HOW FEMALE EDUCATION REDUCES FERTILITY: MODELS AND NEEDED RESEARCH*

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Improved educational opportunities for women in developing nations has come to be viewed as the prime institutional variable amenable to policy manipulation that can help lower fertility rates. Indeed, there appears to be substantial faith in the mass education of young women as the one sure hope for slowing rapid population growth. This faith has been affirmed in the past decade by a number of empirical studies that show education to exhibit a stronger and more consistent negative relationship to fertility than any other single variable (see Holsinger and Kasarda, 1976a, 1976b for literature review). As one illustration, Bogue (1969), analyzing the relative impact of nine indexes of modernization on fertility found that education alone accounted for 56 percent of the variance in the movement of nations from high to low fertility, whereas all other indexes of modernization combined accounted for only an additional 16 percent of the variance. On the basis of this analysis he concluded:

> Rising education levels, increased school attendance, and elimination of early marriage are much more powerful in promoting fertility reduction than simple urbanization and rising levels of living. A major driving force behind fertility reduction appears to be education. . . . If this is true, *it should be comparatively easy to discover what aspect of rising literacy and educational attainment is most intimately related to lower fertility and then to 'mass produce' it on a large scale to hasten fertility decline* in advance of other aspects of education attainment. (1969:676-677, italics added)

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Most population planners would likely agree that the *italicized* portion of Bogue's conclusion is a key to programs designed to reduce fertility in developing nations. However, whether there are only one or a few major instrumental variables through which female education operates in affecting fertility–and which governments can "mass produce"–is an important policy question in need of an answer. Unfortunately, the research literature to date helps us little. Despite an abundance of published and unpublished studies that document negative zero-order and partial correlations between education and fertility, *none* has specified adequately *the* operators *that link* greater female education to lower fertility (either at the individual or aggregate levels) and submitted these operators to systematic empirical tests.[1] What we have, instead, is a plethora of statistically underidentified, simplistic studies that tend to cloud, more than they clarify, the explicit processes by which female education influences fertility.

Female education, of course, affects or interacts with a wide variety of factors such as age at marriage, employment opportunities outside the home, social mobility, husband-wife communication, religiosity, infant mortality, exposure to contraceptive information and devices, and the like, each of which, in turn, has been proposed to bear directly on fertility. Thus, discovering which aspects of rising female education account for reduced fertility requires considerable refinement in our conceptualization of the education-fertility relationship *and* identification of the complete range of causal variables and operators that mediate female education's effects. The former would involve an explication of the quantity, quality, and substantive content of education as it relates to female status attainment and fertility, as well as a consideration of the potentially potent role of nonformal instruction in family planning and population education. The latter (which will be the focus of this article) would begin with a theoretically integrated model derived from propositions linking variables hypothesized to be instrumental in the female education-fertility relationship.

Regarding the above, I have synthesized propositions found in the research literature on education, female status attainment, and fertility in the form of working models that bring together the key variables that have been hypothesized to be instrumental in the female education-fertility causal chain. In brief, these multivariate, multistage models specify three distinct ways that female education affects fertility: 1) *indirectly*, by influencing a plethora of social, economic, and demographic factors (e.g., age at marriage, employment status, exposure to contraceptive information) which, in turn, bear directly on fertility; 2) *jointly* by *interacting* with contextual factors and other aspects of modernization such that the effects of female education are conditioned by the presence or level of those *conditions*; and 3) *directly* net of intervening and other relevant variables. Let me now present the basic propositions and supporting evidence from which the model specifications were derived.

INDIRECT EFFECTS OF FEMALE EDUCATION ON FERTILITY

As observed above, female education affects many variables that have been proposed to bear on direct influence on fertility. The primary causal links of this nature that require simultaneous analysis include the effect of female education on age at marriage and/or first conception, labor force participation, social mobility, economic utility of children, exposure to mass media and printed materials concerning family planning, knowledge and use of contraceptive devices, husband-wife communication, and infant and child mortality. The propositions concerning female education's indirect effects in the working model, their rationale, and tentative empirical support may be summarized as follows:

Proposition 1: *Increased female education delays age at marriage (or consensual union) and age at first birth which, in turn, lowers completed fertility.* One of the most potent effects of female education on fertility is indirect through its influence on age at marriage (or consensual union) and age of first birth. Research to date suggests that both age at marriage and age at first birth increase with female education (Bumpass, 1969; Busfield, 1972; Momeni, 1972). Completed fertility, in turn, has been found to be lower among those women who delay age at marriage (or first consensual union) and age of first birth (see Agarwula, 1965; CELADE and CFSC, 1972; Davidson, 1973; Husain, 1970a; Mandelbaum, 1974; Yaukey and Thorsen, 1972).

