The Philippine Review of Business and Economics Vol. XIV No. 2 December 1977

INCOME, EDUCATION, FERTILITY AND EMPLOYMENT: PHILIPPINES 1973

By

Dante B. Canlas and José Encarnación, Jr.*

Introduction

The aim of this paper is to replicate and extend a previous study (Encarnación 1974) by using a data file from the 1973 National Demographic Survey (NDS). To account for interrelationships among marital fertility, female employment, family income and wife's education, we construct a recursive model involving five estimated equations with a measure of fertility, husband's income and family income, the wife's age at marriage and her employment as dependent variables.

In that earlier study of quantifiable determinants of marital fertility and labor force participation in the Philippines, Encarnación (1974) tested the hypothesis that the marginal effects of family income and of educational level on fertility are positive or negative depending on whether or not these variables fall below or above certain thresholds: if we suppose a subsistence level of family income below which the health of the mother must be deemed substandard, rising levels of income and more years of schooling of the wife below an education threshold would enable her to gain better health and thus would have positive marginal effects on fertility; beyond the thresholds, higher opportunity cost of the parents' time is likely to induce a negative substitution effect which outweighs a positive income effect.

With regard to labor force participation, the hypothesis is that the marginal effect of education as a proxy for the wife's earning power is negative when the husband's income is below a family income threshold. More hours of work would be supplied on the market by a woman if her earning power is lower, since the family as the deci-

***Assistant Professor and Professor of Economics, respectively, University of the Philippines.** **Computations were done at the University of the Philippines Computer Center by Carson Ho. The authors are also grateful to the Council for Asian Manpower Studies for research support.**

sion-making unit would attempt to reach the subsistence level of income. Above the threshold, the marginal effect could well be positive because of a dominant substitution effect in favor of labor supply to the market. Using a sample drawn from the 1968 NDS, the empirical results supported the hypothesis. Some aspects of these findings for the Philippines appear to be in contrast to those found in developed countries, but only because incomes are higher in the latter.

Cross-sectional studies of fertility behavior in developed countries typically point to a negative relationship between family size and income, although Becker (1960) has argued that one should expect a positive relationship between income and fertility if the level of contraceptive knowledge is held constant.[1] Other studies following his have concentrated on explaining the observed negative association (see, e.g., Mincer 1963, Willis 1973, Michael 1973). One finding running through these studies is the presence of a large negative price or cost effect dominating a positive income effect in the demand for children.

The evidence from time series also shows an inverse relationship between fertility and per capita income in the economically developed parts of the world. Since growth in real income is usually accompanied by growth in real wages, this empirical result is interpreted as indicative of a stronger substitution effect against children. Within a demand-analysis context, an increase in wages represents an increase in the opportunity cost of parents' time spent in child rearing (especially the wife's). The negative association between income and fertility reflects the presence, it is argued, of a substitution effect which outweighs the income effect.

Similarly, a negative correlation is found to exist between wife's education and fertility across households. If household decisions pertinent to fertility can be organized along a time allocation framework, the cost of time hypothesis may appear to be a plausible explanation. This argues that more years of schooling, other things equal, is associated with a higher opportunity cost of women's time in terms of market earnings foregone. This raises the relative price of children who are assumed to be intensive in the mother's time, thus

[1] Becker views children as consumer durables and applies demand theory to fertility behavior. Being normal goods, he argues that an increase in income leads to a higher number of children demanded under a *ceteris paribus* assumption, i.e., tastes, costs and knowledge of contraception remaining constant.

imparting a substitution effect away from children. (Other hypotheses to explain this negative correlation between fertility and education will be reviewed in section 2.)

These findings for developed countries do not seem to hold when incomes are below subsistence levels. Encarnación's findings for the Philippines (1974) has showed support for the hypothesis that below subsistence levels and at a low educational level of the wife, the marginal effects of income and years of schooling on the number of children ever born are positive. The significant and negative influence of education is felt only beyond a certain threshold.

Regarding the labor force participation of married females in modern economies, there was initially an apparent contradiction between the evidence from time series and that shown from cross-section data. In the United States for instance, historical evidence showed a continuing secular increase in participation rates of females, including those married, along with a growth in real income (Mincer 1962, p. 64). However, there were cross-section studies involving areal and family income data regressions which showed a negative relationship between income and labor force participation of married females. Mincer's study (1962) was an attempt to uncover the reasons behind the observed negative association in cross-section data and reconcile the apparent contradiction. He incorporated a price variable in addition to an income variable to capture the opportunity cost of the wife's time spent in nonmarket activities and the empirical results from this cross-section estimation showed a positive price effect on labor supply which outweighed the negative income effect. He also found that the negative relationship was caused mainly by the transitory component of current income and when removed, as in long-run time series estimation, the inverse relationship between income and labor force participation tended to disappear. Other cross-section studies following Mincer's also suggest a positive relationship (e.g. Cain 1966, Ashenfelter and Heckman 1974).

For the Philippines, Encarnación (1974) has found evidence that low income levels, the marginal effect of more years of schooling the wife on her labor force participation is negative while the positive price effect (with education as a proxy for earning power) is observed only beyond a certain income threshold.

The paper proceeds in Section II with a brief survey of various economic hypotheses regarding fertility and labor force participation and draws from other related studies which suggest a broader framework to account for these aspects of household behavior in the Philippines. The threshold hypotheses that we want to test are also discussed. Section III discusses the data and the notation used. Section IV presents a simultaneous equation model the regression results of which are given in Section V. Section VI makes some concluding remarks and suggests some areas for further research.

II. Theoretical Considerations

Fertility, Income and Education

The recent economic literature analyzing fertility is an application of the theory of consumer behavior to the demand for children. The point of departure for this approach is the view that the household, as the relevant decision-making unit, maximizes a utility function whose arguments are children or child services and a composite of other goods subject to income and time constraints. This approach, whether formulated in the classical way or in the household production function framework of Becker (1965), leads to a set of testable hypotheses on such variables as fertility, income and education.

