Institute of Economic Development and Research

SCHOOL OF ECONOMICS
University of the Philippines

Discussion Paper No. 73-13 August 10, 1973

FERTILITY AND LABOR FORCE PARTICIPATION: PHILIPPINES 1968

by

José Encarnación, Jr.

FERTILITY AND LABOR FORCE PARTICIPATION: PHILIPPINES 1968[1]

by José Encarnación, Jr.

1. Introduction

This paper reports the results of an investigation into quantifiable determinants of marital fertility and labor force participation in the Philippines. The aim was to construct an empirical model involving these two variables endogenously, which model could possibly be grafted to some larger economic-demographic model (with feedback from economic to demographic variables) that might be useful for projection purposes. This aim should be kept in mind in what follows, particularly in the choice of variables considered.[2] The chief result of this effort is a recursive model consisting of ten equations including six identities and four estimated equations with fertility, labor force participation, family income and husband's income as dependent variables. Cross-section data from the 1968 National Demographic Survey are used for the estimates.

The specifications of the model include the use of threshold levels for family income and education, relative to which there result qualitative differences in fertility behavior and labor force participation, i.e. the marginal effects of family income and of educational level are positive or negative depending on whether or not these variables fall below certain critical levels. The policy implication is disturbing, for the results indicate that fertility rates are likely to be higher before they get lower during the earlier phases of economic development,[3/] unless large-scale family planning programs are undertaken.

Section 2 discusses a hypothesis regarding family income and education that appears to explain the regression results reported in later sections. The data and notation are briefly discussed in section 3, and section 4 elaborates on the choice of threshold values for family income and education. Sections 5 and 6 consider some exploratory specifications with fertility and labor force participation as the dependent variables. Since the choice of the equations in the model of section 7 was made only after extensive experiments with possible specifications, the significance levels of the coefficients in those equations need to be interpreted liberally (Theil 1971, pp. 605-06). Section 8 makes some concluding remarks.

2. A Threshold Hypothesis

The general view seems to be that, whatever the underlying mechanism or motivation, rising family income and educational levels tend to bring about lower fertility (Simon 1969; Jones 1971, p. 353). At the low income levels of the LDC's, however, it may well be that a major effect of rising incomes is to enable women to acquire better health and to have greater access to medical facilities and prenatal care, resulting in their greater capacity to bear more children.

Suppose a subsistence level of family income FY*, below which the health of the mother must be substandard almost by definition. The lower is income relative to FY*, the probability of still-births and miscarriages may be expected to be higher. On this ground alone, we would expect a woman's fertility (defined as the number of live children she has borne) to rise with family income up to the FY* level. If we associate a fertility norm with FY*, the reason for a woman's lower fertility as family income falls below FY* is not one of deliberate choice -- the reason is simply a biological one.

The hypothesis that we want to consider is that, indeed, there is a threshold level of family income such that below this level, the effect of more income is to increase fertility. Above this level, we follow the general view that the marginal effect of income on fertility is negative. Because of the correlation between income and education, and also for intrinsic reasons, we can state a subsidiary hypothesis in regard to educational level. That is, we can consider that a woman's education, EW, has a positive or negative effect on fertility depending on whether or not it falls below a threshold EW*. At levels below EW*, more education means better knowledge of health practices, thus enabling a woman to bear more children. When educational levels exceed EW*, however, the expected negative response of fertility to more education becomes effective (cf. Michael 1973).

If FY* is the income threshold, corresponding to a subsistence level, a woman's labor force participation will depend on whether or not her husband's income falls short of FY*. At incomes below FY*, our hypothesis says that more hours of work would be supplied on the market by a woman if her earning power (proxied by EW) is lower, since the family as the decision-making unit would attempt to reach the subsistence level of income. Thus in this case, the marginal effect of the wife's earning capacity on labor force participation is negative. At income levels above the threshold, the marginal effect could well be positive because of a more dominant substitution effect.

Suppose, following Mincer (1962), that the amount of market labor supplied NHW (number of hours worked) of a woman is a linear function of her husband's income FYH, her full-time wage FYW and other factors u:

$$NHW = \alpha + \beta \, FYH + \gamma \, FYW + u.$$

We expect that $\phi < 0$ since a higher FYH means a larger family income and, with "leisure" a normal good, the wife will supply less hours of work on the market and at home. Regarding γ the usual expectation would be that $\gamma > 0$ since a higher FYW means a higher opportunity cost, so that home and other non-wage activities become more costly. On the other hand, a higher FYW implies more family income, and this may result in the wife spending more time on non-wage activities and supplying less time on the market for wages. The sign of γ is then an empirical question (as Mincer has stressed) and according to our hypothesis, this will depend on the level of FYH relative to FY*.