Proposition 2: *Increased education enhances a woman's prospects for obtaining employment outside the home that competes with bearing and raising children as a career.* In many developing nations, the only career path open to the uneducated woman is that of housewife and mother; therefore, the basic means by which she can demonstrate her worth is by producing children. The educated woman, on the other hand, can demonstrate her worth by such alternative means as obtaining employment in offices, factories, and other sectors of developing economies (Rothman, 1969; Kasarda, 1971; Kupinsky, 1977). Through well-paying jobs open to her because of her formal training, she may become self-sufficient and less inclined to early marriage. Furthermore, married and single women with better educations are more likely to find jobs that provide them with satisfactions alternative to children, such as companionship, recreation, and creative activity, or the means to such satisfactions in the form of financial remuneration (Blake, 1965; Elizaga, 1975; Kupinsky, 1971, 1977; Youssef, 1974).

A number of researchers have suggested that the relationship between female labor force participation and fertility may be non-recursive (Blake, 1965; Waite and Stolzenberg, 1976; Smith-Lovin and Tickamyer, 1978). That is, fertility may influence labor force participation as well the other way around.

Waite and Stolzenberg (1976) employed two-stage least squares analysis to examine the effects of labor force participation plans and fertility upon each other. Their analysis based on females aged 14-24 showed that the number of children a young woman plans to bear has only a small effect on the probability that she plans to be employed when she is 35 years old. On the other hand, females' plans for participation in the labor force at age 35 were found to have a substantial negative effect on the total number of children planned. Thus, Waite and Stolzenberg conclude that, while mutual causation is evident, labor force plans play a more important role in affecting fertility rather than the reverse.

Smith-Lovin and Tickamyer (1978) also employed two-stage least squares to study the hypothesized mutual relationship between labor force participation and fertility. Their findings, based on actual fertility behavior, did not confirm the Waite-Stolzenberg findings. Smith-Lovin and Tickamyer, therefore, concluded that causal relationships between planning variables need not be entirely consistent with the links between behavior variables.

Because labor force participation is an important intervening variable in the female education-fertility causal chain, its proper specification is critical for appropriate decomposition of education's indirect effects. To aid in this specification, John Billy, Kirsten West, and I have been conducting two-stage least squares analyses of a broad range of Latin American fertility surveys (CELADE, 1970, 1976) to determine the relative importance of each path linking female labor force participation and fertility behavior. Our results, based on data from 10 metropolitan and 4 rural surveys, consistently show that the primary path is from female labor force participation to fertility. For this reason, the indirect causal relationship in the model developed herein will be from education to labor force participation to fertility.

Proposition 3: *Increased education of females fosters higher social and economic mobility which is conducive to the option of smaller families.* By promoting social and economic mobility, rising female education reduces their dependence on children for economic assistance (Birdsall, 1974). The higher status and higher paying jobs held by women with better educations provide them with a growing sense of self-reliance and feelings of security toward older age (Kupinsky, 1977; Mueller, 1972b, 1976). Decisions concerning family size among more educated women can thus be made without so much concern for later economic dependence.

Proposition 4: *Increased female education reduces the perceived economic utility of children, thus lowering the demand for them.* Schooling reduces the economic utility of children in a number of ways (Becker, 1960; Friedlander and Silver, 1967; Mueller, 1972a; Repetto, 1976). Educated women are better able to assess the relative costs and benefits of children under changing economic and social conditions, and those with better education typically have higher educational aspirations for their children. Except perhaps for those of substantial wealth, most parents realize that if their educational aspirations for their children are to be attained, they must limit the size of their families. Often overlooked, too, is the simple fact that, while children (females as well as males) are attending school, either by choice or by law, they are not contributing to the economic support of the family. The longer they remain in school, the more they become a short-run liability. My analysis (1971) of the relationship between the percentage of children between the ages of five and 14 enrolled in school and the percentage under the age of 15 who were economically active revealed a negative correlation of -.64 for 49 nations. Moreover, as had been anticipated, fertility rates were found to be substantially higher in nations where a larger proportion of the youth under the age of 15 were economically active (r = +.54).

Proposition 5: *Female education increases exposure to mass media and printed materials concerning family planning.* Of growing importance to family planning programs in developing nations is the use of mass media as an information device. Here, also, education (and corresponding literacy) indirectly affects fertility by increasing exposure to and understanding of newspapers, magazines, pamphlets, and other printed media for transmitting family-planning information (Cernada and Lu, 1972; Freedman, 1976; Raabe, 1973).