This choice-theoretic framework of fertility behavior treats children as economic goods and points to full-income as the relevant income constraint. The latter involves the household's vector of wage and nonwage incomes. Changes in the wage rates of some members of the household, all other things held constant, can affect the relative price of children. Mincer (1963) and Becker (1965) pointed out that the full price of children entails both direct (such as outlays for children's food, clothes, etc.) and indirect costs (e.g. opportunity cost of time involved in child rearing). The direction of the effect of a change in income on child quantity cannot be deduced *a priori* from this economic framework but would depend on the sources and the relative strengths of certain price and income effects.

The theory predicts that if the compensated change in income emanates from nonwork income, then there will be a pure positive income effect on child members. If the change is brought about by a change in wage rates, price effects are involved and the effect on child numbers would depend on the relative amount of time the parents put into child-related activities. If child rearing is more time intensive than other activities the parents can engage in, then there will be a substitution effect away from children. It is usually held that the substitution effect induced by an increase in the wife's wage rate exceeds the income effect, the assumption being that child rearing is more intensive in the mother's time than her other activities. On the other hand, the substitution effect of an increase in the husband's wage rate is expected to be weaker than the income effect if he puts in less time for child care than in his other activities. In empirical estimation the coefficient of the wife's wage rate is expected to be negative, while that of the husband is positive.[2]

To trace the influence of education on fertility within an economic framework, several economists in the last decade have relied on Becker's formal model of time allocation as an analytic framework (see, e.g., Willis 1973, Michael 1973, De Tray 1973 and Ben-Porath 1973).[3] There are three prominent hypotheses in this regard which carry implications about the possible effect of education on fertility: cost of time, cost of fertility regulation, and child quality-child quantity interaction.

The cost of time hypothesis traces the influence of education on fertility through the effects of years of schooling on the value of time of household members. Several studies on human capital present evidence that more years of schooling increase one's market productivity, money wage rate and thus money income. If children are economic goods, then there is an education — induced income effect on the demand for children. However, there is also a substitution effect away from children since a higher wage rate is linked to a higher opportunity cost of one's time. It has been argued that education also raises one's nonmarket productivity (see Michael 1972). One expects a reallocation in the time of other household members

---

[2] By relying on an economic framework, Mincer's (1963) empirical verification with cross-section data in the U.S. showed a negative coefficient for the wife's wage rate and a positive coefficient for the husband's income with the absolute value of the former exceeding the latter. This is partly relied on to explain the observed inverse relationship between fertility and income in the U.S.

[3] In Becker's (1965) formulation of a theory of consumer behavior, goods and services do not enter directly as arguments in the utility function. Rather, the household is assumed to produce basic commodities using inputs of time and market goods with the technology embodied in a household production function. It is these commodities which are assumed to yield utility to the household. He emphasized that the effect of a change in the price of time on the relative prices of a commodity would depend on its time intensity in production and consumption. The impact of an environmental variable like education can be traced through its effects on the marginal productivity of various inputs in the production of child services.

as a result of a change in the value of time of a particular member. This depends, other things equal, on the relative strengths of productivity increases between market and nonmarket activities. Consider the wife as an example. If the effect of more years of schooling is to raise her market more than her nonmarket productivity then she tends to reduce time intensive nonmarket chores. Children are typically assumed to be intensive in the mother's time. If no adequate substitutes can be found for the mother's time in child care, then we expect a substitution effect away from children. In empirical verification in the U.S., the rising cost of the mother's time has been the key explanation for the observed negative relationship between education and fertility.

Another channel by which education can possibly affect fertility is its influence on the cost of fertility regulation. If fertility control is one of the productive activities of the household then education can affect this activity either by lowering information cost or by affecting the marginal productivity of various inputs used to produce a lower probability of conception.[4] Thus if more educated couples are faced with a lower information cost and are more efficient in the use of contraceptive techniques, these mean a lower cost of fertility regulation *ceteris paribus*. Faced with this lower cost, more educated couples would choose to produce a lower probability of conception. Over time, they would expect lower fertility. Alternatively, if one considers a shadow price for fertility regulation and defines the cost of an additional child as equal to the cost of raising the child minus the cost of avoiding a birth, lower contraception cost raises the cost of an additional birth and would lead to a lower quantity demanded of children.

The link between education and fertility has also been traced through a child quality-quantity interaction framework (notably Becker and Lewis 1973, De Tray 1973). By introducing a nonlinear budget constraint in a utility-maximizing model, Becker and Lewis derived shadow prices for child quality and quantity. They show that the shadow price of child quality depends on its own price and monotonically increases with child numbers. Similarly, the shadow price of quantity depends on its own price and is monotonically related in the same direction with the level of child quality. Hence if

[4] For a detailed exposition of how education affects one's productivity in nonmarket activities such as those related to fertility regulation (see Michael 1972, 1973).

an increase in the parents' education lowers the price of child quality,[5] more educated couples will choose more child quality (which raises the shadow price of child quantity) and thus less children. Alternatively, if the price of child numbers goes up,[6] then the shadow price of child quantity goes up inducing a price effect away from quantity. This leads to a lower price of child quality and increases the level of quality demanded.

