The Pakistan Development Review
Vol. XXIV, No. 2 (Summer 1985)

Landholding, Rural Fertility and Internal Migration in Developing Countries: Econometric Evidence from Cross-National Data

R. E. BILSBORROW and C. R. WINEGARDEN*

We develop an empirical model of the interaction of rural fertility and rural-urban migration which incorporates the effects of landholding patterns. Cross-section data for 26 developing countries are used to test the model. The statistical results support the hypothesis of a positive relationship between fertility and out-migration in the rural sector and lend credence to some of the propositions regarding the impact of landholding patterns. A reduced form of the model is derived from the statistical results, and its policy implications are considered.

I. INTRODUCTION

The importance of the agricultural sector in the process of economic development has been widely documented [43; 44; 76]. Government policy statements at the World Population Conference in Bucharest (1974) and subsequently, together with a mushrooming literature, have stressed the interrelationships between demographic variables and socio-economic change. Since most of the population in developing countries lives in rural areas, it follows that the relationships between the demographic factors and agricultural change must be especially important in the development process. It is in these areas that poverty is deepest and continued high fertility frustrates efforts to slow population growth. Rural areas also supply growing numbers of migrants to hard-pressed cities, a paramount concern of many governments in the Third World [85]. A better understanding of the economic-demographic interrelationships within the rural sectors of developing countries is thus crucial for a better policy formulation.

*The authors have made equal contributions and are listed in alphabetical order. They are grateful to the Carolina Population Center, University of North Carolina at Chapel Hill, and the Department of Economics, University of Toledo, with which they are respectively associated, for logistical support; and to Jack Molyneaux for yeoman research assistance. They are also grateful to Scott Grosse and Frances Kobrin for helpful comments on an earlier version of this paper which was presented at the Annual Meeting of the Population Association of America, San Diego, California, April 29 – May 1, 1982; and to two anonymous referees for helpful comments.

Nevertheless, little is known about the interrelationships between population changes and economic development in rural areas, and even less about the role of landholding patterns. The existing literature has been concerned mainly with isolated aspects of the relationships, or with specialized studies of individual countries. Little formal statistical analysis has been carried out, and the interaction of landholding, rural fertility, and out-migration appears to have been particularly neglected. In this paper, we try to fill some of this gap.

The paper is organized as follows. Section II reviews the relevant theoretical and empirical literature, Section III discusses the data used, Section IV presents the econometric model, and Sections V and VI set forth the empirical findings and their policy implications. The concluding section (Section VII) summarizes the results and provides some caveats.

II. THEORETICAL AND EMPIRICAL BACKGROUND

In this section, we first briefly review the relevant literature on the determinants of fertility and migration, and then consider how changes in fertility and migration may be interrelated over time.

(A) The Determinants of Fertility

A variety of theoretical approaches to the determinants of fertility exist, based on different disciplinary perspectives. Until the 1970s, most of this work was carried out by sociologists and demographers, and suggested a wide range of factors as influencing fertility, including education, women's employment status and location of work, place of residence (current as well as original), family background (parents' socio-economic characteristics and fertility), social class, health, land and other assets, and family planning use [20; 28; 31; 32; 39]. The complementary approach of economists has its origins in Leibenstein [49] and Becker [6] and was further developed in T. W. Schultz [68; 69], T. P. Schultz [67], Turchi [83] and others. It conceptualizes the various factors influencing the demand for children through "price" and "income" effects. For example, under normal conditions the demand for children will increase with an increase in the family income and a reduction in the costs of raising children. Since a major cost includes the opportunity cost of the mother's time in child rearing, and since this cost is a function of level of education, the demand for children is negatively related to level of education.[1] Actual fertility is a function of factors influencing not only the "demand" for children but also their supply, viz. the knowledge and use of fertility-regulating methods [12; 20; 21].

While the theory generally refers to the micro or household level, there does exist a considerable body of literature on the aggregate changes in fertility over time

[1] See, for example, UN [84]; Simon [74]; Williams [88]; McGreevey *et al.* [53]; and Cochrane [16].

in the present-day developed countries. In the absence of adequate time-series for most contemporary developing countries, investigators interested in examining the factors influencing their patterns of fertility decline have relied mainly on cross-country statistics. (Recent references include Faruquee [27] and Winegarden [89; 90]. For a survey see Mauldin and Berelson [52]).

Unfortunately, this considerable literature has little to say about the relationships of special interest in the present paper. That is, there is little evidence on the effects of agricultural land on rural fertility, although some limited evidence exists. For example, from the historical studies of European populations, Knodel [47, p. 125 ff] and Coale *et al.* [15, pp. 60–67] observed positive relationships between the size of landholdings and fertility in the nineteenth century Germany and Russia, respectively. In an early and influential piece, Stys [78] observed a strong positive relationship between family size and women's fertility in Poland. In Sweden, smaller landholdings were also associated with lower fertility [25]. Similarly, in the U.S., Easterline [23] argued that fertility declined over time with increasing population density – the ability of farmers to bequeath land to their children declined with the disappearance of unused "frontier" land.

The effect of land on fertility has received far less attention with respect to contemporary LDCs.[2] Moreover, the evidence is not conclusive. Merrick [54] found only a slight negative relationship between rural population density and fertility for "microregions" in Brazil, while Collver *et al.* [17], Chaplin [13], Kleinman [46], Hicks [41], Rosenzweig and Evenson [65], Aghajanian [1] and Seligson [71] observed stronger relationships for Taiwan, Peru, India, Mexico, Iran, and Costa Rica, respectively. Irfan and Farooq [42] observed a positive relationship up to 20 acres in Pakistan and a negative one thereafter. Hermalin and Lavely [40] recently observed a negative relationship between farm size and fertility in Taiwan.[3] In empirical work, a complicating and unresolved issue has been how to measure the land availability variable: is it the size of the cultivable plot or its *ownership* that influences fertility? Schutjer and Stokes [70] have asserted that land ownership is anti-natalist because it provides a form of old age security which is an alternative to that provided by children. But ownership also provides a more secure basis for children to contribute to family income when they are young. Thus, the net effects of ownership are indeterminate *a priori.* Some evidence on this question will be presented below.

(B) The Determinants of Migration

The substantial literature on the determinants of migration has recently been surveyed in UN [84], Shaw [73], Greenwood [36], Todaro [81], Ritchey [62],

[2] Recent surveys are provided by Stokes *et al.* [77] and Schutjer and Stokes [70].