Proposition 6: *Increased female education provides directly or facilitates the acquisition of information on modern contraceptive devices and use.* Extended schooling beyond the primary grades exposes young women, both formally and informally, to contraceptive information and material not often available through familial or mass media channels. In both developed and less developed nations, knowledge and practice of contraception has been shown to be closely linked to the educational level of wives and husbands (Bhutnagor, 1972; CELADE and CFSC, 1972; Dandekar, 1967; Husain, 1970b, Kripalani et al., 1971; Miró and Rath, 1965; Sen and Sen, 1967; Yaukey, 1961). Most research supports the conclusion of Ronald Freedman and co-workers (1959), that "the more education a wife or husband has, the more likely that the couple has used contraception, that they began early in marriage, and that they planned their pregnancies and avoided more than they wanted."

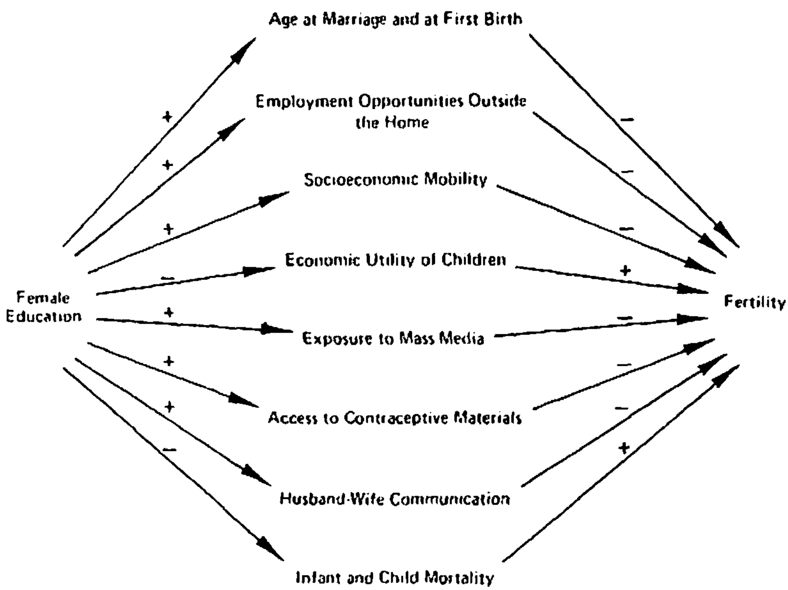
Proposition 7: *Increased female education improves communications between husbands and wives in ways that are conducive to lower fertility.* Increased education has been found to have a strong impact on communication of family-size preferences between women and their spouses (Olusanya, 1971). Those with schooling beyond minimal levels can better express and articulate their feelings concerning the often sensitive issues of contraception and family size (Carleton, 1967). The effect of lack of education on fertility because of limited husband-wife communication can be quite important, as shown by J. Mayone Stycos (1967). His findings in Puerto Rico indicate that numerous couples with little or no formal education actually wanted fewer children, but they did not practice contraception because of the mistaken belief that their spouses desired additional children (see also Stycos et al., 1956).

Proposition 8: *Increased female education indirectly affects fertility by reducing infant and child mortality.* It is well known that infant and child mortality rates are much lower among families where formal education is present than where the parents and children are unschooled. In turn, evidence indicates that, where infant and child mortality rates are low, birth rates are also low (Arriaga, 1970; Chandrasekhar, 1972; Preston, 1978; Schultz, 1976). Since infant and child mortality are lower among children of women with more schooling, and they are cognizant of this fact, educated women do not need–and are not likely to try–to have additional children simply for insurance (Mandelbaum, 1974). Thus, the overall negative association between increased female education and fertility is enhanced.

The primary indirect (additive) causal processes by which female education reduces fertility are summarized in Figure 1.

Figure 1:

SUMMARY DIAGRAM SPECIFYING INDIRECT CAUSAL LINKAGES OF FEMALE EDUCATION TO FERTILITY



DIRECT EFFECTS OF FEMALE EDUCATION ON FERTILITY

An understanding of the direct effects of female education on fertility requires refined conceptualization of the education-fertility linkage. Some argue that there can be no direct effects and that even the hypothesized effects of highly focused instruction programs in sex, contraceptive, and population education must be regarded as indirect owing to the complex and often tenuous link between the teaching act and learning outcome, and between these factors and actual smaller family size. This line of reasoning holds that all influences of female education on fertility bear at best indirectly.