The appeal of this economic theory of fertility behavior lies in its analytical tractability and its capacity to yield implications which are testable. Its static formulation has its obvious limitations but it has been useful in pinpointing cause and effect relations among different sets of variables. However, the pure utility-based theory of fertility behavior, because of its inherent tendency to ignore health and biological considerations and socio-cultural factors, is unlikely to explain much of the observed variation in fertility especially among less-developed countries. Easterlin (1975) has cited the tendency of economists to ignore natural fertility and has argued that in pre-industrialized societies, it is the factors affecting natural fertility that may explain observed fertility variations within certain ranges. Encarnación (1974) argued that below subsistence levels of income, rising incomes enable the mother to acquire better health and up to some point may lead to a positive income-fertility relationship. Leibenstein (1974) proposed a broader socio-economic theory of fertility and argued that as development proceeds, "economic changes are accompanied by other changes which transform the socio-cultural props to high fertility" (p. 453). People move out of certain socioeconomic groups into others each with its own consumption standards. Leibenstein also noted that "to undertake commitments to support one's family at a certain standard may involve a target-oriented behavior pattern and a sense of increasing marginal utility until the target is achieved" (p. 454).

A theory of fertility behavior extended to include supply-relevant factors and socio-cultural considerations may provide an analytical

---

[5] This assumption follows from the observation that more educated couples tend to spend more on goods and services, all other things being equal. These become public goods in the household and children are necessarily exposed to them. This has the effect of lowering the marginal cost of child quality.

[6] More years of schooling is frequently assumed to make parents more efficient in the use of contraceptive techniques which lowers the cost of fertility regulation to them and, as has been argued, leads to a higher marginal cost of a child.

base for the hypotheses that we want to test. There is a threshold level of income such that below it, the effect of rising incomes on fertility is positive. As living standards improve below the threshold, the mother has better nutrition, thus heightening her natural fertility. Moreover, the probability of still-births and miscarriages is relatively high at low income levels and faced with these prospects a couple tends to have little motivation to limit births.[7] Above the threshold, the expected effect of rising incomes could well be negative. Confronted with new consumption standards, there is a tendency to increase expenditures per child, and the effect of rising income would be to induce a substitution effect against children.

A corollary hypothesis that we want to test involves the effects of the wife's years of schooling on fertility: there is a qualitative difference if her educational level falls below or above a certain threshold. At low educational levels, the family is likely to belong to a low income group even if the wife works. In such an environment, her educational level may have little additional relevance to fertility except insofar as more schooling has an effect on better health practices which in turn leads to higher natural fertility. At higher education levels and higher income levels above a subsistence level, we expect that the effect of more years of schooling is a higher opportunity cost of the wife's time in terms of foregone earnings and this should have a negative effect on fertility. In brief, the hypothesis is that there is a threshold level of the wife's education such that below it the effect of more years of schooling on fertility is positive (or possibly zero) while above it the effect is negative.

Labor Force Participation, Income and Education

An analysis of market labor supply provided by married women which extends the traditional work-leisure dichotomy to include time for housework may provide possible insights into the work decision of the wife. In this broader framework initially suggested by Mincer (1962), it was argued that if hours spent in the market is to be derived in a residual fashion, one has to consider not just "leisure" but hours spent in housework as well. As formulated by Becker (1965), the household maximizes a utility function procedure

[7] This is following Easterlin's (1975) arguments that "the potential output of and demand for children jointly determine the motivation for fertility regulation. If the potential output falls short of demand, there is no desire to limit fertility" (p. 56).

subject to production and time constraints. The maximization procedure yields as an equilibrium condition the marginal cost of a commodity (which involves time in consumption and production) as the sum of direct outlays (i.e. cost of market goods) and indirect costs (foregone earnings). Indirect cost is further divided into that resulting from the allocation of goods and that resulting from the allocation of time. This framework has been used to analyze the possible effects of income or earnings on labor force participation. If the income increase is due solely to an increase in nonwork income, there is no change in relative prices and there will just be a pure income effect on the consumption of all normal commodities. Hours of work would decrease since total hours spent on consumption would increase. On the other hand, a change in earnings or wage rates would affect relative commodity prices since different commodities would involve different levels of foregone earnings. There will be a shift away from time-intensive commodities if there is a compensated rise in earnings. A shift away from those commodities would result in a lower amount of time spent in consumption and thus an increase in the time spent at work. The net effect of an income change on labor supply would thus depend on the resultant of the two opposing income and substitution effects.

There is an emphasis above on the role played by marginal considerations in determining the allocation of time among various activities. Such considerations would not seem to be unreasonable in the decision-making of families at above-subsistence income levels. However, the situation may be quite different in the case of families at below subsistence levels. We expect that here, the smaller the husband's income the more likely is the wife going to work. Additionally, the wife is more likely to work if her education level is lower (because her wage rate is lower), simply in order to increase family income towards the subsistence level. Beyond this target level of income, it could well be that the substitution effect induced by an increase in the wife's wage rate against time intensive commodities will outweigh the income effect. Our hypothesis, therefore, is that there is a threshold level of income such that the effect of more years of schooling of the wife (as a proxy for her earning power) on her decision to work is negative when the husband's income is below the threshold. Above the threshold, it could well be positive.

III. Data and Notation

Our sample is drawn from the 1973 National Demographic Survey, a nationwide stratified random sample of 8,434 households which contains economic and demographic information at the household and individual levels.

To test the hypotheses discussed in the preceding section, our sample is limited to single-family households, consisting of a couple and any unmarried children living with them, possibly including unmarried relatives but excluding parents or grandparents of either spouse. The wife was married only once with husband present and was under 45 years of age at the time of the survey. We included only households which yielded full information on a set of variables pertinent to the study, e.g. educational levels of the husband and wife, incomes of the husband and wife, age of wife and husband, number of children born alive and work status of the wife. This selection process yielded 2,342 observations of which 682 are urban and 1660 are rural.[8] This sample possibly comes closest to the theoretical constructs of a model of household behavior where decision-making pertaining to family size and labor force participation rests mainly on the couple.

A similar selection process was used in (Encarnación 1974) and Table 1 presents a comparison of the mean values of certain variables. Table 2 gives the wife's age-distribution for the 1968 and 1973 surveys. The distribution shows a lower mean age of the wife for 1973 as compared to 1968. For 1973, the mean age is about 30 and for 1968, it is approximately 34. This age difference partly serves to explain the differences in some of the mean values of certain variables like the number of live births the woman has had.

