generated by considerations of short run, imperfect land markets and absence of institutional changes concerning land ownership.

<sup>2</sup> Assuming the appropriate boundary conditions, the "labour equilibrium input" is that which solves the following differential equation:

$$\frac{dU_2}{dL} \frac{\partial F}{\partial L} = \frac{\partial U_1}{\partial F}. \text{ (Corner solution type of cases are ruled out here).}$$

Two remarks are in order. First utility is normally taken to derive from food consumed not from food produced. On utilizing an assumption of zero or constant difference the need for exercising the distinction could be put aside. Secondly, under constant, particularly production, conditions on extension from an implicit reference to a one period planning horizon to an explicit reference to a two periods planning horizon is possible. This would involve the assumption that for the second period "things would be about the same" while for the first, perfect foresight is assumed or, alternatively, that foresight into the second period is gained through a known, high correlation between the conditions in the first period and those of the subsequent period. Note that in such a state a non-explicit use of a Neumann-Morgensterian-Marschackian "expected utility" conceptualization is a fortiori acceptable since then, expected utility equals utility. However, once production (and other) conditions change and uncertainty (or at least "risk") is introduced, such a provision is no longer acceptable and an explicit utilization of "expected utility" conceptualization is called for<sup>3</sup>. (In that state  $U_1(F)$  and  $U_2(L)$  will still be used as notations though they will bear the respective interpretations of expected utility and (expected) disutility. Incidentally, due to the additive property of the transformation expectation, expected net utility maximization will continue to imply maximization of the difference between expected utility and expected disutility.

#### B. The Investigation Unit: A Small Farmer's Family

Rather than referring to an individual (labourer) *per se*, reference will now be made to an individual as the head of "a family unit" in which he is, initially, the sole labourer - given the span of time over which the reference is being made. Although by the term "family" it is chiefly meant - at this stage of the analysis - a family of the nuclear type, where there are some "young" (see below) children, other relations who do not actually participate in the labour effort, and who cannot normally be regarded as potential performers of this and other economic activities (i.e. retired old parents), may also be included. Thus, the

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<sup>3</sup> When the issue of a technological change in the production of food is introduced, the potential adopter of the new technology will be envisaged as facing a technological choice in which the new technology is subjectively "riskier" than the "old" technology. As in that stage of the analysis the aim will be to preserve a positive "risk differential" between the new technology and the "old" one, it will simplify things (although it would not be critically necessary, neither would it entail a loss of generality) to view food production under the "old", long experienced, more predictable technology as being "certain" (though, in fact, its "certainty" is only a matter of relativity) and the new technology, as being subject to "risk" and hence, in turn, subject to (explicit) "expected utility" treatment. The reference, in the text above, to the first period as being of "perfect foresight" implies such a reasoning.



reference unit assumed here is a "young" family - in the earlier phases of its existence.

As this re-formulation of the investigation unit implies that at this earlier phase cross-members marginal disutilities are nil, the above reference to the disutility component of the net utility function applies directly and perfectly to this modified investigation unit.

The case with respect to the utility component of the net utility function in which aggregation has to be performed is more difficult<sup>4</sup>, particularly without a cardinalization of the family members' utilities. But, strict cardinality (with identical units of measurement and zero points), though sufficient for aggregation of the different family members' utility functions is not, in fact, necessary.

Assuming that the utility functions of all other family members are also of the ordinal type and are monotonic transformations of the utility function of the head of the family (as well as of each other's), when for any level of food  $F_2 > F_1$  all family members get at least the same quota as under  $F_1$  so that under whatever measure of their utilities the sum total of family utility that corresponds to  $F_2$  is at least as large as that which corresponds to  $F_1$ , a pre- (or quasi-) ordering<sup>5</sup> of aggregation is easily achieved. Ruling out individual externalities - thus equalizing all members' cross marginal utilities to zero - the head of the family can be seen to face an aggregate utility function, drawn from a family of utility functions (all, say, positive monotonic transformations of a single utility function), which is sufficiently specific for carrying out the analysis which follows.

In descriptive terms with one of a number of similar appropriate "scale correction(s)" the family's aggregate utility curve - with general properties as before - and the (as yet unchanged) disutility curve can again be plotted in the  $U_1, U_2, L$  plane.

### C. Compositional Changes in the Family Unit

With the passage of time, two processes take place. Firstly, given the family size, the change in the family's age structure results in greater food requirements. Taking as a "reference family" a family which includes few young children (say in the age group under ten years), its food requirements will grow with time since, other things being equal, the quantity corresponding to the extra food requirements of the growing children will be greater than the quantity corresponding to the diminution (if any) of food requirements of the aging adults (say the parents)<sup>6</sup>.

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<sup>4</sup> Unless, of course, identical intra-members utility functions are assumed.

<sup>5</sup> That is, a ranking which preserves the properties of transitivity and reflexivity.

<sup>6</sup> Support for this point is found in calorie (energy) requirements analysis if the assumption is made (and found plausible) that estimated calorie requirements can be used as an "efficient estimator" of food

...Continued

This holds true irrespective of the composition of the children though allowing specifically for female children vis-a-vis male children would result in a marginally smaller differential. If it is assumed that the quantity of food required is a major - explicit or implicit - consideration when marginal utility values are attached to various levels of

footnote No 6 continued...

requirements. (The term "efficient estimator" is used in a theory of point estimation sense, to mean that if food requirements had been observed as a random variable (with a known distribution function) than, calorie requirements would have been an unbiased estimator of food requirements with minimum variance). In general, food requirements should however be conceived of as a multidimensional vector-calorie requirements being just one of its components.

As a hypothetical case, take a family where in time  $t = 0$  (assuming time to be measured in discrete units - years) the family's age structure and composition is as in the first column of the table below. The family's calorie requirements which are represented in the second column are based on estimated calorie requirements for a "reference man" and a "reference woman" (as defined in pages 10-11 of Calorie Requirements: Report of the Second Committee on Calorie Requirements, FAO Nutritional Studies No 15, FAO 1957) and on calorie requirements for children. The third and fourth columns represent, respectively, for time  $t = 5$  the same as the first and second columns represent for time  $t = 0$ . As indicated by this specific example, the mere change of the family's age structure results in an increase of approximately nineteen per cent in its calorie requirements. (On the basis of the tentative suggestions of one expert - R. Passmore An Assessment of the Report of the Second Committee on Calorie Requirements (FAO, 1957) FAO, Rome, 1964, pp. 11-12 - the estimated increase would be even higher)

Calorie Requirements of a Hypothetical Family

Family member	time		time	
	$t = 0$		$t = 5$	
	1	2	3	4
	age	calorie requirements	age	calorie requirements
Head of the family	30	3,152	35	3,104
Wife	25	2,300	30	2,266
Child 1	6	1,850	11	2,500
Child 2	4	1,550	9	2,250
Child 3	2	1,300	7	1,950
Total	-	10,152	-	12,070
Index	-	100	-	118.9

Source: first two lines of columns 2 and 4 calculated from Table 2, p. 34 of "Calorie requirements" op.cit.; third to fifth lines calculated from the table on p. 37, op.cit.

...Continued

food output, then the change in the family's age structure will alone, over the whole relevant range, raise the marginal utility from food.

Secondly, family size itself changes over time as additional children are brought into the world (and a net increase in the number of children in the family takes place).

In the present framework of analysis, family growth is viewed as an exogenous, constant "variable"; fertility is not a decision variable in it. This is a strong assumption requiring some justification. It does not necessarily imply that fertility decisions are "irrational". Generally, it can be plausibly assumed that non-economic factors - as well as economic factors - impinge on fertility decisions (with the composite, overall impact of these two groups of factors being possibly generated by a non-additive transformation). It may also be postulated that the major economic factors affecting the desired ("optimal") number of children (such as provision of support in old age) are, over a wide range of changing economic conditions and due to the existing institutional set-up (e.g. deficient financial markets for the mobilization of savings) of the nature of fixed constraints. Hence there evolves a domain over which the demand for children is highly inelastic (with respect to such changing conditions). This ties in with the reasoning that it is, in fact, only from the short run point of view - e.g. over a two period planning horizon - that bringing children to life is, as implied by the analysis below, beyond the point at which the marginal utility of bringing an additional child is equal to the marginal disutility of having him (and this, of course, assumes for the general case a utility function which includes children as a direct argument!). In this short run the presence of children depresses net utility but there is no escape from this as it is not possible to transfer backwards future expected utility from children. (The time path of the positive utility stream differs from the time path of the negative utility stream and on the basis of future expected utilities alone, no mechanism is available - with mortgage or indenture by contract of children ruled out - for overcoming this divergence)<sup>7</sup>.

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footnote No. 6 continued...

Finally, if as a basis for these calculations more recent findings are taken, the same change in the family's age structure will result in roughly forty per cent increase in its energy requirements (see FAO Energy and Protein Requirements: Report of a Joint FAO/WHO Ad Hoc Expert Committee, FAO Nutrition Meetings Report Series No. 52 (FAO, Rome 1973) tables 5 (p. 32) and 7 (p. 34). Note that according to this report, energy requirements from 20 up to 39 years of age are regarded as unchanged).

<sup>7</sup> With children entering as a direct argument in the utility function and with  $W_c^{TP}$  and  $W_c^{TNP}$  designating marginal utility schedules where transfer backwards of future utility from children is, respectively, possible and not possible, the postulated relationship between the schedules in a plane where changes in the family's total utility  $dw$  are measured against time  $t$  (other variables held unchanged) is schematically portrayed below:

...Continued

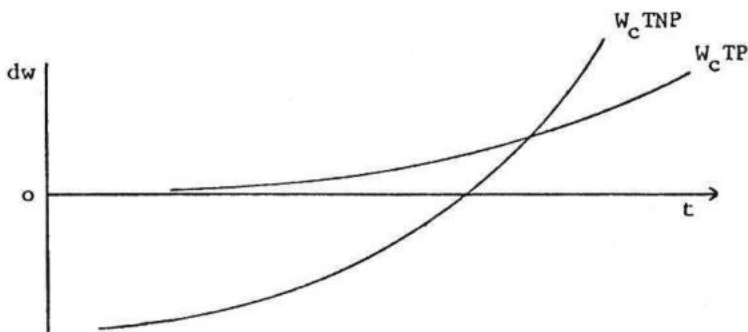
Clearly, these points rest implicitly on the assumption that all births are desired, parents a priori want all children though the explicit acceptance of this still leaves open a further alternative reasoning for divergence from optimality: erring is due to imperfect foresight, e.g. uncertainty concerning mortality and shortsightedness.

Since, in accordance with preceding comments, the total utility to be derived by a family unit from any given food output could not be determined independently of the number of its members and since the plausible assumption here is an inverse relationship between the two, the emerging implication is that an increase in the family's size will along bring about a shift downwards of the utility function.<sup>8</sup>

As a consequence of the operation of both these factors (henceforth referred to as the compositional (or structural) changes) the utility function could be reformulated to account for changes in  $N_s$  - the (standardized, "effective") number of consuming family members - to become  $U_1 = C(N_s) V(F, N_s)$  where  $C(N_s)$  is a monotonic decreasing function

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footnote No.7 continued...



<sup>8</sup> The effect generated by the possible presence in some families of non-working "non-workable" retired old relatives need not change the conclusions which follow. Firstly, over fairly long time intervals, the food requirements of old, non-working adults can approximated by a constant. Secondly, over longer time intervals, the absolute magnitude of the slow diminution in their food requirements falls far short of the opposite change deriving from the extra food requirements of the growing children. It is possible though, given life expectancies, that within the time period referred to in the text, an aged relative will die. This will immediately reduce the family's total food requirements but being a once-and-for-all "stock adjustment" to a "flow problem", its effect will quickly be swallowed up by the birth of other children (or, partially, even before that, by the increased food requirements during pregnancy plus the time adjusted increase in food requirements of other family members) and thus, at best, only defer - not reverse - the process of generating the critical turning point as portrayed below.

of  $N_s$  but where  $\frac{\partial^2 V(F, N_s)}{\partial F \partial N_s} > 0$  representing respectively the changing level (intercept), the shift downwards of the utility curve, and the changing rate of change of level (slope), the increase in marginal utility over the relevant range.<sup>9</sup>

The picture is schematically portrayed in Figure 2. (as  $U_1$  is viewed at different points of time, a subscript  $j$  is introduced, i.e.  $U_{1j}$   $j = 0, 1, 2, \dots$  stands for utility function  $U_1$  at time  $j$ ).

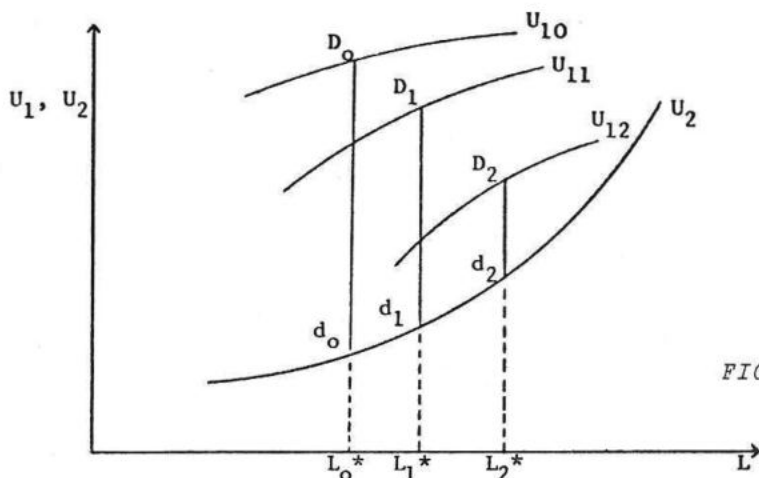


FIGURE 2

Note that firstly given the time span over which the family is observed,  $U_{1,t+1}$  is derived "from"  $U_{1,t}$  by a "downwards projection and twist", accounting for the full effect of the change in  $N_s$ .

But secondly, with a change by an increasing rate of  $N_s$ , the "shift factor" for successive "equally spaced" pairs of utility functions is not uniform; given any input of labour, the vertical distance between some utility function and its predecessor (where all utility functions are taken to differ one from the other by equal time intervals - all referring to the above specific time span) will be greater, the higher is its time order; as represented in Figure 2, a greater "gap" prevails between  $U_{12}$  and  $U_{11}$  than between  $U_{11}$  and  $U_{10}$ .

<sup>9</sup> The distinction between changes in locus (scale) and changes in marginal evaluations (age structure) though convenient for expositive and analytical purposes abstracts from the impact of the former changes on the latter ones. However this impact only reinforces the change in slope referred to in the text.

As a consequence of the shift of the utility function, the labour equilibrium input shifts too. The obvious reason is that for the labour equilibrium input at time  $t = 0 - L_0^*$ , marginal utility of food on the downward shifted utility function is greater than marginal disutility of labour. Therefore, (observing Figure 2) and referring to time periods  $t = 0$  and  $t = 1$ , net utility would be maximized at time  $t = 1$  at a labour equilibrium input  $L_1^*$ , sufficiently to the right of  $L_0$  to allow for a decrease in the marginal utility of food to a level at which it will be equal to the higher marginal disutility of labour. Similarly, with reference to time periods  $t = 1$  and  $t = 2$ , the ensuing new labour equilibrium input is  $L_2^*$ .

The implication of these successive shifts in the utility function and the ensuing shifts in the labour equilibrium input is that the position of the family unit as evaluated in terms of net utility - the family's maximand - is worsening, a deterioration which is monotonically increasing with time; in Figure 2 the vertical distance between  $U_{11}$  and  $U_2$  (at  $L_1^*$ ) is smaller than that between  $U_{10}$  and  $U_2$  (at  $L_0^*$ ) and similarly  $d_2D_2 < d_1D_1$ . Moreover  $|d_2D_2 - d_1D_1| > |d_1D_1 - d_0D_0|$ .

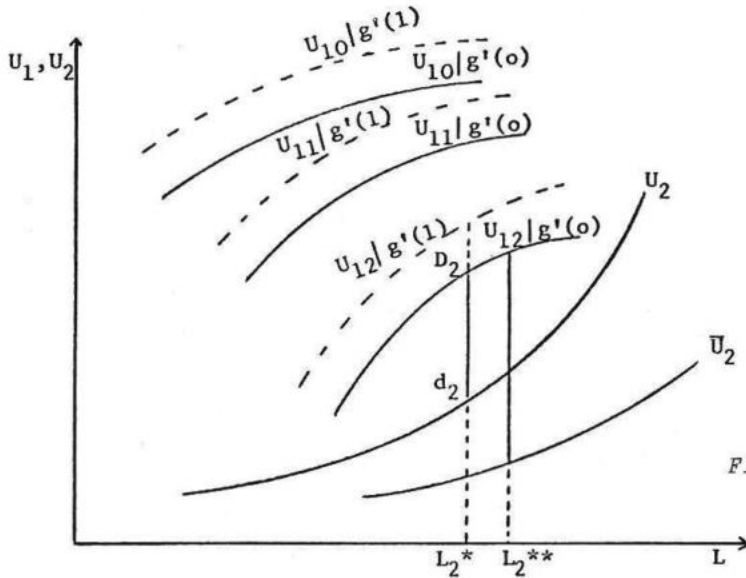
#### D. The Implication of a Land Augmenting Technological Change

Before pursuing further the main line of the argument, it is useful to consider at this stage the net utility implications of a land augmenting technological change in food production, the change itself being examined in Appendix I.

From a utility vantage point, an increase at a given point of time in food output produced with a given input (or input mix) is an increase of an argument in which the utility function is monotonically increasing throughout. This means that in a  $U_1, L$  plane, the utility curve which corresponds to a production function subjected to technological progress will lie above that which corresponds to the original production function. As this utility function, like the utility function which corresponds to the original production function, is subject to the impact of the structural changes of the family unit, its level and rate of change of level will, too, change throughout (for all given labour inputs over the relevant range) and the former will lie above the latter.

In Figure 3 the picture is summed up where alongside  $U_{10} | g'(0)$ ,  $U_{1j} | g'(1)$   $j = 1, 2$  are depicted,  $g'(0)$   $g'(1)$  referring to the production function under the original and the new technology respectively.

There are two immediate implications of this probing into the utility dimensions of different technologies. Firstly, the net utility maximizing head of the family unit will, *ceteris paribus*, improve his position by operating along  $U_{1j} | g'(1)$  as compared with operating along  $U_{1j} | g'(0)$  for any given  $j$ . Secondly, the incentive to operate along a  $g'(1)$  function rather than along a  $g'(0)$  function increases with the



passage of time. It is clearly not easy to quantify the intensity of the incentive to incur this move nor can any one specific index be expected to be generally approved of as being (or proved to be) superior to all other indices. (Furthermore, an index number type of problem may also be involved as two points are to be compared). Nevertheless, a measure of intuitive appeal is, given the labour equilibrium input, the difference between the expected net utility along, say, (see Figure 3)  $U_{12} | g'(1)$  and the actually enjoyed net utility - along  $U_{12} | g'(0)$  (- as measured between  $U_{12} | g'(0)$  and  $U_2$  at  $L_2^*$ ).<sup>10</sup>

Given the prevalence throughout of an incentive thus defined to change food production technology, why then is the technological change not incurred while operating say (see Figure 2) at  $L_0^*$ ? It is clear that if the impetus to incur the change at labour equilibrium inputs to the right of  $L_0^*$  is greater - or even if it is at least as great as at  $L_0^*$  - that it should be expected, a fortiori, to take place "there" but why not earlier?

<sup>10</sup> Throughout the present analysis it is assumed that the head of the family unit is aware of the existence of the superior technologies (- at least their blue-prints are available on the technologies shelf in the local community centre). See, however, on this point in the text below.

E. Characteristics of the Technological Transfer: Its Surplus Requirements and Its Risk Increasing Nature

Given the behavioural characteristics of the head of the family (they are explicitly spelled out below) the crux of the answer lies in the hypothesized inter-section between two sets of factors - the set of factors which characterise the land augmenting new technology and the set of factors which characterise the institutional and the non-institutional "surplus-risk state" confronting the head of the family unit. Lying at the heart of the analysis which follows is the argument that when the head of the family is positioned at the interlocking point of these two sets of factors, his capacity to carry out the net utility increasing technological change depends on moving out from this point, on the removal of the relevant constraints. Under such "a regime of multiple constraints" a family produced RUMOL turns out to be its only route for bringing the move about.

Refer first to the factors assumed here to characterise the technological transfer. These are its a priori direct or indirect surplus requirements and its a priorily conceived risk increasing nature.

The critical role of surplus could usefully be illustrated by way of the following example, the implication of which is believed to be of wide applicability. ("Critical" may well be interpreted here in its pure connotation in physics: "marking transition from one state to another").

Consider a technological transfer from traditional varieties to "high yielding varieties" e.g. the Southeast Asian case of rice - the most important crop (according to a wide range of relevant criteria) in the region's agricultural production. It is a well experienced and proven feature of the new rice varieties (e.g. IR-5 and IR-8) that unless their use is complemented by intensive application of fertilizers, their advantage over the traditional varieties (e.g. peta), if any, is minimal; their high degree of fertilizer-responsiveness is the key to their higher yields. Moreover, the new varieties may be (and IR-5 and IR-8 actually have been) more susceptible to various insects and pests unlike the traditional varieties for which a long past use has resulted in a considerable degree of resistance. Intensive fertilization then turns out to be useless without effective management of plant disease and pests. To these must be added the third major and critical complementary determinant of the new varieties' output levels - rigorous water control. From the point of view of the small farmer the implementation of measures necessary for controlling water supply effectively (water storage construction is one example, digging a well and installation of a water lift another) is usually the most costly single outlay involved in the new technology.

Thus, due to strong interactions and complementarities, the new composite input intensive varieties are high yielding only under the optimal input bundle which, in turn, necessitates the a priori availability



of surplus.<sup>11,12</sup>

With regard to the risk-increasing nature of the technological transfer, arguing that it increases the "risks" involved in the production of food makes it necessary to specify what a riskier state is. Although referred to in detail later in this section of the paper, risk could be conceptualized here to derive from the adopter's beliefs (that is, his subjective evaluations) about the levels of food output; these, in turn, are assumed to be "summarizable" by a subjective probability distribution. A riskier technology would then be such that this distribution is stretched, that is any transfer of probabilities outwards except a shift solely to the right.

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<sup>11</sup> *That the availability of surplus is a critical pre-condition of technological change features predominantly in a large number of the Country as well as the Analytical papers comprising U.S. Department of State, Agency for International Development, A.I.D. Spring Review of Small Farmer Credit (Washington, 1973), Vols. 1-20. For another example see John C. de Wilde Experiences with Agricultural Development in Tropical Africa (two volumes, Baltimore, 1967).*

A vivid illustration contained elsewhere reads "Although recent experiments in Maragoli (Kenya) have shown that hybrid seed, fertilizer, a sufficient labour force and good husbandry can more than double most current maize yields, farmers complain that they cannot find the few hundred shillings with which to make this investment in their land." (Joyce Lewinger Moock "Pragmatism and the primary school: the case of a non-rural village" Africa Vol. 43, No. 4, October 1973, p. 306 (reprinted as University of Michigan, Center for Research on Economic Development CRED Reprints (New Series) No. 37, pp. 302-316).

<sup>12</sup> A presence such as this of strong complementarities is probably a general phenomenon characterising most relevant technological transformations. Consequently, a sharp distinction between transformations which critically depend on really indivisible factors and those depending on divisible ("pseudo-indivisible") ones is somewhat misconceived. (Replacement of a light wooden plough also requires draught animals of a superior breed, installation of a tubewell - a pump set). Of course, it is always possible to argue that, prima facie, some components in a "package" can be hired (draught animals) or purchased (tubewell water) from, say, neighbour farmers. This may or may not be possible (synchronization of the use of draught animals dictated by the seasonality factor) or relevant (structures which are an integral part of the land (e.g. a canal) may still be required). But perhaps, an equally important consideration here is that a meaningful change (that is of the potential of increasing output by more than a small, marginal magnitude) implies that even if arrangements of the above nature reduce, though clearly not eliminate, the need for an a priori availability of surplus they manifestly introduce an additional element of risk. As it emerges elsewhere in this study, the "surplus insufficiency" (see in the text below) and the degree of risk enhance each the severity of the other.