My working model will be expanded to include direct effects of female education (i.e., net of other causal variables) because it treats fertility more broadly to include attitudes, values, and sentiments toward smaller families. In this respect, female education has been found to affect a broad spectrum of social-psychological orientations in a woman, including freedom from tradition, heightened aspirations for themselves and their children, views concerning family size, and modern values that promote her use of contraception to control her body and life destiny (Caldwell, 1968; Chung et al., 1972; Carleton, 1967; DeJong, 1975; Dixon, 1976; Inkeles, 1974; Jaffe, 1959; Mandelbaum, 1974). These important social-psychological attributes which are most frequently held by the educated woman lead to the following proposition:

Proposition 9: *Education imparts a woman with a sense of self-efficacy, a positive feeling of control over her own body and fate, and a trust in science and technology, all of which promote her use of contraception to limit her fertility.*

INTERACTION EFFECTS

In addition to specifying female education's direct and indirect effects on fertility, an adequate causal analysis must take into account the fact that female education interacts with other exogenous variables such that the actual influence of female education is conditioned by the presence or level of these variables. A good example of an interaction of this form was reported by Westoff, Potter, and Sagi (1973). They found education to be related to fertility in *opposite* directions when comparing active Catholics with Protestants. Their data, in fact, indicated that higher education in Catholic institutions may promote rather than diminish values compatible with high fertility.

For countries where traditional religious values apparently still play an important role, such as in Latin America, a working proposition describing the possible conditioning effects of religiosity should be included in one's theoretical model. Proposition 10 is illustrative.

Proposition 10: *Increased female education in Latin America will significantly depress fertility among non-Catholic women and among less active Catholic women but will have little or no effect among those women who are very active Catholics.*

Another interaction effect that must be considered in the female education-fertility causal chain is the interaction between female education and urban versus rural residence. The urban milieu as the nucleus of social change in developing nations restricts young women less to traditional kinship norms and makes contraception information and material more readily available to women who desire it (Berry and Kasarda, 1977; Goldberg, 1976). Furthermore, the actual as well as opportunity costs of raising children are higher in urban centers while the economic returns of children to the family unit tend to be less in urban as compared to rural sectors (Kasarda, 1971). Such circumstances should lead one to examine the following proposition:

Proposition 11: *The effect of increased female education on fertility will be substantially greater among women residing in metropolitan areas than among women residing in rural regions.*

Finally, whenever considering the effects of a woman's education on fertility, it is absolutely essential to consider the nonadditive interaction with husband's (or companion's) education. Basic cross-tabulations have shown that the effect of female education on fertility is conditioned by level of husband's education (CELADE and CFSC, 1972; Velasco, 1973; Westoff and Ryder, 1977) and that the effects are neither linear nor additive (hence, multiple regression analysis would be misleading). This important interaction effect between a woman's and her spouse's educational levels should be incorporated and assessed in a causal analysis as follows:

Proposition 12: *A woman's education and her spouse's education interact and operate to jointly affect fertility, such that the amount of fertility reduction to be expected with additional female education is predicated on the educational level of her spouse.*

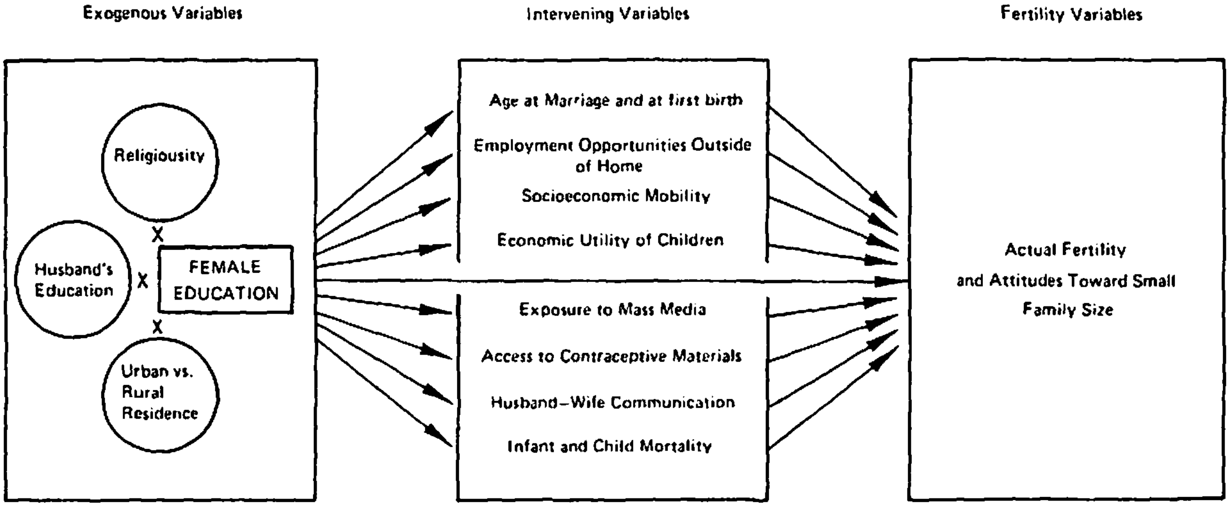
The above 12 propositions identifying the direct, indirect, and interactive processes by which female education affects fertility can be brought together and assessed concurrently in the form of the block-recursive model diagramed in Figure 2.