[3] Stokes and Schutjer would interpret this as reflecting a tendency for higher-income households to develop high aspirations

Da Vanzo [18] and Bilsborrow *et al.* [10]. Factors influencing people's decisions to migrate are thought to include relative income and employment conditions in origin and destination areas, educational levels and access to education, land availability and population density, family ties, and the relative availability of health and other amenities across areas. Beginning with Sjaastad [75], economists developed a theory of migration which asserts that individuals strive to maximize expected income over time and space, but it is clear that many other factors are also involved in individual migration decisions. Unfortunately, except perhaps for education, these other factors are often difficult to measure at the areal or country level; so macro-modelling of rural-urban or interregional migration flows has focused on income differences and other economic variables [63; 64]. One investigation which has gone beyond this approach is Mundlak [57]. He investigated factors influencing rates of out-migration of the labour force from agriculture across a mixture of 70 developed countries and LDCs. He found the rate of out-migration positively related (and statistically significant) to the urban-rural income differential, the ratio of the non-agricultural to the agricultural labour force (a measure of absorptive capacity), the level of education, and the rate of population growth. The results for the last-mentioned variable are of particular interest, suggesting a role for demographic "push" variables. However, both of the last two variables were measures for the country as a whole rather than for rural areas. Moreover, since the rate of population growth is not a direct measure of *either* fertility or population density, the mixture of countries raises questions about the relevance of the findings for LDCs [7], and the dependent variable is the migration of only a select portion of the rural population.

Although the literature on migration is rich and rapidly growing, empirical evidence of the explanatory variables of particular interest for the present study is limited and inconclusive. Again, some evidence from the European fertility studies is relevant.[4] Knodel [47, Ch. 5] observed that the (expected positive) relationship between rural density and out-migration across administrative areas of Germany largely disappeared when the level of development was taken into account, and Anderson [3] observed a positive effect of rural density on out-migration from rural areas of European Russia to Asiatic Russia but not to urban areas of European Russia.[5]

Given the importance of land to all aspects of life in rural areas of LDCs, it is surprising that there has not been more empirical work on the effects of size of landholding on out-migration in contemporary LDCs at either the micro or areal level. But Shaw [72] observed a significant positive effect in several Latin American countries, as did Kessinger [45] in an in-depth, longitudinal study of a village in India.

[4] Among the many references are Knodel [47], Coale [14], Coale *et al.* [15], and Tilly [80].

[5] However, the statistical results are quite weak. A lack of relationships was found in the historical studies of Knodel [47, Ch. 5] on Germany and Anderson [3] on Russia.

Other examples, largely descriptive and derived from the anthropological and geographical literatures, are cited in Bilsborrow [8] for Uganda, Nigeria, Puerto Rico, and Chile. Finally, there are three other relevant cross-country studies on factors influencing rural-urban migration rates. Firebaugh [29] observed the expected effect of land in a cross-section of Latin American countries, using census data. Preston found a significant positive relationship between rates of rural natural *increase* and rural-urban (out-) migration, but specifically cited his omission of "important unmeasured variables such as rural density" [61, p. 12]. Nevertheless, in an earlier cross-country analysis based on 1950–1960s data, Annable [2] found rural density to be insignificant in his rural-urban migration function.[6] And, finally, as with fertility change, the form in which land availability influences out-migration remains to be determined empirically.

(C) The Interrelationships between Migration and Fertility

The theory of the demographic transition was expanded by K. Davis [19] and Friedlander [33] to allow a wider range of demographic responses to increased rural population density instead of considering fertility decline only. Davis conceptualized the responses as "multiphasic", including increases in the age at marriage, out-migration, and even infanticide, in addition to reductions in fertility. But a linked inverse relationship between the two most general possible responses – decline in fertility and out-migration – was not explicitly postulated until Friedlander noted the interrelationship in contrasting the historical responses to increased density in France and Sweden. We may infer that the greater the out-migration the less the need for fertility to fall; and the greater the fertility decline the less the "vent for surplus" of out-migration [8].[7]

[6] Annable's work was based on 27 countries and included as the dependent (endogenous) variables the rate of rural-urban migration and the size of the urban traditional sector. There are a number of problems, unfortunately, with the variables in the migration function, including the way the dependent variable is measured as the rate of urban population growth minus that of the total population. The extent to which the procedure yields valid measures cross-country depends not on compensating differences in age structure (as the author states on p. 400) but on the extent to which urban-rural fertility and mortality differences cancel out [85]. His measures of the size of the urban traditional sector and of the urban-rural wage gap leave much to be desired as well, leaving moot the question of whether rural density has positive effects on out-migration.

[7] This conceptualization of the responses to rural population pressures may be too narrowly demographic. It does not admit the possibility of major economic responses, as it assumes the supply of land and technology to be inflexible. Boserup [11] suggests that its Malthusian-Ricardian assumption of constant technology is incorrect: as arable land becomes scarcer relative to population, land may be used more intensively. For example, more of the land may be irrigated, or devoted to multiple cropping (more than one crop per year on the same land). Examples illustrating increases in land-intensifying technology are indicated in Grigg [38] and Bilsborrow [8]. To the extent such land intensification occurs, the other responses are *less* likely. In a little-known aspect of his article on fertility, Stys [78] noted an inverse relation between the size of the family's landholding in Poland and out-migration of children. General surveys on the interrelationships between migration and fertility at the micro level include Goldstein [35] and Oberai [58].

III. THE DATA

The observations relate to the 26 developing countries for which all necessary data could be obtained for the relevant time periods.[8] The small number of observations reflects the combined effect of the paucity of both demographic and economic data for the *rural* sectors of developing countries.[9] By limiting the observations to LDCs, we may have made it more difficult to produce significant regression results, but we have acquired some immunity to cluster and outlier effects: see [7].

Apart from sample size, there is the problem of data quality. In addition to the usual caveats pertaining to cross-national data for LDCs, there are further difficulties associated with the measurement of rural fertility and the estimation of internal migration rates, the two key dependent variables in this paper. The estimation of fertility (total fertility rates) was particularly complex because of the well-known lack of reliable published estimates for rural areas. Moreover, for purposes of this project, it was not desirable to use the crude birth rates employed in most cross-country studies because of the effects of migration on the age-sex distribution. A number of data sources were used to ferret out what we believe to be reliable estimates, mainly using the U.S. Bureau of the Census [87].[10] In the majority of cases, no separate estimates of rural fertility were available, so they were approximated using data on total fertility rates – children ever born or child-woman ratios, and the proportion of women of childbearing age living in rural areas.[11]

The computation of net rates of rural-urban migration is even more problematic because of the different definitions of "urban" and because of the difficulties in separating out that proportion of city/town growth resulting from reclassification of contiguous areas through annexation. In general, the data source was the UN [87],

[8]The data are available on request from the authors. The countries included in the sample, listed by present names, are; Benin, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Egypt, Guatemala, India, Indonesia, Iran, Jamaica, Kenya, Korea (Republic of), Malaysia, Mexico, Nicaragua, Pakistan, Panama, Paraguay, Peru, Philippines, Sri Lanka, Thailand, Uganda, and Venezuela.

[9]Data on landholdings are from Food and Agriculture Organization [30]. Other economic data (except as noted below), literacy, and life expectancy at birth are taken from the World Bank [91]. Other demographic data are described below in the text.