...Continued

There is little doubt that the new technology encompasses some risks thus defined. Its novelty, as such, (to some extent risk is inherent in any kind of innovation) and its adoption involving a commitment (often an irreversible commitment) over time, which hence subjects it to imperfect knowledge, generate risks.<sup>13</sup>

The likely riskier property of the new technology is however a result of the presence of specific categories of risks; risks which belong to existing specific categories of risks are magnified by the new technology and risks which belong to categories of risks hitherto not endured, are also introduced by it. On the one hand, there is ambiguity as to how the new technology will match the various environmental conditions, both the general ones and in particular those specific to the adopter's farm. (Predominant here are microclimatic variations, local soil conditions and localized pests and diseases). On the other hand, factors and inputs previously irrelevant to or not incorporated in the production process could, under the new technology, become critical and their as yet unexperienced efficiency and reliability a major source of risk. (The performance and the quality of the various services rendered by central administration and government agencies is a case in point)<sup>14</sup>.

The factor which perhaps assumes particular importance is that the technological transfer embodies an increased risk when it becomes impossible to continue to utilize risk reducing practices which were used under the old technology. Clearly, under conditions of imperfect control over the environment, food output can be envisaged as containing a random component distributed independently of the adopter's actions. (This is somewhat simplified conceptualization - the component standing in fact for a vector of uncontrolled variables). But, given the technology, the range and effectiveness of these actions which, in turn, determine the characteristics of the distribution of the random component (e.g. its spread) directly depend, more than anything else, on the time

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footnote No.12 continued...

Finally it should be added that a great many (most?) "relevant technological transformations" of recent times (particularly of the last two decades or so) depend on new factors and inputs, elements in which the technological change is "embodied". This in itself, independently of the factor of complementarity creates strong, discrete needs for "sufficient surplus", produces a new pattern of technological change which differs from a "traditional technological change" - a continuous technological change involving a gradual increment to the quantities of existing factors facilitated, in turn, by a continuous, if sporadic, accumulation of surplus.

<sup>13</sup> If the commitment involved is more irreversible, the ensuing state is, *ceteris paribus*, riskier.

<sup>14</sup> Actions of other agents (- these are also subject to the uncertainty generated by human behaviour and the "fundamental random nature of human decisions") may for example be responsible for the production process being interrupted due to the non-availability (- or the non-availability at the proper time) of key inputs.

span for which the technology has been in use.<sup>15</sup>

Serving as built-in risk-reducing devices are many traditional practices such as the staggered planting whereby deviations from optimal planting time (reduction in expected yields) are traded in for minimization of the effects of e.g. randomly incurred periods of water stress, and the interplanting of one crop with another (intercropping) where the different crops differ substantially in their "environmental resistance" - to a stochastic environmental variability - e.g. to drought, local pests and birds damage. (Mixing staple grains with legumes and roots or with each other are usual practices, e.g. sorghum with millet or maize in parts of Africa or barley, peas, gram and oil seeds with wheat, bean-sprouts with millet in parts of the Indian sub-continent).<sup>16</sup>

Referring though, for example, to this latter practice, under the new technology - e.g. where a new variety is involved - the same intercropping may be either useless or even harmful (e.g. when the mixed crops, directly or indirectly interact negatively) or may simply be out of question e.g. when considerations of future use demand preservation of the purity of the seed. Though it may be possible for other husbandry practices to supplant the traditional, (subjective) risk lessening practices, this is likely to require production experience and thus time!<sup>17</sup>

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<sup>15</sup> Past operation along the "old" technology has undoubtedly generated some direct relationship between given actions and preferred consequences; ignorance about the environment and the future had been reduced through the lengthy, time proportional processes of collection of information and gaining of experience. However, these "assets" may become largely obsolete once a new production technology is incorporated (- see in the text below).

<sup>16</sup> It should not though be deduced from this that mixed cropping on its different versions is practiced exclusively for the sake of depressing risks. For example, manuring or the application of some chemical fertilizers can, to some extent, be substituted (or complemented) by a simultaneous planting of, say, staple grains with nitrogen producing legumes.

<sup>17</sup> It is also likely - particularly if following the anthropologists' stressing, it is accepted that in the agrarian sector of a developing economy, economic and social variables strongly interact, exhibit high cross elasticities - that adoption of a new technology will give rise to such social repercussions that some of the previous interactions between the economic and the social factors would be weakened - these being precisely risk reducing ones. By the same token, the new technology may also render it impossible to continue to maintain some "strictly economic" arrangements, a characteristic of which is the sharing and elimination of risks. (A shift from a wooden to an iron plough severs the reciprocal relationship between a small farmer and the village carpenter). For an interesting discussion of this direction see however Irma Adelman "Social and economic development at the micro level - a tentative hypothesis" in Eliezer B. Ayal (ed.) Micro Aspects of Development, Praeger Special Studies in International Economics and Development, (New York, 1973), pp. 3-13. See also Everett E. Hagen On the Theory of Social Change: How Economic Growth Begins (Homewood, 1962), especially chapter 4.

It is also important to note that when a structural feature of the new technology is a higher working capital (intermediate inputs) output ratio then a given objective probability of output failure implies, considering the absolute quantity involved, a higher level of risk under this technology than under the old one.<sup>18</sup> This implicitly assumes a given degree of farm management efficiency but if this degree is inversely related to the absolute quantity of the working capital, the risk embodied in the new technology could a fortiori be greater even if the intermediate inputs-output ratio is not higher but the quantity of these inputs is larger.

The "more advanced" new technology probably embodies some features which increase the adopter's control over the environment. This implies a certain lessening of objective risk which, in turn, can be expected to depress the subjective risk. However, *ex ante*, the impact of this - and other elements - do not seem to diminish significantly the accumulated weight of the above set of factors - most certainly not to such an extent as to render the subjective riskiness embodied in the new technology less than that of the old technology.

#### F. Characteristics of the "Surplus-Risk State" Confronting the Small Farmer's Family

The small farmer head of the family is assumed on the one hand to possess no or "insufficient surplus" and no capacity for an engagement in "sufficient" self insurance. At the same time, and on the other hand, he is assumed to face ill functioning financial markets with neither institutional nor non-institutional credit supply and insurance coverage,<sup>19</sup> except perhaps at a prohibitive price.

"Sufficiency" is of course a relative term used in a dynamic sense, sufficient surplus being that minimal surplus necessary for carrying out of the relevant technological transfer. (Standing as an extreme example is the case of some indivisible "key" inputs critical to the adoption of a number of new technologies such as tubewells and minor irrigation works). Likewise, the sufficiency of an insurance coverage could be

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<sup>18</sup> In footnote 12 in Part II below, the adopter of the new technology is shown - given his utility function - to be more sensitive to a relative change in the magnitude of a production failure than to an equal relative change in the probability of the failure.

<sup>19</sup> There are a number of possible reasons why insurance markets do not even form. Some may directly relate to the nature of the economic system (the degree of integration) which may not only hinder specialization by insurers in given classes of risks (thus limit their capacity to make use of the law of large numbers) but also generate situations whereby occurrences cannot be said to bear little or no causal relation one to the other. Other explanations may stem from the reason of the "moral hazard" (a situation where the very provision of an insurance might alter behavioural patterns these in turn determining to some extent the occurrence of the "undesirable event").

interpreted (but see Part II) as being that minimum which, considering the risk aversion profile of the risk averse head of the family and the (subjective) risk-increasing nature of the new technology (with other factors kept constant), will render food production under the new technology no riskier than food production under the "old" one.

This state of affairs - the likely absence - or insufficiency - of existing surplus and the likely absence or insufficiency of exogenous mechanisms and arrangements for overcoming this shortage are in general, respectively, strong characteristics of the small farmer and the profile of the rural sector within which he operates.

With the family initially endowed with the "cruel parameter" of only a small holding, with average capacity to generate surplus being directly proportional to on the farm food production but inversely proportional to the (standardized) number of family consuming members, the prevailing surplus and the expected surplus are likely to be low. This is particularly so at the time when the elder son is reaching maturity. The far from smoothly functioning financial markets, largely endowed with oligopolistic or even monopolistic elements, is a characteristic largely responsible for the creation of a state whereby the surplus and insurance requirements of the new technology must be met from "within" the family unit.<sup>20,21</sup>

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<sup>20</sup> Although taken up in Part II below, it worth noting here that even under conditions of smoothly functioning financial markets and money-lending institutions, borrowing - vis-a-vis self-finance - is not risk neutral. The risk element embodied in taking a loan (=claim on subject-to-risk future production would, moreover, be imposed on a risk averter already exposed to a high level of subjective risk. Unless loan taking is neutralized by some concurrent "counter-measures" (e.g. backed by an appropriately linked and rated insurance coverage - see Part II) the strong aversion of the head of the family to incur debts can be expected to withhold him from doing so.

<sup>21</sup> There is now a substantial body of evidence on the ill functioning of rural financial markets in general and on the characteristics of the credit supply curve confronting small farmers in particular. See, inter alia, M. L. Dantwala "Institutional credit in subsistence agriculture" International Journal of Agrarian Affairs, Vol. 5, No. 1, December 1966, pp. 52-61; Josef Vasthoff "Small farm credit and development: some experience in East Africa with special reference to Kenya" IFO - Institute für Wirtschaftsforschung München, Afrika-Studien 33 (München, 1968); Reserve Bank of India Report of All-India Rural Credit Review Committee (Bombay 1969), especially chapter 18; Jiryis S. Oweis Agricultural Credit Policy in Developing Countries, U.S. Agency for International Development, Bureau for Program and Policy Coordination, Office of Policy Development and Analysis (March 1972); H.K. Pandey "A study of credit requirements and advances to farmers by lead bank in Varanasi, U.P." Economic Affairs, Vol. 17 Nos. 9-10, September-October 1972, pp. 442-447; Giordano Dell'Amore Agricultural Credit Markets of Africa (a series of monographs under the general editorship of Professor Giordano Dell'Amore) Cassa Di Risparmio Della Provincie Lombarde - Milan (Milan, 1973); U.S. Department of State, Agency for International Development A.I.D. Spring Review of Small Farmer Credit (Washington, 1973), Vols. 1-20.

## G. The "Migration by the Maturing Son" Strategy as a Solution

Returning now to the main line of the argument, with the impetus to incur technological change as implied earlier, a turning point in the sense of breaking the grip of the second set of constraining factors (the accumulation of surplus - the reduction-of-risks insufficiency) so as to meet the impositions of the first set of factors (the surplus-risk facets of the new technology) is that point of time which corresponds to the elder son reaching maturity and joining the "ranks of the workers".<sup>22</sup>

This "point of time" - even conceptually - is not easily defined. In the rural setting it may be freed from an unnecessary connotation of specific age, though age as such may be highly relevant, directly or indirectly, in the context of the urban labour markets (e.g. the issues of employability or educational attainment) and thus - important within the migration nexus discussed below.

The basic conceptual difficulties involved here stem however from the problem of reasoning the incorporation of the maturing son's labour and hence his disutility from work into the now aggregated family's disutility function. To be clear, given the characteristics and the additive separable nature of the utility function assumed throughout, incorporation of the maturing son's labour when the family unit is in position  $L_2^*$  (Figure 3) is compatible with net utility maximization only if in so doing, the family's disutility at  $L_2^*$  is lowered. But how then is the new "aggregated"  $U_2(L)$  arrived at? This introduces a complex of issues similar to those explicitly touched upon, though in a different context, in Part II below. It is however instructive to illustrate here some possible conditions under which the aggregated  $U_2(L)$  might be constructed, even if the price of so doing is the introduction of some simplifying, specific and restrictive assumptions.

If comparability of some nature is possible then, (considering first a static position referring later to the dynamic element) when labour contributions of different family members are equally weighted at the margin, the necessary condition for relieving the head of the family of some of the labour burden he endures by way of transferring it to the maturing son's labour is that over at least part of the range of the labour inputs which are smaller than the presently applied one -  $L_t^*$ , the disutility of the maturing son is lower than that endured by the head of the family. Within such a comparative framework, it is possible to give a dynamic content to "the elder son is reaching maturity" - this being said to occur at time  $t$  if for the labour equilibrium input ruling at that point of time -  $L_t^*$ , substitution of the elder son's labour for that of the head of the family significantly reduces the disutility from effort which the family unit, as a whole, is enduring while applying  $L_t^*$ . Indeed, around that time interval within which the

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<sup>22</sup> *The possibility of seasonal RUMOL by the head of the family prior to the maturing of his eldest son is examined in detail and shown to be of limited plausibility in a note at the end of this section.*

elder son is said to reach maturity, his disutility schedule depicted in a utility/disutility - labour plane can, as time goes by, be regarded as shifting south eastwards.

At time point  $t$ , the head of the family unit taken throughout to be its decision-maker, (as a net utility maximizer over a two period planning horizon) is confronted thus with two mutually exclusive "strategies". The first strategy involves an increase in net utility through incorporation of the maturing son's labour on the family farm. An instantaneous increment to net utility is produced when a transfer of some of the labour effort e.g.  $L_2^*$  (see Figure 3) to the maturing son results in a disutility level lower than  $d_2$ . Furthermore, with overall marginal disutility from labour at  $L_2^*$  also falling below its previous level, a move away from  $L_2^*$  is incurred - with the disutility curve around the relevant range being as is schematically depicted by  $U_2$  - a new equilibrium input is reached  $L_2^{**} > L_2^*$ . However, since for a given  $N_s$  (and food production technology) the extra utility generated (through  $C(N_s) V(F, N_s)$ ) as a result of the application of a higher labour input will depend on the magnitude of the elasticity of food output with respect to labour input  $-\eta^F/L$  - over the relevant range of marginal labour inputs, with  $\eta^F/L$  being small, the "utility effect" as a proportion of the net utility increase due to the substitution of  $L_2^{**}$  for  $L_2^*$  is low. The smaller is  $\eta^F/L$  - other things being the same - the lower is this proportion.

#### H. The Role of RUMOL in Removing the Surplus Constraint

To verify the above relationship assume first that the only factor which inhibits a shift away from the current technology to the new technology is the inadequacy of the family's surplus. Then, with the utility to be incurred from cropping along the new technology being above that which is to be derived from operating along the current one, the criterion for choosing between the two strategies is, *ceteris paribus*, the sign of the surplus accumulation differential between them.

In a discrete world, both strategies can be intersected with three "states of nature"; the maturing son's contribution to the accumulation of surplus, over the planning horizon, is positive, nil or negative. Producing on the farm, necessarily (under the present set of assumptions) along the "old" technology, over a range for which  $\eta^F/L$  is low ranks the probabilities which correspond to these three states of nature in an increasing order. That the family unit may, incidentally, possess some, "partial surplus" i.e. a surplus which falls short of the "sufficient surplus" as defined earlier, is of no direct help in transforming say the nil surplus accumulation state into one of positive surplus accumulation. The head of the family may find himself envisaging no (or only little) hope (i.e. zero or very low positive probability) of accumulating the "sufficient surplus" over his planning horizon while adopting the first strategy.

When the probability of accumulating the "sufficient surplus" through adoption of the second strategy is however higher this strategy will be chosen. On designating the food equivalent of the total net urban income, - net of non-optional urban incurred costs - expected to accrue to the maturing son in the first planning period by  $F_u$ , the alternative total food output on the family farm imputed to derive from his labour by  $F_a$  and his urban and farm real (food) consumption levels by  $F_{cu}$  and  $F_{cR}^{23}$  respectively, the second strategy will clearly be chosen when  $F_u - F_{cu} > F_a - F_{cR}$ . On utilizing as a working assumption, to be shortly relaxed, the condition that the real (food) consumption level of the migrant son is constant over sectors i.e. that  $F_{cu} = F_{cR} = F_c$ , the inequality converges to  $F_u > F_a$ . Such will still be the choice if both  $F_u, F_a < F_c$  or even if  $F_u, F_a \leq F_c$ . (Included as a special case here of course the situation where  $F_a = 0$ ). However, though sufficient, this state of affairs is not necessary. The argument can, under "a regime" of an "insufficient surplus", sustain choice of the second strategy in conjunction with a first period's  $F_u < F_a$  if later on the adoption of this second strategy will produce (or will lead to the accumulation of) "sufficient surplus". In such a case, particularly if  $F_u (< F_a) < F_c$ , some surplus already possessed by the family unit may be used to provide an initial support for the migrant member; a substitution of holding some surplus with probability smaller than one and having the sufficient surplus with probability greater than zero, for having some surplus with unit probability but sufficient surplus - with zero probability is thus taking place.<sup>24,25</sup> Indeed, the probability of accumulating sufficient surplus may increase with the allocation of more surplus out of the partial surplus already possessed - e.g. through enhancing the prospects of obtaining a better paid urban job.

<sup>23</sup> Frequently referred to as the "subsistence cost", usually identified as the "supply price".

<sup>24</sup> This point should be contrasted with the assertion that the family's support to the migrant is bounded from above by the absolute magnitude  $F_c - F_a$ . (See, for example, J.B. Knight Wages and Employment in Developed and Under-Developed Economies, Oxford Economic Papers (New Series), Vol. 23 No. 1, March, 1971, pp. 42-58). This supposition (like others) is due, *inter alia*, to both the failure to realize that the migration decision is not a "one-period decision" and the overlooking of the probable existence of some, already accumulated, surplus.

<sup>25</sup> Needless to say, such a substitution need not be made for any set of probabilities which conform to the above; the feasible probabilities' space would depend and be uniquely determined by the specific utility function on its implied risk aversion property. That this space is far from being the trivial one is considered here to be a safe assumption.

...Continued



That the partial surplus may not however suffice to top up  $F_u$  - if  $F_u < F_c$  - to the "constant over sectors real consumption level" need not cause much concern. (The main appeal of holding  $F_c$  constant is that it renders it easier to focus attention on the farm family as a whole without having to pay explicit, special attention to the migrating son who is then characterized by a "cross sectoral indifference"). For, as with the expected utility gain, a utility loss incurred by  $F_u < F_{cR}$  will somehow be shared by all, the migrating son included (- in view of  $F_u < F_{cR}$ ,  $F_{cu}$  will diminish too). Hence (with the condition  $F_{cu} = F_{cR}$  no longer being maintained) the task is eased with some part of the difference  $F_{cR} - F_u > 0$  being endured by the migrant son himself, some - being made good by allocation of the surplus (or from the surplus) already possessed by the family.

But the problem which still has to be looked at is that relating to the planning span. The incorporation of a situation whereby accumulation of a sufficient surplus is, at best, deferred to take place over a second period with, as argued below, technological change carried out in the following period is not, technically speaking, compatible with a strictly defined two-periods planning horizon. Clearly migration concomitant with a first period  $F_u < F_a$  amounts to preference of "be hungrier today, expect bread tomorrow, bread and butter the day after" to "have (and then expect) bread in each of these days". Although technically it is not particularly difficult to smooth out this complication, the main problem which could arise here is conceptual rather than technical. When over such a multiple period time span, (at least) until sufficient surplus is accumulated, compositional changes of the family unit continue to occur, how can RUMOL's implication - the immediate and continuous utility loss (when  $\eta_{F/L}$  is strictly positive), accruing from the maturing son not labouring on the farm, be sustained over time?

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footnote No.25 continued...

*It is worth noting that pushing this point to the extreme would expose the fallacy of the guaranteed (assured) level of consumption on the farm as being of a great explanatory power in RUMOL causality. Under  $F_u > F_a$ , the maturing son migrates merely because of the positive net effect that this would bear on surplus accumulation, given that his assured level of consumption is constant over sectors. But given that his assured level of consumption in the urban sector is smaller than in the rural sector, he may still migrate. The divergence of the widespread theoretical treatment of the migrant's level of consumption from the presently outlined one originates in the failure of the first to reckon RUMOL's scope, both in terms of the identities of the decision-making unit and, the relevant planning horizon. (Related to the first of these is the reference, in the first place, to the migrant's consumption margins - not to his cross sectoral marginal outputs).*

The crux of the answer is, in a way, concealed in this very formulation of the problem: the utility loss need not be sustained over time; as and when the next son reaches maturity he may, in turn, produce as much as  $F_a$  himself. In such a case, a low, upper bound is placed on the opportunity costs of RUMOL - as measured in utility units - with a possibility of them reaching this limit before (at least) a sufficient surplus is accumulated. In other words, these RUMOL opportunity costs need not accrue for the whole of the maturing son's migration period.<sup>26</sup>

Finally, an important clarification is in order. The close nexus claimed to exist between RUMOL and the accumulation of surplus - with the former producing the latter need not, indeed should not, imply that surplus is necessarily, partly or wholly, directly accumulated by the migrant son in the urban sector. To take the case where for a constant over sectors  $F_c$ ,  $F_u > F_a$  with both  $F_u$ ,  $F_a < F_c$ , surplus is accumulated on the family farm when some (farm produced) food which would have had to feed the maturing son had he stayed on the farm is now freed. The relevant magnitude (or part of it) is thus turned into, strictly speaking, farm generated surplus. In another case e.g. a non RUMOL state whereby  $F_a = F_c$  has prevailed, with RUMOL producing  $F_u > F_c$  (other production/consumption relations remaining unchanged), surplus is, certainly at the margin, directly urban produced. Similarly, other states whereby surplus is, directly, partly farm produced and partly urban produced can easily be constructed.

While conceptually the inter-sectoral distribution of actual surplus creation is immaterial so long as the production/consumption, homogeneous nature of the family unit remains intact,<sup>27</sup> this is no longer the case when considerations of search for evidence prevail - e.g. the issue of remittances; RUMOL can be associated with accumulation of a surplus which to an important extent exceeds that recorded by (even a fully documented) "urban to rural (net) flow of remittances". If anything, such remittances may thus serve as a downward biased estimate of the true volume of surplus accumulated by the family unit as a whole.<sup>28</sup>

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<sup>26</sup> Issues concerning the implications of "multiple son" families - within a RUMOL context - are explicitly touched upon early in Section 2 of Part I and in Part II below.

<sup>27</sup> The nature and extent of alternative communal pressures (rural vis-a-vis urban) on the usage of a given surplus and consequently, on the very incentive for its accumulation are not incorporated here. (Surplus accumulated on the farm may, for example, be subjected to strong social pressures for it to be spent on immediate, communal consumptive ends).

<sup>28</sup> Reference to this point will be made in Appendix II where the issue of remittances is more fully examined.

between the receipt of which and the receiving of two other levels with equal probabilities a risk averse decision-maker is indifferent is always smaller than the arithmetic average of these two levels; "actuarially fair bets" are always rejected).<sup>30,31</sup>

Various indices have been offered for the measurement of risk aversion, the more important ones<sup>32</sup> mainly for the purpose of predicting the effect of changes in related variables on the risk averse decision-maker's degree of risk aversion (and hence, on his total economic behaviour).<sup>33</sup> From the view point of the requirements of the argument which follows, the critical stipulation is, however, that on introducing the new technology, though facing a riskier situation, the decision-maker's degree of risk aversion has not, simultaneously, been decreased

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<sup>30</sup> In a formal setting, a risk averse individual can indeed be defined as an individual who, starting from a position of certainty is unwilling to take an actuarially fair bet. Then, it is easy to prove that the negativity of the second derivative of his utility function is a necessary and sufficient condition for his risk averseness.

<sup>31</sup> It is interesting to note that the fact that the risk aversion of the head of the family impinges critically on his choice of technology has discernibly and informally been pointed out by Horace Holmes "Helping the Asian villager to help himself" in the National Society for the Study of Education, the fifty-eight yearbook of the National Society for the Study of Education: *Community Education: Principles and Practices from World-Wide Experience* (Chicago, 1959), Part 1, pp. 191-207; "... the Asian villager ... like any other careful person, is unwilling to exchange something that works, even poorly, for something that he is not sure will work at all. This villager, schooled by experience, taught by his father and his father's father, cannot be expected to experiment with new and unproven things" (-p. 191). A similar point has been made by John M. Brewster "Traditional social structures as barriers to change" in Herman M. Southworth and Bruce F. Johnston (eds.) *Agricultural Development and Economic Growth* (Ithaca, 1967), chapter 3; "So close is life to the bone that [people's] impulse to take a chance on gaining a whole loaf from new and untried techniques is inhibited by anxiety over losing the crumb they feel sure of getting from their old practices". (-pp. 67-68).