Specifically, we would expect that if FYH < FY*, $\gamma < 0$. That is, at low income levels, the income effect of a woman's higher wage rate exceeds the substitution effect involved. The reason is simply that with a given FYH below the subsistence level of income, the wife has to put in more hours of work for wage income if her wage rate is lower. Using the wife's educational level EW as a proxy for her earning power, we then expect the coefficient of EW to be negative when EW is less than some level corresponding to FY*. This level need not be the same as the EW* already cited in connection with fertility, but for simplicity here we will assume them to be the same.

In summary our hypothesis states the following: there is a threshold level of family income FY* and a corresponding level of education EW* such that the marginal effects of FY < FY* and EW < EW* on fertility are positive. When FY ≥ FY* and EW ≥ EW* these effects are negative as usually expected. In regard to a woman's labor force participation, if her husband's income FYH < FY* the marginal effect of EW < EW* is negative (if FYH ≥ FY* the hypothesis is silent).

Accordingly, instead of using FY in specifying the fertility equation, we will use FYN = min(0, FY - FY*) and FYX = max(0, FY - FY*) in order to get the appropriate coefficients. The coefficient of FYN is relevant if FY falls short of FY*, and that of FYX otherwise. This formulation appears simpler than the more usual one with quadratic and higher-order terms when relationships are non-linear, and it is naturally suggested by a theoretical framework wherein choice is essentially multidimensional (Encarnación 1969). For present purposes it suffices to say that using FYN and FYX in the specification is the straightforward thing to do when a kink in the relationship is assumed.

The question that arises, then, is what value to take for FY*. We will assume that FY* = 1.5 thousand pesos a year, which was close to the median FY in 1968 according to the survey data. More important, this would be the annual wage income of a worker earning the daily minimum wage and working ₱250 days during the year.

3. Data and Notation

The data were obtained from the National Demographic Survey (NDS) conducted in May 1968, a joint undertaking of the Bureau of the Census and Statistics and the University of the Philippines Population Institute. The NDS contains a valuable body of data which, though not flawless (Harman 1970, p. 14), gives both economic and demographic information at the household and individual levels. It is a nationwide stratified random sample of 7,237 households, records for 97.7 percent of which are relatively "complete". However, a post-enumeration survey one month after the NDS indicated that some completed questionnaires were apparently concocted by the interviewers, and it is difficult to check precisely the general accuracy of the NDS data.

In regard to the income data in particular, it appears from a comparison with the 1957, 1961 and 1965 Family Incomes and Expenditures surveys of the Census Bureau and the GNP estimates for the corresponding years, that family income data of the NDS could have been underreported by perhaps 12 percent on the average.[4/] The major cause is apparently the undercoverage of income in kind, so that income data from rural areas is probably more seriously understated than those from urban areas. Despite the data defects of the NDS, however, we have no other recourse as it is the only one of its kind available. We expect the numerical values of regression coefficients would be affected, but not their signs.

For estimation purposes we used a subsample of the households whose records were relatively "complete", obtained by including only single-family households where the family is of the so-called "nuclear" type (i.e. one 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 has married only once and was under 45 years of age at the time of the survey, and responses to the following items of information were reported: educational levels of both husband and wife, age of wife and duration of marriage, number of children born alive, incomes of wife and of husband, and total family income. This selection process has probably reduced errors in variables more than otherwise, and yielded a sample of 3,629 observations.

We use the following notation.

AM = age of woman when she got married in years

CNk = 1 if the woman belongs to age-cohort k and 0 otherwise

DM = duration of the marriage, in years

EH = educational level of the husband, coded as follows--

0 = no schooling

1 = finished from one to four years of grade school

2 = five to seven years of grade school

3 = one to three years of high school

4 = high school graduate

5 = one to three years of college

6 = college graduate

EW = educational level of the wife, coded like EH

EWN = min(0, EW - 2.75)

EWX = max(0, EW - 2.75)

FY = annual family income, in thousand pesos

FYH = annual income of the husband, in thousand pesos

FYHN = min(0, FYH - 1.5)

FYHX = max(0, FYH - 1.5)

FYN = min(0, FY - 1.5)

FYNR = FYN if rural and 0 if urban

FYNU = FYN if urban and 0 if rural

FYX = max(0, FY - 1.5)

FYXR = FYX if rural and 0 if urban

FYXU = FYX if urban and 0 if rural

k = code number for age-cohorts, where k = 4 for age 15-19, 5 for age 20-24, ..., 9 for age 40-44

LOC = 1 if urban, 0 if rural residence

LPW = 1 if the woman is in the labor force and 0 otherwise[5/]

NB = number of children the woman has had (live births only)

RUR = regional unemployment rate, in percentage units

The choice of the constant in EWN and EWX will be explained in the next section.