The variables and their notations follow:

AM = age of woman when she got married, in years

CWK = 1 if the woman belongs to age-cohort K and O otherwise

where K is coded as

4 = age 15-19
5 = age 20-24

---

[8] This urban-rural ratio reflects the true population ratio accurately. In contrast, the sampling proportions in the 1968 NDS were 1:400 and 1:1200 for rural and urban respectively, such that the unweighted regression results and other statistical estimates reported in (Encarnación 1974) are possibly misleading.

6 = age 25-29
7 = age 30-34
8 = age 35-39
9 = age 40-44

(CW) = (CW5, CW6, CW7, CW8, CW9)

EHK = 1 if the educational level of the husband is K and 0 otherwise, where K is coded as

0 = no schooling
1 = finished 1 to 4 years of grade school
2 = finished 5 to 7 years of grade school
3 = finished 1 to 3 years of high school
4 = high school graduate
5 = finished 1 to 3 years of college
6 = college graduate

(EH) = (EH1, EH2, EH3, EH4, EH5, EH6)
EWK = 1 if the educational level of the wife is K and 0 otherwise, where K is coded as in EHK
(EW) = (EW1, EW2, EW3, EW4, EW5, EW6)
EWN = min(0, EW − 1.5)
EWX = max(0, EW − 1.5)
FY = annual family income, in thousand pesos
FYN = min(0, FY − 2.5)
FYX = max(0, FY − 2.5)
KH = age-cohort number of the husband which takes values 4, 5, 6, 7, 8, 9, 10 where 4 is for age 15-19 and 10 is for age 45 and above (cf. the coding for CWK)
LPD = 1 if the wife is working and 0 otherwise
LOC = 1 if location of residence is urban and 0 if rural
NB = number of children the woman has had (live births only)
YH = annual income of the husband, in thousand pesos
YHN = min(0, YH − 2.5)
YHX = max(0, YH − 2.5)

The income threshold that we assume corresponds to a subsistence level of income. In (Encarnación 1974) the threshold value was 1.5 thousand pesos a year. This represented the annual wage income of a worker earning the daily minimum wage and working 250 days during the year. For this paper, we adjusted price changes between 1968 and 1973 and used 2.5 thousand pesos a year as the income threshold. This appears as the constant in the variables FYN, FYX, YHN, YHX.

In the previous paper, the education threshold was obtained by taking the partial derivatives of fertility and labor force participation functions (with a quadratic term for EW) with respect to EW and equating them to zero. A threshold value of 2.75 resulted. Initially we tried the same threshold value with the 1973 data but results were not significant. After some experimentation, a threshold value of 1.5 appeared superior. To rationalize this, it can be argued that in the course of economic development there would be a secular rise in the years of schooling[9] and a movement of households from one socio-economic group to another (Leibenstein 1974), while the consumption standards of one are likely to have demonstration effects on others. The use of contraceptives is a case in point. Over time, knowledge and use of contraceptive is likely to spread from high-income to low-income groups. With government intervention the process may be speeded up. Between 1968 and 1973, these factors could have contributed to a lowering of the education threshold with regard to fertility.

IV. The Model

To quantify interrelationships among income, education, fertility and work status of the wife we consider a simultaneous equation model involving AM, YH, LPD, FY and NB as endogenous variables. In the absence of an explicit model that yields functional forms, we assume linear functions. The model involves 5 estimated equations and 6 definitional equations, where a variable to the left of a colon is taken to be a linear function of the variables on the right.

(1) AM : (EW), LOC
(2) YH : (EH), KH, LOC
(3) LPD : (CW), YHN, YHX, EWN, EWX, LOC
(4) FY : EH, LOC, LPD
(5) NB : (CW), AM, FYN, FYX, EWN, EWX, LOC, LPD
(6) $YHN = \min(0, YH - 2.5)$
(7) $YHX = \max(0, YH - 2.5)$
(8) $EWN = \min(0, EW - 1.5)$
(9) $EWX = \max(0, EW - 1.5)$

[9] See Table 1 for rural averages for EW; the difference between the urban figures is probably not significant.

(10) $FYN = \min(0, FY - 2.5)$

(11) $FYX = \max(0, FY - 2.5)$

Equation (1) gives a woman's age at marriage as a function of her years of schooling[10] and location of residence. More years of schooling is expected to raise a woman's age at marriage while previous studies generally show that women in urban households marry at a later age than those in rural families.

In equation (2) education and experience proxied by age[11] explain the husband's income. There is plenty of evidence in human capital studies that years of schooling and experience have positive effects on earnings.

Equation (3) is the work equation of the wife, where the dependent (dummy) variable LPD takes the value 1 if the wife works and 0 otherwise. The 1973 NDS questionnaire on labor force distinguishes those working from nonworking, but there is no labor force participation variable available. LPD seems appropriate with the model that we want to consider, however, since in the family income equation, the important consideration is whether the wife does market work or not, augmenting the family income if she does. In line with the hypothesis that we want to test we use YHN, YHX, EWN, and EWX. Based on the hypothesis we expect that $\partial LPD/\partial YHN < 0$ and $\partial LPD/\partial EWN < 0$. The use of (CW) permits differential effects of age (and corresponding presence of young children in the household) on fertility.[12]

Equation (4) gives family income[13] as a function of the husband's age and education, the wife's work status, and location of residence. All the included explanatory variables are expected to have positive effects on family income.

---

[10] (EW) is a 6-element vector at most one of whose elements corresponding to the wife's educational level takes the value 1. Thus if she is a college graduate, K = 6 and (EW) = (0, 0, 0, 0, 0, 1).

[11] (EH) applies to the husband's educational attainment and is formulated as in (EW).