<sup>32</sup> See Kenneth J. Arrow *Aspects of the Theory of Risk-Bearing* Yrjö Jahnsson Lectures (Helsinki, 1965) - the second lecture "The theory of risk aversion" pp. 28-44 (reprinted as chapter 3 in Kenneth J. Arrow *Essays in the Theory of Risk-Bearing* (Chicago, 1971); John W. Pratt "Risk aversion in the small and in the large" *Econometrica*, Vol. 32, pp. 122-136.

<sup>33</sup> The second derivative of the utility function, though perhaps the first such measure to be thought about, is useless since it varies with monotone transformations to which, however, the preference ordering of the utility function is indifferent. (See, in particular, Arrow *op. cit.*). Hence, the measure known as "absolute risk aversion" which is based on this derivative, standardized by the first derivative of the function, i.e.

$$Ar_a = - \frac{U''(F)}{U'(F)}$$

## I. The Role of RUMOL in Removing the Risk Constraint

Assume now that the key factor with respect to which the two technologies differ, the element which constrains the adoption of the (otherwise superior) new technology, is the "risk factor" (rather than the "surplus factor"). RUMOL has been pursued resulting in accumulation of sufficient surplus (say) in the first of the two planning periods. Ignoring in the present setting all time lags, in particular, given a decision to incur the technological change - that the shift is instantaneous, will a decision to adopt the new, riskier technology be taken? Clearly the answer depends on the behavioural characteristics of the decision-maker in the face of choice situations involving risks. These are determined however by the characteristics of the (class of) utility function(s) as presented at the beginning of this Part; implied in the function(s) is the attitude of the head of the family, its decision-maker, towards risk-bearing: he is a "risk averter".<sup>29</sup> The condition of a strictly concave utility function, imposed at the outset of the present section, as well as being a necessary condition for a maximum as above (- and this is in addition to its ranking power) implies that given any two levels of the "utilized" variable (food) say  $F_1$ ,  $F_2$  ( $F_2 > F_1$ ) which lie within the interval on which the utility function is defined, he whose preferences are given by such a function would prefer  $\bar{U}$  to  $\underline{U}$ , where  $\bar{U} = U(\alpha F_1 + \beta F_2)$  and  $\underline{U} = \alpha U(F_1) + \beta U(F_2)$  for  $0 < \alpha < \alpha + \beta = 1$ . It is convenient to take  $\alpha = \beta = 1/2$  (so that  $\bar{U} > \underline{U}$  is  $U\left(\frac{F_1 + F_2}{2}\right) > 1/2 [ U(F_1) + U(F_2) ]$ ) a case for which the verbal interpretation is that a risk averse decision-maker is one who would prefer the arithmetic average of a pair of levels of the utility generating variable to the alternative "bundle" of receiving each of these levels with an equal probability. (Equally, the level of the utility-generating variable to be offered with unit probability (a "guaranteed level")

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<sup>29</sup> It is worth pointing out here that the concepts of risk and risk aversion that will be shown in the text to emerge from the postulated expected utility system are not, in any direct intuitive sense, necessarily strictly superior to other possible concepts. Risk indices may, for example, be based on various functions of expected "loss" only - which, in a discrete formulation, is taken to mean the sum of all losses multiplied by their respective probabilities - or on functions of some "losses". In the first case, loss is any deviation below, say, the mean; in the second, "loss" is taken to mean a deviation below some critical, arbitrarily determined value e.g. subsistence level plus non-optional obligations such as the servicing of a debt.

However, these alternative risk concepts are not compatible with the general expected utility structure (neither do they represent the critical Pratt-Arrow (see footnote 33) property of "absolute risk aversion" decreasing with wealth). And, from the point of view of the limited axiomatic web of the present study (- as noted at the outset of this part), expected utility is an accepted yardstick exhibiting consistency with general theoretical principles (as well as being successful in explaining economic behaviour).

to such an extent as to render him sufficiently less risk averse - in the sense that acting positively and explicitly to counter-balance the impact of the riskier situation which he is facing becomes (at best) unnecessary.

That this is not the case can be taken as an axiomatic postulation though it could also emerge from a tentative examination of the relevant "risk aversion variables". When the new technology is introduced, with the surplus accumulated in the previous period(s) embodied in the food production process, an increase in "terminal assets" or "terminal wealth" (= "initial wealth" plus the algebraic magnitude of the current period's income) to which risk aversion is inversely related can hardly be assumed to have occurred. (When the ratio between a given period's expected level of income and the increment to terminal wealth is low (that is, significantly lower than one), risk aversion can, other things being the same, safely be assumed to have decreased. However, such is not the case in the present context where the ratio is anything but low). Furthermore, with the relationship between the degree of risk aversion and the (standardized) number of family consuming members -  $N_s$  being an increasing one (or at least non-decreasing), an increase in  $N_s$  over the relevant time span will also imply that the decision-maker (at least) has not become less risk averse.<sup>34</sup>

With none of these variables thus operating, from the point of view of the present context, in the "wrong" direction, the degree of risk aversion when the decision to shift the production technology is taken can be assumed to be at least as great as that which had prevailed before. It should be re-emphasized that though sufficient, this requirement is, in fact, stronger than the necessary one; even if the decision-maker is, to some extent, less risk averse, with the new technology being to a large extent riskier, the essence of the argument which follows will remain intact. (From the point of view of the direction of a behavioural response, a given degree of risk aversion combined with a given risky prospect and a lesser (greater) risk aversion combined with a riskier (less risky) prospect are equivalent, although in general there is no reason to assume that the "elasticity of substitution" between risk aversion and the riskiness of the marginal prospect is constant).

Given therefore that without any loss of generality the head of the family can be envisaged as a constant-risk-averse decision-maker who confronts a riskier situation, the following proposition will be made.

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<sup>34</sup> *The foregoing relationships assumed to hold in general were presented without discussion. They are taken to be intuitively plausible (e.g. considering the differing intensities of the unwillingness to accept actuarially fair bets) as well as concurrent with most economic observations. With reference to the first relationship, consult the early, interesting discussion in Michael Kalecki Theory of Economic Dynamics: An Essay on Cyclical and Long Run Changes in Capitalist Economy (London, 1954), chapter 8. Also see his "The principle of increasing risk" Economica, Vol. 4, November 1937, pp. 440-447, an altered version of which appeared later in Michael Kalecki Essays in the Theory of Economic Fluctuations. (London, 1939).*

The imposition of an increased risk on a (consistent) risk averse decision-maker who maintains (at least) a constant degree of risk aversion will induce him, in the face of the riskier situation, to adopt a strategy of a risk reducing nature. The introduction of a new risk increasing technology in the production of food will be synchronized with the adoption of a risk depressing strategy. With the strategies' space being the allocation of the maturing son's labour in the urban sector or on the family farm, the former will be chosen.<sup>35</sup>

In supporting this proposition a general diversification rule, in a portfolio selection theory sense, is of use in indicating the sort of response in portfolio allocation terms and hence which of the alternative strategies is the optimal choice.<sup>36</sup> Given a utility function of a fairly

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<sup>35</sup> In spite of the fact that risk is of profound importance in explaining the economic behaviour of agricultural producers, the traditional theoretical literature has remarkably avoided explicit treatment of risk as an explanatory factor in RUMOL causality. In those very few cases where awareness of the risk factor does seem to prevail, analysts either simply brush it aside apparently without being particularly worried about the analytical repercussions or incorporate it but correlate it "directly", apparently never "inversely", with RUMOL causality. Studies which seek to explain RUMOL causality in terms of "selectivity" illustrate the latter case. Maintaining that migrants come from select groups, these studies argue that those who have the highest propensity to migrate are "the dynamic risk-taking beings who have a high capacity to detach themselves from the traditional surroundings and adapt themselves to the unfamiliar environment" (emphasis added). Gian S. Sahota "An econometric analysis of internal migration in Brazil" *The Journal of Political Economy*, Vol. 76 No. 2, March/April 1968, p. 220). Of the studies holding this view, the clearest exposition seems to be contained in Simon Kuznets, "Introduction: population redistribution, migration and economic growth" in Hope T. Eldridge and Dorothy Swaine Thomas "Demographic analyses and inter-relations" - *The American Philosophical Society, Population Redistribution and Economic Growth, United States, 1870-1950*, Vol. III (Philadelphia, 1964), p. xxxii. For another example see Gunnar Myrdal *Asian Drama: an Inquiry into the Poverty of Nations* (New York, 1968), Vol. III Appendix 11 "Notes on migration", pp. 2140 and 2148. Another example is provided by Michael P. Todaro "A model of labour migration and urban unemployment in less developed countries" *American Economic Review*, Vol. 59 No. 1, March 1969, pp. 138-148. Risk loving is a positive element implicit in the analysis; migrants take the risk of urban unemployment seeking the reward of a high wage industrial work. A sharp illustration of the former case is "... to simplify the analysis, I shall abstract from uncertainty..." Milton Ame. Iyoha "The optimum rate of rural-urban migration in a developing country" State University of New York at Buffalo, Department of Economics, Economic Research Group, Discussion Paper No. 176, November 1971, p. 7.

<sup>36</sup> "Spreading risks is the great way of diminishing uncertainty" - John Hicks, *Critical Essays in Monetary Theory* (Oxford, 1967), p. 29.

general type such as that utilized in the present paper, on the basis of the independence assumption supplemented by alternative sets of fairly general postulations, alternative theorems which practically state that in order to achieve the optimal portfolio it is compulsory to diversify can be proved. Particularly, and more specifically, if a given investment (security) which, like the other investments is of finite (non-zero) variance and of a mean at least as great as of any other investment is independently distributed from all other investments, it must enter positively in the optimal portfolio<sup>37</sup>.

Consequently, it is possible to show that if one of two alternative investments is of a mean at least as great as the other's and if each of these investments is independently distributed from all "other investments" then - with all investments being of finite (non-zero) variance - the portfolio into which, in addition to these "other investments", the first investment enters is the optimal portfolio.<sup>38</sup>

That application of this corollary to the present specific choice problem implies choosing an urban allocation of the maturing son's labour as the optimal strategy needs but little elucidation.

Assuming, given operation along the new technology, an inter-personal independence of labour rewards (externalities are ruled out - e.g. food output produced by the family unit excluding the elder son being indifferent to the sectoral allocation of his labour) the expected reward from utilization of the maturing son's labour on the farm (the mean of the second investment) should be compared with that expected to derive from his continued stay in the urban sector (the mean of the first

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<sup>37</sup> Paul A. Samuelson, "General proof that diversification pays" *Journal of Financial and Quantitative Analysis*, Vol.2 No.1, March 1967, pp. 1-13.

<sup>38</sup> Proof.

Denote the "first investment", the other investment and "all other investments" by  $Y_1$ ,  $Y_2$ ,  $X$  respectively (taking for simplicity's sake and without loss of generality the latter to be one, "homogeneous" investment) then

$$(Y_1, Y_2) \sim P(Y_1) P(Y_2)$$

$$(Y_1, X) \sim P(Y_1) P(X)$$

$$(Y_2, X) \sim P(Y_2) P(X)$$

$$\sigma^2_{Y_1} < \infty, \sigma^2_{Y_2} < \infty, \sigma^2_X < \infty$$

$$EY_1 = \int Y_1 P(Y_1) > \int Y_2 P(Y_2) = EY_2 .$$

If  $Y_1$ ,  $Y_2$  are independently distributed random variables, clearly so are the transformations  $Z_1 = Y_1 + X$ ,  $Z_2 = Y_2 + X$  - given the value of  $X$ .

...Continued

investment). Clearly the subjective probabilities which determine the magnitude of these expected rewards are not independent of the magnitude of the actual remunerations of the preceding period(s). Thus, on the one hand, the accumulation of sufficient surplus over the preceding period(s), deriving directly or indirectly from some such positive remuneration, has the likely effect of pushing rightwards the subjective density distribution of urban derived rewards; to the extent that past urban income is due to the capturing of a fairly secure job, probability density is moved from the left tail rightwards. On the other hand, the subjective probabilities which determine the magnitude of the expected remuneration from the application of the labour of the maturing son on the family farm for the first time under the new technology will, most probably, not produce a higher mean (- higher than the urban mean).

Diversification via an off-farm utilization of the maturing son's labour over that period in which food is produced for the first time under the new technology is then mandatory - given, along with other, earlier made suppositions, the risk characteristics of both the head of the family unit and the new technology.

Two final clarifying notes are in order. The case for considering RUMOL as a manifestation of the above corollary is indeed particularly strong in its "second period version"; expecting the mean of urban income to be higher rests on relatively more secure grounds when in the first period RUMOL has been proved "successful" ("sufficient surplus" has been accumulated). Moreover, the rationale evoking RUMOL is thus reinforced through the interaction between its capacity to meet the "surplus"

footnote No. 38 continued...

(For define  $A^* = \{ y_1 : z_1 \in A \}$

$B^* = \{ y_2 : z_2 \in B \}$

so that  $z_1 \in A \iff y_1 \in A^*$ ,  $z_2 \in B \iff y_2 \in B^*$

Then,  $P(z_1 \in A, z_2 \in B) = P(y_1 \in A^*, y_2 \in B^*) =$

since  $Y_1, Y_2$  are independently distributed

$= P(y_1 \in A^*) P(y_2 \in B^*) = P(z_1 \in A) P(z_2 \in B).$  )

To show then that  $Z_1$  is preferred to  $Z_2$  is to show that

the solving of  $\max EU = \max \sum U(\alpha_1 Z_1 + \alpha_2 Z_2) P(Z_1) P(Z_2)$

where  $\alpha_1 \alpha_2 = 0$

$\alpha_1 + \alpha_2 = 1$

renders the optimal values  $\alpha_1^* = 1, \alpha_2^* = 0$ .

...Continued



requirement and the "risk" requirement. (The interdependence between the level of surplus endowment and the degree of aversion to a given risk (or - given the degree of risk aversion - the riskiness conceptualized to be embodied in (say) a given security) has been hinted at earlier and is explicitly referred to in Part II below).

footnote No. 38 continued...

$$\text{Since } \frac{\partial EU}{\partial \alpha_1} = \sum \sum U' (\alpha_1 Z_1 + \alpha_2 Z_2) Z_1 P(Z_1) P(Z_2)$$

$$\text{and } \frac{\partial EU}{\partial \alpha_2} = \sum \sum U' (\alpha_1 Z_1 + \alpha_2 Z_2) Z_2 P(Z_1) P(Z_2)$$

$$\text{then } \frac{\partial EU}{\partial \alpha_1} \left| \begin{array}{l} \alpha_1 = 0 \\ \alpha_2 = 1 \end{array} \right. = \sum [\sum U' (Z_2) P(Z_2)] Z_1 P(Z_1) = EZ_1 EU'(Z_2)$$

$$\text{and } \frac{\partial EU}{\partial \alpha_2} \left| \begin{array}{l} \alpha_1 = 0 \\ \alpha_2 = 1 \end{array} \right. = \sum [\sum U' (Z_2) Z_2 P(Z_2)] P(Z_1) = E[U'(Z_2) Z_2]$$

so that it is now sufficient to show that

$$\frac{\partial EU}{\partial \alpha_1} \left| \begin{array}{l} \alpha_1 = 0 \\ \alpha_2 = 1 \end{array} \right. - \frac{\partial EU}{\partial \alpha_2} \left| \begin{array}{l} \alpha_1 = 0 \\ \alpha_2 = 1 \end{array} \right. > 0$$

(- that a change (gain) in the expected utility resulting from a change in  $\alpha_1$  (from 0 to 1) is greater than the concomitant change (loss) in the expected utility resulting from an inverse change in  $\alpha_2$  (from 1 to 0)).

$$\text{Proceeding thus, } \frac{\partial EU}{\partial \alpha_1} \left| \begin{array}{l} \alpha_1 = 0 \\ \alpha_2 = 1 \end{array} \right. - \frac{\partial EU}{\partial \alpha_2} \left| \begin{array}{l} \alpha_1 = 0 \\ \alpha_2 = 1 \end{array} \right. =$$

$$= EZ_1 EU'(Z_2) - E[U'(Z_2) Z_2] >$$

$$\text{since } EY_1 > EY_2 \implies EZ_1 = E(Y_1 + X) > E(Y_2 + X) = E(Z_2)$$

$$> EZ_2 EU'(Z_2) - E[U'(Z_2) Z_2] =$$

$$= -E[U'(Z_2) Z_2] + EZ_2 EU'(Z_2) + EZ_2 EU'(Z_2) - EZ_2 EU'(Z_2) =$$

$$= -E\{ (Z_2 - EZ_2) U'(Z_2) - (Z_2 - EZ_2) EU'(Z_2) \} =$$

$$= -E\{ [Z_2 - EZ_2] [U'(Z_2) - EU'(Z_2)] \} .$$

...Continued

Yet the risk-lesening impact of RUMOL by the maturing son is not inherently a "second period" feature. When, in the opening state, the available surplus just suffices to meet the direct surplus requirements of the new technology, the initial, a priori, increase in riskiness will be mitigated by diversification via RUMOL if only - given the conditions of the above corollary and ignoring all transfer costs - the mean of the maturing son's urban expected income is higher than the farm one. In such a situation, RUMOL is paired with increased risk, is incurred solely in order to compensate for it, with no other motives, such as surplus insufficiency, generating it.

Secondly, the case for considering RUMOL as a manifestation of the above corollary should not be weakened by the decision leading to the maturing son's RUMOL being a zero-one decision. The "portfolio asset" defined by this RUMOL is not necessarily indivisible - RUMOL need not be a "discrete variable". The possibility of controlling the volume of holding of this "asset" which, to a large extent, can be brought about through manipulating the duration of migration ensures this.

*footnote No. 38 continued...*

*Observing however that for any monotone decreasing function*

$$W = W(R) \quad \frac{dW}{dR} < 0,$$

$$\rho = \frac{\text{COV}(W,R)}{\sqrt{\sigma^2 W \sigma^2 R}} = \frac{E[(R - ER)(W - EW)]}{\sqrt{\sigma^2 W \sigma^2 R}} < 0,$$

*or designating  $U'(Z_2) = W$ ,  $Z_2 = R$ , with*

$$\frac{dW}{dR} = \frac{dU'(Z_2)}{dZ_2} = U''(Z_2) < 0, \text{ it is obvious that}$$

$$E \{ [Z_2 - EZ_2] [U'(Z_2) - EU'(Z_2)] \} < 0. \text{ Hence}$$

$$- E \{ [Z_2 - EZ_2] [U'(Z_2) - EU'(Z_2)] \} > 0.$$

A Note on "Seasonal RUMOL" by a Small Farmer  
Prior to the Maturing of His Eldest Son

The purpose of this note is to suggest some reasons - apart from very general ones such as the need of the head of the family to "keep an eye on his land and on squabbling family members" - for holding the view that a farm family will prefer RUMOL by the elder son once he gains maturity to "seasonal RUMOL" by the head of the family which may have been adopted previously. In a weaker sense the argument can be taken to imply that earlier "seasonal RUMOL" by the head of the family may at best complement but not substitute a (seasonally unconstrained) RUMOL by the eldest son.

The feasibility of seasonal RUMOL requires, as a pre-condition, that, under existing technology and intensity of cropping, expansion of labour towards agricultural production and allied activities will stretch over a continuous period of time substantially shorter than a year. Such clearly may well not be the case.

Secondly even when a busy season-slack season dichotomy is, in general, a valid one, busy season labour input and slack season labour input need not be perfectly independent; to some extent they can (or even should) be regarded as substitutes for each other. (Clearing a canal in the slack season may reduce requirements of carrying water in buckets from old-style wells in the busy season). This immediately implies that the marginal product of labour applied at the slack season need not be nil so that seasonal RUMOL, even due to this consideration alone, is not cost-free. It is perhaps more plausible to consider busy season labour input and slack season labour input as complementary. (Transplanting in the slack season may increase volume of output harvested by given labour input in the busy season). With the respective partial cross derivatives being positive slack season RUMOL even due to this consideration alone is definitely not cost-free.

Thirdly, in the hypothetical context of a seasonal RUMOL, the assumption made earlier in Part I of negligible transfer costs cannot possibly hold. Generally speaking, the ratio between the related costs and the relevant benefits is likely to be high. (This refers not only to the relevant pecuniary ratio but also to the relevant time ratio; the acts of RUMOL and return may stretch over a significant portion of the slack season's span).

Fourthly, the structure and conditions characterizing urban labour markets (as referred to, for example, in Section 2 of Part I below) lean heavily against seasonal RUMOL. Considerable waiting time prior to the securing of a job, the high likelihood of never re-obtaining it if before the end of the slack season (e.g. due to emergency) or at its termination it has to be given up, and the period of time required to gain familiarity with urban conditions and, for example, to enter into some quasi-stable trading and commercial relationships are only few relevant factors which contribute to an entry into (both the formal and the informal) urban sub-sectors being time consuming and difficult.

Fifthly and most importantly, the small farmer decision-maker has been assumed to be a net utility maximizer: both utility from food and disutility from labour count. (The analysis in the foregoing text which did not introduce seasonal separability clearly implies that a seasonal RUMOL has to be compatible not with any positive utility but with maximum net utility). There is no need therefore to go here as far as to argue that given the existing technology, relative rest over the slack season is needed to build a reserve of (storable) energy (body fat) which at the complementary season will be fully exhausted and that labouring to the full in the former may deplete this reserve if not even cause an irreversible deterioration of health and of labour productivity. (The prevalence of some such inter-seasonal externalities does seem highly plausible). Note that under fairly general conditions it can be shown that seasonal equalization of labour input and of income, *ceteris paribus*, raises net utility.<sup>39</sup> But the *cetera* are not *pares*. The adverse impact on output in the busy season may offset at least part of the increment to income resulting from the seasonal RUMOL, given income produced via RUMOL in the slack season may well demand substantially greater effort.

Sixthly, ignore for a moment all above considerations. Allow extreme simplifications and assume that the duration of the slack season is four months and that the sufficient surplus needed to meet the surplus requirement of the new technology can, given the state of urban labour markets, be secured in two years of urban employment. Seasonal RUMOL by the head of the family prior to the maturing of the eldest son will, *ceteris paribus*, render technological change possible after six years; if RUMOL is by the eldest son - after two years. However note that of course the *cetera* are, once again, not *pares*.

The analysis earlier in Part I has taken great pain to argue that the new technology is (subjectively) riskier. To the extent that it is possible to substitute for meeting this consideration via diversification embodied in RUMOL by the eldest son by accumulation of additional surplus, seasonal RUMOL exercised by the head of the family will render technological change possible only after more than six years though if (non-seasonal) RUMOL is by the maturing son, transformation is still feasible after two years. Furthermore, the "two years" span is probably, in the present comparative context, an overestimation. A better educated son may secure a better employment (see Section 2 of Part I below) hence, with a higher urban income-time ratio, facilitating a technological change after a time span shorter than two years.

Bringing in a host of other considerations (e.g. the costs of two(?) journeys instead of more than twelve) only strengthens the point. It is worth noting that the very drawing of a long term plan for generating the required surplus (via a series of repeated seasonal RUMOLs) requires,

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<sup>39</sup> For example, given that more utility is preferred to less, that utility is derived from income only, that the "time point" marginal utility of income (that is, the additional unit of income utility derived at a given point of time) is decreasing and that rural money markets are imperfect (the interest rate facing a borrower is significantly higher than the lending rate he can enjoy) a more (intra-year) even distribution of income would be preferable.

*inter alia*, presence of an incentive to transform production technology and a long planning horizon. The argument in Section 1 above implies that many years prior to the eldest son reaching maturity the former is (at least) weaker and that the latter is unlikely.

