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Relationship between Migration and Fertility Decisions in Rural Sectors of LDC's

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This paper investigates how the implication of rural-urban migration for the rural fertility rate in LDCs is influenced by the ways the reward from this migration is generated and utilized by the rural family. It is shown that to maximize the capital stock needed for agricultural transformation parents in the rural sector send the children to the urban sector and invest the resulting capital (generated from remittances and agricultural surplus which would otherwise be consumed by migrating children) for upgrading the production technique. This family migration decision makes the family demand more children when they provide both utility and needed supplies of capital compared to the situation when they provide only utility or both utility and direct labor input to family production. Under the scenario, the rural fertility decision is also linked to different urban parameters. The analysis suggests that different problems of underdevelopment are interrelated and a lopsided attempt to separately cure any one of them might intensify other problems.

I. Introduction

Along with a high rate of population growth, two other important demographic characteristics usually observed at the early stages of development of less developed countries (LDCs) are (1) huge rural to urban migration and (2) higher fertility rate in the rural sectors relative to that in the urban sectors. In spite of a vast and growing literature focusing on each of the problems separately, and in spite of common wisdom that problems of underdevelopment are interrelated, only a few attempts (see Katz and Stark (1986), Lee and Farber (1985)) have been made to see whether these two aspects of development (or underdevelopment) have any connection with each other, or whether trying to solve any one of the problems separately might intensify the other problems.

In an insightful study about the rural fertility rate, Katz and Stark (1986) linked fertility decision to migration decisions. They concluded that in less developed countries (LDCs) in the presence of rural-urban migration opportunities if migrant children have altruistic motives to remit, the rural fertility rate will be higher than when migrant children have selfish motives to remit.[1] While the selfish motives to remit result from the optimization of individual interest, family's interest gets the highest priority in the altruistic motive. It is this family that also becomes crucial in a family decision like the fertility decision. In that respect, although the

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1. Altruistic motives put emphasis on family's well-being even though the person in question might not gain individually. Selfish motives in their paper include the desire to partake in the family's mutual insurance scheme. See also Lucas and Stark (1985).

effort to compare the fertility rates for two different motives for remittances (Katz and Stark (1986)) enhances our understanding of the problem, it makes us wonder whether the fertility decision can be related to migration more meaningfully if instead of motives to remit, motives for migration are looked into. More specifically, the question is how fertility decision is affected by migration when this migration decision itself (rather than remittance decisions) is a family decision (where family works on a sphere of altruism, see Stiglitz (1969) and Bhattacharyya (1985)) as opposed to an individual decision.[2]

Using this altruistic attitude this paper investigate how the relation among fertility, migration and reward from migration is influenced by the ways this reward is generated and is utilized by th rural family. The fertility decision in this paper is not related to migration opportunities that are random individual choices, it is systematically woven into a migration behavior that is a rational family decision under the circumstances.[3]

The typical rural family in the LDCs realizes that to get out of the vicious cycle of poverty the family needs to change the primitive methods of production. The main problems that this family faces for agricultural transformation are (a) lack of ownership of investment capital and (b) limited access to a properly functioning credit market. These force the rural family to go outside the rural sector to look for the capital needed for agricultural transformation and it reorganizes its resource utilization accordingly.[4]

The paper show that, to optimize the objective of building the capital stock needed for agricultural transformation, parents send their children to the urban sector and invest the resulting capital for upgrading the production technique. This creates a motivation for having more children. Thus the family makes a rational family migration decision which naturally influences its fertility decision. Under the scenario the analysis of the relation among fertility, migration and agricultural transformation in this paper results in the following conclusions:

a) When the investment capital generated from children's migration is used for agricultural transformation, the demand for children would be higher than what it would be if children provide only utility or both utility and direct labor input for family production or if the reward from migration is used as additional consumable income.[5] Thus this analysis would explain

2. Although recently attention is given to the differences in objectives or preferences among family members within the household and to the possibility of strategic interactions, in the rural sectors of LDCs where the means of survival are of prime concerns, the unity among family members to fight poverty is very visible. Individual differences very seldom get a chance to show their presence, although a few incidents would not be hard to come by.
3. For this family migration decision the migrant himself/herself does not make the decision to move and the migrant is not motivated by his/her own personal gain. The family or the head of the family sends some members (e.g., children) to the urban sector if it is best for the family's interest. This is called a family decision about migration where the expected wage differential between the rural and the urban sectors is neither necessary nor sufficient to induce migration, because migration includes other types of return apart from the wage differences (see Stiglitz (1969) and Bhattacharyya (1985)).
4. The data compiled in All India Rural Credit Survey (1954) reveal the financial position of cultivators in rural India. Since the farming is operated at the subsistence level, savings or generation of capital is not at all feasible. The proportion of farmers indebted is more than fifty percent and they have a very poor repayment performance because loans are tied to high rates of interest and unfair deals. Khusro (1968) points out that this is valid for most of LDC's rural sectors.
5. A vast body of research on fertility rates has focused on different motivations for having children. Becker (1960),

the rural-urban fertility rate difference better than what has been done so far. This happens because not only the true shadow price of children becomes less than the observed price by the amount of the gain generated by the investment capital, but also the difference between these prices is higher in this case than that in any other case. The gain from this investment capital acts as a consumption subsidy for the parents while the rural family diversifies risks involved in agricultural pursuits.[6]

b) Furthermore, within the framework of this model the rural fertility rate becomes related to the parameters of the urban sector such as urban wage, urban consumption etc. In this model when the rural family decides to send their children to the urban sector, child migration contributes to the problems of huge migration from the rural to the urban sector of LDCs. The existing literature on rural-urban migration suggests that any increase in the urban wage will create more migration. By contrast, this paper shows that an increase in the urban wage may reduce the need for sending children to the urban sector and also the demand for children in the rural sector.