Table 1 gives the means of the more important variables as well as the sizes of various subsamples using different classifications of the observations, and table 2 is a correlation matrix. (All tables are collected at the end of the paper.) There is a high correlation between EH and EW ($r = .97$) so that in most of what follows, we will be using EW as proxy for EH to reduce the number of variables to be considered.

Finally we note that the NDS sampling fractions for urban and rural households are 1:400 and 1:1200 respectively. Since all the regressions reported in this paper are unweighted, this creates some problems if urban and rural behavior are essentially different. In the specifications of section 7, we assume that the dummy variable LOC for location of residence is sufficient for purposes of distinction.

4. Threshold Values for Family Income and Education

Consider the specification

$$NB: \ AM, DM, DM^2, FYN_z, FYX_z$$

where $FYN_z = \min(0, FY - z)$, $FYX_z = \max(0, FY - z)$, and NB is regressed on the variables following the colon. (All estimated equations reported in this paper were obtained by ordinary least squares.) The term DM^2 is called for in view of the nonlinear relationship between DM and NB. Trying alternative values of z from 0.5 to 1.7 at intervals of 0.1 on the "all" sample of 3,629 observations we find that z = 0.9 gives the highest $\bar{R}^2$:

$$\text{(i)}\quad NB = 1.42 - \underset{(-4.49)}{.0392\,AM} + \underset{(21.89)}{.4210\,DM} - \underset{(-8.14)}{.0057\,DM^2} + \underset{(5.61)}{.7738\,FYN_{0.9}} - \underset{(-2.30)}{.0204\,FYX_{0.9}} \qquad \bar{R}^2 = .467$$

(Numbers in parentheses underneath regression coefficients are t-values.) We also find that as the value of z is lowered from 0.9, the regression coefficient of FYN_z increases and that of FYX_z decreases (in absolute terms) -- which is to be expected -- and their t-values fall off. As the value of z is raised from 0.9, the coefficients of FYN_z decreases and that of FYX_z increases (in absolute terms), with the t-values of FYN_z decreasing and that of FYX_z increasing until at z = 1.5 the t-value of FYX_z reaches a maximum:

$$\text{(ii)}\quad NB = 1.47 - \underset{(-4.59)}{.0402\,AM} + \underset{(21.90)}{.4217\,DM} - \underset{(-8.17)}{.0057\,DM^2} + \underset{(4.99)}{.3559\,FYN_{1.5}} - \underset{(-2.57)}{.0236\,FYX_{1.5}} \qquad \bar{R}^2 = .466$$

In other words, we have the highest t-value for FYN_z with (i) and the highest t-value for FYX_z with (ii). Considering the differences between (i) and (ii) and also the other equations "between" them, taking 1.5 as the threshold value for FY seems the most appropriate choice. Four of the t-values in (ii) are higher and only one is lower, while the difference in $\bar{R}^2$ is negligible. Moreover we are interested in FYX_z whose t-value in (ii) is better. At any rate we have already assumed that 1.5 is the threshold value of FY, and (ii) merely supports this choice. Henceforth we write $FYN_{1.5} = FYN$ and $FYX_{1.5} = FYX$. (It might be mentioned that FY is not significant in the equation NB: AM, DM, DM^2, FY, FY^2.)

The threshold value for EW has now to be considered. We have the following two equations for NB and LPW, involving EW and EW^2.

$$\text{(iii)}\quad NB = 1.20 - \underset{(-3.97)}{.0354\,AM} + \underset{(21.8)}{.4188\,DM} - \underset{(-7.98)}{.0056\,DM^2} + \underset{(4.51)}{.3487\,FYN}$$

$$- \underset{(-1.49)}{.0145\,FYX} + \underset{(3.05)}{.2138\,EW} - \underset{(-3.56)}{.0400\,EW^2} \qquad \bar{R}^2 = .468$$

$$\text{(iv)}\quad LPW = .743 - \underset{(-3.25)}{.0080\,FYH} - \underset{(-8.81)}{.1493\,EW} + \underset{(9.73)}{.0262\,EW^2} - \underset{(-6.87)}{.0189\,RUR}$$

$$- \underset{(-2.00)}{.0373\,LOC} \qquad \bar{R}^2 = .050, \qquad F = 38.8$$

From (iii) we can calculate $\partial NB/\partial EW$, and setting this to zero gives EW = 2.67. The maximum of NB is attained at this value of EW. A similar calculation with (iv) gives EW = 2.85, where LPW falls to a minimum. In view of these results we now assume a common threshold value EW* = 2.75 appropriate to both NB and LPW.

Except for FYXR, whose coefficients in the four equations are not significant, all coefficients have the expected signs. Also, EWN and EWX show the effect of EW at different levels. Only at higher levels is the effect of more education the usually expected one of reducing fertility. The residence dummy variable is significant, but LPW is relatively weak.