There is no need to explain that all the considerations enumerated above are significantly mitigated if not completely collapse when RUMOL by the eldest son who has reached maturity is "on the cards". At the same time it is necessary to stress that the foregoing argument should not be taken to deny the possibility that under favourable conditions prior to the maturing of the eldest son seasonal RUMOL may or actually does take place. What the argument suggests is that such can be expected to be the case only in a minority of special instances. And indeed the weight of that evidence which is available does seem to indicate, and fairly conclusively too, that RUMOL in the main is not seasonal (and that in that "RRMOL" which is seasonal (e.g. rural India) landless labourers represent a proportion which is significantly higher than their share in the rural population. Note that in this context, in addition to many of the above-mentioned considerations, "RRMOL" requires that a busy person in an "accessible" elsewhere should coincide with at least a large part of the slack season at the source area). For a useful summary of the evidence see John Connell et al. Migration from Rural Areas: the Evidence from Village Studies, Institute of Development Studies at the University of Sussex, Discussion Paper No.39, January 1974, chapters 1, 4 and 6.

SECTION 2  
SOME COMPLEMENTARY REFLECTIONS

From the point of view of the evolution of RUMOL, is the point of time when the eldest son is reaching maturity the rather than a "turning point"? Given RUMOL's critical role, why then is the maturing son the migrating member whereas the head of the family is the one who stays behind? With respect to the family as a whole, what are on one hand the general explicit presuppositions, on the other the overall implications of the choice of the (or a) son who is reaching maturity as the family's migrating agent?

The main task of this section is to refer to these and some other related questions. While in so doing much of the simplifying nature of the preceding section's argument is mitigated, the purpose here is to strengthen the internal consistency (hence plausibility) of the basic argument rather than to extend its domain of applicability through relaxation of the opening assumptions. To a limited extent this section also immerses the argument in some of the general conditions which typify a less developed economy thus providing a fuller perspective for evaluating its validity.

A. The Timing of RUMOL

Given the external institutional and non-institutional constraints to which the family which occupies and tills its own small holding is subjected and the "surplus-risk" characteristics of a new land-augmenting technology, the differential between an expected net utility increment deriving from operation along a new technology and that which is to accrue from a continuous operation along the current technology could in general vary quite considerably. Clearly, beyond the present labour equilibrium input the levels, and rates of change in levels, of the elasticity of food output with respect to additional labour input, of the composition (standardized number of members) of the family and of the family's total disutility from labour can combine to produce large or small net utility increments accompanying the incorporation, on the farm, of the maturing son's labour. In an extremely favourable set-up, the above elasticity, denoted in the preceding section by  $\eta_{F/L}$ , could be high and diminish slowly, overall disutility could be substantially lowered and ensuing compositional changes might be spaced and modest. Had the head of the family unit behaved myopically, the point of the decision-making (how to allocate the labour of the son who is reaching maturity) would not have become a RUMOL turning point. However, with the case of a single period planning horizon being eliminated from consideration altogether, the consequences stretching beyond the current period of a decision taken at its outset cannot be ignored. On the other hand, the planning horizon cannot, realistically, be conceptualized to stretch over too many production periods. The prospect that only in a far future period will a continuous operation along the current technology thrust the family unit into an inferior net utility position is unlikely to affect presently taken decisions; with an extremely favourable set-up of conditions, the depressed, "short-run" planning

horizon inducement, measured in net utility terms, to shift food production technology is unlikely to be enhanced by this "long-run" prospect. Even so, unless the incorporation of the maturing son's labour on the farm facilitates a sufficiently rapid accumulation of more than "sufficient surplus" (- to cater for both the surplus and the risk requirements of the new technology) the propensity to produce RUMOL as a catalyst of technological change even if lowered is still far from being eliminated. With the utility schedule which corresponds to the new technology lying, over the whole relevant range, above that which corresponds to the present technology, deferment of the technological change is clearly subject to net utility "opportunity costs" which are increasing with time and at an increasing rate. (Compared with its "competitive" (migration) strategy, the non-migration strategy is delaying that process which would lead to the technological transfer). The longer the non-migration strategy is adhered to, the higher (and increasingly so) are these costs. Of course, if the family's evaluation of a RUMOL incurred surplus accumulation (evaluation which is assumed to be summarizable by a given cumulative subjective probability distribution) is strictly dominated by that which corresponds to a non-RUMOL strategy (a situation fostered for example by highly saturated urban labour markets, high probability of early severance (see below) etc.), RUMOL by the eldest son who alone has reached maturity will not reduce these costs. But if the subjective probability of accumulating (at least) "sufficient surplus" throughout the planning horizon is nil without RUMOL<sup>40</sup> - positive with it, RUMOL will still be pursued as a means of reducing these net utility "opportunity costs".

An excuse for deferring RUMOL could however be that given the state of the urban labour markets, availability of some surplus, which in a fairly short period of time can be generated on the farm (with the application there of the labour input of the maturing son) is a necessary precondition for RUMOL to meet the surplus and risk requirements of the new technology. In such a case, the earlier observation of a certain point of time before which RUMOL is not feasible but at which it becomes mandatory and is performed is blurred with RUMOL now being constrained by a twofold requirement (reaching maturity, the availability of some surplus). If the ensuing, newly defined point of time happens to coincide with the reaching of maturity by the next son, he may become the family's migrant (incorporation of the eldest son's labour on the farm thus paving the way for RUMOL by the successive son); but, if the necessary surplus is accumulated before that, the eldest son may still be the family's migrant.<sup>41</sup> In both cases RUMOL is a lagged execution of a past decision; the conditions which prevail when the phenomenon is observed are not, strictly speaking, the ones responsible for taking the decision to incur

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<sup>40</sup> Note the anticipated increase in food requirements (- consumption needs) over the planning horizon as argued and illustrated early in Section I.

<sup>41</sup> It is possible that considerations such as lower probability of severance, higher level of education (see on both in the text below) and so on will, however, tilt the balance in favour of (yet further delayed) RUMOL by this next son.

it.<sup>42</sup>

It should be stressed that these reflections have important empirical implications, not only because of the care which needs thus to be exercised when given statistical results are interpreted (factors causing an "as if behaviour" are in operation) but more particularly because of the need to design the collection of data itself in such a way that true, if implicit, linkages, rather than visible ones, are unfolded. (See Appendix II).

Note that from an even wider perspective but by the same token, a specific combined impact of the span of the planning horizon, the availability of some surplus, the magnitude of  $\eta_{F/L}$  and the compositional changes of the family may generate a state whereby RUMOL is exercised in an even later stage in the life cycle of the family - a state which coincides with or follows the maturity of yet another son. (The need to accumulate some surplus when accumulation is possible on the family farm may, for example, cause this - incorporation of the labour of the first  $n-1$  son(s) ( $n \geq 2$ ) being a prerequisite for RUMOL by the  $n$ -th one). Over such a stage too the family may be observed to include a number of young members and to be exposed to processes and incentives similar to those of an earlier stage. In general though it seems permissible to assert that the very nature of the decision-making process analyzed in Section 1 strongly suggests that over a specific range of its life cycle the probability of the family deferring RUMOL by a maturing son inversely relates to his rank order and that the cumulative probability function of the family producing RUMOL may schematically be portrayed by a step-wise function with each discrete, upwards shifted segment corresponding to the event of another son reaching maturity.

#### B. The Choice of a Migrant: A Maturing Son vis-a-vis the Head of the Family

Granted that in accordance with the analysis of Section 1 technological transfer will be accomplished if, and only if, migration from the family farm takes place, it remains however to be positively explained why according to the basic argument the maturing son is the migrating member, whereas the head of the family is the one who stays behind to till the family farm. It has implicitly been assumed above that such inter-sectoral allocation is due to comparative advantage considerations and their consequent dictate of specialization. These, in turn, originate in the relationship between the magnitudes of three major variables: efficiency (productivity) in on-the-farm food production; probability of securing urban employment; urban wage rate (in particular urban income in general) once employment has been secured. Generally,

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<sup>42</sup> *To the extent that considerations of the state of supply and demand in urban labour markets are incorporated into the migration decision-making process (according to some analysts, these considerations are of primary importance) they can, in a similar vein, be seen to affect partially the timing of RUMOL within the planning horizon rather than the migration decision per se.*



the sign of the difference between the magnitude of these variables with respect to the two family members and across the two sectors could not be expected to be uniform. (For example, that family member who is more efficient in the production in one sector may also be the one who enjoys a higher wage rate in the other sector). In order to resolve an inter-sectoral inter-personal allocation problem it would then be necessary to specify the appropriate production functions and to generate the relevant elasticities. However, given the specific characteristics of the case in hand, the sign of the difference appears to be uniform throughout. Consequently, there is no need to construct a special theoretical apparatus to determine the optimal allocation.

Compared with his maturing son who either did not participate in agricultural production or did so, but only for a short period, the head of the family is most probably the better farmer. He is more likely to command a good level of husbandry which presumably depends most both tradition and personal past experiences ("on the job training"), the first being fully grasped through the latter.<sup>43</sup> His choice of enterprises and practices, timing of operations and general management of farm production can be expected to be nearer to their optimum levels (that is, given the overall set of production constraints).<sup>44</sup>

The reverse seems to hold with regard to production efficiency in the urban sector. More than any other single characteristic, and as compared with experience in agricultural production, some form of (general) education (e.g. basic skills of communication and computation, sometimes enriched by some vocational training) is a more likely prerequisite of the capacity to perform a wide range of urban jobs; it is the maturing son who is more likely to possess a given (or often any) level of education.<sup>45</sup>

This supply feature, apart from endowing him with a necessary capacity and a higher productivity in the performance of some jobs, also implies that more urban labour markets are accessible to him; lack of given educational qualifications palpably excludes job seekers from many skilled labour markets. (Filtering and displacement, if prevailed, are in the downward direction). To the extent that this factor is a critical determinant of employability, in the demand for labour of many urban industries either from the point of view of employers because the knowledge embodied in the education of potential employees directly enhances

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<sup>43</sup> Embodied in these factors is frequently the only basis for the crucially important capacity of environmental predictions, however limited.

<sup>44</sup> Note that throughout the analysis the head of the family is taken to be a decision-maker who is both aware of the new technology and strongly desires to adopt it.

<sup>45</sup> For evidence on the (particularly recent decades) inter-generational education differential including the rural sectors of developing economies see, for example, Unesco Statistical Yearbook 1972 (Paris, 1973), tables 1.5 (pp. 49-64) and 2.7 (pp. 92-114) and Gunnar Myrdal Asian Drama: an Inquiry into the Poverty of Nations (New York, 1968), Vol. III, chapter 32, section 4 (pp. 1666-1685) and chapter 33.

their productivity or because educational attainment is employers' best single indicator of the desirable characteristics of potential employees, the maturing son should be the potentially more successful job seeker.<sup>46,47</sup> Moreover, it is this factor which is likely to furnish him with more (as it is scarce) and better (as it is not of a uniform quality) job information.

This attribute thus turns the second variable too, the probability of securing urban employment, in favour of choice of the maturing son as "the family migrant".

If education can be used as a satisfactory proxy for "labour quality" or its level of "human capital", (general knowledge, skills, capacity for on-the-job training, initiative, motivation) and if urban wage structure is such that wage differentials are positively and closely associated with labour quality whether directly or indirectly through the occupational structure of urban wages then, comparison in terms of the third variable - the urban wage rate - would also favour RUMOL of

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<sup>46</sup> This should not be interpreted to imply that employers do not weigh other characteristics ranging from age and physical health to the likely acceptance of industrial discipline. However, it does not appear that with regard to these, any uniformity would prevail nor, in particular, that their combined effect would be such as to unequivocally increase the probability of the head of the family securing an urban job vis-a-vis that of the maturing son.

<sup>47</sup> This should not be confused with the finding of some studies that those who are educated vis-a-vis the ones who are not experienced a higher rate of urban unemployment. (See, for example, Paul Bairoch Urban Unemployment in Developing Countries: the Nature of the Problem and Proposals for Its Solution (ILO Geneva, 1973), chapter 3). Objections concerning data interpretation left aside, education per se is unlikely to be a cause of higher unemployment; from the point of view of employability, the acquisition of education should leave one at least as "well off" as without it unless, of course, some employers attach negative weight to job seekers being educated or job seekers' expectations generated by the education attainment process are reducing the elasticity of their offer curve. (See, on this point, ILO Matching Employment Opportunities and Expectations: a Programme of Action for Ceylon (Geneva, 1971), especially chapter 3 and ILO Employment, Incomes and Equality: a Strategy for Increasing Productive Employment in Kenya (Geneva, 1972), especially chapters 4 and 14 ). Apparently, in the heart of the theoretical apparatus behind this latter point lies a divergence between the educated job seeker's subjective estimate of the distribution of wage rates and the actual distribution of wage rates; the consequence of this is a discontinuous offer curve, with a highly inelastic section which corresponds to actual wage offers lower than those subjectively estimated and an elastic section over the range for which actual wage offers are higher than the subjective estimates of wage offers. The existence of the differential in unemployment rates could, for example, be attributed to longer duration of search (waiting period) which, in turn, may derive - in the spirit of the preceding comment - from the educated having a higher "acceptance wage", the lowest wage for which a job would be accepted.

the maturing son.<sup>48</sup> Imperfections, rigidities and frictions though weakening this association are unlikely to nullify it, the migrant labourer who possesses more "human capital" can expect a positive probability of employment in more urban markets whose wage levels, as compared with those pertaining in the other markets, are generally higher.<sup>49</sup>

Hence, examining separately each of the three variables suggests that compared with those which would have occurred to the family if the head of the family were the family migrant, the real opportunity costs and the expected returns involved in the migration by the maturing son are smaller and higher respectively. Since, if anything, the three variables are positively correlated, their combined dictate would a fortiori be that the maturing son should be chosen as the family migrant.<sup>50</sup>

It was presumably noticed that the preceding analysis was carried out under the implicit assumption that with regard to all other relevant variables, the head of the family and the maturing son are "just the same" or at least that discrepancies are none too great and thus can be ignored or, finally, that deviations from equality in these,

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*As hinted upon in the text, the positive relationship between labour quality (in particular - educational attainment) and the level of wage rates may, but need not, be direct. Wages can be job specified, invariant with the characteristics of those filling them. But in such a case, given plausible assumptions on the demand side (employers' preferences), a high rank correlation coefficient is likely to prevail between jobs ordered by their wage rates and the level of qualifications which are essential (or at least are desirable) to secure them. Alternatively, wage rates may, at least partially, directly vary with the qualification level of job seekers who offer themselves for a given job.*

<sup>49</sup> Two examples in this context are R.H. Sabot "Education, income distribution and rates of urban migration in Tanzania", University of Dar es Salaam, Economic Research Bureau, March 1972, and Michael Todaro "Education and rural urban migration: theoretical constructs and empirical evidence from Kenya", Conference on Urban Unemployment in Africa, Institute of Development Studies at the University of Sussex, September 1971. See also Gary S. Fields "The private demand for education in relation to labour market conditions in less developed countries", The Economic Journal, Vol. 84, No. 336, December 1974, pp. 906-925.

<sup>50</sup> Two additional factors, omitted from the present analysis would, if considered, only strengthen this general conclusion. Firstly, it is likely that for the (more) educated son the non-pecuniary psychic costs of migration would be smaller than those for the head of the family who is more attached to the rural traditional patterns of life. Secondly, to the extent that education facilitates access to urban financial (and other) institutions (e.g. capital borrowing by a self-employed entrepreneur) the (more) educated migrant son may, everything else being the same, face a higher probability of capturing non-wage urban income.

many, variables though of various magnitudes randomly receive opposite signs and thus, in ultimate summation, cancel out. (Since none of these variables is believed to be of a dominant importance, they are equally weighted ("the principle of insufficient reason") and hence the above assumptions).

Generally speaking, there seems to be no objection to this. However, one of these other "relevant variables", of a sign different from that of the above three variables, may assume a level of significance which merits some comment. Loosely defined this variable is the severance, by the maturing son, of the economic ("instrumental") ties between himself on the one hand and the head of the family (and the rest of the family unit) on the other (henceforth designated the "severance variable").

The probability that these ties would be broken off, which is greater when the maturing son rather than the head of the family, is the migrating agent,<sup>51</sup> and the severity of such a severance are not independent of the inter-sectoral distribution of the actual generation of the "sufficient surplus", of its successful utilizations, of the level, if any, of the initial support (out of the "partial surplus") provided by the family and of the migration span. (For example, when the largest portion of the accumulation is of an urban end origin, technological change, in the first place, critically depends on (net) overall urban to rural remittances by the migrating son).

In order to elucidate the general significance of the "severance variable" it would be useful to refer now explicitly to one of the basic elements of the earlier argument, that RUMOL, as the strategy which for the family as a monolithic entity maximizes future utility from on-the-farm food production, is uniformly desired by all. This assertion is a derivative of the form of the utility function as presented at the outset of the analysis of Section 1. According to that form, what matters is the sum total (of food) which, when increased, means a greater absolute amount available for sharing among all family members (though, in fact, it may result in only some receiving more granted that, concomitantly with the constraints imposed on the function, none receives less).

Given, moreover, the same general "background" postulated system but viewed in a wider perspective, the desirability for all of RUMOL by the maturing son could, once again, be established. As a matter of fact, more than one set of fairly non-restrictive assumptions would render it optimal. Under such sets of assumptions, the problematical state generated by a *prima facie* conflict between the head of the family and the maturing son vanishes in the presence of cooperation that endows each with more net utility than could have been secured without cooperation.

This does not have to rest on reasoning à la "two person cooperative game" (implying perhaps going "too far" in the sense of viewing the head of the family and the maturing son, in the phase preceding cooperation, as maximizers in a non-cooperative play).

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<sup>51</sup> *The ensuing paragraphs will exemplify.*

Mutual benefit and mutual dependence (reciprocity) are, in fact, interlocked in the strategy of "the maturing son migrates - the head of the family stays behind". On the one hand, successful technological transformation will directly benefit the head of the family, as well as the other family members who stay behind. This, in turn, is subject to the maturing son's "successful" migration and hence is one direction of dependence.

On the other hand, and at least for a considerable time span, the maturing son's migration in its entirety is subjected to the explicit or implicit backing of the head of the family (the "ones" who stay behind). This is not only due to the role which the family's "partial surplus" plays in determining migration's degree of success.<sup>52</sup> After all, uncertainty prevails in all futures, that of urban employment (and its duration) included. In particular, urban employment markets are vulnerable to cyclical fluctuations; the markets where the maturing son is more likely to find employment are perhaps the first to witness contraction of the demand for labour (expressed in redundancies and layoffs rather than in reduced wage rates) as the downswing of a cycle commences. The maturing son may thus be compelled to withdraw from the urban sector, back to his family in the rural sector.<sup>53</sup>

Uncertainty (here a shorthand for uncorrelated, inter-sectoral uncertainties) thus acts as a catalytic agent for enhancing a dependence of one branch of the family unit located in one sector on the other branch located in the other sector.

A by-product of the later reflections on the common desirability of the maturing son's migration which is worth referring to is the blunting of doubts concerning the appropriateness of an analysis based on identifying the head of the family as the family's decision-maker. Given the form of the family's utility function utilized throughout, a maturing son decision-maker will derive and arrive at the same allocation rules and strategy choice. Given, as mentioned earlier, alternative sets of fairly non-restrictive assumptions, the maturing son has already been shown to desire the RUMOL-by-himself strategy and to be unlikely to benefit from deviations from its prescribed pattern.

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<sup>52</sup> For simplicity's sake and in the light of a point previously made, it can be assumed that (a) job search and employment are competing uses of the migrating son's urban time and (b) that, *ceteris paribus*, longer search time will facilitate a "better" allocation of the maturing son's labour. ("Better" or "more efficient" in the sense of finding that job where the differential between the "quality" (skills) he possesses and the skills required is minimized, given that wage rates are an increasing function of the latter). It is, in this context, that provision of the family's already accumulated "partial surplus" towards facilitating a larger job search duration is, *inter alia*, a determinant of migration's success.

<sup>53</sup> Within the explicit framework of the urban dual labour market concept, presently not adhered to, considerable instability can in fact be seen as a fundamental permanent characteristic of employment in that segment of the market where the migrant member is more likely to find a job.

This being the case, the range of probabilities which the severance variable may assume is substantially narrowed - the latter argument "chopping off" the higher values. However, to some extent, the preceding reasoning is subject to a time constraint, its full vigour being limited to the short and medium run (to mean, broadly, a time span of not more than few production periods). The temporal variability of the validity is due only partly to weakening of some of the points mentioned in the course of the preceding reasoning. It is more so because of the emergence of others, the attainment by the migrating son of lifecycle stages which are consequent upon the "pre-marital adolescence" stage being a more important one.

Without considering explicitly the decision-making process concerning the timing of marriage, or a fortiori the "microeconomics of marriage", in view of the actual establishment of the migrating son's own nuclear family or even with its explicit planning, the utility underpinning of the analysis would probably have to be modified; a utility function which does not allow (does not include argument(s) standing) for intra-family (inter-family branches) distribution no longer seems to fit. A utility "substitution" effect is likely to prevail; along some domain positive net utility would derive from, say, remitting less to the "old" nuclear family, more towards the costs of setting up the new nuclear family. Undoubtedly, such a shift in "grants" will only take place if the net utility  $\mu_1$  which will accrue from remitting directly to the "new" nuclear family will be greater than the expected net utility  $\mu_2$  which the "new" family would be able to elicit (to recoup) from an increased production on the ("old") family farm, consequent upon a technological change depending on "full" remittances.<sup>54</sup>  $\mu_2$  is, of course, subject to a discount factor composed of both time and risks rates of discount.

The "severance variable" may thus assume a non-zero probability though the paragraphs preceding the last three have patently pointed out that the magnitude of such a probability is still smaller than is likely to be expected on first thought.

Given that this probability may still be positive, an interesting derivative emerges. Scrutinizing the family's lifecycle, not only is the technological transformation tied to the maturing and the migration of the "maturing son" thus, timewise, being bounded from below, but also its time non-neutral optimality is bounded from above. If the age at which the maturing son is likely to become an independent head of family decision-maker is  $A_k+h$  (determined, for example, by the customary marriage age),  $A_k$  being his age on migration then, utilization of his migration towards facilitating technological change would have to be

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<sup>54</sup> Indeed it is possible, perhaps very plausible, that in some cases a successful transformation of agricultural production technology on the family farm is a necessary precondition which, once met, will enable the migrant son to establish his own nuclear family - especially if this is to be done in the rural home area. In a situation such as this, the probability of severance (or of "cut" in remittances) before an accumulation of "sufficient surplus" and its successful utilization is indeed small.

confined to the specific time interval of the  $h$  years.

The positive subjective probability attached to the "severance variable" may thus entail a technological transformation which necessitates a smaller surplus accumulation and/or a quicker utilization. In spite of the peril of lumping factors into "uninformative categories" it has to be noted that to a great extent, this subjective probability is a derivative of social, cultural and religious factors, each playing its own part in determining the eventual cohesion of the family. These are subject to a temporal and spatial variability and may be in consonance or dissonance with the economic factors, thus blurring the pure (visible) impact of the later factors (in the latter case, limiting their relative significance).

PART II

RUMOL, SOCIAL WELFARE CRITERIA AND  
POLICY ORIENTED IMPLICATIONS



The twofold objective of this part is (a) to examine the social welfare implications of RUMOL by way of confronting it with different social welfare criteria that are likely to prevail and (b) to explore the conditions for the existence of substitutes for RUMOL, substitutes that do not hinder those of its consequences which, given the social welfare criterion, are assumed socially desirable.