METHODOLOGICAL PROCEDURES

Research to date would lead one to anticipate that the largest effects of female education operate indirectly, via the intervening variables shown in Figures 1 and 2. The crucial necessity for making proper causal inferences and policy decisions, however, is to determine the relative importance of each of the effect parameters and to estimate the amount of change in female education, as well as in each of its mediating variables, to achieve a given change in fertility. This would require a set of fertility surveys of high quality and high comparability that contain all relevant variables hypothesized to be instrumental in the female education-fertility relationship. Application of appropriate statistical procedures to the survey variables arranged in the form of fully and properly specified multivariate models would then

Figure 2:

Causal Model to be Assessed Specifying Female Education's Direct, Indirect, and Interactive Effects on Fertility



NOTE: X signifies an expected interaction factor conditioning the effects of female education.

enable researchers to decompose female education's direct, indirect, and joint effects.

For relevant data bases, the World Fertility Surveys are excellent sources. Many of the surveys not only contain extensive data about women's pregnancy histories, opinions on ideal family size, and knowledge, attitude, and practice of contraception, but they also include good measurement of the complete range of intervening and conditioning variables contained in the models present in Figures 1 and 2. The data thus would allow one to assess simultaneously the bulk of the mediating and interactive relationships proposed above and replicate the tests across a number of different countries.

To assess the causal relationships proposed in the female education-fertility working models and to provide concrete estimates of the magnitude of each parameter, three statistical procedures are suggested. The first is path analysis as developed by geneticist Sewell Wright (1960) and explicated more recently by sociologists O.D. Duncan (1966), K.C. Land (1969), and H.M. Blalock (1971). In essence, path analysis is no more than conventional multiple regression analysis with certain assumptions about linearity, additivity, and causality. Path analysis provides algorithms for decomposing zero-order associations between female education and fertility into education's direct effects and its indirect causal effects via each intervening variable. Path coefficients are typically computed in standardized form (i.e., Beta weights). However, when one wishes to estimate the absolute rather than relative amount of change in each intervening causal variable and in fertility produced by a given change in female education, unstandardized partial regression coefficients (i.e., partial slopes) should be substituted for the standardized coefficients in the algorithms for estimating female education's direct and indirect effects. The unstandardized coefficients should always be used when comparing results across different samples.

One problem that I would anticipate as a result of the tight causal nature of the working models presented above is multicollinearity. This should especially be the case among female education and a number of the proposed intervening variables. It is well known that, when assessing multivariate models under conditions of multicollinearity (i.e., highly correlated independent variables), ordinary least squares regression analysis will frequently yield unreliable parameter estimates. In short, high correlation among predictor variables will result in large standard errors so that estimates of the true parameters become unstable. Parameter estimates will tend to vary from sample survey to sample survey and, for any given sample, some estimates may be excessively large and even of the incorrect sign while other important predictors may be eliminated from the model because of statistical nonsignificance. The latter which has been labeled as the "partialing fallacy," I believe, has occurred in a substantial number of recent multiple regression analyses of determinants of fertility. (For discussions of problems of multicollinearity in causal analysis, see Blalock, 1963; Johnston, 1972; and Rockwell, 1975.)

Suggested "solutions" to problems of multicollinearity have included blocking correlated independent variables and treating the subset as a single factor; eliminating one or more of the correlated independent variables from the model; or algebraically transforming the variables so that their zero-order correlations are reduced. For causal analysis of female education and fertility, however, these procedures may be unsatisfactory. The independent variables that are likely to be highly correlated (i.e., female education, age at marriage, labor force participation, social mobility, etc.) are conceptually distinct and each may have unique and important effects on fertility and family-planning practices. These effects could be masked, lost, or made uninterpretable by blocking, dropping, or algebraically transforming the causal variables.

To disentangle and obtain the unique effects of highly correlated independent variables, a statistical procedure called Ridge Regression has been introduced by Hoerl and Kennard (1970a, 1970b). Hoerl and Kennard show that, by adding a very small (and insignificant) number to the diagonal of the correlation matrix of independent variables, it is possible to substantially reduce error variance and obtain reliable and consistent causal estimates.