c) It is shown that, if the expected wage differential hypothesis for rural-urban migration is accepted, the policy of lowering this difference by raising the rural wage will reduce not only migration but also the rural fertility rate. The rise in the rural wage is likely to reduce the demand for children in this model more than what is observed in models where children provide only utility or both utility and direct labor inputs for family production.

Instead of pursuing their previous policies of forceful family planning only, the governments of a number of LDCs have recently combined family planning measures with other social and economic welfare measures for controlling population growth rates. The implications of the model in this paper justify this approach.

Apart from providing an analysis which would enhance the explanation of the rural-urban fertility rate difference in LDCs, the present study reevaluates and reemphasizes the importance of looking at the interrelationships among various aspects of underdevelopment and reminds us how a lopsided effort to separately cure any one of the problem might intensify other problems. For example, the literature on growing rural-urban migration suggests that the economic disparity between the rural and the urban sector needs to be reduced to lower the exodus of rural population. According to this model, even though migration of children constitutes only a part of the total rural-urban migration, an attempt to modernize the method of production or to increase the rate of growth of per capita income in the rural sector without paying attention

Easterlin (1968), Gardner (1972), and Dutta and Nugent (1984) among many others help to have an idea about how children's roles in the family affect fertility decisions.

6. It must be noted that the existing literature has focused on different ways of reducing risks in agricultural production in the rural sector. The objective in this paper is to show how rural-urban migration together with the fertility decision can be used as a means of diversification. This paper does not intend to compare different methods of reducing risk in agricultural production. It shows that the interrelationship between these two demographic decisions explain the rural-urban fertility difference better than what has been explained so far and at the same time it also serves as a tool of reducing the production risk in the agricultural sector.

to the inadequacy of the rural capital market may raise the population growth rate and rural-urban migration. Therefore, policies designed to reduce the economic disparity between the rural and the urban sector need to be reevaluated within the context of interconnectedness of problems.

The following section presents the model. The comparative static analysis is shown in Section Three. The last section concludes after the summarization of the results.

II. Model

Before presenting the model that relates family's fertility decision with its migration decision, I would show what happens when each decision is taken separately.

Fertility Decision: children used as sources of joy[7]

In this part it is shown that while making its fertility decision, if a typical rural family uses children only as sources of joy even when there is inadequate supply of capital, the family will be in a suboptimal situation. Consider a representative rural family with a farm of fixed size, where all consumption and production decisions are made jointly by the parents (husband and wife). Suppose parents receive utility according to a quasi-concave, smoothly rising and differentiable utility function

$$U = U(n, x, z), \quad (1)$$

where n = child service,[9]

x = a rural commodity,

z = an urban commodity.

The family wants to maximize its utility subject to its constraints (time and resources). To reduce nonessential complexity, it is assumed that the husband devotes his entire time, T_H, in the family business or family farm production. The wife, however, can divide her full time, T_W, into family farming (T_F), nonfarming activities (T_{NF}), childraising (T_n) and the production of the rural good (T_x).[10]

Since the wife participates in the wage employment (nonfarm sector), her wage $W = Pf'_F$,

7. If the family uses children for production purposes or for both consumption purposes (as sources of joy) and production purposes, the choice between using them directly in farm production and sending them to the urban sector becomes crucial. The analysis of this choice is explained in the next part.
8. *n, x,* and *z* are substitutable to some extent.
9. If N_0 is the initial stock of children then $n = \alpha N_0$, where α is the fixed rate of flow of service per child. It is assumed that qualitative relationships between parameters affecting child quantity and child service are identical. The higher demand for children would therefore imply the higher demand for child services.
10. This rural commodity represents a composite of other services enjoyed by the family.

where W wage rate and $Pf_F =$ value of wife's marginal product in the farm sector. So the wife's full income = $T_w W$.[11]

The family has a non-earned income, A. The farm family knows that its farm production is subject to uncertainty because of its vulnerability to unpredictable climatic conditions. If q is the probability of having favorable weather, and $(1-q)$ is the probability of natural disaster, then the family farm production generates the expected income Π where

$$\Pi = P\{qf(T_H, B(K)T_F, Q) + (1-q)(T_H, B(K)T_F, Q)\} - \phi_K K - WT_F - \phi_Q Q$$

$$= PEf - \phi_K K - WT_F - \phi_Q Q,$$

$P =$ price of farm output,

$Ef =$ expected farm output,

$\phi_K =$ price of capital,

$\phi_Q =$ price of Q,

$Q =$ a composite of other inputs such as seeds, fertilizer, etc., needed for production.