## SECTION 1.

### RUMOL AND SOCIAL WELFARE CRITERIA

In the light of the conceptual framework developed in Part I, RUMOL appears to facilitate ends which are desirable from both "private" and "social" points of view. Acting as a catalyst for technological progress in agricultural production, it directly increases the expected utility of the respective rural families, hence generating a "privately preferable" state. Moreover, it may also, indirectly, increase the expected gross utility of others, e.g. urban families through, for example, the increment to the production of food. To the extent that the "welfare function" of the society at large is constructed by aggregation of familial preferences, (the welfare function is of the "individualistic" type), there is a *prima facie* case for considering the state ensued by RUMOL to be also "socially preferable". In fact, if only the social welfare function is based on familial preference orderings, this may be so; if  $SW = V(U^1(F,L), U^2(F,L), \dots, U^N(F,L))$ , what is needed is that  $\frac{\partial(SW)}{\partial U^i} > 0 \forall i$  where  $U^i(F,L)$   $i = 1, \dots, N$  is the utility function of the  $i$ -th family. Abstracting from Arrow's "impossibility theorem"<sup>1</sup> (e.g. by way of accepting one of the "escape routes" from the theorem) and thus remaining within the realm of such a social welfare function the difficulty, however, is that while generating  $\frac{\partial(SW)}{\partial U^i} > 0$ , RUMOL may not leave some  $U^j$   $j \neq i$  intact so that the sign of  $d(SW)$  may not be positive. This is equivalent to saying that RUMOL may not imply a Pareto improvement and hence, a fortiori, not Pareto optimality; though increasing the expected utility of some by making them better off, it may concurrently depress the expected (net) utility of others (e.g. urban labourers with whom the rural migrant labourers compete for urban jobs<sup>2</sup>). This, in itself, clearly need not render RUMOL socially undesirable since, in accordance with the compensation principle, if (ignoring redistribution costs) the rural gainers were, in fact, to compensate the urban losers so that the latter would be left no worse off and the former would still retain some gain, Pareto optimality

<sup>1</sup> Given a set of intuitively plausible conditions, the logic underlying which is difficult to challenge, the theorem asserts that a social welfare function cannot simply exist (social welfare function being interpreted as an ordering of social states based exclusively on individual preferences). See J. Kenneth Arrow *Social Choice and Individual Values*, Cowles Foundation for Research in Economics at Yale University, Monograph 12, second edition (New Haven, 1963), pp. 46-60.

<sup>2</sup> But see discussion of this point below.

would still be preserved. (The form that such a compensation could take is a lump sum transfer, such as an "entrance fee" or a residence tax payable, for example, at the end of fixed time intervals to the respective urban authority.<sup>3</sup>). If the judgement as to whether a situation is Pareto optimal is to depend however only on such transfers being hypothetically possible, compensation does not actually take place, it will not, of course, a priori be conceptually possible to assert whether or not RUMOL is a "social evil", given the present criterion alone.

That RUMOL is nevertheless a source of "social concern" may yet derive not necessarily from its failure to satisfy Pareto optimality but indeed, in spite of the possibility of satisfying the criterion, from that the Pareto optimal state with which it is compatible is inferior to other Pareto optimal states (states among which the *optimum optimorum* is to be found). The analysis of Part I hints that an alternative to technological transformation of agricultural production with RUMOL as its leverage is technological transformation with "externally" made available and "internally" acceptable credit and insurance arrangements. Of course, examination of a consideration such as this presupposes going beyond the concepts of Pareto optimality to rely on a social welfare function drawn from a class of social welfare functions that specify an ordering of the set of the alternative relevant social states. In such a framework it is possible that RUMOL, irrespective of its Paretian position, would be considered undesirable since the ensuing state, *quo ad* social state, is of low ranking.<sup>4</sup>

It appears, therefore, that in evaluating the relative attraction of RUMOL as a means for achieving socially desirable development goals and, particularly, when the revealed urban end consequences attributed to RUMOL (not its rural end producing forces) e.g. externalities of the traditional varieties are the cause for policy prescriptions to reduce it, an implicit choice of a very specific welfare function or set of welfare functions is implied.<sup>5</sup>

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<sup>3</sup> This is, of course, only the necessary requirement; sufficiency depends on the urban authority identifying - and actually transferring - compensatory benefits to the losers.

<sup>4</sup> These "Bergson-Samuelson" type social welfare functions are more general than the social welfare functions of the "individualistic" type. In fact, the latter can be seen as a special case of the former where the only variables, on which the ordering of the functions depends, are familial utilities. (The origin of this conceptualization of the social welfare functions can be traced back to the late thirties - A. Bergson "A reformulation of certain aspects of welfare economics", *Quarterly Journal of Economics*, Vol. 52, May 1938, pp. 310-334 and its refinement to the late forties - P.A. Samuelson "Foundations of economic analysis", *Harvard Economic Studies*, Vol. 80 (Cambridge, Massachusetts, 1947), chapter 8, especially pp. 219-230.

<sup>5</sup> Could the embodied ethical conceptualization be a (further) manifestation of the prevalence of an "Urban bias"? (See Michael Lipton *Urban Bias and Agricultural Planning* in M. Lipton and P. Streeten (eds.) *The Crisis of Indian Planning* (Oxford, 1968), chapter 4, especially pp. 135-144, and Michael Lipton *The Persistence of Poverty: why Poor People Stay Poor*, 1976 (in press).)

SECTION 2  
RUMOL SUBSTITUTES; POLICY IMPLICATIONS

Indeed, if under some social welfare functions, due to some of its correlates - but not because of its major rural end consequences, the RUMOL state is sub-optimal (is of apparent lower rank than alternative attainable states), its functions in the accumulation of surplus and the control of the level of risk taken up, respectively, by specific forms of (at least) medium term finance and a "technological transformation insurance" (to cater, in particular, for the initial high level of subjective risk involved in the technological change) might be a socially desirable act.

If "internally rational", such specific forms being acceptable by the decision-makers concerned as perfect substitutes for RUMOL, then given the objective function and the estimated rate of technological transformation under RUMOL, the exercise which planners would have to perform is to calculate the social opportunity cost of the implied loanable and insurance funds, as these are certain to generate large and positive social marginal productivities if used elsewhere. It may well be the case that the emerging conclusion would then be that technological transformation via RUMOL without a credit-insurance organizational scheme is socially preferable to (the given rate of) technological transformation levered by such a scheme with either no or substantially restricted RUMOL.

To a large extent the likelihood of such a result would emerge from the generally high costs (with rapidly increasing marginal costs) involved in creating the necessary loanable funds on their carrying organizational infrastructure and in the actual process of loan-making, e.g. the administrative costs of lending and collection, losses due to incomplete enforceability of credit contracts, e.g. non-repayments (defaults) etc. Some further costs are incurred as a direct response to the internal decision-making process which sets out the constraints under which loans would actually be taken at all. (*Inter alia*, they require the RUMOL substituting institutional credit to be at least a medium term credit.) These constraints would probably dictate that a certain level of subsidy has to be embodied in the terms of the loans - a dependence of the supply price of credit on the structure and characteristics of its demand.

The same internal decision-making process also implies that the act of borrowing to finance a risk-increasing venture assumes the nature of "adding fuel to the fire"; loans, as deferred claims on future production, though catalysts of output increments are loss magnifiers in the case of production failure and may be rejected - even if provided under particularly favourable terms by a potential adopter of a new technology who already envisages his future position as saturated with added subjective (and objective) risk.<sup>6</sup> Risk aversion is thus transformed into and manifested as loan-taking aversion. This does not necessarily imply that all loans are always unacceptable, i.e. an absolute refusal to incur

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<sup>6</sup> *In the face of an external credit constraint, the potential adopter of a new technology may self-impose a limitation on his level of borrowing so as not to jeopardize his borrowing and bargaining power when credit turns to become critical for survival.*

(additional?) debts. It suggests, however, that steps would be taken to reduce the risk element.<sup>7</sup> Loans may be taken but, whereby only part of the borrowed sum is used to finance the technological transformation, the other part, in the face of a non-satiated "precautionary demand for reserves", being held as a reserve liquidity constituting an "insurance (emergency) fund", "a hedge against uncertainty".<sup>8</sup> Payment of interest and other direct and opportunity costs of holding non-utilized credit as contingency reserves which are, in a sense, the equivalent of insurance premiums, imply that the marginal utility which accrues to the borrower from experiencing his "liquidity preference" outweighs the foregone expected marginal utility to accrue from using these funds for a more intensive technological change. The presence of risks (unaccompanied by provision of a formal insurance) thus implies that less credit is used to facilitate the technological change than that which would have been used if risks were absent; the utilization of credit falls short of the point where the marginal value of its product equals its price. Hence, the ensuing social opportunity costs of the above form of "an informal insurance" are high, *inter alia* because funds are wastefully tied and, given the level of borrowing, because of the positive magnitude of foregone technological change resulting from withholding part of the credit from production commitments.

The points made in the last paragraph naturally illuminate the need for the provision of a formal insurance, a "technological transformation credit insurance"; given that a loan is used to facilitate technological change and given the consequent estimated marginal effect on the level of output, a formula of insurance may be designed such that loan repayments would be offset against "crop failures" or negative deviations of actual output levels from the expectation, the estimated mean level.<sup>9</sup> If, whatever is the magnitude of the actual failure, the insured would be fully compensated for it (i.e. the equivalent of the failure would be deducted from his loan repayments, the schedule of which could, in the first place, relate to the expected schedule of food outputs) and the mean of the distribution of failure magnitudes is the size of the insurance premium, i.e. the insurance scheme is "actuarially fair" then, a risk

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<sup>7</sup> One such step could indeed be a risk-reducing RUMOL! This re-inforces the contention (see in the text below) that only a "package" of credit and insurance can replace RUMOL.

<sup>8</sup> Clearly, this is in a perfect analogy with the theory of the competitive firm under uncertainty where inventories are held and a preference towards flexible capital equipment is prevalent.

<sup>9</sup> Though clearly not the only possible device for shifting risks (e.g. through pooling, common stocks can also facilitate the reduction of risks), given the nature of risks here involved and the prevailing structure of the economic system here depicted it is most likely to be the more relevant and effective form.

avertter would prefer paying it to not.<sup>10</sup>

However, from the point of view of the internal self finance of the insurance scheme, the insurance premium would clearly have to be higher than the above mean because e.g. the inter-families risks incurred may not be independent, administrative and operating costs prevail, etc.. It may then be the case that the risk avertter would reject the corresponding actuarially unfair insurance; the higher are the various costs, the less "actuarially fair" would the premium be and the less likely is it to be internally acceptable. This enhances the requirement of the

<sup>10</sup> Proof. Taking food output  $F$  to be a discrete random variable with values  $F_1, \dots, F_n$  received with probabilities  $P(F_i)$   $i = 1, \dots, n$  the expected utility of food output, in the absence of an actuarially fair insurance against failure, is

$$(1) \quad {}^1E U(F) = \sum_{i=1}^n P(F_i) U(F_i)$$

Defining (2)  $\bar{F} = \sum_{i=1}^n F_i P(F_i)$  and arranging all  $F_i$  in an increasing order,

(1) can be re-written as

$$(1)' \quad {}^1E U(F) = \sum_{k=1}^r P(F_k) U(F_k) + \sum_{h=r+1}^n P(F_h) U(F_h)$$

where  $F_k \leq \bar{F}$   $k=1, \dots, r$  maintains  $F_k \leq \bar{F}$

and  $F_h > \bar{F}$   $h=r+1, \dots, n$  maintains  $F_h > \bar{F}$

Defining (3)  $\bar{F}_r = \sum_{k=1}^r F_k P(F_k)$  then, from the risk aversion property

(to a probability distribution with a given mean, the given mean with a unit probability is preferable)

$$(4) \quad U(\bar{F}_r) > \sum_{k=1}^r P(F_k) U(F_k)$$

so that (5)  ${}^2EU(F) = U(\bar{F}_r) + \sum_{h=r+1}^n P(F_h) U(F_h) > {}^1EU(F)$ .

Since  $U(\bar{F}_r) = U \left[ F_1 P(F_1) + \dots + F_r P(F_r) \right] < U \left[ (F_1 + (\bar{F} - F_1)) P(F_1) + \dots + (F_r + (\bar{F} - F_r)) P(F_r) \right] = U \left( \bar{F} \sum_{k=1}^r P(F_k) \right)$

the risk avertter would be better off by accepting an "actuarially fair" insurance - paying an insurance premium  $\bar{F}$  for securing, in return, the "topping up" to  $F$  of any crop failure, i.e.

$$(6) \quad {}^3EU(F) = {}^2EU(F) - U(\bar{F}_r) + U(\bar{F} \sum_{k=1}^r P(F_k)) = \\ = \sum_{h=r+1}^n P(F_h) U(F_h) + U(\bar{F} \sum_{k=1}^r P(F_k)) > {}^2EU(F) > {}^1EU(F).$$

insurance coverage being offered on concessional rates.<sup>11,12</sup>

<sup>11</sup> It should be noted that the passage of time and the application of other, specific, policy measures are likely to reduce the subsidy component. The learning from experience and gain in familiarity which will depress the subjective risk involved in the adoption of the new technology to the objective risk (subjective probabilities will converge to objective probabilities) explain the former: efficient extension services illustrate the latter. These, however, have to be financed too, though they may represent a preferred alternative if, under them, the respective marginal funds for sustaining a given rate of technological transformation (with a given degree of production success) are smaller than the corresponding subsidy fund.

<sup>12</sup> The implication of the (subjective) risk aversion property for the relative efficacy of an insurance scheme, that is, vis-a-vis that of alternative policy instruments, can be shown to stem from the following relationship.

If  $F_i$  is the magnitude of food output and  $P_i$  is the probability of output being only  $G_i$  i.e. failing to reach  $F_i$  ( $G_i < F_i$   $\forall_i$ ,  $i=1, \dots, n$  denoting, say, states of nature with  $F_i$  being defined for "environmental (and other ex-farm) average" conditions,  $G_i$  resulting from deviations in them) then, the ensuing expected utility for food output  $F_i$  is:  $EU_i = (1-P_i) U(F_i) + P_i U(F_i - G_i)$ .

Hence:  $\frac{\partial EU_i}{\partial P_i} = -U(F_i) + U(F_i - G_i)$ ,  $\frac{\partial EU_i}{\partial G_i} = -P U'(F_i - G_i)$

Denoting the following elasticities (and omitting subscripts)

$\xi_P = \frac{\partial EU}{\partial P} \frac{P}{U}$  and  $\xi_G = \frac{\partial EU}{\partial G} \frac{G}{U}$ , they become

$\xi_P = \frac{-U(F) + U(F-G)}{U} P$ ,  $\xi_G = \frac{-U'(F-G)G}{U} P$ . Therefore,

$\xi_P \geq \xi_G \iff \frac{U(F) - U(F-G)}{G} \leq U'(F-G)$ .

Since  $U$  is a utility function of a risk averter, the left hand side of the second inequality (average change in utility) is greater than the right hand side (marginal change in utility) so that  $\xi_G > \xi_P$ ; a risk averter is thus more concerned about a relative change in the magnitude of the failure than about an equal relative change in the respective probability.

Hence, aggregating for all  $i$ 's, if, as it is most frequently the case, the new technology is such that, as compared with the prevailing technology, its probability of expected failure -  $P$  - is smaller but the magnitude of the expected failure -  $G$  - is greater then, ceteris paribus, a necessary condition for adoption of such a technology is that  $P$  would be significantly smaller - smaller by proportionately more than  $G$  is greater. Since (in the short run)  $P$  may be of limited amenability to policy measures, the role of an insurance scheme in reducing the magnitude of the expected failure is particularly enhanced.

Hence, by way of conclusion, to persuade rural decision-makers to substitute for RUMOL requires the provision of a package of specific credit and specific insurance, the likely joint claim of which on scarce development funds is high. If elimination of RUMOL is the sole objective for prescribing the package, its high social opportunity cost may well be a sufficient reason for rejecting it; the (ordinal) welfare value which the utilized social welfare function specifies for the "RUMOL state" may, indeed, be higher than it might appear to be at first sight.<sup>13</sup>

A salient feature of the conceptual apparatus which has been evolved in Part I renders, however, an "externally" available package (given its special terms) as such an insufficient surrogate for RUMOL. In the light of the argument in Part I, rural decision-makers can be "bribed" to exchange RUMOL for the package and then to carry out the technological transformation if the package is made available at a specific time span. Given their short planning span, the inter-temporal changes in the size and age profile of the family unit, the pattern of the decision-making process, the production constraints and the set of the external (particularly institutional) conditions, the analysis of Part I has identified that specific phase in the life cycle of the family unit where an inducement for technological change prevails. It is at that stage that RUMOL and the transforming of technology are intimately connected. Hence if e.g. subsidized loans backed by an insurance at concessional premiums are made available before that specific time span, they may either not be taken or taken and utilized for relieving debt loads of previously incurred loans (the terms of which are relatively less favourable) or, for what may generally be labelled direct consumable ends; given the social planning span, these are unlikely to be compatible with the existing ordering of social preferences; that is to say when the social demand price of a unit of surplus in terms of a currently foregone unit of consumption is higher than a unit of consumption. From the point of view of facilitating technological change directly, these funds are virtually sterile.

A greater degree of realism would be gained by replacement of the above discrete and dichotomizing reference to time by a smoother reference. The inducement to shift production technology attains then a peak at that stage of the life cycle of the family which corresponds to the elder son reaching the age of adolescence. The extent by which a policy instrument

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<sup>13</sup> Note that to the extent that the technological change involves utilization of new inputs they can be offered to respective decision-makers at subsidized prices. However (but notice the provision below), since this cannot be conceived of as a surrogate, implicit form of credit i.e. a loan which is expected to be repaid at a future date, a package which contains it is, a fortiori, less socially desirable than RUMOL is (inferior to a direct credit-insurance package which, in turn, is not socially preferable to RUMOL). Of course, manipulating other prices, e.g. farm output prices so as to deliberately turn the terms of trade against the respective farmers may extort a de facto repayment of funds advanced to them in the first place. Needless to say (apart from all new complexities involved) this is a disguised but complete credit cycle, the relative, dubious social desirability of which need not be referred to again.

like the "credit-insurance package" would succeed in maintaining the impetus to shift production technology without incurring RUMOL would depend on the goodness of fit of its time-offer profile to this pattern.<sup>14</sup>

This point generates policy implications that should be confronted with the hackneyed "blanket" solutions often prescribed for "curtailing the inflow of rural migrants". Given that the policy aim is to reduce RUMOL and given the background of the analysis of the foregoing sections the desirability of using "limited development funds ... to raise rural incomes through programs of land consolidation and registration, provision of increased agricultural extension services and general rural development schemes"<sup>15</sup> cannot be denied. But, the relevant question is what is the relative efficacy in achieving the above declared objective of such general and largely indirect measures, vis-a-vis alternative ones. If applied to a given rural community, e.g. a village, the impact of a given measure may be too diluted to affect directly and as desired individual families. Even if not, it may still fall short of generating the desired effect due to an ill fit of the time profile of the variable RUMOL propensity of individual families and thus, either help to "lock the stable-door after the horse is gone" or, to lock it before the horse is at all likely to go (or, perhaps, after its return! ...)

If the "dilution effect" or the "ill fit effect" are to be eliminated by allocation of larger development funds and/or by a continuous flow of large development funds respectively, the mere cost involved may, in its turn, reduce again the relative efficiency of the measures.

An alternative policy instrument would be the channelling of development funds (via credit-insurance packages as above) aimed at reaching different individual families at specific different points of time. The notable advantage of this measure, its direct impact on the families concerned, is enhanced by the added advantage of the intertemporal spreading of scarce development funds (different families manifest a greater

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<sup>14</sup> *Attributing RUMOL and the prevalence of inducement for technological change to a number of specific stages in a specific time span of the life cycle of the family, probably result in the corresponding schematic depiction being a sinuous curve - composed of more than one such peak.*

<sup>15</sup> M.P. Todaro *The Urban Employment Problem in Less Developed Countries: an Analysis of Demand and Supply*, Ph.D. dissertation (Yale University, 1967), p. 89. See also, to cite only one more recent example, Paul Bairoch *Urban Unemployment in Developing Countries: the Nature of the Problem and Proposals for Its Solution* (ILO Geneva, 1973), pp. 94-99 where it is argued that "a substantial reduction of the rural urban drift ... could be brought about through the simultaneous application of a large number of measures" dominant among which are "an expansion of the opportunities for productive employment in agriculture", promotion of "a rapid rise in the income levels of farmers by increasing productivity in this vitally important [rural] sector" and "a better geographical distribution of the appropriate [social] facilities [as this] would help to damp down appreciably the propensity to emigrate".



inducement to transform technology, and to produce RUMOL, at different points of time).<sup>16</sup>

This argument should not, however, be seen as an attempt to nullify the importance of measures and organizational efforts such as extension services, etc.. Combining these with the latter policy instrument may produce even greater efficacy than that to be expected from summing up the separate impacts of each. But advocating these measures (a) usually derives from an analysis whereby the causal nexus between them and the mechanism of RUMOL is vague and (b) in a dichotomic way of argumentation implies a given degree of effectiveness in eliminating RUMOL; to re-stress, given that this is the policy objective it is likely to require lesser funds if pursued via the afore-mentioned alternative policy instrument.

Would then an effective package of appropriate (in the above sense) terms of credit and insurance and of proper timing be, indeed, accepted by rural families as a substitute for RUMOL? The cause and nature of a likely doubt will now be briefly examined.

Clearly if, as catalysts for technological change, surplus accumulation and the control of risks are the only reason for RUMOL, a package can be envisaged such that the family unit would reveal an indifference between receiving it and RUMOL. An infinitesimally improved package would therefore be preferred to RUMOL and could thus be tied to an understanding by the rural family that RUMOL will not be preferred.

On the other hand, a derived implication of risk reduction via a "RUMOL type" diversification is the prevalence of an expectation that part of the family portfolio embodied in the urban migrant member will be a "security of high rate of return". If proved to be so, it could, by way of reducing portfolio fractions held in other securities, be extended, e.g. other family members joining the urban "branch". Given that this element stands as an independent argument with respect to which the elasticity of RUMOL's propensity is not insignificant, a strict credit-insurance package may well fail to substitute RUMOL. But, does it?

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<sup>16</sup> *This characteristic of RUMOL should also assist in dissipating the likely worry concerning the possible consequences of all small farmer families producing RUMOL. It is clear, that the structural changes, the internal capacity to overcome the surplus and the risk constraints and the imperfect access to external sources of credit and insurance being not uniform across families will not generate RUMOL by all. Furthermore, and not less importantly, given the group of potential RUMOL-producing small farmer families, each individual family will be an actual producer of RUMOL at a specific, different, point of time. The intertemporal spreading of RUMOL reduces therefore the potentially undesirable effect which could have ensued from "a total and a simultaneous" RUMOL. For example, within the framework of a general equilibrium analysis such an effect would have been a derivative of the total, urban produced surplus available for rural-end technological changes not being increased by extra migration - benefits would probably be illusory - whereas its costs are real. (Benefits are probably illusory when the "amount" of technological change is not affected, only its allocation between rural families is affected.)*

A RUMOL generated by arguments such as this seems to require a postulated utility system different from that laid down earlier in the present study. Purchase of a security because its random rate of return could actually be high so that an increase in the fraction of wealth held in this security would then be called upon is (*ex ante*) compatible with a diminution of the prevailing level of absolute risk aversion. It is incompatible with the anticipated behaviour of a risk averse decision entity that dislikes increased risks throughout. If the "extension of a probably successful portfolio security" motive prevails, it is fairly likely to creep into the conceptual RUMOL causality function via its "technical" interdependence with the accumulation and diversification motives involved in RUMOL (as a "by-product in a joint production"), rather than appearing as an independent argument; sheep-raising that stems from the decision of a profit maximizer to produce wool (which, say, enjoys a high price on a highly elastic demand curve) necessarily introduces the production of mutton. Replacement of sheep raising, profit maximizer, wool and mutton by RUMOL, utility maximizer, surplus accumulation and risk minimization and the element concerned respectively, produces the complete analogy.

The foregoing exposition concerning the relative social desirability of RUMOL as the carrier of technological transformation has noticeably avoided the issue of the type of the technological change; technological change of the land-augmenting kind in on-the-family-farm food production as technological progress has loosely been assumed to be generally desirable. However, the possible interdependence between the precise strategy in operation and the kind of technological change might be a cause for some uneasiness. Even if, given the social welfare criterion and a given improved technology, RUMOL as such may not be dominated, in a social efficiency sense, by other strategies, could not the ensuing RUMOL-determined technique be nevertheless socially undesirable ?