Of course, before applying either path or ridge regression analysis to fertility survey data, one should examine each proposed causal linkage for linearity. This is necessary because a number of studies in less developed countries indicate that the basic relationship between education and fertility may not be linear. For the first few years of schooling, no relationship or even a positive relationship to fertility has been observed, especially where the general social and economic setting in which this education is obtained is one in which schooling is not likely to alter one's general station in life in an appreciable manner (see Bjork, 1971). Under such circumstances, regression analysis would give us very misleading results and certainly would not tell us the critical threshold of years of female schooling required to have a significant effect on fertility.

Moreover, the general model presented in Figure 2 specifies possible statistical interactions among the causal variables. It would be possible for one to introduce multiplicative terms into the path and ridge regression analysis, but such terms are not always readily interpretable. To deal with both the potential problem of nonlinearity (threshold levels) and test all possible statistical interactions in the female education-fertility causal chain, Goodman's log-linear techniques are highly applicable (Goodman, 1971, 1972a, 1972b, 1973).

Goodman's log-linear techniques are especially designed for multivariate analysis of survey data (such as the World Fertility Surveys) that contain qualitative variables (e.g., religion, urban vs. rural residence) and where quantitative relationships may not be linear or additive. In brief, Goodman's log-linear techniques analyze relationships among cell frequencies of multilevel contingency tables and provide effect parameters roughly analogous to path coefficients and measures of association analogous to partial, multiple, and multiple-partial correlation coefficients of conventional regression analysis.[2] Application of Goodman's log-linear analysis to pertinent survey data would enable one to estimate the main effects of female education on fertility as well as each order of statistical interaction of female education with other relevant variables and make causal inferences based on the direction, strength, and significance of each parameter.

CONCLUSION

Decomposing the education-fertility relationship into female education's direct, indirect, and contingent (interactive) effects using reliable fertility survey data should not only contribute to a substantially better understanding of how education influences fertility in developing nations, but it should also have important policy potential. The latter is so because, as I initially stated, female education appears to be the major social institutional variable amenable to policy manipulation that can help solve the problem of rapid population growth in developing nations. However, only if we specify and empirically verify the various causal mechanisms (and their relative importance) by which female education influences fertility, can effective policies be implemented. Thus, as a hypothetical example, if one finds that female education's effects on fertility are primarily indirect via such intervening variables as female labor force participation outside the home and exposure to contraceptive materials, it would be a fruitless policy exercise for governments to focus solely on female educational improvements without concurrently improving employment opportunities for women and making contraceptive materials available to those who desire them.

NOTES

1. In causal analysis, an operator is defined as a material structure or structured process which implements a causal relation (Heise, 1975, p. 6). Heise points out that, while causal transmutation of phenomena cannot occur without an appropriate operator to support transmutation, a causal relationship need not depend on a single operator.

2. For a discussion of Goodman's techniques and their application to causal modeling using international survey data, see Kasarda and Janowitz, 1974.

REFERENCES

Agarwala, S.N.
1965 "Effect of a rise in female marriage age on birth rates in India." Rural Population Conference Working Paper No. 18, Belgrade, Yugoslavia.

Arriaga, E.E.
1970 *Morality Decline and its Demographic Effects in Latin America*. Berkeley: University of California Population Monograph Series No. 6.

Berry, Brian J.L. and John D. Kasarda
1977 *Contemporary Urban Ecology*. New York: Macmillan Company.

Becker, Gary S.
1960 "An economic analysis of fertility." Pp. 209-231 in *Demographic and Economic Change in Developed Countries*. Princeton, N.J.: Princeton University Press for the National Bureau of Economic Research, *Universities National Bureau* Conference Series II.

Bhutnagar, Shri
1972 "Status of women and family planning in India." *The Journal of Family Welfare* 18:21-29.

Birdsall, Nancy
1974 "An introduction to the social science literature on 'woman's place' and fertility in the developing world." Carolina Population Center Annotated Bibliography 2:1-39.

Bjork, Robert M.
1971 "Population education and modernization." In Don Adams (ed.), *Education in National Development*. London: Routledge and Kegan Paul.

Blake, Judith
1965 "Demographic science and the redirection of population policy." *Journal of Chronic Diseases* 18:1181-2000.

Blalock, H.M., Jr.
1963 "Correlated independent variables; the problem of multicollinearity." *Social Forces* 42:233-237.
1971 *Causal Models in the Social Sciences*. Chicago: Aldine.

Bogue, Donald J.
1969 *Principles of Demography*. New York: John Wiley and Sons.

Bumpass, Larry
1969 "Age at marriage as a variable in socio-economic differentials in fertility." *Demography* 6, No. 1 (February):45-54.

Busfield, Joan
1972 "Age at marriage and family size: social causation and social selection hypotheses." *Journal of Biosocial Science* 4:117-134.