[10]Other sources for the 1960s period, for one or more countries, were Ominde [59], and "Women in Development" data tape of the U.S. Bureau of the Census. Census data, reported in the UN Demographic Yearbooks, provided figures for the child-woman ratios and the urban-rural numbers of women aged 15–49. Far more fertility data are available for the 1970s (from the WFS and other sources), but we could not use them because the latest detailed agricultural data from the FAO World Census of Agriculture relate to the period around 1960 [30].

[11]The procedure was as follows:

Let F = total (national) fertility, F_R = rural total fertility rate, F_U = urban total fertility rate, C_R and C_U = the corresponding child-woman ratios or children ever born, and w = proportion of women of child-bearing age in the country in rural areas. Then

$$F_R = F \cdot C_R/[C_R w + C_U (1\text{-}2)].$$

which computed migration rates by subtracting observed national growth rates from observed rural rates of population growth. This approach was accepted after noting that there were only minor discrepancies with estimates which incorporated adjustments for differential urban and rural survival rates [87, p. 22].[12] Inability to separate out effects of reclassification also creates "noise" in the data, but in the only available sample of (four) developing countries it was found to be only 20 percent of net migration on the average.

The analytical limitations of the cross-sectional approach are widely known. In the present case, however, it has not only the virtue of necessity, given the extreme scarcity of historical data for developing countries, but also the positive advantage of utilizing the widely varying conditions prevailing in these countries. This great range of variation probably simulates the effects of long-term processes far more realistically than the limited experience of a particular country.

IV. THE MODEL

In order to test the hypotheses regarding interrelationships among fertility, migration, and landholding patterns in the rural sector, we develop a two-equation stochastic model. The general form of the model is:

$$RF_{it} = f(M_{it-k}, L_{it}, X_{it}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

$$M_{it+k} = f(RF_{it}, L_{it}, X_{it}) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

where RF is the (rural) total fertility rate, M the rate of rural-urban migration, L a vector of exogenous variables measuring land use and landholding, and X a vector of exogenous control variables. The i subscript denotes the rural sectors of a cross-section of developing countries. Both t and k are time subscripts which pertain, respectively, to *circa* 1960 and to the decade preceding $(t-k)$ or following $(t+k)$ that year. On the basis of the discussion in Section II above, the rural fertility and migration variables are hypothesized to be positively related. The land variables, it should be noted, are intended to gauge landholding effects independently of the influence of income factors which are included among the control variables.

It is evident that this model is recursive. To some degree this may be justified *a priori.* Only after a period in which population pressures are reduced by out-migration does it seem likely that fertility will increase; conversely, pressures on living standards associated with high fertility also intensify over time, as young children grow into workers and adult consumers. There is, in addition, a straightforward

[12]Mundlak [57] made a parallel assumption regarding the measure of migration of the agricultural labour force. Ledent [48] noted that our approach rarely results in non-trivial errors.

empirical consideration in that efforts to validate a simultaneous (non-recursive) model were not unsuccessful, whereas the recursive structure yielded conceptually defensible results. This suggested to us that the true relationships may be best reflected with a lag structure, although the specific periods used in this model represent mainly an accommodation to available data rather than dominant theoretical considerations. Also, it should be noted that temporal ordering increases the plausibility of a causal interpretation, although it does not conclusively establish causation.

The generalized relationships of equation (1) are specified in detail below. Variables are presented in unsubscripted form to simplify notation. Except where otherwise noted, the time reference is to 1960 or the available year closest to 1960.

$$RTFR = a_0 + a_2\, MLAG + a_3\, Ln\, AGY + a_4\, SMALL + a_5\, CONC + a_6\, OWN + a_7\, ADENS + a_8\, LIT + a_9\, EX + a_{10}\, (EX)^2 + u_{RTFR} \qquad (1.0)$$

where

- *RTFR* = total fertility rate in rural areas;
- *MLAG* = rural-urban migration, average annual rate, 1950–60 (in percent of rural population at the beginning of the period, viz. 1950);
- *Ln AGY* = natural logarithm of GDP per agricultural worker (in U.S. dollars)[13];
- *SMALL* = small-holder index: i.e. number of agricultural holdings in the 1–5 hectare range as percentage of all agricultural holdings of one hectare or over[14];
- *CONC* = concentration index: i.e. percentage of total *area* of all agriculture holdings (1+ hectares) in holdings over 50 hectares, *divided by* percentage of total area of holdings in the 1–5 hectare range;
- *OWN* = land ownership index: i.e. percentage of all agricultural holdings owned by their operator;
- *ADENS* = agricultural density: i.e. number of persons in the agricultural labour force per hectare of agricultural land;
- *LIT* = literacy rate for the adult population (in percentage); and
- *EX* = mean expectation of life at birth, 1955-60 (in years).

Predicted signs of the estimated parameters are indicated below, followed by a brief justification for the expectations.

[13] GDP in local currency was converted to dollars, using the prevailing exchange rates, then deflated to 1967–69 prices for purposes of uniformity, and further adjusted for differences in internal purchasing power parity (per Summers, Kravis, and Heston [79]).

[14] Except for a subsample of countries, the FAO data exclude holdings under one hectare. It appears, however, that the extent of holdings under one hectare is reasonably well represented by the 1–5 hectare data.

$$a_2, a_3, a_6, a_9 > 0$$

$$a_4, a_5, a_8, a_{10} < 0$$

$$a_7\ ?$$

A positive (and significant) estimate of a_2 would be consistent with the hypothesis that out-migration serves as a demographic safety valve in helping to maintain high rural fertility.

Inasmuch as *AGY* is a proxy for the income of agricultural workers, a positive sign is anticipated for its coefficient when the impact of other variables has been taken into account. This conforms to prevailing micro-economic theory, which postulates that the "pure" income effect on fertility is positive; see reviews in Simon [74] and Mueller and Short [56].

The next three variables in the equation – *SMALL, CONC,* and *OWN* – pertain to the distribution of land and the prevailing forms of tenure. The greater the concentration of landholdings in the small (1–5 hectare) size category, the lower the productivity of child labour on the farm, the smaller the economic value of children, and, in turn, the lower the expected fertility (following a line of reasoning developed by Mueller [55]). Concentration in the *ownership* of agricultural land is expected to be antinatal in that it implies that a few landowners have very large plots and the majority of these plots are too small to benefit from additional family workers. Ownership by those who work the land (as distinguished from tenancy and sharecropping arrangements) seem likely to have a positive effect on fertility, in the sense that children make a positive contribution to output on family farms (as well as provide old-age security).

The *ADENS* variable has been used to take into account the influence of the labour-intensity of land use in the base period. Such intensity varies greatly among countries, depending on the quality of land, crops grown, extent of livestock grazing, farming technology, and other long-standing historical differences. The expected effects of *changes* in density are reflected in the coefficient of *MLAG;* the sign at the *ADENS* coefficient is, therefore, not predicted.

Literacy generally acts to lower birth rates, according to a now substantial body of literature on the effects of education on fertility [16; 52; 53; 88]. In the present case, however, data on the extent of literacy in the *rural* sector are not available for most of the developing countries; so national rates must serve as a less than ideal proxy.