[12] (CW) is a 5-element vector which applies to the age-cohort to which the wife belongs. If the wife belongs to the 20-24 age-cohort, CW5 = 1 and (CW) = (1, 0, 0, 0, 0).

[13] The estimation of family income data is discussed in Appendix A.

The dependent variable in equation (5) is the number of live births a woman has had. In line with our hypothesis, we expect the coefficient of FYN to be positive and that of EWX to be negative. The use of (CW) allows for nonlinearity in the effect of age, and we include LPD as an explanatory variable.

We note that an objection has been raised against using the wife's labor force participation as an independent variable in a fertility equation (see Wachter 1975, p. 610). Taking a suggestion from Mincer (1963, pp. 78-79) who dropped such a variable in an estimate of a fertility equation after his empirical tests showed that the variable was not statistically significant, Wachter has argued that in a static one-period utility-maximizing model, fertility and labor force participation are simultaneously determined by the same basic economic variables of price, income and taste. We do not feel constrained by such an objection, however, since we are looking for empirical relationships and our model is not derived explicitly from an optimizing framework. Also, it is not at all clear that a static one-period utility-maximizing model is an appropriate one to use in regard to fertility behavior.

We also note that we use the same income and education threshold values for both the fertility and employment equations, although there is no intrinsic reason why this should be so. Computational convenience is our consideration here, plus the fact that the previous study using the 1968 NDS data show that using the same threshold values is empirically not inappropriate.

The model as formulated is recursive. Equations (1) and (2) are determined by a set of exogeneous variables. Equation (3) is a function of exogenous variables and endogenous variables already determined. Equation (4) is obtained once LPD is determined. Finally, NB in equation (5) is determined by exogenous variables and endogenous variables already obtained. Accordingly, we estimate the model using ordinary least squares. In addition, since there are likely to be differences in home production and consumption technology, we estimate separate sets of parameters for the rural and urban subsamples.

V. Regression Results

Fertility

Table 3 gives the ordinary least squares estimates of the parameters of the fertility equation. For the sample considered, NB increases monotonically with increasing age of the wife. A delay of one year in the woman's age at marriage decreases a woman's number of live births by about 0.27. The coefficients of FYN and EWN are both positive. The t-value of the FYN coefficient is significant but that of EWN is significant only at the 20 percent level. Nevertheless, we see that below the threshold, income and years of schooling are positively related with a woman's fertility. The estimated coefficient of FYX is not significantly different from zero. However, EWX exerts a negative effect on fertility. These results are consistent with our hypothesis. At income levels above the threshold, it is education rather than income that bears a negative relationship with fertility. A substitution effect against children arising from an increase in the opportunity cost of the wife's time possibly dominates a positive income effect above the threshold. Working mothers for the sample we used have lower fertility as shown by the coefficient of LPD which is negative and significant.

The location of residence dummy did not add to the explanatory power of the fertility regression model that we considered. One infers that the simple rural-urban dichotomy fails to account for fundamental differences in the two environments. However, we share the general observation that there is a host of cost-related factors which are likely to affect desired family size (see, for example, Schultz 1969, p. 172). The weakness of the location dummy is a reflection perhaps of its inability to capture all those cost concepts and to gain additional insights, we found it worthwhile to estimate separate parameter sets for the two settings.

For the urban and rural subsamples, the number of births monotonically increases with a rise in the age of the wife. There are no large differences in the estimated coefficients of the various age-cohort dummy variables. A one year delay in the age of marriage decreases births by about 0.31 in an urban household as against 0.25 in a rural household.

For the urban case, the estimated coefficient of FYN is positive while that of EWN is not significant, as also those for FYX and EWX. Still the coefficient of EWX is negative as expected.

For the rural case, the signs of the coefficients of FYN, FYX, EWN and EWX obtained are as expected. We observe, however, the low t-value for FYN. It has been noted that there are several difficulties in coming up with a measure of family income for the rural case. A majority of the population are engaged in agricultural occupations, and transactions in goods and services may not be in cash; if one fails to account for noncash income, a serious downward bias in the income measure would result. In our estimates, we included both cash and noncash income but the usual problem of recall in data collection may still bias the noncash component. This problem might be a less serious one for the urban case where income in kind is expected to represent only a small portion of total family income. In addition to the above, there are information limitations due to the nature of the income data available in the 1973 NDS. Only income brackets are reported rather than income levels (see Appendix A).

Work Status of the Wife

Table 4 summarizes the regression results of the wife's employment function. For the all sample, the estimated coefficients of YHN and EWN are negative and significant. The coefficient of YHX is not significantly different from zero. More years of schooling above the education threshold is positively related with LPD and the t-value of the estimated coefficient is quite significant. It can be inferred that above the threshold, more years of schooling of the wife is likely to produce a substitution effect in favor of market work which outweighs the income effect. The same pattern is observed for the separate regressions using the rural and urban subsamples.

Age at Marriage, Husband's Income, Family Income

Tables 5, 6 and 7 summarize the regression estimates for the AM, YH, and FY equations.

For the all sample, one observes a kink in the relationship between AM and EW. For our sample of women, we notice the coefficients declining from EW1 to EW2 and rising from EW3 to EW6. We attribute this simply to sampling variation. The urban sample of women marry later than those in the rural areas as shown by the positive coefficient of the LOC variable.

YH increases monotonically with a rise in the husband's years of schooling and is positively related with his age. Other things equal, the income of the husband in the urban areas is about 440 pesos a year greater than in the rural.

FY is positively related to EH and KH. If the wife works, family income is augmented by 1.3 thousand pesos a year, *ceteris paribus*, for the all sample. The urban working wife contributes approximately 2.1 thousand pesos per year as against 973 pesos contributed by the wife who works in the rural area.