Caldwell, John C.
1968 "The demographic implications of the extension of education in a developing country: Ghana." Paper presented at the meeting of the Population Association of America, Seminar 6.

Carleton, Robert O.

1967 "The effect of educational improvement on fertility trends in Latin America." Pp. 141-145 in *Proceedings of the World Population Conference*, Belgrade, 1965. New York: United Nations

CELADE and Community and Family Studies Center

1972 *Fertility and Family Planning in Metropolitan Latin America*. Chicago: University of Chicago, CFSC.

CELADE

1970 *Manual Para Usuarios de las Encuestas Comparativas de Fecundidad Pecfal-Urban*. Doc. PECFAL-Urban No. 39.

1976 *Manual Para Usuarios de las Encuestas Comparativas de Fedundidad Pecfal-Rural*. Doc. FECFAL-Rural No. 39.

Cernada George and Laura Lu

1972 "The Kaoshiung study." *Studies in Family Planning* 3:198-203.

Chandrasekhar, Sripati

1972 *Infant Mortality, Population Growth and Planning in India*. Chapel Hill: University of North Carolina Press; London: George Allen and Unwin.

Chung, Bo Mo, J.A. Palmore, and S.J. Lee

1972 *Psychological Perspectives: Family Planning in Korea*. Seoul: Hullym Corporation.

Dandekar, Kumundi

1967 "Effect of education on fertility." Pp. 146-149 in *Proceedings of the World Population Conference*, Belgunda, 1965. New York: United Nations.

Davidson, Maria

1973 "A comparative study of fertility in Mexico City and Caracas." *Social Biology* 20:460-472.

De Jong, Johanna

1975 "La situación de la mujer y algunas precondiciones de la plantificación familiar." In *Factors Associated with the Adaptation of Contraception in Rural Latin America*. CELADE.

Dixon, Ruth B.

1976 "The roles of rural women: female seclusion, economic production and reproductive choice." Pp. 290-321 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.

Duncan, O.D.

1966 "Path analysis: sociological examples." *American Journal of Sociology* 72:1-16.

Elizaga, Juan C.
1975 "The participation of women in the labor force of Latin America: fertility and other factors." *Ekistics* 40:40-45.
Freedman, Ronald, P.K. Whilpton, and A.A. Campbell
1959 *Family Planning, Sterility and Population Growth*. New York: McGraw-Hill.
Freedman, Deborah S.
1976 "Mass media and modern consumer goods: their suitability for policy interventions to decrease fertility." Pp. 356-386 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.
Friedlander, Stanley and Morris Silver
1967 "A quantitative study of the determinants of fertility behavior." *Demography* 4:30-70.
Goldberg, David
1976 "Residential location and fertility." Pp. 387-428 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.
Goodman, Leo A.
1971 "The analysis of multidimensional contingency tables: step-wise procedures and direct estimation methods for building models for multiple classifications." *Technometrics* 13:33-61.
1972a "A modified multiple regression approach to the analysis of dichotomous variables." *American Sociological Review* 33:28-46.
1972b "A general model for the analysis of surveys." *American Journal of Sociology* 77:1035-1086.
1973 "Causal analysis of data from panel studies and other kinds of surveys." *American Journal of Sociology* 78:1135-1191.
Heise, David
1975 *Causal Analysis*. New York: John Wiley and Sons.
Hoerl, A.E. and R.W. Kennard
1970a "Ridge regression: biased estimation for nonorthogonal problems." *Technometrics* 12:55-68.
1970b "Ridge regression: applications to nonorthogonal problems." *Technometrics* 12:69-82.
Holsinger, Donald and John D. Kasarda
1976a "Education and human fertility: sociological perspectives." Pp. 154-181 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.
1976b "Does schooling affect birth rates?" *School Review* 84:71-90.

Husain
1970a "Education status and differential fertility in India." *Social Biology* 17:132-139.
1970b *An Urban Fertility Field: A Report on the City of Lucknow*. Lucknow: Demographic Research Center, Lucknow University.

Inkeles, Alex
1974 "The school as a context for modernization." In Alex Inkeles and Donald B. Holsinger (eds.). *Education and Individual Modernity in Developing Countries*. Leiden: E.J. Brill.

Jaffe. A.J.
1959 *People, Jobs, and Economic Development*. Glencoe, Ill.: Free Press.

Johnston, J.
1972 *Econometric Methods*. New York: McGraw-Hill.

Kasarda, John D.
1971 "Economic structure and fertility: a comparative analysis." *Demography* 8:307-317.

Kasarda, John D. and Morris Janowitz
1974 "Community attachment in mass society." *American Sociological Review* 39:328-339.