A quadratic functional form is suggested for the effect of life expectancy on fertility [4; 24; 90]. (This form generates an inverted-U curve.) A rise in mean expectation of life implies an improvement in health conditions that acts to enhance fecundity. However, the gain in *EX* also acts to reduce fertility because of the well-known inverse relationship between the probability of child survival and the desired number of births. At low levels of *EX*, therefore, the positive effect will dominate, but as *EX* rises, a net negative influence will emerge. Positive effects of mortality reductions on fertility in the early stages of modernization have been observed by Arriaga [5] for Latin America and Page and Lesthaeghe [60] for Africa. Again, as with literacy, we lack direct data on life expectation in rural areas and must make do with national statistics.

Turning now to the determinants of rural-urban migration, the general relationships of equation (2) are specified below.

$$M = b_0 + b_1\,RTFR + b_3\,Ln\,AGY + b_4\,SMALL + b_5\,CONC + b_6\,OWN + b_7\,ADENS + b_8\,LIT + b_9\,EX + b_{11}\,URB + b_{12}\,GAP + u_M \quad \ldots \quad (2.0)$$

where

- M = rural-urban migration: average annual rate of out-migration, 1960-69 (as percent of the 1960 rural population);
- URB = urban population in relation to total population (percent); and
- GAP = the ratio of GDP per non-agricultural worker is GDP per agricultural worker.

Other variables are as defined for the preceding equation, and the time reference is also to *circa* 1960, except for the dependent variable which leads the explanatory variables and therefore pertains to the 1960–69 decade.

Predicted signs of the estimated parameters are as follows:

$$b_1, b_5, b_8, b_9, b_{11}, b_{12} > 0$$

$$b_3, b_6 < 0$$

$$b_4, b_7\ ?$$

Again, a proposition embodying the "multiphasic response" has been incorporated into the estimating equation – the positive sign for rural fertility hypothesizes that out-migration occurs in part as a response to an intensification of demographic pressures (actual or anticipated) arising from high fertility.

All else being equal, low rural incomes should induce (or force) out-migration by the poor. The various facets of landholding – *SMALL, CONC,* and *OWN* – are expected to have mixed effects. Concentration in landholdings should be associated with the departure of landless workers and very small landholders (or members of their families) to the city. Ownership of land should have the opposite effect. The net effect of the relative incidence of smallholding is uncertain. If small size implies inadequate amounts of land, b_4 will be positive; if smallness does not carry this implication, a negative coefficient should result. The sign can, therefore, be determined only by empirical means. As in the fertility equation, *ADENS* has the function of taking into account the impact of intensity of land use and, therefore, its sign is open to empirical determination.

Literacy increases both the awareness of urban opportunities and the capacity to benefit from them. Unfortunately, the available data are national averages that do not take into account urban-rural educational differences that may impinge on the decision to migrate. In using national averages, we are implicitly forced to assume that they are correlated across countries with rural literacy rates (which may not be implausible).

The role of the mean expectation of life at birth in this equation is simply to account for differential probabilities of survival in different countries which should condition the effect of fertility (i.e. for any given level of the rural *TFR*, a lower value of *EX* implies a reduction in the rate of increase in demographic pressures resulting from fertility). Once again, national averages must substitute for specifically rural data for mortality.

A priori expectations regarding the *URB* and *GAP* variables are straightforward. The higher the degree of prior urbanization, the greater the absorptive capacity of urban areas and, therefore, the greater the ease for rural people to migrate. *GAP* is expected to exert a positive influence on the migration rate, following the discussion in Section II above, which noted the urban-rural income differential as a main causal factor in migration flows.

V. EMPIRICAL RESULTS

Regression results for the rural fertility and migration equations are presented in Table 1. These results provide substantial support for our major propositions as well as considerable evidence on behalf of most of the secondary hypotheses. Let us examine each equation in turn.

Starting with the initial formulation of the fertility equation (1.0), we see that the coefficient for lagged migration is positive, as hypothesized, although less than twice its standard error. Given the smallness of the sample and the deficiencies of the data, this may be viewed as reasonably satisfactory. Moreover, there is the likelihood that migration also acted to depress fertility (by reducing the masculinity ratio in the ages of marriage and reproduction), so that a positive net effect provides more support for our thesis than the results directly reveal.

When outcomes are compared with *a priori* expectations for the other variables in equation (1.0), it is evident that none of the specific predictions has been directly contradicted with respect to *sign,* although at least two of the t-ratios leave something to be desired. The lack of an effect of literacy is surprising, and may indicate that urban-rural differentials in literacy rates did in fact vary widely across countries,

Table 1

Regression Results

Explanatory Variable	Dependent Variable and Equation Number *RTFR* (1.0)	*RTFR* (1.1)	*M* (2.0)	*M* (2.1)
Intercept	–9.1424 (1.23)	–7.7614 (1.14)	5.6374 (2.01)	4.3467 (1.78)
RTFR			.4804* (2.45)	.3871* (2.37)
MLAG	.2980 (1.50)	.2756 (1.45)		
Ln AGY	.9806* (2.43)	.8786* (2.52)	–1.7823* (3.37)	–.9484* (2.99)
SMALL	–.0336* (3.00)	–.0295* (3.62)	.0226* (2.44)	.0192* (2.24)
CONC	–.0106* (2.20)	–.0100* (2.18)	–.0054 (1.31)	–.0058 (1.45)
OWN	.0209* (2.53)	.0189* (2.62)	.0061 (.92)	.0088 (1.41)
ADENS	.2410 (.54)		–.7916* (2.39)	–.6543* (2.14)
LIT	–.0076 (.77)	–.0064 (.69)	.0063 (.96)	
EX	.4365 (1.66)	.4096 (1.62)	–.0060 (.28)	
$(EX)^2$	–.0042 (1.74)	–.0040 (1.71)		
URB			.0890* (7.28)	.0907* (7.65)
GAP			–.1404 (2.04)	
Ln NAGY				–.5241 (2.05)
$\bar{R}^2$	.51	.53	.82	.83
(F)	(3.86)	(4.49)	(12.25)	(16.02)

Notes: Unstandardized regression coefficients in upper rows; t-ratios in lower rows (in parentheses).

*Indicates significant at the 5% level.

or that education's effect on fertility is largely an urban phenomenon in developing countries (as expected by some scholars, including Cochrane [16]). The insignificant result for agricultural density may perhaps be explained by an approximate balance between the opposing forces previously discussed.

The positive coefficient for rural income provides evidence of a positive income effect on fertility in rural areas as it is statistically significant at the .05 (two-tailed) level. The anticipated quadratic form of the relationship between life expectancy and fertility is also confirmed. This function yields a turning point at 51.6 years, which is very close to the findings from other investigations [24; 90].