This farm production uses only family labor, purchases seeds and fertilizers and hires the capital input K which can be used only to introduce some form of technological changes (e.g., for using some new machines on the farm to increase production). If B is the technological parameter, then $B = B(K)$ with $B(0) = 1$, $B'(K) > 0$, and $B'' < 0$. For its capital requirement, the family relies on the capital mobilized by the government from the urban sector. Since the objective of the government of a LDC is to help the rural sector, family farmers can hire capital services at a low price fixed by the government. (See Khusro (1968)).[12]

Child services and the rural commodity are produced according to the following production functions:

$$n = h(T_n, S_n),$$

$$x = g(T_x, S_x),$$

11. This does not imply that opportunity for wife's wage employment is pervasive in LDC's rural sector. Nevertheless the opportunity does exist to a degree and this is more for finding the opportunity cost of wife's time.
12. For example, in India through the five year plans, the Indian Government tried to provide low cost credit to farmers. The government helped to build co-operative credit system and community development program for this purpose. See Readings in Agricultural Development by A.M. Khusro (1968, p.240-261 and p.452-463). The articles also show that this is true for Pakistan and some other developing countries.

where

T_i = wife's time in producing i,

S_i = some purchased goods used in producing i,

$i = n, x$.

The urban commodity z is obtained through trade with the urban sector. $p_n(=p_s S_n + WT_n)$ is the consumption price of child services and, $p_x(=p_s S_x + WT_x)$ is the consumption price of the rural commodity where p_s = price of purchased goods used for the production of n and x. p_z is the price of the urban commodity. The price of the urban commodity in terms of the rural commodity $p(=p_z/p_x)$ is given (small economy assumption). The family thus, maximizes $U = U(n, x, z)$ subject to a full income constraint I where

$$I = T_W W + A + \Pi - p_n n - p_x x - p_z z. \tag{2}$$

The solutions of this optimization problem would suggest that parents would be demanding children and other two goods up to a point where marginal utility equals marginal cost for each of the commodities. The derived demand for the wife's farm time, capital services, and the composite input is determined when the value of the marginal product of each of these inputs equals the respective input price.

Although the government tries to supply the rural sector with capital, this supply usually falls short of demand. The family-farm's demand for capital can, thus, only be satisfied at a suboptimal level. The rural family does not have any better alternative but to live in this suboptimal state unless something is done to boost capital supply in the rural sector.[13]

Family Migration Decision: children used as suppliers of capital[14]

The objective here is to explain why, if the family decides to use children as suppliers of the needed capital to cure the suboptimal situation, it prefers to send them to the urban sector instead of directly employing them in farm production an how this family migration decision as opposed to individual migration brings forth the sectoral components that can eventually be manipulated to help the rural families. Since the capital market is imperfect and the credit

13. Even if the family tries to buy highly priced capital from the urban sector, it would still suffer from a suboptimal choice problem because of the budget constraint. Since it would not then be able to choose something else optimally. Note, that inclusion of urban commodity in the utility function does not make any difference, except that it helps to portray a more realistic picture where urban and rural sectors are engaged in trade.
14. Children in this part do not enter directly into family's utility function. Family's utility now depends on a composite rural good (where children's presence is taken into account) and an urban good. For this part the cost of raising children before their productive capacity matures is included in S_x.

market is inefficient, the peasant family usually has very little bargaining power when, as an alternative sources of capital it turns to private sources (rich landlords) for loans. The rates of interest or the condition of the loan are such that the peasant family runs the risk of defaulting. If the family defaults in repaying the loan, then this ultimately results in the distress sale of land or other collateral owned by the family (see Appelbaum and Katz (1991), and Cain (1981)). The family therefore reorganizes its resources so that it can (a) generate adequate capital needed for agricultural transformation, and (b) reduce the risk involved at the same time. The family can choose one of the following two options.

Once the productive capacity of the children has matured, the children can directly participate in family production and generate a stream of income, which the family uses as capital needed for agricultural transformation. Alternatively, it can send its children to the urban sector. This migration would build up the additional capital stock from (a) the agricultural surplus generated from the savings of the output used for the consumption of those children before migration, and (b) the remittance sent by the children.

But each one of these two options is subject to uncertainty. The agricultural sector as it is mentioned before (see the expression for Π on page 81) faces uncertainty due to its dependence on nature, and migration to the urban sector gives rise to uncertain income because of the uncertainty involved in getting a job once the migrant is there. The family will choose that option which gives the higher expected income. Let's suppose that v is the probability of being employed in the urban sector, and $(1-v)$ is the probability of being unemployed. On the other hand, as already used in describing uncertainties in production, q is the probability of a successful crop in the agricultural sector and $(1-q)$ stands for the probability of a crop failure due to the bad climatic conditions.