If the social welfare criterion is such that planners and policy analysts are particularly concerned about the degree of labour intensity of the technique chosen, an aspect which projects on the problem of maximizing the present value of the stream of employment over time (for which maximization of the present level of employment could be taken either as a surrogate or as an equivalent), then some closer examination of RUMOL will be required.

In Section 2 of Part I, reference has already been made to the broad implications that the "severance variable" may have for the technological choice. It would simplify the ensuing short exposition if the probability function of the "return variable" as below is to be "mashed", to be reduced to "return does/does not take place", with the variable assuming only zero and unit probabilities.

Technological change would be conducted under one of the two alternative assumptions, either "return" is expected or "no return" is expected. Since *ex post* both may actually take place, expected return (e.r.) and expected no return (e.n.r.) could each be matched by realized return (r.r.) and realized no return (r.n.r.).

When the measuring rod for the evaluation of RUMOL is that the degree of labour intensity of the technique chosen is such that ("productive")

employment for all family members is generated, then RUMOL is clearly efficient if the event (e.r.) n (r.r.) occurs; the technique chosen will be geared towards the future incorporation of the labour effort of the migrant son which would actually be put in. In the case of events (e.r.) n (r.n.r.) and (e.n.r.) n (r.n.r.) (provided that in the latter the direction of causality is not that (e.n.r.) conditions (r.n.r.)), the (n.r.) reveals an "urban preference" by the migrant son which implies an expected urban net utility at least as high as the farm one. Given then his implied employment, the question is whether, in the first of these two events, the unexpected stay in the urban sector by the migrant son would not impede the utilization of other family member(s) labour on the family farm. Given the technique chosen, with the degree of labour intensity tailored to the expected participation of a returning migrant, this would largely depend on the extent of the existence of infra-family labour complementarities and an *ex post* substitutability of production factors. Generally, these will differ among technologies and within (along different techniques) technologies. Increased production and full utilization of the family farm labour will be hindered if the *ex post* substitutability is severely restricted, if labour complementarities are strong and if the relevant time span is the short run. (In the absence of the latter condition, e.g. when maturity is gained by the next son, the constraining effect of the former two conditions will be greatly weakened.) This event probably posits a greater difficulty than that presented by the reverse situation, the event (e.n.r.) n (r.r.), where the *ex post* substitutability via utilization of increments of labour inputs, given the quantities vector and the organization of all production factors under the new technique chosen, is likely to be greater.

Therefore, it looks as if when *ex post* perfect foresight is found to prevail - events (e.n.r.) n (r.n.r.) and (e.r.) n (r.r.) - RUMOL is compatible with employability of all family members. In the presence of other events, and there may well be a *prima facie* case for assigning smaller probabilities to these<sup>17</sup>, unless specific and strict conditions prevail, compatibility is likely.

Conceptually more difficult is the situation where the measuring rod for the evaluation of RUMOL is its overall impact on employment, the utilization of labour over the economy as a whole. At the present level of abstraction, it is difficult to pass judgement on the urban end employability consequences of RUMOL without specific recourse to conceptualizations of, to say the least, unemployment, equilibrium search, job search strategies and labour demand schedules and elasticities. However, when the migrant son queues for and secures an urban job, external effects are normally generated as this bears an impact on the employment

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<sup>17</sup> In the event (e.r.) n (r.n.r.) when the implication of (n.r.) is that the migrant will be deprived from reaping the gains embodied in the technological transformation, the ensuing opportunity cost to his stay, in terms of on-the-farm expected utility, is high. The higher it is, the smaller is the probability of (e.r.) n (r.n.r.) taking place.

probabilities that other job seekers face. Still, given that proposed by utilizing the previous measuring rod, to find RUMOL to be socially undesirable under the present measuring rod would require it to generate adverse urban "employability effects" (e.g. displacement of other urban labourers) that would outweigh the employment gain of the migrant member as well as the time discounted employment gain of other members of his family on the farm. When equal weights are assigned to the employment of all labour force participants then, it is not easy to show that a requirement of this kind actually holds.<sup>18</sup>

It is also possible that the social evaluation criterion will be concerned with ranking alternative strategies according to their expected contribution to the overall accumulation of surplus. The very prevalence of such a criterion stems, of course, from the fact that different social weights are assigned to marginal units of surplus and consumption, indicating in turn a social non-optimality of the existing surplus-consumption ratio. When the ratio is regarded as being too low (given sufficient time, marginal surplus will generate future consumption which, given the social rate of discount, will outweigh the short run foregone consumption), a higher rank would be assigned to a technological choice which generates a greater surplus. RUMOL could thus be subjected to a twofold scrutiny. The surplus accumulation inherent in it as compared with the surplus to be generated by alternative strategies (net of all social costs necessary to bring it about) would rank it high - perhaps highest. But the question is whether the state of affairs which RUMOL will eventually entail would not be accompanied by consumption patterns which will wipe out the surplus accumulated in the first place.<sup>19</sup> To more than offset

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<sup>18</sup> Assuming, for example, the labour force, the number of job vacancies -  $n$  and the rigid wage rate to be fixed, if  $N > n$  is the number of candidates competing for these jobs, all facing equal probabilities, then, unless specific postulations (e.g. regarding motivations) are introduced, the accumulated reduction in the probabilities of employment of all other candidates is clearly identical to the increase in the employment probability of the migrant. (For him, the increment is from  $\frac{n}{N}$  to 1; for the rest  $\left(\frac{n}{N} - \frac{n-1}{N-1}\right) (N-1) = 1 - \frac{n}{N}$ ).

<sup>19</sup> This is a quantitative aspect to be differentiated from qualitative notions; even without increment to consumption, RUMOL may produce socially unfavourable "consumptive effects" - by way of the composition of urban consumption being socially undesirable (e.g. a higher import content under conditions of severe foreign exchange constraints). However, consideration of the whole nucleus of compositional type issues would, by the same token, illuminate the "over" desirability of other RUMOL derivatives, inter alia, a farm capital formation - generated through the accumulation of surplus - as, vis-a-vis non-farm capital formation of an equal magnitude, its likely content of scarce imported inputs, as well as of scarce local ones (e.g. skilled labour), is smaller.

Whether thus the application of an "overall" social evaluation criterion which encompasses a number of specific criteria would reveal the unfavourable impact of "compositional factors" of the first type to more than offset the favourable impact of compositional factors of the later type is a question at present not adhered to.

the original accumulation, such an increase in consumption would have to be at a rate greater than the growth rate of output, output growth being a resultant of that accumulation. It is difficult to envisage how this would be ensued relatively more by RUMOL than by other strategies designed to supplant it, except for the case where the cause is inherent in the *ex post* inter-sectoral distribution of labour, when the migrant remains in the urban sector. From the point of view of the social undesirability of RUMOL, the condition is therefore that as compared with the total production elasticity of consumption, when the migrant returns (of N family members on the farm), the weighted average of the partial production elasticity of consumption on the farm (of N-1 members) and the partial income elasticity of consumption in the urban sector is higher. Unless the weight assigned to the second elasticity is significantly inflated due to the existence of "externalities" to an urban sector consumption, hardly any *prima facie* argument seems to prevail as to why the above condition should be fulfilled.<sup>20</sup>

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<sup>20</sup> The "externalities" which stem from a positive (variable) *de facto*, though not (necessarily) conceptual, relationship between each unit of urban "private" ("internal") consumption and the number of consumption units of public urban amenities and services may depress the overall social welfare: (a) through the direct decrease in the welfare of other urban dwellers and (b) through the ensuing demand for capital expenditures (e.g. roads) aimed at minimizing (a) and at eliminating its negative effects, if any, on urban production efficiency. ((b) implies loss of, foregone, consumption, a direct argument in a social welfare function). It seems appropriate to examine this qualification more closely.

As far as (a) is concerned, the important point is the relevance of the state of the initial distribution of public goods amongst all families, rural and urban alike. If, in order to isolate the main aspect presently of interest, it is assumed that the additive separable utility function of each family depends (a) upon the amount of its "private" consumption and (b) upon its share of public goods (these being regarded as consumption goods) and, furthermore, that private consumptions are equal throughout (utility thus turned into a one variable function i.e. in (b)) then, for an "individualistic" social welfare function where, if implicit, inter-familial comparabilities are involved (see above, the opening paragraphs of this part) changes in the existing distribution of (given) urban public goods may, in fact, be welfare increasing. (To gain even greater simplicity, the intra-sectoral distributions of public goods are assumed inequality-free). When every family has the same utility function, the level of social welfare which corresponds to an initial, unequal inter-sectoral distribution of public goods will, in fact, be lower than that which ensues from a shift in favour of migrant members of rural families. (Notably, the welfare of families is identified here, as throughout Part II, with the level of their utility). Alternatively, if different families have different utility functions but, around the present distribution point, the marginal utility of urban families is lower than that of rural families, social welfare maximisation would indeed advocate a shift as above. (If, in addition, the absolute level of utility which the latter enjoy is lower, such a shift would also be compatible with egalitarian considerations). It is, in fact, likely that rural families enjoy lower absolute levels of utility and manifest higher marginal utilities - at least at the neighbourhood of the present division point -

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Even if the condition holds for those cases where migrants remain in the urban sector, as not all migrants do, it cannot necessarily be inferred that their effect would or could be strong enough to outweigh the fully socially desirable effect of the accumulation of surplus in those cases where RUMOL is not followed by remaining in the urban sector (plus, of course, the "partially" socially desirable effect of the accumulation of surplus which relate to those cases where remaining does follow).

Finally, a brief reference to the nature of policy weapons hitherto excluded from consideration is due. The weapons which have been examined above are geared towards tackling the very elements which elicited RUMOL (i.e. the "surplus" and the "risk" elements) and they are directed at facilitating its replacement. That policy instruments can be aimed at eliminating the evolution of the need for RUMOL requires but little elucidation here. Shifting the distribution of land holdings in favour of the small farmers and/or population policy (e.g. provision of family planning services) are obviously potential methods for treating "the problem" at its root since they can prevent or reverse the net utility diminution analyzed in Section 1 of Part I.

Since the whole of the analysis has treated land holdings of small farmers and fertility patterns as given, such weapons are placed outside the "armoury" of the present work. If, in a wider perspective, they are nevertheless considered, it has to be recalled that compared with those measures examined earlier, they are, generally speaking, longer term measures (population policy as well as "dynamic land redistribution" that is redistribution by way of influencing the pattern of accumulation of land over time) or, politically speaking, more radical ("static land reform", "political opposition" to family planning). The nature of these constraints places such measures on a different level than the ones considered in the text above; their admissibility depends on both temporal and political constraints apart from obvious considerations of relative costs. On all or some of these grounds, given the social welfare function, their implementation may not be feasible.

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...footnote No.20 continued

*with nothing inherent which, vis-a-vis the urban families, causes them to derive lower utility from any given level of income. Therefore, if the utility functions of rural and urban families are broadly "similar" - that the "private" consumption of rural families is lower would only enhance the conclusion - the shift in the distribution of public goods in their favour is, indeed, desirable under a bias free set of social welfare functions as above.*

Much of the history of American technological progress can be attributed to the bottle-necks of scarcity of labour relative to capital (as a profit rate depressor) and land (as a rent rate depressor).<sup>3</sup> In the same vein, a different endowment situation - scarcity of "natural resources", i.e. land, fuel, power has a great explanatory power for the case of Britain's history of technological progress.<sup>4</sup>

In the case of Japanese agriculture (over the 1883-1963 period), the scarcity before World War II of land and capital relative to labour appears to have resulted in a technological change biased towards the "labour using" direction whereas the increasing scarcity of labour in the post war period has led to a technological change biased towards the labour saving direction.<sup>5</sup> A more detailed analysis (covering a similar period - from 1880 to 1960) attributes to the overall, continuously increasing relative scarcity of land the land-saving bias of the technological progress in Japanese agricultural production; changes in relative factor endowments, observed directly or transmitted through the mechanism of relative factor prices are argued to have induced Japanese farmers both to innovate and to do so in the indicated direction.<sup>6</sup>

The increase in the scarcity of labour relative to land is likewise (and for the same period) seen as the factor determining the direction of the (labour-saving) bias of the technological change in U.S. agriculture.<sup>7</sup>

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...footnote No.2 continued

Committee for Economic Research and the Committee on Economic Growth of the Social Science Research Council (Princeton, 1962), pp. 171-188; Jacob Schmookler Invention and Economic Growth (Cambridge Massachusetts, 1966); John Jewkes, David Sawers and Richard Stillerman The Sources of Invention (Second edition, London, 1969).

<sup>3</sup> That consequently the technological change in the U.S. (since 1900) has been biased in a labour-saving direction is a conclusion reached by Paul A. David and Th. Van De Kludert "Biased efficiency growth and capital-labour substitution in the U.S. 1899-1960" The American Economic Review, Vol. 55 No. 3, June 1965, pp. 357-394.

<sup>4</sup> See H.J. Habakkuk American and British Technology in the Nineteenth Century : the Search for Labour Saving Innovations (Cambridge, 1962).

<sup>5</sup> See Shūjiro Sawada "Technological change in Japanese agriculture : a long-term analysis" in Kazushi Ohkawa et al. (eds.) Agriculture and Economic Growth : Japan's Experience (Tokyo, 1969), pp. 136-154.

<sup>6</sup> See Yujiro Hayami and Vernon W. Ruttan Agricultural Development : an International Perspective (Baltimore, 1971).

<sup>7</sup> *Op.cit.* In a recent study it is argued that a strong labour-saving biased technological change, causally attributed to the rapid increase in the price of labour, has occurred in U.S. agriculture in the post World War II period. (Hans P. Binswanger "The measurement of technical change biases with many factors of production" The American Economic Review,

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## APPENDIX I

### A NOTE ON AN INDUCED TECHNOLOGICAL CHANGE

The argument in Section 1 of Part I rests, *inter alia*, on the supposition that owners of a set of employed production factors who witness a growing shortage of one of the production factors relative to the other production factors are expected to be induced and stimulated to search for and adopt a technology which would amount to : a direct increase in the volume of the scarcer production factor as measured in efficiency (quality) units; and/or to an increase (absolute or qualitative) of other, more abundant, substituting production factors where the more substitutable (for the factor in shortage) are approached first - hence saving in the scarcer production factor; and/or to the opposite, a decrease (for a given volume of output) of other production factors - when output elasticity with respect to the real costs of production is both positive and smaller than unity. (In output elasticity terms, the implications of the first and third changes are increased output elasticity with respect to the scarcer production factor, of the second change, increased output elasticity with respect to the other production factors).

Measuring inputs in absolute units, the first change thus amounts to a reduction in the input coefficient of the scarcer factor, other input coefficients remaining unchanged, the second change amounts to a reduction in the scarce input coefficient while other inputs coefficients are increased (i.e. amounts of the scarcer input are released from production) and the third change to a reduction in other than the scarcer inputs coefficients (i.e. amounts of other than the scarcer inputs are released from production).<sup>1</sup>

The line pursued in Part I which rests on the suppositions that to a large extent technological progress is (demand) induced rather than being autonomous ("falling like manna from heaven" hence being both "non neutral" - biased and endogenous) and that the owners of production factors who witness a "critical" shortage of a given production factor are the agents in charge of making the technological progress is indeed significant in explaining a considerable share of variability of past and present technological progress (the diffusion - of innovations - dimension though the inventive activity dimension too).<sup>2</sup>

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<sup>1</sup> *The increased scarcity of a production factor is taken here to be manifested directly, that is physically, although it can be transmitted through changes in relative factor prices with these fairly accurately representing the changes in the resource endowments. For reference to factor prices as a source of biases and for specification of the mechanism of the process, see respectively John R. Hicks The Theory of Wages (London, 1932) chapter VI, especially pp. 121-127 and Syed Ahmad "On the theory of induced invention" Economic Journal, Vol. 76 No. 302, June 1966, pp. 344-357.*

<sup>2</sup> *John R. Hicks op.cit.; Syed Ahman op.cit.; William Fellner "Does the market direct the relative factor - saving effects of technological progress?" in The Rate and Direction of Inventive Activity : Economic and Social Factors, a conference of the Universities - National Bureau*

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Much of the history of American technological progress can be attributed to the bottle-necks of scarcity of labour relative to capital (as a profit rate depressor) and land (as a rent rate depressor).<sup>3</sup> In the same vein, a different endowment situation - scarcity of "natural resources", i.e. land, fuel, power has a great explanatory power for the case of Britain's history of technological progress.<sup>4</sup>

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The increase in the scarcity of labour relative to land is likewise (and for the same period) seen as the factor determining the direction of the (labour-saving) bias of the technological change in U.S. agriculture.<sup>7</sup>

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<sup>3</sup> *That consequently the technological change in the U.S. (since 1900) has been biased in a labour-saving direction is a conclusion reached by Paul A. David and Th. Van De Kludert "Biased efficiency growth and capital-labour substitution in the U.S. 1899-1960" The American Economic Review, Vol. 55 No. 3, June 1965, pp. 357-394.*

<sup>4</sup> *See H.J. Habakkuk American and British Technology in the Nineteenth Century : the Search for Labour Saving Innovations (Cambridge, 1962).*

<sup>5</sup> *See Shūjiro Sawada "Technological change in Japanese agriculture : a long-term analysis" in Kazushi Ohkawa et al. (eds.) Agriculture and Economic Growth : Japan's Experience (Tokyo, 1969), pp. 136-154.*

<sup>6</sup> *See Yujiro Hayami and Vernon W. Ruttan Agricultural Development : an International Perspective (Baltimore, 1971).*

<sup>7</sup> *Op.cit. In a recent study it is argued that a strong labour-saving biased technological change, causally attributed to the rapid increase in the price of labour, has occurred in U.S. agriculture in the post World War II period. (Hans P. Binswanger "The measurement of technical change biases with many factors of production" The American Economic Review,*

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It is similarly argued that the scarcity of labour relative to land has induced a labour saving biased technological change in New Zealand's agriculture (- for the period 1945-1967).<sup>8, 9</sup>

However, these and other cases though lending support to the proposition that the process of technological change in agricultural production should be conceptualized (a) as an endogenous one and (b) as a dynamic response to changes in resource endowments or in relative factor prices which fairly accurately represent them, cannot and should not be taken to imply that changes in factors' scarcities are sufficient for an induced technological change to materialize. The way to technological change is paved with obstacles, institutional factors and the explicit requirements of the new technology being the major ones. These factors and requirements create a barrier between the "desire" and the "ability" to introduce a technological change. It is the pulling down of such a barrier that RUMOL, as argued in Part I, is aimed at.

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...footnote No.7 continued

Vol. 64 No. 6, December 1974, pp. 964-976). That substantial changes in factor prices (or in factor endowments) are needed perceptibly to affect the direction of a technological change, as is indicated in this case, clearly does not diminish the applicability of the moral of these and other studies to the case at hand.

<sup>8</sup> R.W.M. Johnson "Efficiency growth in New Zealand agriculture : a review" *Economic Record*, Vol. 48, March 1972, pp. 76-91.

<sup>9</sup> A note of caution is in order. Of course, unless (to say the least) the elasticity of substitution between  $Z$  and  $X$  is equal to the elasticity of substitution between  $Z$  and  $Y$  the intensity of a technological advancement stimulus exerted by a scarcity of factor  $X$  relative to factors  $Y, Z$  which originates in the lagging growth rate of  $X$ , should not be expected to equal that of the stimulus exerted by a scarcity of  $Y$  relative to factors  $X, Z$  which originates in the lagging growth rate of  $Y$ . (This holds even when the same growth rates differentials are assumed in both cases). Inter alia, this stems from the differential in the net balance of external-institutional, political, social as well as economic general conditions. Nevertheless, the difference in stimuli is believed to be one of degree rather than of kind.

## APPENDIX II

### SOME EVIDENCE : THE AVAILABLE AND THE DESIRABLE

This appendix is a product of close scrutiny of available evidence relevant to the basic issues under review in the present paper. As such it intermittently presents methodological reflections - derivatives of "learning from experience" and explicit evidence which bears on the relevant questions. It has to be pointed out at the outset that practically all the general observations concerning the different aspects of "the state of the arts" (the existing inventory of evidence) are of the nature of reflections on necessary elements which an "optimal" empirical enquiry should include. This point is not always explicitly re-iterated.

The opening few paragraphs consist of a short reference to some general methodological issues. Then, a specific scenario, a summary of the analytical structure which is explicitly confronted with available evidence is formulated. This is followed by such general evidence and consequently by a general examination of some relevant aspects of the issue of remittances. This examination although preceding a detailed reference to specific evidence on remittances and hence exposed to the danger of sounding too aprioristic, is also based on and consequently is a summary of both the fundamental drawbacks of some, probably most of the existing evidence and its relevant suggestions. Reference to evidence on technological changes causally related to RUMOL complements a close scrutiny of a number of studies containing evidence on the other components of the above scenario. The concluding paragraphs stress some further explicit implications for related future research.

Do existing "migration studies" lend support to the fundamental proposition of Part I that in the case of the small farmer RUMOL is a catalyst of technological change in agricultural production? Does RUMOL, directly or indirectly, produce "surplus" and provide "insurance" which would otherwise be lacking thus inhibiting the shift to a new technology which is both surplus-demanding and risk-enhancing? In particular, does RUMOL consist of "sons" who directly (and indirectly) contribute to the accumulation of surplus on the family farm, that is their fathers' farms? If available migration studies fail to shed the desired light on these and related issues, what should be the foundations on which "an appropriate" study is to be based?

A painstaking scrutiny of a substantial proportion of the migration literature produces two largely anticipated results, the first being a derivative of the second. These are that utilization of existing studies to validate some, if not all, of the issues indicated by the above questions as well as by related ones demands assumptions which at best are specific and sometimes arbitrary (even if, to some extent, plausible) and secondly, that the capacity of a given study - say a sample survey composed of questions on reasons for migration - to provide answers to questions as above is not independent of the explicit or implicit "migration model" conceptualized by the researcher.<sup>1</sup>

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<sup>1</sup> None of the Indian National Sample Surveys cited below has gone beyond providing respondents with a choice of general reasons (such as

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If, to take just one example, lying at the heart of a model is the supposition that the critical explanatory variable is the inter-sectoral "income differential", questions aimed at say determining rural income prior to RUMOL rather than future use of expected urban income (use which need not be made by the migrant himself!) are likely to be predominant.

Of course, a migration model which is not carefully conceived is responsible not only for failing to ask the "right" questions (or for their inadequate refinement) but also for failing to "properly" interpret given answers. Whether, for example, the behaviour of an entity beyond the migrant himself is captured by such a model and whether the presently much stressed issue of ensuing technological changes is considered are not immaterial for such an interpretation. A good illustration is provided by the case where RUMOL is reported to derive from the need to accumulate sufficient savings towards meeting the high cost of bridewealth, a case frequently documented in the context of RUMOL in different parts of Africa as well as elsewhere. It is undoubtedly true that such a reason may faithfully reflect personal motivations but it does fall short of explaining many related questions namely why a high bride price necessitates RUMOL (vis-a-vis alternative strategies), why the bride price is high and so on. It is tempting to speculate - indeed, the issue of fungibility referred to below invites this (though clearly this is a chance among many) that bridewealth constitutes "an effective leverage" to enforce a transfer of surplus, necessary for carrying out technological change, from migrants to the rural community; the level of the bride price can then be largely accounted for by the surplus requirements of a new technology - but with RUMOL *per se* yet to be explained.