Hypotheses regarding the three landholding variables receive strong statistical support (significant at the 5-percent level), and are of particular interest for the present paper. The *CONC* variable provides evidence that the greater the concentration of land ownership, the lower the fertility, apart from its effects through income (since that is already included in the equation). Note that the *SMALL* variable turns out to be both negative and significant, whereas *OWN* is significant in the opposite direction. These results may suggest that, in the first instance, some smallholders seek additional land more than extra family labour (farm units are so small that additional children are more a cost than a benefit), and that, in the second instance, land ownership *per se* generates demand for family workers by providing a more secure basis for a contribution from child labour.

The initial fertility equation was also re-estimated, in equation (1.1),[15] with *ADENS* deleted. Parameters for the other variables, as noted, show virtually no changes as a result of this operation.

Estimation of the migration equation (2.0) also yields results generally supportive of the hypotheses. Most importantly, the coefficient for rural fertility is both positive and significant at the .05 level.

Comparing outcomes with expectations for the remaining variables in equation (2.0) produces a somewhat mixed picture. The best results are the very highly significant coefficients in the expected direction for agricultural income and the degree of urbanization (negative for the former and positive for the latter). Our results for *URB* parallel those of Mundlak [57] and Annable [2]. The *URB* variable is so powerful that it indicates that macro-level studies of migration in low-income countries are likely to be seriously biased if they do not take into account the absorptive capacity of cities. The negative impact of the *ADENS* variable suggests that, as intended, it measures mainly the intensity of land use, with the effects through scarcity captured by other variables in the equation. In particular, the positive and significant effect of the smallholding variable may indicate that many such holdings were perceived as inadequate in size, resulting in out-migration.

[15] For this estimated equation as well as for estimated equation (2.1) mentioned later in this section, see Table 1.

Contrary to expectations, the diffusion of land ownership *per se* apparently did not reduce migration rates. Perhaps the mere availability of land to the cultivator (through rent or share-cropping arrangements) was generally sufficient to ameliorate out-migration. Alternatively, land ownership may have facilitated the out-migration of individuals (even heads of households, as in parts of Africa) who had the security of being able to return to their rural home. To the extent the size of landholding was insufficient to support the entire rural household, this would seem especially likely (since income per worker is already in the equation). The coefficient of the literacy variable has the predicted sign, but its error variance is large, perhaps again indicating the drawbacks of using national averages as a proxy for specifically rural data.

The remaining three variables in equation (2.0) have "incorrect" signs. Fortunately, two of them are not statistically different from zero. We take up these two first. With regard to *EX,* the problem may lie in the necessary substitution of national for rural data. And, while the coefficient of the concentration variable is only slightly larger than its standard error, we can offer no ready explanation for its sign. The only real problem is the significant and negative coefficient estimated for *GAP.* Even when we re-specified the equation by substituting a direct measure of income in the non-agricultural sector (the natural log of GDP per non-agricultural worker or *ln NAGY*), the results are the same: see equation (2.1). Simultaneous-equation bias may in part explain this unexplained outcome, if migration itself affects the urban-rural income differential as is likely.[16] However, estimation with *GAP* as an instrumental variable (not shown here) did not produce a materially different result. Another possibility, which cannot be explored with the available data, is omitted variable bias. If urban unemployment, a potentially important variable – see Todaro [81; 82] – is positively correlated with non-agricultural wage levels and negatively correlated with rural-urban migration, then the estimated coefficient of *NAGY* will be biased in a negative direction. Still another possibility is suggested by the work of Greenwood *et al.* [37] on Mexican migration. Beyond a threshold distance from the destination, higher incomes in the areas of origin make migration easier to afford.

In any event, the regression results for the structural equations generally support our main hypotheses. These results may therefore be used for the reduced-form analysis which follows.

VI. REDUCED-FORM ANALYSIS: POLICY IMPLICATIONS

Estimation of structural equations reveals only direct, or first-order, impacts. In a system of two (or more) equations, these estimates do not include cross-equation effects, and, thus, cannot fully reflect the consequences of variation in the explanatory variables. Because changes in rural fertility and out-migration are mutually reinforcing, cross-equation feedback intensifies the final impact of altering the value of an explanatory variable, except in those instances where the coefficients differ in sign between the two structural equations. Thus, for example, *OWN* has a greater total effect on *RTFR* and *M* than its structural coefficients would indicate, because its coefficient has the same (positive) sign in both equations. Similarly, although *URB's* direct influence is limited to the migration equation, it indirectly affects rural fertility, which, in turn, affects migration, thus contributing to the total effect of *URB* on both dependent variables. *AGY,* however, operates on migration and fertility in opposite directions so that cross-equation feedback diminishes its ultimate influence.

In order to gauge the total effect of changes in the explanatory values, particularly those with distinct policy implications, reduced-form equations have been derived from the structural results, using equations (1.1) and (2.1). Reduced-form coefficients were computed at mean values of the non-linear variables. The results of this operation, restated as beta coefficient and elasticities, are shown in Table 2.[17]

Viewed in a policy perspective, both opportunities and obstacles are highlighted by the reduced-form results. On the assumption that the usual policy orientation is to reduce rural birth rates and diminish the propensity to migrate to cities, we find only three variables that operate in the same desired direction with respect to both goals. These are *ADENS,* which accounts for the intensity of land use, *LIT,* and *EX.* The effect of *ADENS,* however, is mainly limited to migration; its influence on fertility is quite small. The impact of literacy is also largely limited to a single objective function, fertility in this case. It will be recalled, moreover, that our proxy for this variable is crude and indirect. The reduced-form coefficients for expectation of life at birth, although formally correct, are deceptively small in absolute magnitude. The quadratic function (in the fertility equation) is evaluated at the sample mean, which, at 51.6 years, is only slightly above the turning point for that function. Given the continuing improvement in mortality conditions achieved in most LDCs since 1960, the effects of this variable on both rural fertility and out-migration should now be much more substantial.

Several variables appear to have mixed effects in the policy context. Raising the real incomes of the agricultural labour force seems to reduce migratory outflows,

[16] Such bias may arise where the dependent variable affects a supposedly exogenous explanatory variable. The resulting correlation between the explanatory variable and the error term may distort the "true" value of the estimated regression coefficient.

[17] In this process, we substituted the right side of the migration equation for *MLAG* in equation (1.1) and the right side of the fertility equation for *RTFR* in equation (2.1). This requires the assumption that the parameters of these functions remained invariant over the relevant time periods. The derived reduced form used here should be distinguished from the direct reduced form obtained by regressing the endogenous variables on all predetermined variables in the equation system. The former is a mathematical process that utilizes the estimated parameters provided by the structural equations [34].