Either because of a deeper sense of altruism or because of some form of intrafamily contract, total farm output or income net of purchased input cost is divided equally among its members. Suppose that this per head output or income is $\bar{a}$ which is also the required per head consumption.[15] After the productive capacity matures, if a child is employed in family farming, his earnings, say $\bar{a}$, would be the additional earnings or savings for the family. But if the child moves to the urban sector, $\bar{a}$ becomes one of the two sources of savings. (Note that when the child leaves, the family looses child's marginal product, $\bar{a}$. Still this family saves because $\bar{a} > \bar{a}$ i.e., average product > marginal product). The other source is the remittance sent by the migrant child. W_u is the urban income earned by a migrant child if employed, and C is the per head urban consumption. Since the types of jobs available in the urban sector require skills different from the skill needed for farming, the family will face a difference in education cost in sending the children to the urban sector. The family allocates this additional cost equally over its planning periods. Suppose the per period cost is L. So $W_u - C - L$ is the size of the remittance that the family can use. The family would be evaluating the present value of the expected income stream of a child from each of the sectors once the productive capacity of the child matures. This discounted expected income of a child in the rural sector over two periods, for example, is

15. Note that this per head consumption is of a basket of goods, *x* and *z*, on which per head income is spent.

$$Ef_r = \{q \cdot \bar{d} + (1-q) \cdot 0\} + \gamma[q[\{q \cdot \bar{d} + (1-q) \cdot 0\}R] + (1-q) \cdot 0 + \{q \cdot \bar{d} + (1-q) \cdot 0\}] \quad 0$$

For a successful crop in the first period, the expected income is $q \cdot \bar{d}$; otherwise, it is zero. In the next period, the expected income from a child would be expected value of that period's total income (which is made up of this period's income and the return on previous period's income. R is the rate of return on investment in agriculture). For simplicity, we are assuming that both q and υ stay the same for all the periods, and the family discounts the expected income at the same rate γ. The urban sector, on the other hand, provides the discounted expected income

$$\begin{aligned} Ef_u = & \{\upsilon(W_u - C + \bar{d} - L) + (1-\upsilon)(-C + \bar{d} - L)\} \\ & + \gamma[q[\{\upsilon(W_u - C + \bar{d} - L) + (1-\upsilon)(-C + \bar{d} - L)\}R] \\ & + (1-q) \cdot 0 + \{\upsilon(W_u - C + \bar{d} - L) + (1-\upsilon)(-C + \bar{d} - L)\}]. \end{aligned} \quad (4)$$

If successful in getting a job, the migration sends the remittance $(W_u - C - L)$ to the family and the family also gets the agricultural surplus $\bar{d}$. The net savings in that case would be $(W_u - C - L + \bar{d})$. If unemployed, the migrant needs C from the family. Thus, the net saving or dissaving in case of unemployment is $(-C + \bar{d} - L)$. In the following period, if there is no crop failure, the family gets the return on investment of the first period's savings and also the new savings form the urban sector. It is assumed here that once the migrant gets the job in the first period, he or she keeps it for the following period. In the event of a crop failure in the period following the first period, the family ends up with $\upsilon(W_u - C + \bar{d} - L) + (1-\upsilon)(-C + \bar{d} - L)$ when there is migration. Otherwise, family ends up with no income. The family would not be willing to send anybody to the urban sector if $Ef_r = Ef_u$. Therefore, we have:

Proposition 1: The family will send a child to the urban sector since $Ef_u > Ef_r$.

Proof: Since uncertainties due to nature are usually more unpredictable and uncontrollable than uncertainties involved in getting a job in the urban sector, it would be rational to assume that $\upsilon > q$. In spite of the uncertainties in getting a job in the urban sector the rural family is considering migration. This would suggest that $\upsilon > 1-\upsilon$. The net returns from these sectors are assumed to be equal i.e., $(W_u - C - L) = \bar{d}$.[16] The expected income from each sector

16. The literature on rural-urban migration mostly uses Harris and Todaro's expected wage differential concept to explain migration. In this paper my objective is to show that even if there is no wage gain net of cost from the urban sector, the family would be encouraged to send migrants to the urban sector because there are additional

is positive; otherwise they would not be viable alternatives. The first terms and the last element in the second terms of the RHS of Equations (3) and (4) are the same. Comparing, we find that

$$\{v(W_u - C + \bar{d} - L) + (1-v)(-C + \bar{d} - L)\} > \{q \cdot d + (1-q) \cdot 0\}, \tag{5}$$

because usually $(C + L - \bar{d}) \leq d$, i.e., although the total expenses for the migrating child, $C + L$, are expected to be higher than the expenses if they stay home, it is reasonable to assume that the difference between these two expenses, i.e., $C + L - \bar{d}$ is not greater than d, the expenses for the child in the rural sector.

Following the argument and the evidence (see Katz and Stark (1986)) that the return on investment in agriculture is an increasing function of the amount of investment, at least in the initial period, the comparison of the first elements of the second terms shows that

$$\{v(W_u - C + \bar{d} - L) + (1-v)(-C + \bar{d} - L)\} R > \{q \cdot d + (1-q) \cdot 0\} R. \tag{6}$$

So $Ef_u > Ef_r$.[17]

The expected income of a child is higher if the child is sent to the urban sector than if the child stays in the rural sector, because in case of natural disaster the agricultural sector does not provide any income while the urban sector at least can provide $\{v(W_u - C + \bar{d} - L) + (1-v)(-C + \bar{d} - L)\}$ for that period. The family only loses the previous period's investment and the return on that investment. Even in the absence of crop failure, migration to the urban sector would be preferred because it not only helps children to send the remittance which equals net reward from the family production, but in addition, it also creates the agricultural surplus $\bar{d}$. So the family is not only generating a higher income stream but also spreading its risk across sectors.