A host of general methodological and statistical questions are known to be posed by the sample survey techniques but many of these are intimately related to the conceptualized migration model. The axiom that motivation can be detected by asking migrants why they moved is clearly more questionable if the decision-making unit whose total utility is the relevant maximand is the family - including the migrant but not only

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...footnote No.1 continued

*"in search of or for better employment" or "to take up job"). This is a vivid illustration of the prevalence, if implicit, of a "migration model" that implies little more than that migrants (voluntarily) migrate solely because of an obvious desire to better themselves. In particular, no direct or indirect questions or measures which could have furnished the researcher with means to examine those issues mentioned in the third paragraph of the appendix are included. See The Cabinet Secretariat : Government of India "The National Sample Survey ninth, eleventh, twelfth and thirteenth rounds : May 1955-May 1958, No. 53, Tables with notes on internal migration" (Delhi, 1962), pp. 10-12, 25, 45-47, 61-70, 80 and The Cabinet Secretariat : Government of India "The National Sample Survey eighteenth round : February 1963-January 1964, No. 182, Tables with notes on internal migration" (Delhi, 1972), pp. 221-250.*

*Another illustration of this point is provided by the fact that apparently none of the available surveys enquiring into RUMOL causality (in India or elsewhere) have questioned the (age determined) rank order of migrants within their fathers' families.*

the migrant.<sup>2</sup> Furthermore, if a focal point is the nature of the rural end consequences, e.g. the lagged shift in agricultural production technology then, there is no escape from embracing the RUMOL phenomenon (a) at distinct points of time (so as to reveal the indicated interaction between RUMOL and technological change over time) and (b) at both ends. The choice, say of those to be interviewed in a "migration sample survey" is then constrained for it is clearly not the migrant himself, located at the urban sector, who is best positioned to inform a researcher that an ensuing rural end technological change has already been carried out.<sup>3</sup>

It should however be added here that it is possible that in spite of RUMOL's causality being (*ex ante*) as depicted in the foregoing analysis, RUMOL's consequences will be different. For example, *ex post*, RUMOL may fail to produce "sufficient surplus" or notwithstanding the accumulation of "sufficient surplus", intervening external factors may impede the technological change (e.g. improved short-strawed fertilizer-responsive seeds, certain plant nutrients or spare parts for well pumps may turn out to be completely out of reach). Because of the potential prevalence of cases such as these, the design of data collection should be such that rather than drawing negative conclusions concerning the very applicability of the conceptual framework of the foregoing analysis, it will (a) facilitate the identification of the intervening factors and (b) point towards policy instruments which once operated will transform or reinstate RUMOL as a successful catalyst of technological change.

Apart from difficulties which stem from problems of orientation, verification of the foregoing conceptual postulations by existing studies is hindered by problems of presentation and aggregation. (When trying to utilize existing data the analyst is always at the mercy of past decisions). For example, a number of studies, albeit a minority, contain evidence concerning both RUMOL and technological change in agricultural production. However, the level of aggregation is usually such that a study which from the point of view of the present interest could have been particularly useful is of only limited pertinence. Given that the decision-making unit which produces RUMOL and changes its production technology is the family unit, that the respective two sets of data are given for a larger rural community - say a village - critically diminishes their relevance; it is impossible in such a case to infer that those families within the community which had experienced RUMOL are the very

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<sup>2</sup> This does not however weaken the contention (see in the text below) that cross-section associations and their interpretations could be a major tool for tracing motivations.

<sup>3</sup> The dominant role attributed to the rural end consequences of RUMOL invariably reduces issues such as the degree of "assimilation" and the level of personal "satisfaction" in the urban sector to a secondary importance while at the same time raising issues such as those concerning urban-to-rural remittances and the consequent changes in the organization of agricultural production to a primary importance. It is thus instructive to notice that whereas the former issues were given a top research priority in a large number of sample surveys reviewed by a recent article, almost none of these surveys appears to have inquired into the latter issues. See Pamela H. Brigg Migration to Urban Areas, International Bank for

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ones who have incurred the change in production technology.<sup>4</sup>

It is not particularly surprising then that in view of the novel theoretical constructs of RUMOL causality put forward in this paper, none of the available migration studies is tailored to test fully these conceptualizations. This however cannot serve as an excuse for not attempting to transform existing studies if not into "complete validations" then at least into partial ones. Efforts of this nature usually produce also a useful by-product viz. the dominant contours of the design of future "optimal" empirical studies, identification of critical areas of inquiry hitherto largely neglected. The remainder of this appendix will intermittently report on both these aspects.

The conceptual construct advanced in Part I suggests and implies that *inter alia*, but in particular, RUMOL is by young single males who contrib-

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...footnote No. 3 continued

*Reconstruction and Development, International Development Association, Economics of Urbanization Division, Economic Staff Working Paper No. 107, June 1971.*

<sup>4</sup> This is unfortunately the case with the great majority of the Indian village studies which contain data on RUMOL and technological changes as well as other related variables, e.g. urban-to-rural remittances. (See reference to both these aspects in the text below). The village level data available from the Agricultural-Economics Research Centres (under whose auspices a large number of studies based on a common methodology have been carried out) are no exception to this unhappy rule. (With the exception of those cases in which village surveys were shadowed by re-surveys, the inadequacy of the Agricultural Economics Research Centers studies for the present needs stems from another fundamental reason. By reporting, though comprehensively, on the economic profile of a village at a specific point of time, the dynamic process of RUMOL at one point of time generating technological change at a consequent one is not captured; separating cause from effect is hardly a possibility. In those cases where the pairing of surveys with re-surveys generates the time dimension or where some cross-section analysis based on comparable "single shot" studies could have been pursued, the level of aggregation as mentioned in the text above still critically hinders the use of the data). Taking just one other case (-one among many) a study by Friedrich W. Fuhs and Jan Vingerhoets Rural Manpower, Rural Institutions and Rural Employment in Thailand, Government of Thailand, National Economic Development Board, Manpower Planning Division (Bangkok, 1972) embraces detailed information on "changes in family techniques and family methods" over a ten year period as well as detailed information on migration. Yet, again, both types of information are aggregated at the "project area" level (consisting of a number of villages in a given region) making a decomposition to farm level data impossible.

ute positively<sup>5</sup> to otherwise<sup>6</sup> unachievable accumulation of surplus on the farms of their fathers' families where consequently technological change in agricultural production ensues.

The validation even of this "reduced form", *prima facie* simple, not over specific, scenario is not at all easy though evidence concerning some of its components is fairly readily available and apparently conclusive.

The findings of a large number of studies summed up in a small number of recent survey articles and reports indeed suggest that the overwhelming majority of rural-to-urban migrants are male,<sup>7</sup> young<sup>8</sup> (in the age group 15-24) and single.<sup>9, 10</sup>

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<sup>5</sup> Possibly indirectly too.

<sup>6</sup> Given the planning horizon which is not long (a fairly high rate of time preference).

<sup>7</sup> See Pamela H. Brigg Migration to Urban Areas, International Bank for Reconstruction and Development, International Development Association, Economics of Urbanization Division, Economic Staff Working Paper No. 107, June 1971, especially p. 38; United Nations, Department of Economic and Social Affairs, "The determinants and consequences of population trends: new summary of findings on interaction of demographic, economic and social factors" Population Studies No. 50 (New York, 1973) Vol. I, pp. 181-182; John Connell, et al. Migration from Rural Areas: the Evidence from Village Studies, Institute of Development Studies at the University of Sussex, Discussion Paper No. 39, January 1974, chapters 2 and 8; Natala Carynyk-Sinclair Rural to Urban Migration in Developing Countries, 1950-1970: a Survey of the Literature, International Labour Office, World Employment Programme, Working Paper (Geneva, February 1974), especially p. 20. (Note however that all four studies referred to above point out that, generally speaking, in the case of the Latin American countries, the male dominance in RUMOL is significantly weaker).

<sup>8</sup> See Pamela H. Brigg (1971) *op.cit.*, especially pp. 12, 38, 67; United Nations, Department of Economic and Social Affairs (1973) *op.cit.*, p. 81; John Connell et al. (1974) *op.cit.*, chapter 2 (though here references are to rural migration in general including rural-to-urban migration); Natala Carynyk-Sinclair (1974) *op.cit.*, especially p. 19.

<sup>9</sup> See Pamela H. Brigg (1971) *op.cit.*, especially p. 67; John Connell et al. (1974) *op.cit.*, chapter 2. Direct information on rural-to-urban migration differentials by marital status is more scanty, less systematic and less reliable (in many cases marital status at the time of RUMOL has to be inferred from available information on status at the time of enumeration). In some cases it is possible to infer - with a reasonable degree of confidence - that migrants are single from detailed information concerning their age (possibly reinforced by general observations on marital age).

<sup>10</sup> Related evidence is contained in some of the studies scrutinized in detail later in the appendix. For its exposition - see below.

Taking RUMOL to be then by those who are male, young and single - "sons", does it result in accumulation of surplus otherwise not attainable? To the extent that accumulation of surplus is indicated by the prevalence and persistence of urban-to-rural flows of remittances over a considerable period of time the answer is a qualified affirmative.<sup>11</sup>

However, from both qualitative and quantitative points of view and from the vantage point of the needs of the present study, "remittances" are embedded in a nexus of complex issues. The presences of biases is one.

The process of gathering data frequently fails to record rural-to-urban flows (in particular the allocation of that earlier referred to "partial surplus" already possessed by the family towards enhancing the success of the family member migrant). This omission alone may result in an overestimation of the true magnitude of surplus accumulated because of RUMOL.

It has already been pointed out (see Part I, Section 1) that, on the other hand, inflow of remittances - even if accurately recorded - may well under-estimate the true magnitude of surplus accumulated by the family unit following RUMOL since it does not register that surplus which probably and consequently is accumulated on the family farm.

These two opposing biases when exerting themselves simultaneously may however neutralize each other with the consequent result being a gross flow accurately reflecting the true magnitude of the accumulated surplus. Before turning however to the other relevant complex issues in which remittances are embedded, some further reference to the former of the above two biases is in order.

Most studies which, in some form, address themselves to urban-to-rural remittances ignore initial flows in the inverse direction. This can probably be accounted for by the fact that in general, when the urban-to-rural flow of remittances from working migrants is, in some sense, substantial, the overall net flow does not fall much below the gross flow and hence, for all practical purposes, the distinction can be ignored.

Establishing definite positivity of the net flow of remittances is generally hindered by lack of appropriate data. Elaborating in short, the rural-to-urban flow consists mainly of the cost of fares and the support with which the migrant is furnished between his arrival to the urban sector and his securing of employment.<sup>12</sup>

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<sup>11</sup> A large number of RUMOL studies register such flows. Indeed, the weight of the evidence suggests a robust generalization - that RUMOL is followed by a reverse transfer of "considerable" volume of resources. (See in the text below).

<sup>12</sup> This of course does not encompass all real costs generally incurred by a sending rural family due to RUMOL, particularly not those of foregone production. But note that when, as has been assumed in Part I, RUMOL closely follows maturing, these costs can be assumed nil or negligible, if the relevant index is foregone production net of consumption - even negative.



If urban employment is achieved and retained for a number of years - a concomitant prevalence of urban-to-rural flow of remittances indicates that such is the case - the initial costs of travel can be assumed a minute proportion of total (gross) urban-to-rural remittances and hence be ignored. The main effort has to be directed then towards evaluating the magnitude of the probable support over the time lag between arrival and employment. If most migrants secure employment within a relatively short period of time (e.g. "half a year or less", or "less than a year") but remit substantially for a number of years, net remittances can be assumed positive particularly if allowance is made for the fact that over the initial period migrants are not wholly supported by remittances from their families at the rural end but also by urban located relatives and friends to whom most probably gratuities are paid in return though obviously these are not reflected in any of the inter-sectoral flows of remittances.

In order to place this point in a perspective which is even less abstract, consider a hypothetical profile of a migrant labourer over the first few years, say three, following his arrival to the urban sector. Assume that in the first half year of his stay he is totally unemployed (earns no income) and is wholly supported by his family at the rural end. To ease exposition, accept a linear approximation implying that for the next two and a half years in which he is employed he remits, on average, one third of his yearly urban income - say in regular monthly instalments. Assume that the two-thirds of his income which are not remitted exactly exhaust his urban costs of subsistence which, like his income, are assumed constant. (Ignore the rate of interest factor as well as all other factors many of which probably exert impacts that neutralize each other). Under these conditions net remittances are nullified eighteen months after arrival in the urban sector. The prevalence of remittances beyond that period indicates then that net remittances are definite positive and their persistence over the first two and a half years of urban employment produces a ratio of two and a half to one between urban-to-rural remittances and rural-to-urban remittances. (If the cost of travel to the urban sector is brought in and is assumed to equal a full monthly urban income, net remittances are definite positive if remittances are prevalent beyond the twentieth-first month from the date of the migrant's arrival). It should be pointed out that far from being arbitrary, the parameters used in this example are fair reflections of the orders of magnitude revealed by much of the evidence referred to below<sup>13</sup> (as well as by other related evidence).

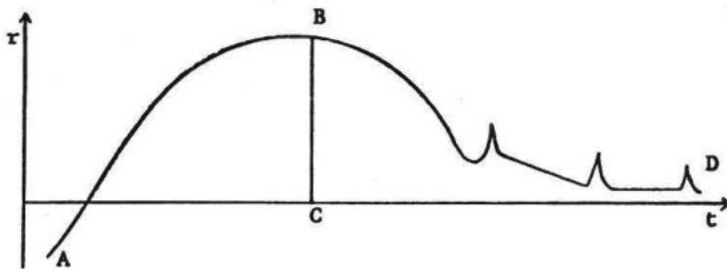
A second major pitfall involved in interpreting available evidence on remittances relates, in several ways to the time factor. Not only do

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<sup>13</sup> *Of the studies examined below all those which explicitly refer to the time factor in remittances flows indicate that sizable transfers do indeed stretch over a number of years. (See below the studies by John C. Caldwell (1969), (and also John C. Caldwell (1967), p. 142) and John Aderanti Adepoju (1973). This is however also implicit in other studies, e.g. that by G.E. Johnson and W.E. Whitelaw (1972)).*

remittances vary with time (both because of the impact of intensity and nature of kinship relationships, cohesion and social control and because of the changeable economic status of the migrant - these two producing perhaps an inverse bell type functional relationship between remittances and time<sup>14</sup>) but also the full and real impact of them on total surplus accumulation can only be established if they are aggregated and summed up for a number of periods of time; needed is their (changeable!) magnitude not during the n-th or the m-th year after the act of RUMOL but over a given time horizon - say the first k years.

<sup>14</sup> The probable general relationship between net urban-to-rural remittances (measured in absolute terms at fixed prices)  $r$  and  $t$  is schematically portrayed below: ABC - mainly when the migrant returns (or is joined by his family), ABD - when he does not return; the spor-



adical pattern BD reflects remittances in response to acute needs or special events in the rural end (e.g. marriage of a sibling, a festival). Evidence contained in some of the studies referred to below, e.g. those by John C. Caldwell (1969) and John Aderanti Adepoju (1973) largely validates this pattern. See also G.E. Johnson and W.E. Whitelaw Urban-Rural Income Transfers in Kenya: an Estimated Remittances Function, University of Nairobi, Institute for Development Studies, Discussion Paper No. 137, June 1972. This study, based on a sample survey carried out in Nairobi in 1971, concludes that nine-tenths of those who "had some income" (in a given surveyed month) were remitting "regularly" (presumably monthly), their remittances representing, on the average, more than one-fifth of their total urban income. (It is implicit in the study that for all practical purposes these persons can be assumed to be rural migrants).

The study ascertained that the proportion remitted out of total income was falling as income was increasing. This proportion was found to be higher for the low income earners. Both these findings can be indicative of the effect of duration of stay (low income earners being probably the late arrivals) and indeed a linear regression analysis does suggest that this proportion was significantly and positively related to the (calendar) year of arrival.

Thirdly there is the crucial aspect of the identity of the rural unit in receipt of remittances, the evidence with respect to which is, in many cases, and from the point of view of the present needs, too general and inadequate. That the transfer is revealed to be to "the migrant's family" - rarely explicit in the evidence - is of only limited use; substantiation of the conceptualization advanced in Part I obviously requires evidence indicating this family to be that of the migrant's father. Such evidence is even rarer. Nevertheless in some cases, given the information concerning the migrant's marital status or at least his age (hence if young, the likelihood of his being single), that the migrant remits to "his rural family" makes it possible to deduce that the recipient family is, most probably, his father's family.

It is worth adding at this point that though far from being a direct proof, that a (sizable, net) transfer is between a migrant son and his father's family can be interpreted as more consistent with a decision function involving maximization of familial net utility (as argued in Part I above) than with that involving maximization of individual utility.<sup>15</sup>

Finally and not least difficult is validation of the claim that without RUMOL, accumulation of "sufficient surplus" would not have been accomplished. This requires some estimation, in absolute terms, of the potential accumulation of surplus by the whole family including the migrant son had he not migrated.<sup>16</sup>

For RUMOL to be shown to fulfil its aim - as suggested earlier - it is necessary (though of course not sufficient) to establish more than that the migrant has remitted  $y$  per cent of his urban income, or an absolute sum of money  $x$ . (This assumes of course a "provisional" state where both the biases and the factors of timing mentioned earlier have been accounted for). The ratio between remittances and the total income or expenditures of the rural family, supplemented by information on the family's structure and the going rural wage rates for hired labourers may, in some cases, go a good way towards meeting the above end.

With these provisions in mind, a close review of a number of studies which, in some detail, have partially addressed themselves to the relevant remittances-surplus accumulation issues in the context of RUMOL is pursued.

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<sup>15</sup> *The prevalence of some transfer in the inverse direction (i.e. a rural-to-urban one by the rural family in support of the migrant son) may only enhance the case for such an interpretation. Indeed this can be viewed as a manifestation of the point made earlier in Part I viz. preference of a probable "sufficient surplus" to an existing certain "partial surplus" - an intimate derivative of the process involving maximization of familial net utility.*

<sup>16</sup> *In a study geared explicitly towards this end the issue may, in principle, be resolved by comparing magnitudes of surplus accumulated by say two families identical in all respects except that one has no migrant son and one does though this still leaves open the preliminary question that RUMOL, as being generated by subjective evaluations, need not posteriorly coincide with them.*

From an early survey of the village of Uppattur, Ramanathapuram district, Madras (now Tamil Nadu) India<sup>17</sup>, the characteristics of the migrants from the village at the survey point (at 1958) can be inferred to be as follows. Nearly two-thirds of the migrants were of the age group 15-24 years; four-fifths were males; practically all were single (both direct and indirect evidence); "in almost all cases the families from which the migrants come are seen to have more than one male member"<sup>18</sup>; most came from small farmer families (three-quarters from those owning less than five acres)<sup>19</sup>; nine-tenths were residing at towns or cities. Hence "RUMOL by sons". Unfortunately, data on remittances are scanty. Given are only remittances aggregated for the whole village hence, too, as a proportion of the total village income (- about one per cent, or as per household or per capita). With the number of migrants (63) far below the number of households (nearly 500) it is in particular impossible to determine in any meaningful way the significance of remittances for those families who had expelled migrants and were in receipt of remittances. From the point of view of the current interest, that "the income from remittances [during a given year] was insignificant compared to total village income" - an observation frequently made in village studies<sup>20</sup> - is clearly "neither here nor there"; that remittances are a very small proportion of a village income is perfectly compatible with them being a very large proportion of a given family's income. Needless to add, a strong intra-village inequality coupled with RUMOL from families of the smaller farmers reinforces this point. There is explicit evidence that at least the former of these two characteristics applies to Uppattur.<sup>21</sup>

An account of migrants from Aralikottai, another village in Ramanathapuram district, Madras based on a survey carried out in 1963<sup>22</sup> reveals that most were recent (i.e. migrated during the four years preceding the survey), young (three-fifths in the age group 15-24) and from farmers' families. Their urban destination can be inferred from occupational data : in particular none worked in agriculture. Almost all were males. Here too evidence on remittances is scanty - the study refers only to a regular flow of remittances from these migrants amounting to

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<sup>17</sup> *University of Madras, Department of Economics, Agricultural Economics Research Centre Uppattur Village, Village Surveys No. 47, 1959.*

<sup>18</sup> *Op.cit.*, p. 86.

<sup>19</sup> *T.S. Yeshwant "Rural migration - a case study in four Ramanathapuram villages" Agricultural Situation in India, Vol 17 No. 6, September 1962, pp. 655-663.*

<sup>20</sup> *The quotation above is from N.R. Shah Oon (Surat District, Gujarat), Sardar Patel University, Agro-Economic Research Centre (for Gujarat and Rajasthan), Indian Village Studies No. 13, 1968, p. 81.*

<sup>21</sup> *University of Madras Uppattur Village, (1959), op.cit.*, pp. 90-91.

<sup>22</sup> *University of Madras, Department of Economics, Agricultural Economics Research Centre Re-Survey of Aralikottai - a Dry Village in Ramanathapuram District, 1969.*

more than one-eighth of the village income. Once again it is not possible to relate specific magnitude to specific families but the study explicitly points out that capital expenditure by "medium cultivators" was made possible by the "inflow of remittances".<sup>23</sup> (In proportion to total income, capital expenditure was relatively high - one-tenth).<sup>24</sup>

Data for as many as sixteen North Indian villages (in the states of Punjab, Uttar Pradesh and Himachal Pradesh) based on surveys carried out in the period 1957-1961<sup>25</sup> reveal that (aggregated for all villages together) the majority of migrants were working males<sup>26</sup> coming from farmers' families (self employed agriculturalists households)<sup>27</sup> and urban<sup>28</sup> (indirect evidence - only a negligible minority were employed in agriculture - as well as direct evidence). Nearly two-thirds of the working migrants were young (in the age group 15-24)<sup>29</sup> although a very high proportion - indeed most - were married. From the point of view of the present interest this latter finding is however of little meaning since it refers to present marital status not to marital status at the time of migration. In spite of this latter characteristics - with many working migrants residing with their nuclear families at the urban sector - the evidence suggests<sup>30</sup> that in the case of most villages, the majority of migrants were remitting and that the amount remitted (village averages) ranged from 26 per cent to 69 per cent of migrants' income. (In two villages migrants remitted, on average, about two-thirds of their income, in three about half and in five others about a third of their income).

A comprehensive study of rural-to-urban migration in Ghana based on a detailed survey carried out at both rural and urban ends in 1963<sup>31</sup>

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<sup>23</sup> *Op.cit.*, p. 86.

<sup>24</sup> The study seems to indicate that these expenditures were incurred while the remitting migrants were still away. This may suggest fulfilment of the control of risk ("insurance") role.

<sup>25</sup> The data were originally collected by the University of Delhi, Agricultural Economic Research Centre under its Continuous Village Surveys programme.

<sup>26</sup> John Connell et al., *op.cit.*, chapter 8, table 8.11.

<sup>27</sup> *Op.cit.*, chapter 8, table 8.12.

<sup>28</sup> *Op.cit.*, *op.cit.* and *op.cit.*, p. 8-30.

<sup>29</sup> *Op.cit.*, table 8.13.

<sup>30</sup> *Op.cit.*, chapter 5, table 5.1.

<sup>31</sup> John C. Caldwell *African Rural-Urban Migration: the Movement to Ghana's Towns*, (Canberra, 1969). (See also, John C. Caldwell "Migration and urbanization" in Walter Birmingham et al. (eds.) *A Study of Contemporary Ghana*, Vol. II "Some aspects of social structure" (London, 1967), pp. 111-146).

concluded that rural-to-urban migrants were predominantly young (15-29 years of age) males and single<sup>32</sup> and that migration was accompanied by a "significant" (see below) reverse flow of remitted money and goods.<sup>33</sup> Excluding the rural Ashanti - a region which is in a far more advanced stage of development than is the rest of rural Ghana - two-fifths to two-thirds of all rural families known to have urban migrant members were in receipt of remittances.<sup>34</sup> These proportions most probably understate the true proportions since included are many families from whom migrants left just prior to the survey date and it is well understood that "migrants are least likely to remit money during the initial settling-in period when they are still unemployed or perhaps working for very low wages".<sup>35</sup> (The study also points out that concerning the rural families in receipt of remittances - with the exception of one-sixth - the flow of remittances took place without any request being made<sup>36</sup>). There is explicit evidence that nearly four-fifths of the remitting migrants have sent the money to their parents<sup>37</sup>, most at least monthly.<sup>38</sup>

The clear pattern is then of RUMOL by sons, remitting to their fathers' families.