Table 2

Beta Coefficients and Elasticities of the Derived Reduced-Form Equations

Explanatory Variables	Dependent Variable and Equation Number: *RTFR* (1.2)	*M* (2.2)
AGY	.415	−.332
	[.102]	[−.601]
SMALL	−.694	.197
	[−.252]	[.525]
CONC	−.653	−.482
	[−.046]	[−.252]
OWN	.608	.405
	[.212]	[1.037]
ADENS	−.124	−.398
	[−.015]	[−.341]
LIT	−.202	−.069
	[−.054]	[−.136]
EX	−.033	−.016
	[−.028]	[−.071]
URB	.558	1.781
	[.128]	[3.001]
NAGY	−.117	−.354
	[−.025]	[−.140]

Notes: Beta coefficients are shown in the upper rows; elasticities in the lower rows [in brackets].
Based on the structural parameters of equations (1.1) and (2.1), respectively, in Table 1.
Reduced-form coefficients are computed at variable means. *AGY* and *NAGY* have been transformed from logarithmic to natural numbers.

but at the cost of higher rural birth rates. Fortunately, the elasticity of the latter is only one-sixth as high as that of the former.

Two of the policy-linked variables apparently operate in the wrong direction *vis-a-vis* both policy goals. Decreased concentration in landholdings and greater diffusion of landownership – both basic aspects of what is generally meant by "land reform" – unfortunately show net effects here that both raise fertility and increase rural-urban migration rates. This outcome, it should be stressed, does not eliminate

the case for land reform which is highly desirable for reasons of equity and perhaps efficiency of land use as well. But the results here suggest that land reform be accompanied by family-planning programmes as well as measures to reduce out-migration.

But the problem here may not be as serious as first appears. When all three of the landholding variables are considered together (*SMALL, CONC,* and *OWN*), we see from the elasticities in Table 2 that the effects largely cancel each other, especially for fertility. The strong effect of ownership on migration, however, is still disturbing. But it may mainly reflect the vast amount of non-family (individual) migration, which rural households find necessary, together with the receipt of subsequent remittances, given the persistence of rural poverty in most low-income countries.

Finally, the reduced-form results suggest that the level of urbanization may aggravate the problems of the rural sector with respect to fertility as well as out-migration. We do not suggest direct restrictions on the growth of cities, but to the extent that rural-urban migration has net negative effects on the society, the observed relationships point to the need to slow down rural population growth (e.g. through making family planning facilities more accessible in rural areas) and to improve the attractiveness of life in the countryside. The latter is desirable in any case to improve the standard of living of the majority of the population who live in rural areas and often continue to be neglected in government's development decisions [50].

VII. SUMMARY

The purpose of this paper is to investigate the interrelationships between rural fertility, rural-urban migration, and landholding patterns in developing countries. We develop a two-equation recursive model in which the endogenous variables are the level of rural fertility and the rate of out-migration from rural to urban areas, with each (with appropriate attention to lags) influencing the other. Landholding patterns as well as a number of other variables are included in each equation. The model is tested for a cross-section of those (26) developing countries for which the necessary data were available on all variables for the decade of the 1960s.

The statistical results provide strong support for the major hypotheses regarding the effects of landholding patterns on rural fertility and rural-urban migration. Moreover, the results indicate that fertility and out-migration are interrelated – the higher the fertility the higher the subsequent rate of out-migration, and the higher the out-migration in the previous decade the higher the subsequent fertility. The former relationship is stronger than the latter which was expected.

We confess to some surprise at the apparent strength of most of the statistical results, given the weak data base and the partial nature of the model tested.[18] These are important caveats to bear in mind. Moreover, the robustness of the findings should be tested in the future as later information on landholding becomes available. Further exploring the lag structure,[19] taking family planning programme effort into account, and expanding the model to capture greater endogeneity in certain variables are all desirable. But these are tasks for the future.[20]

Finally, we use a reduced-form analysis to derive possible policy implications from the empirical results. As this analysis clearly suggests, there are no simple answers to the problems of high rural fertility and higher rural-urban out-migration.

[18] It would not be difficult to elaborate a host of potential other indirect interrelationships between migration, fertility, landholding, and the other "exogenous" variables included here, in a larger macroeconomic-demographic model, *à la* the Bachue model and others. See [63] and [64]. Clearly much more knowledge of the interrelationships between demographic and economic factors within rural areas is desirable [9] and [66, p. 240].

[19] For example, the full impact of mortality changes on fertility may not appear until enough time has elapsed for the altered probabilities of survival to be generally perceived.

[20] The results from an exercise such as this, using country-level, cross-sectional data to infer relationships over time, should be compared to results from micro-models formulated to test parallel relationships using detailed household survey data. But we are not aware of any such empirical studies, though appropriate data sets do now exist.

REFERENCES

1. Aghajanian, A. "Fertility and Family Economy in the Iranian Rural Communities". *Journal of Comparative Family Studies.* Vol. 9, No. 1. Spring 1978. pp. 119–127.
2. Annable, J. "Internal Migration and Urban Unemployment in Low-income Countries: A Problem in Simultaneous Equations". *Oxford Economic Papers.* Vol. 24, No. 3. November 1972. pp. 399–412.
3. Anderson, Barbara. *Internal Migration during Modernization in Late Nineteenth Century Russia.* Princeton: Princeton University Press. 1980.
4. Anker, Richard. "An Analysis of Fertility Differentials in Developing Countries". *Review of Economics and Statistics.* Vol. 60, No. 1. 1978.
5. Arriaga, Eduardo E. "The Nature and Effects of Latin America's Non-Western Trend in Fertility". *Demography.* Vol. 7, No. 4. November 1970.
6. Becker, Gary S. "An Economic Analysis of Fertility". In *Demographic and Economic Change in Developed Countries: A Conference of the Universities-National Bureau Committee for Economic Research.* Princeton, N. J.: Princeton University Press. 1960. (National Bureau of Economic Research Special Conference Series, No. 11)
7. Bilsborrow, Richard E. "Dependency Rates and Aggregate Savings Rates Revisited: Corrections, Further Analyses, and Recommendations for the Future". In J. Simon and J. Da Vanzo (eds.), *Research in Population Economics.* No. 2. 1980. pp. 183–204.
8. Bilsborrow, Richard E. "Population Pressures and Agricultural Development in Developing Countries: A Conceptual Framework and Recent Evidence". *World Development.* Forthcoming.
9. Bilsborrow, Richard E. "Priority Areas for Future Research on Demographic-Economic Interrelationships". In United Nations, *Population and Development Modelling.* Population Studies No. 73, Proceedings of UN/UNFPA Expert Group Meeting, Geneva, 24–28 September 1979, pp. 74–87. New York: United Nations. 1981.
10. Bilsborrow, Richard E., Guy Standing, Amarjit Oberai and Peter Peek. *Migration in Low-Income Countries: Guidelines for Survey and Questionnaire Design.* London: Croom Helm (for the International Labour Office). 1984.
11. Boserup, Ester. *Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure.* London: George Allen and Unwin. 1965.
12. Bulatao, R., and R. D. Lee (eds.). *Determinants of Fertility in Developing Countries.* Vols. 1 & 2. New York: Academic Press. 1983.
13. Chaplin, D. "Some Institutional Determinants of Fertility in Peru". In D. Chaplin (ed.), *Population Policies and Growth in Latin America.* Lexington, Mass.: D. C. Heath and Co. 1971.