After evaluating its options, the family will send its children to the urban sector. The family saves $\bar{d}$ for each migrant child. The total savings $(= \bar{d}$ times $n)$ is called the surplus from agriculture generated by the migration of children. The amount generated from remittance payment is $G = n(W_u - C - L)$. So the total funds available for investment in agricultural transformation (dK) is given by $n\{W_u - C - L) + \bar{d}\}$.[18]

sources of gains. This assumption therefore, is much weaker than the usual assumption where W_u-L-C > d. This just would show the robustness of the conclusion.

17. Thus, this happens not only because the initial earnings resulting from migration are higher, but also because of the positive relation between the return on investment in agriculture and the amount of investment, as least in the initial periods. Equation (6) can be manipulated to show that $v(\bar{d} + d) + (1-v)(\bar{d} - (c + L)) > q \cdot d$.

18. This part shows family's preference for migration when children are used for production purposes only. Note that the family's utility under such circumstances (not presented in this part), would depend on x and z only and the family would demand each of these goods up to a point where marginal utility equals marginal cost for each of them. The derived demand for each input is determined where marginal product of each input equates

the respective input price. Children here are indirect inputs that enhance the capital supply. The demand for children is determined when $\frac{dK}{dn}$ = observed cost of raising children.

Family Fertility and Family Migration Decision: children used both as sources of joy and as providers of capital[19]

Finally, under this heading family's fertility decision is presented when children are used both as consumption items and also as providers of investment capital. If the capital needed for improving agricultural production techniques is generated from children's migration, the family's demand for children would be higher than if the children are used only as sources of joy or both as sources of joy and as direct participants in family production. Thus, the analysis of the interrelationship between fertility decision and migration decision will explain the rural-urban fertility difference better than what has been done so far. If the family knows that it can also use its children as providers of capital, it will maximize Equation (1) subject to the full income constraint I' instead of I to decide on the optimum number of children and other goods. The difference between I and I' is that the term Π in Equation (2) has been replaced by Π'. We can then write

$$I' = T_w W + A + \Pi' - \phi_n n - \phi_x x - \phi_z z, \tag{7}$$

where

$$\Pi' = P\{qf(T_H, B(K')T_F, Q) + (1-q)f(T_H, B(K')T_F, Q)\} - \phi_K K - WT_F - \phi_Q Q$$

$$= PEf - \phi_K K - WT_F - \phi_Q Q$$

and

$$K' = [n\{(W_z - C - L) + \bar{d}\}] + K.$$

The first order conditions are

$$U_n + \lambda PEf' B_n T_F[\{(W_z - C - L) + \bar{d}\} + n\bar{d}'] - \lambda\phi_n \leq 0 \text{ or } n = 0, \tag{8}$$

$$U_x - \lambda\phi_x \leq 0 \text{ or } x = 0, \tag{9}$$

$$U_z - \lambda\phi_z \leq 0 \text{ or } z = 0, \tag{10}$$

$$PEf_F B - W \leq 0 \text{ or } T_F = 0, \tag{11}$$

$$PEf_K B_K T_F - \phi_K \leq 0 \text{ or } K = 0, \tag{12}$$

19. Children become one of the arguments in the utility function and also participates as providers of capital.

$$PEf_Q - P_Q \leq 0 \text{ or } Q = 0, \tag{13}$$

$$I' - T_w W - A - \Pi' + \phi_n n + \phi_x x + \phi_z z \geq 0. \tag{14}$$

$\bar{a}' = \frac{\partial \bar{a}}{\partial n}$, assuming α is constant.

Therefore we have:

Proposition 2: The true cost of children is less than their observed cost when children provide utility (as consumption items) and also generate capital stock needed for agricultural transformation.

Proof: After manipulating Equation (8), we get

$$\frac{U_n}{\lambda} = -PEf' B_n T_F [\{(W_w - C - L) + \bar{a}\} + n\bar{a}'] + \phi_n, \tag{15}$$

$\phi_n =$ observed cost.

$\phi_n - PEf' B_n T_F [\{(W_w - C - L) + \bar{a}\} + n\bar{a}'] =$ true cost.

So true cost is less than observed cost.[20]

According to Equation (15), parents do not compare marginal utility from children with the observed cost. The observed cost is reduced by the gains due to technological innovation in the process of production made possible by the capital invested from remittances and agricultural surplus.[21] The parents compare marginal utility to this reduced cost and demand more children. The true shadow price of children takes into account the benefits of technological progress made possible by investing the resources built from remittances and the agricultural surplus. Children here not only provide utility to their parents, but also contribute to the transformation of agriculture or the transformation of the mode of production via migration. Note that the differences between the true cost and the observed cost is higher when capital is generated via migration than when it is generated from children's direct participation in family production. Conditions 9 to 14 are the usual first-order conditions denoting that the

20. It helps to note that P_n is the cost of rearing a child up to the age when the child's productive capacity matures. After that time, savings, $\bar{a}$, could be the cost if they stayed with the family and L is the education cost spread over the planning period which is incurred only if the family decides to send the child to the urban sector.
21. The first term on the right hand side of Equation (15) suggests that if children are employed directly in the family farm instead of migrating to the urban sector, then the gain from investment will be lower. The observed cost would not be reduced as much and the demand for children would be lower.

marginal utility of each of the composite goods should be equalized to its shadow price, productive service should receive according to the value of its marginal product and the total family expenditure should equal the total family income. The full shadow price of each of the composite consumption goods is equal to its cost. But the full shadow price of children includes some elements which depend on the number of children; and, therefore, it is endogenous. The gains due to technical progress are used as consumption subsidies. Even if the technical progress is labor-saving, $\Pi' > \Pi$ and the conclusions would hold.