From a study based primarily on a sample survey carried out in 1971<sup>39</sup>

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<sup>32</sup> *Op.cit.*, pp. 84-85.

<sup>33</sup> Evidence concerning absolute magnitude refers only to "average per year" which is clearly of limited significance given the hypothesized pattern of the remittances curve depicted earlier and the absence of information concerning the rank order of the year and the number of years over which remittances were made. Evidence referring merely to range-remittances constituted between one-twentieth and three-quarters of the stated income of the remitting migrants (*op.cit.*, p. 169) - is also of very limited significance. As to the intra-year frequency (regularity) of remittances and the magnitude of a given transfer, here, as in other cases (see below), the two were inversely related one to the other and affected by considerations such as effective distance, frequency of home visits and availability and capacity to use postal and banking facilities. At least to some extent frequency is determined then by "technical considerations" not by "substantive considerations".

<sup>34</sup> *Op.cit.*, p. 153.

<sup>35</sup> *Op.cit.*, pp. 153-154.

<sup>36</sup> *Op.cit.*, pp. 154-156.

<sup>37</sup> *Op.cit.*, p. 159. Both these findings may be interpreted to indicate maximization of familial net utility.

<sup>38</sup> *Op.cit.*, p. 154.

<sup>39</sup> Mohed Elowad Galal-El-Din Internal Migration in the Sudan since World War II, with Special Reference to Migration to Greater Khartoum  
Ph.D. dissertation, University of London, 1973.

it is possible to conclude that the overwhelming majority of "recent" migrants to Khartoum (that is migrants who arrived in the four years preceding the survey) came from rural areas (three-quarters)<sup>40</sup> were young (three-quarters were below 24 years of age at their arrival - but see below)<sup>41</sup> and male<sup>42</sup>. Data on marital status (for those of marital age) are not given for recent migrants only but for all those who were born outside Khartoum. The respective proportion of single males is near half<sup>43</sup> implying that, a fortiori, most recent migrants were, most probably, single. Surveyed "under special questionnaire" were all those male migrants who had arrived in Khartoum when they were 14 years of age and over. Evidence concerning remittances refers only to these hence the presence of a built-in downward bias in all estimates of urban-to-rural remittances, given that the relevant remittances question was related to the survey year. (The above migrants clearly include both those who had remitted heavily in the past but who were not doing so any longer and the very recent arrivals who have not as yet started to remit).<sup>44</sup> Even so, most migrants were found to remit "regularly"<sup>45</sup> and of these the number of those remitting to their parents' family was two and a half times that of those remitting to their nuclear family.<sup>46</sup> Adding to this that "in many cases money is taken by migrants on their revisits or is sent with relatives who visit the capital" the case for the "typical" migrant being a remitting son seems, here too, to be fairly strong.

A study which examined migration from the rural North West Frontier Province of Pakistan to the urban centres of the Punjab and Sind during 1971-72<sup>47</sup> utilized simple least-square regression models to investigate explicitly a number of remittance variables related to the question under review. Based mainly on interviews with both migrants and migrants' families at the rural sending areas, the study found that during the survey year remittances were sent by 91 per cent of the migrants. On the average migrants remitted 37 per cent of their monthly income. Explicit

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<sup>40</sup> *Op.cit.*, p. 137.

<sup>41</sup> *Op.cit.*, p. 151.

<sup>42</sup> *Op.cit.*, pp. 153-154.

<sup>43</sup> *Op.cit.*, p. 157.

<sup>44</sup> *The respective question (see op.cit., p. 233) seems to be somewhat misleading. "Do you send regular money back to your place of origin?" (Emphasis added!) Clearly those whose response was "no" should not be - though they were - classified as non-remitting migrants. This introduces a further downward bias.*

<sup>45</sup> *Op.cit.*, p. 233.

<sup>46</sup> *Op.cit.*, *op.cit.*

<sup>47</sup> *Ali Mohammad, Walter R. Butcher and Carl H. Gotsch Temporary Migration of Workers and Return Flow of Remittances in Pakistan Harvard University, The Center for International Affairs, Development Research Group, Economic Development Report No. 234, August 1973.*

evidence concerning the characteristics of the migrants is absent and therefore it is not possible to know with certainty what the respective kinship relationships were. However the actual utilization of the remittances in carrying out technological changes while the migrants were still away<sup>48</sup> suggests that other males were present with the sending rural families. (The highly significant positive relationship between urban income and the educational level of the migrants probably indicates that families have chosen as migrants the better educated ones - probably the sons rather than the fathers (See Part I, Section 2).

In any case, what is very likely is that in the absence of RUMOL the ensuing surplus accumulation and technological change would not have been incurred; a little less than half of total expenditures and nearly half of the total investment in "physical capital" by the migrants' rural families (see below) were found to have been financed by remittances.

On the basis of a study of migration to the town of Oshogbo, South West Nigeria, based in turn on a sample survey carried out in 1971-1972<sup>49</sup>, it can be concluded (referring to the year preceding the survey date) that most migrants were remitting, and nine-tenths did so regularly (3-12 times a year).<sup>50</sup> Combined with the predominance of young, unmarried men among

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<sup>48</sup> This may also be interpreted as supportive evidence to the control of risks role of RUMOL which, timewise, is actually fulfilled by the migrant member staying at the urban sector while technological change is pursued on the family farm.

<sup>49</sup> Aderanti Adepoju "Rural-urban socio-economic links : the example of migrants in South-West Nigeria" in Samir Amin (ed.) Modern Migrations in Western Africa (London, 1974), pp. 127-137.

<sup>50</sup> It is worth pointing out that a close look at the evidence seems to indicate that an inverse relationship prevails between frequency of transfers and their magnitude. See John Aderanti Adepoju Internal Migration in South-West Nigeria : a Demographic and Socio-economic Study of Recent In-migration into the Towns of Ife and Oshogbo Ph.D. dissertation, University of London, 1973, p. 188. A similar pattern seems to be suggested by the Ghanaian evidence referred to above (footnote 31). However, with regard to the question of who are the ones who remit more regularly the available evidence seems to produce somewhat conflicting accounts. The Nigerian study suggests that those whose incomes were higher - including the wage earners - tended to remit infrequently, but once they remitted, the absolute sums involved were substantial; whereas low income earners (including the self-employed) remitted more frequently, with the sums each time being small. The Ghanaian study seems to suggest that it is the wage earners who tend to remit more frequently. (Of the probable explanations stability and regularity of income stream, easier access to postal facilities (literacy) are but some). Evidence for Dar es Salaam, Tanzania, based on a survey carried out in 1971, seems to support the latter pattern with migrants who are non-wage earners being less likely to make regular remittances vis-a-vis wage earners migrants. See M.A. Bienefeld The Self-employed of Urban Tanzania Institute of Development Studies at the University of Sussex, Internal Working Paper No. 17, May 1974. This finding can be explained not only (as it is indeed

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the migrants<sup>51</sup> (much more so at the time of their migration, not at the survey point of time) the evidence (considering both the 1973 and the 1974 studies) does again permit reference to "remitting sons". There is some quantitative evidence suggesting that in the survey year the proportion of income remitted was around one-tenth across all groups of urban income earners.<sup>52</sup> This however cannot be taken accurately to reflect the true proportion since it omits money and gifts taken home at visits which were particularly frequent in the case of the young migrants.<sup>53</sup> It is also possible to infer<sup>54</sup> that about a quarter of the migrants remitted, on average, as much as the national per capita income or that on average a migrant remitted as much as three-quarters of the national per capita income and that had he not migrated the same absolute sum would have amounted to nearly a fifth of his significantly lower rural income (for which the earnings of an average full day farm labourer can be accepted as a crude surrogate). It is highly probable then that otherwise, the ensuing accumulation of "surplus" would not have been achieved.

Even if RUMOL (a) is followed then by urban-to-rural flow of net remittances which leads to accumulation of surplus and (b) is providing for the reduction of the subjective risk involved in a technological transformation, does a technological change in agricultural production at the family farm level ensue? Can then the causal relationship between RUMOL and the technological change be verified?

It is unfortunate that with but few exceptions studies which have addressed themselves to the remittances aspect of RUMOL either do not refer to the consequential rural end effects, particularly not to the impact on production technology or if they do, it is in a way which is far from being adequate from the point of view of the present needs.

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...footnote No.50 continued

suggested) by lower incomes (*op.cit.*, p. 33) but also, if less frequent transfers imply, *ceteris paribus*, smaller total transfers by the surprising finding of the survey that the non-wage earners were the earlier arrivals and were older (*op.cit.*, pp. 21 and 1 respectively) hence they probably had weaker ties with their rural families or alternatively by a somewhat greater frequency of home visits by them (*op.cit.*, p. 33) in which case transfers were probably made by the migrants themselves, deferred until their home visit.

The main operative implication from the point of view of the present interest is that the regularity aspect as such is of limited significance. Once more, aggregation of all sums of remittances say over a number of years is essential.

<sup>51</sup> John Aderanti Adepoju (1973) *op.cit.*, e.g. p. 64.

<sup>52</sup> *Op.cit.*, p. 189.

<sup>53</sup> *Op.cit.*, p. 173.

<sup>54</sup> See *op.cit.*, pp. 189-191.

Referring to the latter situation, the tool most frequently used is a simple questionnaire. This however is far from being a perfect device not only because the respective questions are frequently put to the migrant who (as has already been pointed out) being located in the urban end is not best positioned to inform a researcher that an ensuing rural end technological change has already been incurred but also because - and regardless of who is being approached - tags can hardly be tied to remittances; it is the consequent release of other resources which causally relates (or may fail to relate) a transformation to a RUMOL produced accumulation of "sufficient surplus".<sup>55</sup>

The straightforward implication seems then to be that there is no escape from nor, for that matter, any excuse for failing to examine farm families before, during and after RUMOL - along with other families differing only in their RUMOL performance - so as to record changes in total resource endowments, in composition of expenditures and in production behaviour. As pointed out below this suggests then that at least from the point of view of the issues under review the usefulness of studies does critically depend on their capacity to capture and devise a multi-dimensional enquiry - across families, through time (- at different points of time along the RUMOL process).

This relates to the obvious specific point which nevertheless should be explicitly mentioned, that the mere presence of the time factor will tend to produce completely different responses to questionnaire enquiries and hence possibly diverse interpretations to otherwise "uniform" situations. The analysis of the preceding parts and the evidence already referred to in the present appendix have clearly indicated that technological change is a "lagged response" to RUMOL. Achieving its role in accumulating surplus and provision of risk control is time consuming and therefore the observed rural end consequences say two and a half years after RUMOL will most probably be totally different from those observed say after a year. Some short term reactions to RUMOL by the migrant's family may even contrast with the longer term responses. There is no need to specify what observations confined only to the former time span may lead to.

In the absence of desirable evidence a coerced scrutiny of available evidence is unavoidable. A number of case studies (or quasi-case studies) have touched upon or captured evidence bearing on the causal relationship between RUMOL and technological change and it is to the examination of these studies that the following few paragraphs will turn.

In a study which draws heavily on "practical experience of a decade and a half of economic work in Africa"<sup>56</sup> an examination of African agri-

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<sup>55</sup> To exemplify note respectively the above mentioned studies by John Aderanti Adepaju (1973) where the question "what is the money sent home used for?" (*op.cit.*, p. 193) was put to the urban migrants and by John C. Caldwell (1969) in which this very same question was put to rural families in receipt of remittances (*op.cit.*, p. 159).

<sup>56</sup> Andrew M. Kamarck *The Economics of African Development*, Pall Mall Series on International Economics and Development (London, 1967).

culture at large points to the key role played by labour migration in the "transition from subsistence to market agriculture". On identifying and scaling different stages in this transition, it is pointed out that it is acquisition of the required capital which enables African farmers to become "progressive farmers"; "work experience outside the traditional environment ... very often serves as a means to accumulate capital to invest in farming by the purchase of better farm tools and equipment".<sup>57</sup>

A comprehensive study of tropical Africa which draws heavily on field investigation of thirteen areas chosen to constitute a "reasonably representative sample" (according to pre-selected criteria of variability)<sup>58</sup> concludes that "surprising[ly] ... much development has taken place in tropical Africa with comparatively little or no credit". Granted that the availability of surplus is a critical pre-condition of such a development, the generation of "savings for investment in agriculture" must thus account for this development. It is in this context that the following point is made: "... the migrant labourer often saves a surprisingly large proportion of his meagre pay to take back or transmit to his native locality ... [-] cash which can be devoted to productive purposes provided there is a sufficiently strong interest in, and opportunities for, development" (pp. 198-199).<sup>59</sup>

In a paper which draws on "the author's experience selling agricultural chemicals to small farmers in Uganda and Kenya"<sup>60</sup> the nature of the key argument is more categorical. "Remittances from migrants in the high wage sector ... are a significant source of working capital for the smallholder sector." Working capital, being "both a constraint and the source of the ability to increase output and adopt new techniques", is necessary "to take advantage of productive opportunities in the smallholder agricultural sector". (Emphasis added. From here only a short step is required to facilitate an argument that the very intensity of the incentive to migrate is directly related to the "net return" which can be obtained "through the use of remittances as working capital on the farm").

A study of RUMOL from Kharga Oasis<sup>61</sup> which lies in a low depression west of the Nile, Egypt, to the Nile Valley argues - concerning that "migration type" which is "the norm" - that "it is not the mere concern

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<sup>57</sup> *Op.cit.*, p. 105.

<sup>58</sup> John C. de Wilde *Experiences with Agricultural Development in Tropical Africa*, Vol. I "The synthesis" (Baltimore, 1967).

<sup>59</sup> It should though be noted that migration of labour refers here to "migration of labour not only between rural areas and town but [also] from one agricultural area to another" *op.cit.*, p. 51.

<sup>60</sup> Alan Rufus Waters "Migration, remittances and the cash constraint in African smallholder economic development" *Oxford Economic Papers* (New Series), Vol. 25 No. 3, November, 1973, pp. 435-454.

<sup>61</sup> A.M. Abou-Zeid "Migrant labour and social structure in Kharga Oasis" in Julian Pitt-Rivers (ed.) *Mediterranean Countrymen: Essays in the Social Anthropology of the Mediterranean* (Maison des Sciences de l'homme: Recherches Méditerranéennes, Etudes 1, Paris 1963) pp. 41-53.

of the individual who migrates. It is rather the whole family who decides on who among its members should migrate, ... how long a migrant should stay away ...". Once migration takes place, with the resulting "increase of cash in the hands of the people, new projects are contemplated for drilling new wells or rather cleaning the long neglected Roman wells". "Investment in such projects" by these families thus facilitates a major change in the nature of the cropping pattern (of millet, wheat and rice) by way of reducing the "sense of insecurity" which arises out of "the erratic nature of the water supplies".

From a study of a Hokkien Chinese agricultural community - the Hsin Hsing village in Pu Yen Hsiang, Chang-hua county (in the west-central coastal plain) Taiwan, conducted in 1958-1959<sup>62</sup> it is not possible to infer beyond doubt that it is the surplus accumulated due to RUMOL (chiefly to Taipei) which has facilitated a switch from traditional rice crops to cash crops such as vegetables (- a switch involving a "gamble")<sup>63</sup>, from cultivation in the "traditional manner" to "improved agricultural methods". Nevertheless it does seem that such is most probably the case.

The nexus between labour migration, though not only RUMOL, accumulation of surplus ("cash") by the migrants and a shift from "subsistence sweet-potato cropping" to "cash producing" (of coffee as well as of cattle) is reported to have prevailed in the case of Koroba and Pangia (sub-districts in the Southern Highlands district) Papua New Guinea.<sup>64</sup> Such has been the case in the late sixties but this is also expected to continue, with RUMOL featuring "as a means of providing funds for investment projects".

In a study based on "empirical investigations" into two "representative villages" (Vijvaharia and Surdahpur Raja in the district of Gorakhpur, East Uttar Pradesh) in north India, conducted in 1961,<sup>65</sup> a major "economic consequence" is reported to derive from the fact that "emigrants continually send money to their relatives left behind in the villages". The ensuing "significant ... influence on village society" is "the effect of technology" with farmers investing "more money than before" on the purchase of mechanical implements, fertilizers" as well as other agricultural implements and oxen of superior breed. (Emphasis added).<sup>66</sup>

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<sup>62</sup> Bernard Gallin *Hsin Hsing, Taiwan: a Chinese Village in Change*, (Berkeley and Los Angeles, 1966), especially pp. 125-126, 276.

<sup>63</sup> Enabled by portfolio diversification in RUMOL ?

<sup>64</sup> G.T. Harris "Labour supply and economic development in the Southern Highlands of Papua New Guinea" *Oceania*, Vol. 43, No. 2, December 1972, pp. 123-139.

<sup>65</sup> Rampal Singh Gaur and G.S. Nepal "Causes and consequences of rural emigration in East U.P." *Journal of Social Research*, Vol. 5, No. 1, 1962, pp. 145-154.

<sup>66</sup> A similar "impact" i.e. "introducing technology" through a purchase - facilitated by migration - of "agricultural implements such as chaff-cutters, hand pumps and improved type of ploughs" is reported in

The econometric study of RUMOL from the rural North West Frontier Province of Pakistan to the urban centres of the Punjab and Sind to which reference has already been made<sup>67</sup> also stresses the crucial role of remittances for "rural investment in physical capital and education" ("physical capital" standing for "physical capital and productive inputs" - "seeds, fertilizers, minor agricultural apparatus, construction and repair of farm buildings, a pair of bullocks"). Nearly half of the "total investment in physical capital" and practically all expenditures on education<sup>68</sup> are accounted for by remittances.

In spite of diverse methodologies and orientations these studies do seem to tell a story, the general recurrent theme of which appears to be a priori awareness of a superior technology, combined with removal by RUMOL of the constraints hindering its adoption. But, together with other studies earlier referred to - and most of many more which were not - they also illuminate and re-sharpen critical weaknesses and deficiencies in the current state of the RUMOL knowledge. By implication they identify the minimal contours in a design of empirical investigations which should go a long way in furnishing researchers with appropriate data concerning the real and full nexus of causes and effects in the case of the RUMOL phenomenon.

The need for collecting disaggregated data of which development economists have been clearly aware is one such contour though perhaps insufficient emphasis has been placed on focussing observations at the rural family level in the particular context of RUMOL. To a large extent, this need can hardly be met by single point questionnaires directed at a single "homogeneous" group - the migrants or their rural families. It may demand from the questionnaire tool "more than it can deliver". Of course, a questionnaire aimed at collecting cross-section data based on a large number of independent observations (referring to many families at different stages in the RUMOL process) may, in principle, by holding constant

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...footnote No. 66 continued

*the case of Rampur another village located in Gorakhpur district. S.L. Srivastava "Impact of emigration on structure and relations in a village in Eastern U.P." Journal of Social Research, Vol. 11 No. 2, 1968, pp. 73-86.*

<sup>67</sup> Ali Mohammad, Walter R. Butcher and Carl H. Gotsch (1973) *op.cit.*.

<sup>68</sup> As has already been mentioned, the study has utilized simple least-squares regression models to determine the effects of "educational level" on migrant's income and of migrant's income on the level of his remittances. In view of the statistically significant results (with the respective variables having positive signs) it is tempting to postulate that the "investment in education" of other family members is an "intermediate strategy" deliberately aimed at enhancing the level of remittances to be derived from their future migration and urban employment - with these remittances being fully utilized to facilitate a technological change.

the effects of all other variables correlated with RUMOL, provide the necessary background for analysing the functional relationship between, e.g. surplus, risk and RUMOL. But whether in practice such a coverage can be achieved (with the well-known advantage of overriding the problems of simultaneity which confront data of the time series type) is open to doubt. A far better exploitation of the survey method could well be to collect cross-section data over a number of distinct points of time. The stronger case (at the same time perhaps the unavoidable minimum) seems however to be for combining such cross-section data collection with some form of direct "participant observation" and perhaps dissection of certain types of documented information. Referring explicitly to the surplus and risk factors, the structure of rural credit and insurance markets, the capacity to engage say in self-insurance (the success or failure of risk averse small farmers to reduce risks by (for example) shifting them onto others) the degree by which the "objective risk" inherent in a new technology is surpassed by subjective risk and the extent by which the differential is made up by the migrant member having a somewhat secured independent urban source of income, the changes in production technology which finally follow the successful removal via RUMOL of the surplus and risk constraints, all these require more than even an elaborate questionnaire. Reference, e.g. to bank records of applications for credit could help to fill lacunae with a good example for discerning causal relationship being provided by the case where RUMOL is observed to follow a turning down of such applications.<sup>69</sup>

The need to observe rural families rather than (only) their migrant members has already been emphasized. The need to learn about that RUMOL causality which is conceptualized in the present paper by including in the rural end survey population non RUMOL families, should however be stressed. This need originates even in less strong statements that the palpable way to prove that RUMOL has acted as a catalyst for technological change is to show that none would have taken place in its absence.<sup>70</sup> Apart from an obvious "control group standardized for the relevant variables" consideration it derives from a plausible comment that the present paper's analytical constructs should be interpreted to suggest that in the real world, where strict dichotomies are rarer, the propensity to produce RUMOL is higher for those family units whose credit and risk constraints are stricter, that the "intensity" of technological changes incurred by families which do exercise RUMOL is higher than that of similar ones which do not (the latter need not be - from the point of view of transforming production technologies - absolutely stagnant), and so on.

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<sup>69</sup> Note however that since in many cases RUMOL may take place when the available surplus is negative (i.e. the family is in debt) negative response to an application for credit may never be recorded - an application will not even be made when the chance of it being approved is nil.

<sup>70</sup> Such is of course a formidable experiment though if substitute procedures and analytical methods are utilized, e.g. comparisons of total family budgets at distinct points in time as well as comparison with non RUMOL families as suggested in the text, a surrogate experimentation is possible.

From the vantage point of the requirements of the present argument and the current state of general knowledge concerning the mechanisms which elicit RUMOL, studying then longitudinally fifty families over a five year period - where some of these families are non RUMOL ones, the rest at different stages of RUMOL - may, most probably amount to a better use of given evidence searching efforts than interviewing say twenty times as many families at a given point in time.

Finally, in addition to the "direct" approach for collecting data which ensues as a natural implication to the foregoing analytical structure, a brief reference is due to an alternative "residual" procedure for testing the functional relationship between technological change and RUMOL lying at the heart of that structure.

An empirically oriented enquiry can clearly set out not only from a RUMOL plateau but also from a technological change plateau. Observation can be directed towards (the sample population be composed of) family units "registered" as having shifted their production technology. Given the surplus requirements and the risk characteristics of a new technology as elaborated in Section 1 of Part I, the ensuing assumption is that these must have been provided for, externally and/or internally. If a close look at the rural market and non-marked mechanisms external to the family unit eliminates the possibility that it is they which have assumed the full burden of the surplus and risk requirements involved in the technological change, the implication will clearly be that the family unit itself must have generated the means to meet them - on the farm and/or "from" RUMOL. If the conclusion then reached is that the observed families can hardly be assumed to have produced "any margin above the barest subsistence income" (e.g. saleable hoards) without engaging in RUMOL, the credit for the provision of surplus and insurance would have to be assigned to RUMOL.

It seems that none of the available studies of technological change at the family farm (such as the farm management studies) have utilized this procedure, nor do they lend themselves to such a utilization. Once more the analyst is faced with a situation where "the range of feasible analytical methods is rigidly constrained by past decision".<sup>71</sup> It is perfectly possible that with but modest increase in research effort future studies in this field will, in such a "reverse" direction, facilitate empirical verifications of the analytically suggested nexus between RUMOL and technological changes.

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<sup>71</sup> Henry S. Shryock, Jacob S. Siegel and associates *The Methods and Materials of Demography*, U.S. Department of Commerce, Social and Economic Statistics Administration, Bureau of the Census (second printing (revised) Washington, May 1973), chapter 25 "Some methods of estimation for statistically underdeveloped areas", p. 811.

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