Kripalani, Gul, P. Maitra, and T. Bose
1971 "Education and its relation to family planning." *Journal of Family Welfare* 18:3-8.

Kupinsky, Stanley
1971 "Non-familial activity and socioeconomic differentials in fertility." *Demography* 8, No. 3 (August):353-367.
1977 *The Fertility of Working Women: A Synthesis of International Research*. Praeger Special Studies. New York: Praeger Publishers.

Land, K.C.
1969 "Principles of path analysis." Pp. 3-37 in Edgar Borgatta (ed.), *Sociological Methodology* 1969. San Francisco: Jossey-Bass.

Mandelbaum, David
1974 *Human Fertility in India*. Berkeley and Los Angeles: University of California Press.

Miró, Carmen A. and Ferdinand Rath
1965 "Preliminary findings of comparative fertility surveys in three Latin American cities." *Milbank Memorial Fund Quarterly* 43:36-68.

Momeni, Djamchid A.
1972 "The difficulty of changing the age at marriage in Iran." *Journal of Marriage and the Family* 34:544-551.

Mueller, Eva

1972a "Economic cost and value of children: conceptualization and measurement." In J. T. Fawcett (ed.), *The Satisfactions and Costs of Children*. Honolulu: East-West Center Press.

1972b "Economic motives for family limitation: a study conducted in Taiwan." *Population Studies* 27:383-403.

1976 "The economic value of children in peasant agriculture." Pp. 98-153 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.

Olusanya, P.O.

1971 "Status differentials in the fertility attitudes of married women in two countries in western Nigeria." *Economic Development and Cultural Change* 19:641-651.

Preston, Samuel (ed.)

1978 *The Effects of Infant and Child Mortality on Fertility*. New York: Academic Press.

Raabe, Carlos

1973 "Educación, contacto con medias de difusión masiva, comunicación entre los esposos y uso de métodos anticonceptivos en las zonas rurales de América Latina." CELADE, SIEF A-2/P.

Repetto, Robert G.

1976 "Direct economic costs and value of children." Pp. 77-97 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.

Ridker, Ronald G. (ed.)

1976 *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.

Rockwell, R.C.

1975 "Assessment of Multicollinearity." *Sociological Methods and Research* 3:308-320.

Rothman, Ana Maria

1969 "La participacion femenina en actividades economicas en su relacion con el nivel de fecundidad en Buenos Aires y Mexico." CELADE, Series C, No. 108.

Schultz, T. Paul

1976 "Interrelationships between mortality and fertility." Pp. 239-289 in Ronald G. Ridker (ed.), *Population and Development: The Search for Selective Interventions*. Baltimore: The Johns Hopkins University Press.

Sen, Jutka, and D.K. Sen
1967 "Family planning practice of couples of reproduction age group in a selected locality in Calcutta." *Journal of Family Welfare* 14:13-24.

Smith-Lovin, Lynn and Ann R. Tickamyer
1978 "Nonrecursive models of labor force participation, fertility behavior and sex role attitudes." *American Sociological Review* 43:541-557.

Stycos, J. Mayone, K.W. Back and Reuben Hill
1956 "Problems of communication between husband and wife on matters relating to family limitation." *Human Relations* 9:207-215.

Stycos, J. Mayone
1967 "Education and fertility in Puerto Rico." Pp. 177-180 in *Proceedings of the World Population Conference*, Belgrade 1965. New York: United Nations.

Velasco, Jesus
1973 "Niveles de instruccion y su efecto diferencial en la fecundidad en Colombia." Asociacion Colombiana de Faculta des de Medicina, Bogota Pub. No. 5 Encuesta Nacional de Fecundidad.

Waite, L.J. and R.M. Stolzenberg
1976 "Intended childbearing and labor force participation of young women: insights from nonrecursive models." *American Sociological Review* 41:235-51.

Westoff, Charles, Robert G. Potter, Jr., and Philip C. Sagi
1973 *The Third Child*. Princeton, N.J.: Princeton University Press.

Westoff, Charles and Norman B. Ryder
1977 *The Contraceptive Revolution*. Princeton, N.J.: Princeton University Press.

Wright, Sewell
1960 "Path coefficients and path regressions: alternative or complementary concepts?" *Biometrics* 16:189-202.

Yaukey, David
1961 *Fertility Differences in a Mediating Country: A Survey of Lebanese Couples*. Princeton, N.J.: Princeton University Press.

Yaukey, David and Timm Thorsen
1972 "Differential female age at first marriage in six Latin American cities." *Journal of Marriage and the Family* 34:375-379.

Youssef, Nadia H.
1974 *Women and Work in Developing Societies*. Population Monograph Series No. 15. Berkeley: University of California Press.