Thus, while making a fertility decision, if the rural family considers it's migration decision the family will plan in a special way. If the productive capacity of the children matures in period $t < J$, then the family will maximize

$$V = \sum_{j=1}^{J} \gamma_j U(n, x, z)$$

subject to

$$I = \sum_{j=1}^{J} (T_{xj} W \gamma_j + A\gamma_j) + \sum_{j=1}^{t} \gamma_j \, PEf(T_H, B(K_j) T_{Bj}, Q_j)$$

$$+ \sum_{j=t+1}^{J} \gamma_j \, PEf\,[T_H, B[n_j\{(W_x - C - L) + \overline{d_j}) + K_j] T_{Bj}, Q_j]$$

$$- \sum_{j=1}^{J} \{\gamma_j (\phi_{nj} n_j + W T_{Fj} + \phi_{Qj} Q_j + P_{Kj} K_j + \phi_{xj} x_j + \phi_{zj} z_j)\}.$$

Once the time subscripts and the discount factors are added in, the first order conditions will resemble Equations (8)-(14). The implication is that the demand for children in the rural sector under the scenario will be higher than that in other cases because parents use children not only as consumption items, but also as catalysts for generating the additional stock of capital needed for agricultural transformations though rural-urban migration.

As it has been noted earlier, very little research has been done on the relation between fertility decisions and migration. Specially, for LDCs micro level data are not available to build any connection between them. Therefore, it is impossible to provide any direct evidence in support of this relationship. However, sporadic evidence on the importance of family decisions is available primarily through case studies of villages and districts. For example, Savla (1973) found that in two districts (in the states of Maharastra and Gujrat) in India characterized by heavy migration, it was the cultivating households, and not the landless laborers, who were sending members of their family to urban areas. In Table 1, compiled from Sovani (1966), it is seen that the proportion of households sending migrants to towns is highest among the farm operators in two districts in the state of Orissa in India. Schutjer, Stokes and Poindexter (1983) argued that size of operational holdings has a positive effect on fertility. If farm operators are the groups engaging in family migration decision, earning remittances from urban areas and if farm operators have higher fertility, we might not be hard pressed to think about a

link between migration decisions and fertility decisions. Of course, we must keep in mind that it is not a hard evidence to support the conclusions. But with the lack of the data, it should be taken as a possible implication of the survey studies that have taken place so far.[22]

Table 1 Proportion of Total Households Sending Migrants to Urban Areas Classified by Occupation in Cuttack and Puri Districts (1954-55)[a]

Occupation (1)	Total # of households (2)	# of households sending migrants to towns (3)	Proportion of (2) to (3)
Cuttack			
Farm operators	16,259	2,257	13.8
Agricultural labor	3,074	152	4.9
Trade	240	6	2.5
Services	175	-	-
Industry	1,055	12	1.2
Total	20,803	2,427	11.7
Puri			
Farm operators	7,386	541	7.3
Agricultural labor	1,194	45	4.0
Trade	34	16	4.7
Services	114	-	-
Industry	788	37	4.7
Total	9,516	639	6.7

[a] Source: survey data for Hirakud dam area cited in Sovani (1966).

III. Comparative Static Analysis

The response of the quantity of children demanded to the change in various parameters can be shown by totally differentiating the first order conditions and computing the relevant partial derivative for n^* (see Appendix, page 94).

Wife's Wage Effect

The effect can be denoted as

22. Even after considering the fact that no micro-level data are available, a reflection on Table 1 and the implication of this model suggest that if some forms of area household survey data can be made available (either for a village or for a district) one could regress family's fertility rate on a migration dummy (which is 1 if the family has a migrating member otherwise it is zero) controlling for family per capita income, value of assets like cattle, land, etc. and education to check whether migration has any effect on fertility. In addition, one could select only the migrating household and regress fertility rate on the amount of remittance while controlling for per capita income of the family, education and volume of assets. These would provide some preliminary findings which future research can develop on.

$$E_{nW} = E_n \pi_n^F (\alpha_n - \alpha_x) + \sum_{i=1}^{I} \phi_{nW} + \sum_{i=1}^{I} \frac{\gamma_i T_{ss} W E_I}{I}.$$

$E_n \pi_n^F =$ own compensated price elasticity of children. $E_n P_n^F < 0$ by the second order condition. P_n^F is the true shadow price of children. E_I is the income elasticity of n.

$$\alpha_n = \sum \frac{\gamma_i t_n W}{\pi_n} ; \alpha_x = \sum \frac{\gamma_i t_x W}{\pi_x = \pi_x^F}$$

If children are more time-intensive commodities i.e., $(\alpha_n - \alpha_x) > 0$, the first term would be negative. Since $\pi_n > \pi_n^F$ because of the gain in investment capital even when children and the rural commodity are equally time-intensive, the first term would be negative, i.e.,

$$\frac{t_n W}{\pi_n^F} > \frac{t_x W}{\pi_x = \pi_x^F}.$$

Thus, it appears that, even if market prices and household production characteristics are identical, the compensated effect on fertility will differ between the two populations if children are used as financial intermediaries in one of them.