Reduced Forms

To derive the effects of the exogenous variables on the endogenous variables of the model, we obtain the reduced-form equations from the structural equations. These are presented in Tables 8.1, 8.2 and 8.3 for the all sample. Three separate cases were considered for ease of presentation and computational convenience, since the structural equations for NB and LPD involve values of FY, YH, and EW lying below and above threshold values and it would be easier to consider different intervals with respect to these thresholds.

There is an increasing recognition lately of indirect policies designed to lower population growth. Outside of the direct policies like improving contraception techniques, it is now recognized that indirect measures aimed at altering the work-family roles of the mother may in certain instances be more effective in achieving desired population objectives. Hence we focus here on the effects of EW on NB and LPD.

We note that more years of schooling below the education threshold lowers the probability that the wife works, while above the threshold, the likelihood increases. With regard to the reduced-form of NB, the coefficient of EWN ranges from 0.1475 to 0.1657 for the three cases whereas in the structural form it is 0.1434. The coefficient of EWX in the reduced-forms ranges from -0.1248 to -0.1122 compared to -0.1094 for the structural equation. The effects of education are thus more pronounced in the reduced forms.

From these results, given that working mothers are likely to have lower fertility, then efforts should be exerted so that the education threshold is pushed down to zero.

Concluding Remarks

The results of our empirical investigation show support for the hypothesis that below the income threshold, the marginal effect of income on NB is positive. The marginal effect of years of schooling below the education threshold reinforces the positive effect on NB for the all and rural cases. For the urban case, the estimated coefficient of EWN is negative but is not significantly different from zero. Beyond the income threshold, the coefficient of FYX is not significant in the different estimates but that of EWX is negative and strongly significant for the all and rural cases. The coefficient of EWX for the urban case is negative but not significant.[14] Beyond the income threshold, the wife's education looms as a key handle in bringing down fertility rates.

With regard to the wife's work status, we find support for the hypothesis that the lower the husband's income is below a target subsistence level, the greater is the wife's likelihood to engage in market earning activities; beyond the subsistence level more years of schooling and its concomitant rising opportunity cost of time spent in nonmarket activities appear to induce a substitution effect in favor of market work.

Current population growth rates in the Philippines are already deemed too high as to run counter to public interest and the implication we get from the results of this study is that in the short-run, birth rates are likely to go up before they go down considering that a majority of families are still below poverty levels. Unless massive intervention programs are undertaken, if the crude death rates go down faster than the crude birth rates as a result of better nutrition and access to better health practices, the rate of natural increase would increase population growth rates in the short-run.[15] The results which trace the likely impact of rising years of schooling on fertility are also worth considering from a policy viewpoint. Indirect measures such as creating better market opportunities for women and enhancing their earnings appear to raise the relative price of children and thus may lead to a lower family size within certain income ranges.

For further research, it might be useful to investigate if there are significant differences between subsets of parameter estimates drawn

---

[14] It is reasonable to conjecture that for the urban case, in view perhaps of better access to information regarding family planning, the education threshold is lower compared to the rural and the negative marginal effect of the wife's education on NB is felt at lower years of schooling.

[15] Policies that improve health conditions are expected to lead to lower fertility rates in the long-run. It is argued as in (DaVanzo 1972) that when "the probability of survival to older ages increases, individuals will become more 'future oriented,' longer-term investments will be relatively more attractive than they were before the mortality decline. Parents will tend to invest more in themselves and in their children than they did before. Increased investments in

from the 1968 and 1973 NDS data files. Noncomparability of certain variables has prevented us from doing this without re-estimating another 1968 model. (A comparison of the bare outlines of the two studies is shown in Appendix B.) Further, additional work must be done with regard to the rural and urban cases. Considering that cost factors vary for the two environments, it might be worthwhile to study whether the two cases respond to different thresholds. The problem of bias that results from specification errors, if indeed the thresholds are different for the two cases, requires no elaboration. Also, one could consider a model where the income threshold in the NB equation is endogenous,[16] though the question of what variables nfluence the threshold may involve factors varying over the family's ife cycle. The present model is not equipped to handle such considerations.

Finally, though perhaps needless to say, while we have been considering income and education as scalar variables, it is clear that these are both multidimensional in character and scope. Income is not just money income, and education is not just years of schooling.

APPENDIX A

Family Income Data

Annual family income was obtained as the sum total of the annual cash and noncash incomes of the parents together with other working members of the family. Annual cash and noncash incomes of each respondent in the 1973 NDS are reported for brackets only, thus:

Cash Income	Noncash Income
0 – P 2999	0 – P 500
P 1000 – P 2999	P 500 – P 999

---

hemselves will enhance the attractiveness of alternatives to having children; ncreased investments in their children will tend to bring about a substitution of quality for quantity of children" (pp. 89-90).

[16] This has been suggested by Bryan Boulier in a private communication which pointed out the existence of a possible downward bias in the estimate of he coefficient measuring the effect of income on fertility if the threshold is not djusted to changes in family size.

Table 3

NB Equations

	All	Rural	Urban
const.	5.5760	5.3296	6.3331
CW5	1.5174	1.4744	1.5736
	(7.68)	(6.32)	(4.24)
CW6	3.2430	3.1693	3.3895
	(16.6)	(13.7)	(9.22)
CW7	4.7257	4.6792	4.8253
	(23.8)	(19.9)	(12.9)
CW8	5.7782	5.7978	5.7796
	(26.9)	(22.9)	(14.3)
CW9	6.3873	6.1208	7.1497
	(25.8)	(21.0)	(15.1)
AM	-0.2692	−0.2542	−0.3096
	(−27.5)	(−21.7)	(−17.3)
FYN	0.1204	0.0958	0.1977
	(2.29)	(1.545)	(1.971)
FYX	0.0018	−0.0430	0.0775
	(0.045)	(−0.848)	(1.228)
LPD	−0.1947	−0.2449	−0.0392
	(−2.10)	(−2.16)	(−0.248)
EWN	0.1434	0.2023	−0.2139
	(1.580)	(1.969)	(−0.938)
EWX	−0.1094	−0.1264	−0.0597
	(−3.15)	(−2.54)	(−1.245)
LOC	0.0455		
	(0.576)		
R^2	0.457	0.455	0.471
Sample size	2342	1660	682
s.e.e.	1.587	1.622	1.487
s.d. (NB)	2.153	2.190	2.044