14. Coale, Ansley J. "The Demographic Transition". In *International Population Conference, Liege, 1973,* Vol. 1. Liege, Belgium: International Union for the Scientific Study of Population. 1974.
15. Coale, Ansley J., B. Anderson, and E. Harm. *Human Fertility in Russia since the Nineteenth Century.* Princeton: Princeton University Press. 1979.
16. Cochrane, Susan H. *Fertility and Education: What Do We Really Know?* Baltimore: Johns Hopkins University Press (for the World Bank). 1979.
17. Collver, Andrew, Alden Speare, Jr., and Paul K. C. Liu. "Local Variations of Fertility in Taiwan". *Population Studies.* Vol. 20. 1967.
18. Da Vanzo, Julie. "Macroeconomic Approaches to Studying Migration Decision". In G. F. De Jong and R. W. Gardner (eds.), *Migration Decision-Making: Multi-Disciplinary Approaches to Microlevel Studies in Developed and Developing Countries.* New York: Pergamon Press. 1981.
19. Davis, Kingsley. "The Theory of Change and Response in Modern Demographic History". *Population Index.* Vol. 29, No. 4. 1963.
20. Davis, Kingsley, and J. Blake. "Social Structure and Fertility: An Analytical Framework". *Economic Development and Cultural Change.* Vol. 4. 1956.
21. Easterlin, Richard A. "The Economics and Sociology of Fertility: A Synthesis". In C. Tilly (ed.), *Historical Studies of Changing Fertility.* Princton, N. J.: Princeton University Press. 1978.
22. Easterlin, Richard A. (ed.). *Population and Economic Change in Developing Countries.* Chicago and London: University of Chicago Press. 1980. (Universities – National Bureau of Economic Research Committee for Economic Research, Conference Report, No. 30)
23. Easterlin, Richard A. "Population Change and Farm Settlement in the Northern United States". *Journal of Economic History.* Vol. 36, No. 1. March 1976.
24. Entwisle, Barbara, and C. R. Winegarden. "Fertility and Pension Programmes in LDCs: A Model of Mutual Reinforcement". *Economic Development and Cultural Change.* Vol. 33, No. 1. 1984.
25. Eriksson, I., and T. Rogers. *Rural Labour and Population Change: Social and Demographic Developments in East Central Sweden during the Nineteenth Century.* Uppsala, Sweden. 1978.
26. Farooq, Ghazi, and George B. Simmons (eds.). *The Economics of Fertility Behavior in Developing Countries: Research and Policy Issues.* London: MacMillan. 1985.
27. Faruqee, Rashid. "Sources of Fertility Decline: Factor Analysis of Intercountry Data". Washington, D.C.: IBRD. 1979. (World Bank Staff Working Paper No. 318)

28. Featherman, David L. "Marital Fertility and the Process of Socioeconomic Achievement: An Examination of the Mobility Hypothesis". In L. L. Bumpass and C. F. Westoff (eds.), *The Later Years of Childbearing.* Princeton, N. J.: Princeton University Press. 1970.
29. Firebaugh, Glenn. "Structural Determinants of Urbanization in Asia and Latin America, 1950–1970". *American Sociological Review.* Vol. 44, No. 2. 1979.
30. Food and Agriculture Organization. *Report on the 1960 World Census of Agriculture: Analysis and International Comparison of Census Results.* Rome. 1971.
31. Freedman, Ronald. "Norms for Family Size in Underdeveloped Areas". *Proceedings of the Royal Society.* Series B. No. 159. 1963.
32. Freedman, Ronald. *The Sociology of Human Fertility.* New York: Irvington Press. 1975.
33. Friedlander, Dov. "Demographic Responses and Population Change". *Demography.* Vol. 6, No. 4. Nov. 1965.
34. Goldberger, Arthur S. *Econometric Theory.* New York: Wiley. 1964.
35. Goldstein, Sidney. "Techniques for Analysis of the Interrelationships between Migration and Fertility". UN Economic and Social Commission for Asia and the Pacific, Technical Working Group on Migration and Urbanization, December 1–5. Bangkok. 1981.
36. Greenwood, Michael J. "Research on Internal Migration in the United States: A Survey". *Journal of Economic Literature.* Vol. 13, No. 2. 1975.
37. Greenwood, Michael J., Jerry R. Ladman, and Barry A. Siegel. "Long-Term Trends in Migratory Behavior in a Developing Country: The Case of Mexico". *Demography.* Vol. 18, No. 3. August 1981.
38. Grigg, David B. *Population Growth and Agrarian Change.* Cambridge: Cambridge University Press. 1980.
39. Hawthorne, Geoffrey. *The Sociology of Fertility.* London: Collier-McMillan. 1970.
40. Hermalin, Albert I., and William R. Lavely. "Agricultural Development and Fertility Change in Taiwan". Paper presented at the Annual Meeting of the Population Association of America, Philadelphia, April 1979.
41. Hicks, Whitney. "Economic Development and Fertility Change in Mexico, 1950–1970". *Demography.* Vol. 11, No. 3. Aug. 1974.
42. Irfan, M., and G. Farooq. "An Investigation of Household Reproductive Behaviour in Pakistan". Islamabad: Pakistan Institute of Development Economics. 1983. (Population, Labour Force and Migration Project, Report No. 4)
43. Johnston, Bruce F. "Agriculture and Structural Transformation in Developing Countries: A Survey of Research". *Journal of Economic Literature.* Vol. 8, No. 2. 1970.

44. Johnston, Bruce F., and John W. Mellor. "The Role of Agriculture in Economic Development". *American Economic Review.* Vol. 51, No. 4. Sept. 1961.

45. Kessinger, Rom G. *Vilvatpur 1848–1968: Social and Economic Change in a North Indian Village.* Berkeley: University of California Press. 1974.

46. Kleinman, David S. "Fertility Variation and Resources in Rural India". *Economic Development and Cultural Change.* Vol. 21. 1973.

47. Knodel, John. *The Decline of Fertility in Germany, 1871–1939.* Princeton: Princeton University Press. 1974.

48. Ledent, Jacques. "Rural-Urban Migration, Urbanization and Economic Development". *Economic Development and Cultural Change.* Vol. 30, No. 3. April 1982.

49. Leibenstein, Harvey. *Economic Backwardness and Economic Growth: Studies in the Theory of Economic Development.* New York: John Wiley and Sons. 1957.

50. Lipton, Michael J. *Why Poor People Stay Poor: Urban Bias in World Development.* Cambridge, MA: Harvard University Press. 1977.

51. Mauldin, Parker. "The Determinants of Fertility Decline in LDCs: An Overview of the Available Empirical Evidence". *International Population Conference,* Manila, 1981. Vol. 1. 1981.

52. Mauldin, W. Parker, and B. Berelson. "Conditions of Fertility Decline in Developing Countries, 1965–75". *Studies in Family Planning.* Vol. 9, No. 5. 1978.