The second term in the wife's wage effect Equation, ϕ_{nW}, is the elasticity of demand for children with respect to the wife's wage, considering that both children and the wife participate in raising family income. For example, as W increases, the wife devotes less of her time to family farming, and family income from farm production goes down. So the volume of agricultural surplus out of the prospective migrant child goes down. Since the gain from children as investment intermediaries acts as a consumption subsidy for parents, the demand for children goes down as investment surplus goes down due to a rise in W. The gap between the present value of marginal utility of the stock of children and their capitalized cost is no longer made up as much as it was before by the gain derived from the use of children as financial intermediaries. The third term shows the regular income effect which depends on the income elasticity and the share of the wife's income in the total family income.[23]

The uncompensated elasticity of child demand with respect to the wife's wage depends on the strength of the positive income elasticity (assuming children are normal goods) compared to the compensated own-price elasticity of demand for children and the degree of complementarity between the wife's time and children in their contribution to the family's wealth.

If children were only consumption items and not catalysts for generating investment capital, the second term would vanish and the observed cost π_n would be the true cost. In

23. If the observed income elasticity for children is the same irrespective of whether children are considered as financial intermediaries, and if it exceeds zero, the true income elasticity will be higher for a family where children act as financial intermediaries than for a family where they are not financial intermediaries. This is because of the fact that increase in the demand for children following a rise in income will increase family's consumption subsidy or will reduce the shadow price of children. The family then will demand more children.

this model, therefore, any rise in W makes a reduced demand for children more likely compared to the model in which children are considered only as consumption commodities, and also compared to the model in which children are used directly in the production process and also function as consumption items. When children participate directly in the production process, the second term would raise the demand for children because children would be substituted for the wife's time when W increases.

Urban Wage Effect

$$E_{n W_u} = \sum_{i=1}^{I} \bar{E}_{n W_u} + \sum_{i=1}^{I} \phi_{n T_{Fi}}.$$

Both the number of children and the urban wage play a positive role in building up the stock of investment capital, thereby helping to modernize the family farm. The first term on the right hand side of this equation shows that, when W_u goes up, the family might consider reducing the number of children and investing the time and resources saved in other activities - if they want to maintain the same level of investment capital.

Everything else remaining unchanged, an increase in W_u means an increase in the ability of the migrant children to send more remittances. This remittance payment, as explained in Section Two, would provide an increase in the consumption subsidy, so that the family would be able to afford more children. Furthermore, this remittance payment will increase the productivity of the wife's time in the agricultural production. Since W is exogenously given, this implies that the use of T_{Fi} will go up. The rise in T_{Fi} will have two effects: (1) The complementarity between the demand for children and T_{Fi} in farm production will increase the demand for children, (2) However, less time will be available for raising children. So the demand for children shown by $\phi_n T_{Fi}$ would depend on the relative strength of these two factors. The final effect on $E_n W_u$ would be ambiguous.

Output Price Effect

An increase in P increases the value of current d. It also increases the gain from the technical progress. These two factors reduce ϕ_n^F and therefore the demand for children goes up. Furthermore, a rise in P raises the value of marginal product of all inputs used in production. So the supply of T_{Fi} might go up. This also affects the demand for children positively.

IV. Conclusion

This paper shows that, for a rural family in a less developed country, demographic decisions such as fertility decision and migration decision are interrelated. Katz and Stark (1986) have shown that the effects of migration on fertility rates would depend on the motivation to remit

and according to them migration would have a bigger effect on fertility if there is an altruistic motive to remit as opposed to other selfish motives to remit.

However, a fertility decision is a family decision. In my paper it is related to migration when migration is also a family decision, i.e., the interrelation between fertility and migration has been studied from the altruistic attitude.

Thus, the paper focuses on the family migration decision rather than th individual migration decision. The motivation for this decision comes from rural families' desire to build a capital stock that is needed for agricultural transformation and which is not otherwise available because of imperfect capital markets and inefficient credit systems. The paper shows that the effect of migration on fertility works itself not only through remittance payment but also through an additional gain called agricultural surplus. This agricultural surplus is generated from the saving of the output that would otherwise be consumed by the children if they would not have migrated.

Furthermore, the analysis of family migration decisions in this paper explicitly brings in the sectoral parameters that might affect the relevant decision making process. It provides policy makers with the choice of manipulating these parameters, if necessary, for controlling fertility rates.

Finally, the paper shows that along with enjoying the children as sources of joy when the investment capital generated from children's migration is used for agricultural transformation, the demand for children would be higher than what it would be if children provide only utility or both utility and direct labor input for family production or if the reward from migration is used as additional consumable income. Of course, one could argue that two simultaneous benefits would always generate higher demand than just one benefit. But it would be prudent to note that it is not only the number of benefits or uses that are important, but also how the benefit is generated and utilized for maximum effectiveness is significant. For example, in this paper, the use of children both as sources of joy and as suppliers of capital has been modeled in a way that exposes the link between two important demographic decisions. In fact, this paper provides the structure to explain a well-observed phenomena that for certain groups of people in the rural sectors of LDCs high rural-urban migration coincides with high fertility rates. Furthermore, two simultaneous benefits of having children (utility and direct labor participation) have been modeled before, but the analytic framework in this paper explains the rural-urban fertility rate differences more than whatever we have seen so far. The effect of migration on fertility is determined not only by the amount of the gain generated from migration but also by the way this gain is utilized. The use of the capital generated from children's migration for agricultural transformation provides the family with additional incentives to demand more children. In this analysis larger gain from migration does not come only from larger amount of migration and lower remittance does not mean lower fertility rate.