Table 4

LPD Equations

	All	Rural	Urban
const.	−0.0056	0.0405	−0.1550
CW5	−0.0278	−0.0568	0.0644
	(−0.620)	(−1.110)	(0.702)
CW6	0.0501	0.0140	0.1641
	(1.142)	(0.278)	(1.838)
CW7	0.0576	0.0282	0.1535
	(1.310)	(C.558)	(1.719)
CW8	0.0893	0.0287	0.2531
	(1.946)	(0.544)	(2.73)
CW9	0.1096	0.0554	0.2709
	(2.10)	(0.926)	(2.56)
YHN	−0.0349	−0.0311	−0.0458
	(−3.04)	(−2.36)	(−1.950)
YHX	−0.0065	−0.0023	−0.0108
	(−0.706)	(−0.199)	(−0.701)
EWN	−0.1159	−0.1127	−0.1347
	(−5.64)	(−5.01)	(−2.38)
EWX	0.0803	0.0748	0.0843
	(10.7)	(7.06)	(7.59)
LOC	−0.0176		
	(−0.985)		
R^2	0.067	0.042	0.114
Sample size	2342	1660	682
s.e.e.	0.361	0.357	0.370
s.d. (LPD)	0.374	0.365	0.393

Table 5

AM Equations

	All	Rural	Urban
const.	20.0034	20.2153	19.1187
EW1	−0.5424	−0.8385	1.8949
	(−1.517)	(−2.22)	(1.727)
EW2	−0.8329	−1.0588	1.0615
	(−2.42)	(−2.90)	(1.036)
E3	−0.5407	−0.5938	1.1147
	(−1.327)	(−1.263)	(1.055)
EW4	0.9170	1.0207	2.5572
	(2.04)	(1.757)	(2.40)
EW5	1.2829	0.7429	3.2742
	(2.27)	(0.835)	(2.90)
EW6	3.8230	3.2404	5.8949
	(7.64)	(4.67)	(5.37)
LOC	0.9666		
	(4.82)		
R^2	0.088	0.036	0.117
Sample size	2342	1660	682
s.e.e.	4.056	4.043	4.080
s.d. (AM)	4.247	4.118	4.343

Table 6

YH Equations

	All	Rural	Urban
const.	1.7305	2.2908	1.1108
EH1	−0.7954	−0.8515	−0.2550
	(−5.27)	(−5.67)	(−0.457)
EH2	−0.5111	−0.6165	0.3792
	(−3.42)	(−4.10)	(0.718)
EH3	−0.2741	−0.2724	0.4352
	(−1.578)	(−1.471)	(0.800)
EH4	0.0636	−0.2944	1.1822
	(0.360)	(−1.453)	(2.22)
EH5	0.6793	0.5279	1.5961
	(3.19)	(1.818)	(2.90)
EH6	2.5029	1.6680	3.6909
	(11.3)	(5.33)	(6.66)
KH	0.0762	0.0274	0.2230
	(2.72)	(0.886)	(3.70)
LOC	0.4435		
	(5.00)		
R^2	0.17	0.065	0.25
Sample size	2342	1660	682
s.e.e.	1.774	1.682	1.954
s.d. (YH)	1.952	1.740	2.256

Table 7

FY Equations

	All	Rural	Urban
const.	1.6428	2.2883	0.7946
EH1	−0.7572	−0.8370	−0.1815
	(−4.53)	(−5.21)	(−0.281)
EH2	−0.4472	−0.5790	0.5076
	(−2.70)	(−3.60)	(0.830)
EH3	−0.2260	−0.1389	1.4281
	(−0.728)	(−0.977)	(1.084)
EH4	0.2260	−0.1389	1.4281
	(1.156)	(−0.643)	(2.31)
EH5	1.1273	1.2475	1.9150
	(4.79)	(4.03)	(3.01)
EH6	3.8059	2.8090	4.9011
	(15.5)	(8.41)	(7.66)
KH	0.0716	0.0136	0.2470
	(2.30)	(0.412)	(3.55)
LPD	1.3236	0.9727	2.1276
	(11.9)	(7.95)	(9.30)
LOC	0.5105		
	(5.21)		
R^2	0.29	0.146	0.397
Sample size	2342	1660	682
s.e.e.	1.960	1.794	2.255
s.d. (FY)	2.332	1.942	2.903

Table 8.1

Reduced Form Equations: YH > 2.5 and FY > 2.5

	AM	YH	LPD	FY	NB
const.	20.0034	1.7305	−0.0006	1.6420	0.1897
EW1	−0.5424				0.1460
EW2	−0.8329				0.2242
EW3	−0.5407				0.1456
EW4	0.9170				−0.2468
EW5	1.2828				−0.3453
EW6	3.8230				−1.0291
EH1		−0.7954	0.0052	−0.7503	−0.0024
EH2		−0.5111	0.0033	−0.4428	−0.0014
EH3		−0.2741	0.0018	−0.1376	−0.0006
EH4		0.0636	−0.0004	0.2255	0.0005
EH5		0.6793	−0.0044	1.1215	0.0028
EH6		2.5029	−0.0163	3.7843	0.0100
CW5			−0.0278	−0.0368	1.5227
CW6			0.0501	0.0663	3.2333
CW7			0.0576	0.0762	4.7146
CW8			0.0893	0.1182	5.7610
CW9			0.1096	0.1451	6.3663
EWN			−0.1159	−0.1534	0.1657
EWX			0.0803	0.1063	−0.1248
KH		0.0762	−0.0005	0.0709	0.0002
LOC	0.9666	0.4435	−0.0205	0.4834	−0.2098