53. McGreevey, William P., *et al. The Policy Relevance of Recent Social Research on Fertility.* Washington, D. C.: Interdisciplinary Communications Programme, Smithsonian Institution. 1974. (Interdisciplinary Communications Programme, Occasional Monograph Series No. 2)

54. Merrick, Thomas W. "Fertility and Land Availability in Rural Brazil". *Demography.* Vol. 15, No. 3. August 1978.

55. Mueller, Eva. "The Economic Value of Children in Peasant Agriculture". In Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions.* Baltimore: Johns Hopkins University Press. 1976.

56. Mueller, Eva, and Kathleen Short. "Effects of Income and Wealth on the Demand for Children". In R. A. Bulatao, R. D. Lee, Paula E. Hollerbach, and John Bongaarts (eds.), *Determinants of Fertility in Developing Countries: Vol. 1. Supply and Demand for Children.* New York: Academic Press. 1983.

57. Mundlak, Yair. "Occupational Migration Out of Agriculture – A Cross-Country Analysis". *Review of Economics and Statistics.* August 1978.

58. Oberai, Amarjit. "Demographic and Social Information in Migration Surveys". Chapter VI in Bilsborrow, *et al., Migration in Low-Income Countries: Guidelines for Survey and Questionnaire Design.* London: Croom Helm. 1984.

59. Ominde, S. *The Population of Kenya, Tanzania and Uganda.* London: Heinemann Educational Books. 1975.

60. Page, Hillary J., and Ronald Lesthaeghe (eds.). *Child-spacing in Traditional Africa: Traditions and Change.* New York: Academic Press. 1981.

61. Preston, Samuel H. "International Comparison of Net Rural-Urban Migration Rates". *IUSSP Conference on Economic and Demographic Change: Issues for the 1980s.* Helsinki: International Union for the Scientific Study of Population. 1979. (Session 3.1, pp. 1.1-1.12)

62. Ritchey, Paul N. "Explanations of Migration". *Annual Review of Sociology,* Vol. 2. 1976.

63. Rodgers, Gerry, M. Hopkins and R. Wery. *Bachue Philippines: Population, Employment and Inequality.* Saxon House (for the International Labour Office). 1978.

64. Rogers, Andrei, and Jeffrey G. Williamson. "Migration, Urbanization, and Third World Development: An Overview". *Economic Development and Cultural Change.* Vol. 30, No. 3. April 1982.

65. Rosenzweig, M., and R. Evenson. "Fertility, Schooling and the Economic Contribution of Children in Rural India: An Econometric Analysis". *Econometrica.* Vol. 45, No. 5. July 1977. pp. 1065–1079.

66. Sabot, Richard H. (ed.). *Migration and the Labour Market in Developing Countries.* Boulder, Colorado: Westview Press. 1982.

67. Schultz, T. Paul. *Fertility Determinants: A Theory, Evidence, and Application to Policy Evalution.* Santa Barbara, CA: The Rand Corporation. 1974.

68. Schultz, T. W. (ed.). "New Economic Approaches to Fertility". *Journal of Political Economy.* Vol. 81, No. 2. (Part II). March/April 1973.

69. Schultz, T. W., (ed.). "Marriage: Family, Human Capital, and Fertility". *Journal of Political Economy.* Vol. 82, No. 2. (Part II). March/April 1974.

70. Schutjer, W. and C. Stokes. "Agricultural Policies and Human Fertility: Some Emerging Connections". *Population Research and Policy Review.* Vol. 1, No. 3. October 1982. pp. 225–244.

71. Seligson, Mitchell A. "Public Policies in Conflict: Land Reform and Family Planning in Costa Rica". *Comparative Politics.* Vol. 12, No. 1. 1979.

72. Shaw, R. Paul. "Land Tenure and the Rural Exodus in Latin America". *Economic Development and Cultural Change.* Vol. 23, No. 1. 1974.

73. Shaw, R. Paul. *Migration Theory and Fact: A Review and Bibliography of Current Literature.* Philadelphia: National Science Research Institute. 1975. (Bibliography Series No. 5)

74. Simon, Julian L. *The Effects of Income on Fertility.* Chapel Hill, NC: Carolina Population Center, University of North Carolina. 1974. (Monograph 19)

75. Sjaastad, Larry. "The Cost and Returns of Human Migration". *Journal of Political Economy.* Vol. 70, No. 5. 1962.

76. Southworth, Herman M., and Bruce F. Johnston (eds.). *Agricultural Development and Economic Growth.* Ithaca, N.Y.: Cornell University Press. 1967.

77. Stokes, C. Shannon, W. Schutjer, T. McCoy, and C. Wood. *Rural Development, Land and Human Fertility: A State-of-the-Arts Paper.* North Carolina: Research Triangle Institute and Southeast Consortium on International Development. 1979.

78. Stys, W. "The Influence of Economic Conditions on the Fertility of Peasant Women". *Population Studies.* Vol. XI, No. 2. November 1957. pp. 136–149.

79. Summers, Robert, Irving B. Kravis, and Alan Heston. "International Comparisons of Real Product and Its Composition: 1950–77". *Review of Income and Wealth.* Vol. 26, No. 1. 1980.

80. Tilly, Charles (ed.). *Historical Studies of Changing Fertility.* Princeton, N. J.: Princeton University Press. 1978.

81. Todaro, Michael J. *Internal Migration in Developing Countries.* Geneva: International Labour Office. 1976.

82. Todaro, Michael J. "A Model of Labour Migration and Urban Unemployment in Less Developed Countries". *American Economic Review.* Vol. 59, No. 1. March 1969.

83. Turchi, Boone A. *The Demand for Children: An Economic Analysis of Fertility in the United States.* Cambridge, MA: Ballinger Publishing Co. 1975.

84. United Nations. *The Determinants and Consequences of Population Trends.* New York. 1973.

85. United Nations. *Patterns of Urban and Rural Population Growth.* New York. 1980. (Population Studies No. 68)

86. United Nations. *World Population Trends and Policies, 1979 Monitoring Report, Vol. 1. Population Trends.* New York. 1980.

87. United States. Bureau of the Census. *A Compilation of Age-Specific Fertility Rates for Developing Countries.* Washington, D.C. 1980. (International Research Document No. 7)

88. Williams, Anne D. *Effects of Economic Development on Fertility: Review and Evaluation of the Literature.* Santa Barbara, CA: Center for Advanced Studies, Technical Military Planning Operation (TEMPO), General Electric Company. 1974.

89. Winegarden, C. R. "Income Redistribution versus Accelerated Growth: A Comparison of Demographic Effects". *Oxford Bulletin of Economics and Statistics.* Vol. 46, No. 3. 1984.

90. Winegarden, C. R. "Socioeconomic Equality and Fertility in Developing Countries: A Block-Recursive Model". *De Economist.* Vol. 128, No. 4. 1980.

91. World Bank. *World Tables: 1976.* Baltimore: Johns Hopkins University Press. 1976.