Although the help from migrating children is needed in the process of agricultural transformation, the model can be used to show that once the steady state equilibrium is reached, if the gain from children's migration in a particular period is more than what is needed by the family for agricultural transformation, then carrying this extra cash to the next period not only reduces the demand for children and all other goods, but also reduces the steady-state capital stock of the rural sector. Perhaps that could be a topic of future research.

In the final analysis, the paper therefore suggests that problems of development are interconnected so that any lopsided attempt to cure only one of them separately, will jeopardize the entire development program by intensifying other problems.

Although the recognition of this interconnected of the problems of underdevelopment is not something new, the modeling of this interconnectedness has not received much allocation so far. In this paper the analysis shows explicitly the structure of the interrelationship between two important demographic characteristics, so that it can be used for policy prescription.

Appendix A

$$[\sum(U_{nn}\gamma_i)+\sum\lambda\gamma_i P[(Ef''B_n^2T_F^2+Ef'B_{nn}T_F)[\{(W_u-C-L)+\overline{d}\}+n\overline{d}']^2$$

$$+\sum\lambda PEf'B_nT_F(2\overline{d}'+n\overline{d}'')\gamma_i]]dn$$

$$+[\sum\gamma_i(PEf'B_nT_F[\{(W_u-C-L)+\overline{d}\}+n\overline{d}']-\phi_n)]d\lambda$$

$$+\sum(\gamma_iU_{nx})dx+\sum(\gamma_iU_{nz})dz$$

$$=[\sum\gamma_i\lambda P(\{Ef''_{w_u}B_{w_u}T_FB_nT_F+Ef'B_{nw_u}T_F)[\{(W_u-C-L)+\overline{d}\}+n\overline{d}']n+Ef'B_nT_F)]dW_u$$

$$-[\sum\gamma_i(\lambda Ef'B_nT_F[\{(W_u-C-L)+\overline{d}\}+n\overline{d}')]]dP$$

$$-[\sum\gamma_i(\lambda P(Ef''_{w}B_nT'_FB_nT_F+Ef'B_nT'_F)[\{(W_u-C-L)+\overline{d}\}+n\overline{d}']-T_n)]dW$$

$$+[\sum\gamma_i\lambda P(\{Ef''_CB_CT_FB_nT_F+Ef'B_{nc}T_F)[\{(W_u-C-L)+\overline{d}\}+n\overline{d}']n+Ef'B_nT_F)]dC \quad \text{A}$$

$$\sum(U_{xn}\gamma_i)dn+\sum(U_{xz}\gamma_i)dz+\sum(U_{xx}\gamma_i)dx-\phi_xd\lambda=\lambda T_xdW \quad \text{B}$$

$$\sum(U_{zn}\gamma_i)dn+\sum(U_{zx}\gamma_i)dx+\sum(U_{zz}\gamma_i)dz-\phi_zd\lambda=0 \quad \text{C}$$

$$(\sum\gamma_iP(Ef''_FB_nT_FB+Ef_FB_n)[\{(W_u-C-L)+\overline{d}\}+n\overline{d}'])dn$$

$$=-\sum(PEf_{FF}T''_FB^2-1)\gamma_idW-(\sum P(Ef_{Fw_u}B_{w_u}T_FB+Ef_FB_{w_u})\gamma_i\cdot n)dW_u-\sum\gamma_iEf_FBdP$$

$$+(\sum\gamma_i(PEf_{Fc}B_CT_FB+PEf_FB_C)n)dC \quad \text{D}$$

$$(\sum\gamma_iP(Ef''_KB_nT_FB_KT_F+Ef_KB_{Kn}T_F)[\{(W_u-C-L)+\overline{d}\}+n\overline{d}'])dn$$

$$=-[\sum\gamma_i(PEf_{KF}BT''_FB_KT_F+PEf_KB_K)]dW$$

$$-[\sum\gamma_iP[(Ef_{Kw_u}B_{w_u}T_FB_KT_F+Ef_KB_{Kw_u}T_F)n]dW_u$$

$$-\sum\gamma_iEf_KB_KT_FdP+[\sum\gamma_i(PEf_{Kc}B_CT_FB_KT_F+PEf_KB_{Kc}T_C)n]dC \quad \text{E}$$

$$[\sum\gamma_i(PEf'B_nT_F[\{(W_u-C-L)+\overline{d}\}+n\overline{d}']-\sum\phi_n)]dn$$

$$-\sum(\phi_x\gamma_i)dx-\sum(\gamma_i\phi_z)dz$$

$$=\sum\gamma_i(T_w+PEf_FT''_FB[\cdot]-nT_n-xT_x)dW$$

$$+\sum\gamma_i(Ef)dP+[\sum\gamma_iPEf_{w_u}B_{w_u}T_Fn]dW_u-\sum\gamma_i(PEf_CB_CT_Fn)dC \quad \text{F}$$

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