Table 8.2

Reduced Form Equations: YH < 2.5 and FY < 2.5

	AM	YH	LPD	FY	NB
const.	20.0034	1.7305	0.0212	1.6709	0.0872
EW1	−0.5424				0.1460
EW2	−0.8329				0.2242
EW3	−0.5407				0.1455
EW4	0.9170				−0.2468
EW5	1.2828				−0.3453
EW6	3.8230				−1.0292
EH1		−0.7954	0.0278	−0.7204	−0.0921
EH2		−0.5111	0.0178	−0.4236	0.0545
EH3		−0.2741	0.0096	−0.1273	−0.0172
EH4		0.0636	−0.0022	0.2231	0.0273
EH5		0.6793	−0.0278	1.0959	0.1365
EH6		2.5029	−0.0874	3.6902	0.4613
CW5			−0.0278	−0.0368	1.5184
CW6			0.0501	0.0663	3.2412
CW7			0.0576	0.0762	4.7237
CW8			0.0892	0.1182	5.7750
CW9			0.1096	0.1451	6.3835
EWN			−0.1159	−0.1534	0.1475
EWX			0.0803	0.1063	−0.1122
KH		0.0762	−0.0027	0.0680	0.0087
LOC	0.9666	0.4435	−0.0155	0.4900	−0.1527

Table 8.3

Table 8.3

Reduced Form Equations: YH < 2.5 and FY > 2.5

	AM	YH	LPD	FY	NB
const.	20.0034	1.7305	0.0212	1.6709	0.1855
EW1	−0.5424				0.1460
EW2	−0.8329				0.2242
EW3	−0.5407				0.1455
EW4	0.9170				−0.2468
EW5	1.2828				−0.3453
EW6	3.8230				−1.0292
EH1		−0.7954	0.0278	−0.7204	−0.0067
EH2		−0.5111	0.0178	−0.4236	−0.0043
EH3		−0.2741	0.0096	−0.1273	−0.0021
EH4		0.0636	−0.0022	0.2231	0.0008
EH5		0.6793	−0.0237	1.0959	0.0066
EH6		2.5029	−0.0874	3.6902	0.0236
CW5			−0.0278	−0.0368	1.5227
CW6			0.0501	0.0663	3.2333
CW7			0.0576	0.0762	4.7146
CW8			0.0893	0.1182	5.7610
CW9			0.1096	0.1451	6.3663
EWN			−0.1159	−0.1534	0.1657
EWX			0.0803	0.1063	−0.1248
KH		0.0762	−0.0027	0.0680	0.0006
LOC	0.9666	0.4435	−0.0155	0.4900	−0.2108

REFERENCES

Ashenfelter, D. and Heckman, J., "The Estimation of Income and Substitution
1974 Effects in a Model of Family Labor Supply," *Econometrica*, 42 (January), 73-85.

Becker, G., "An Economic Analysis of Fertility," in *Demographic and Economic*
1960 *Change in Developed Countries*. Universities-National Bureau Conference Series 11. Princeton, New Jersey: Princeton University Press.

________________, "A Theory of the Allocation of Time," *Eco-*
1965 *nomic Journal*, 75 (September), 493-517.

________________ and Lewis, H.G., "On the interaction Between
1973 the Quantity and Quality of Children," *Journal of Political Economy*, *1 (March/April), S279-S288.

Ben-Porath, Y., "Economic Analysis of Fertility in Israel: Point and Counter-
1973 point," *Journal of Political Economy*, 81 (March/April), S202-S233.

Cain, G., *Married Women in the Labor Force*. Chicago: University of Chicago
1966 Press.

Davanzo, J., *The Determinants of Family Formation in Chile, 1960: An*
1972 *Econometric Study of Female Labor Force Participation, Marriage, and Fertility Decisions*. R-830-AID. Santa Monica, California: Rand Corporation, August.

De Tray, D., "Child Quality and the Demand for Children," *Journal of Political*
1973 *Economy*, 81 (March/April) S70-S95.

Easterlin, R., "An Economic Framework for Economic Analysis," *Studies in*
1975 *Family Planning*, 6 (March), 54-63.

Encarnación, J., "Fertility and Labor Force Participation: Philippines 1968,"
1974 *The Philippine Review of Business and Economics*, 11 (December), 113-128.

Leibenstein, H., "Socio-Economic Fertility Theories and Their Relevance to
1974 Population Policy," *International Labour Review*, 109 (May-June), 443-457.

Michael, R., "Education and the Derived Demand for Children," *Journal of*
1973 *Political Economy*, 81 (March/April), S128-S164.

________________. *The Effect of Education on Efficiency in*
1972 *Consumption*. New York: National Bureau of Economic Research.

Mincer, J., "Labor Force Participation of Married Women," in *Aspects of Labor*
1962 *Economics*, edited by H.G. Lewis. Universities-National Bureau Conference Series 14. Princeton, New Jersey: Princeton University Press.

________________, "Market Prices, Opportunity Costs, and
1963 Income Effects," in *Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld*, edited by C. Christ and others. Stanford, California: Stanford University Press.

Schultz, T.P., "An Economic Model of Fertility and Family Planning," *Journal*
1969 *of Political Economy*, 77 (March/April), 153-180.

Wachter, M., "A Time-Series Fertility Equation: The Potential for a Baby Boom
1975 in the 1980's," *International Economic Review*, 16 (October), 609-624.

Willis, R., "A New Approach to the Economic Theory of Fertility Behavior,"
1973 *Journal of Political Economy*, 81 (March/April), S14-S64.

81 (March/April), S279-S288.