Various attempts to obtain significant equations for age-cohorts were unsuccessful. Table 5 gives estimates for the specification

NB: DM, FYN, FYX, LOC

(and also without the LOC variable) for each cohort. For k = 5, 6, 8, 9 the coefficients have the expected signs, but the set as a whole is not usable.

6. Trial Regression Results on Labor Force Participation

The statistical results here are mostly not unexpected. Explanatory powers are low but most coefficients have the expected signs in te[illegible] of our hypothesis.

Similar to table 3[illegible]e 6 gives estimates from various subsamples, us[illegible]ecification

LPW: FYH, EW.

The coefficient of FYH is negative in all cases except for rural FY^- where it is not significant. As for EW, this has a positive coefficient for urban, FY^+, urban FY^+ and rural FY^+ (though not significant in the last case). Negative coefficients appear for rural, FY^-, urban FY^- and rural FY^-, indicating an income effect that dominates the substitution effect. This is the opposite of what has been observed with U.S. data (Mincer 1962 and 1966, Bowen and Finegan 1969, Cain 1966), but consistent with our hypothesis.

This suggests the use of EWN and EWX as explanatory variables, which is done in table 7 for the all sample, and adding LOC and the regional unemployment rate RUR as possible explanatory variables:

LPW: FYH, EWN, EWX, RUR, LOC.

As expected, EWN has negative coefficients in the four equations and EWX positive ones. LOC appears significant, and RUR shows up to have a discouragement effect on labor force participation.[6/]

To investigate the possibility that FYH at different levels may have different quantitative effects on LPW, we consider the use of FYHN and FYHX. Table 8 shows the results for

LPW: FYHN, FYHX, EWN, EWX, RUR, LOC, NB

adding NB as a possible determinant, which does not turn out to be significant however. What is interesting here is that FYHN has much larger (in absolute terms) coefficients than FYHX; moreover, it has large t-values whereas the latter's are not significant. These results are precisely what we would expect on the basis of our hypothesis, which says that the family as the decision-making unit attempts to reach some target level of income. The lower is the husband's income relative to the target level, and the lower is EW (as proxy for her earning power), the more likely is the wife's participation in the labor force.

Similar results appear when age-cohorts are considered, table 9. Except for k = 4, FYHN shows up relatively strongly while FYHX does not, and EWN and EWX behave as expected, in

LPW: FYHN, FYHX, EWN, EWX, RUR, LOC

for each cohort.[7/]

7. The Model

Writing CN = (CN5, ..., CN9), we note first that the variable k trivially determines CN and vice versa. For instance, if k = 6, then CN = (0, 1, 0, 0, 0). Thus from a purely formal viewpoint, k and CN give the same information and could be used almost interchangeably.

However, in the specification of a relationship, using CN as an explanatory variable allows for nonlinear possibilities. In the particular case of the fertility equation, it is more convenient to use CN in place of DM and DM^2, as this permits easier calculation of results for different age-cohorts.

In line with our hypothesis, we can now state the model as follows.

Exogenous variables: AM, EW, k (or CN), LOC, RUR

Endogenous variables: EWN, EWX, FY, FYN, FYX, FYH, FYHN, FYHX, LPW, NB

Since there are ten endogenous variables, we need ten equations,

(1) FYH: EW, k, LOC

(2) LPW: CN, FYHN, FYHX, EWN, EWX, RUR

(3) FY: EW, k, LOC, LPW

(4) NB: CN, AM, FYN, FYX, EWN, EWX, LOC, LPW

(5) EWN: min(0, EW - 2.75)

(6) EWX: max(0, EW - 2.75)

(7) FYN = min(0, FY - 1.5)

(8) FYX = max(0, FY - 1.5)

(9) FYHN = min(0, FYH - 1.5)

(10) FYHX = max(0, FYH - 1.5)

We are taking AM as exogenous since we are not interested in its explanation. It could well be endogenous in another model. In the present instance, the age-at-marriage variable is in any case predetermined as it refers to a past event. The resulting advantage is that the system becomes recursive ~~and, with~~ appropriate assumptions on the error terms, ordinary least squares estimation is applicable (Malinvaud 1970, pp. 679-81).[8/]

The dependent variables in eqs. (5)-(10) are trivially determined by EW, FY and FYH. In (1), FYH depends only on exogenous variables. In (2), LPW depends only on exogenous variables and endogenous variables already determined. The same thing can be said of FY in (3), and then of NB in (4). The model is thus recursive, and the following are ordinary least squares estimates of the first four equations. (s is the standard error of estimate, sd the standard deviation of the dependent variable.)

$$\text{(1')}\quad FYH = -1.1912 + \underset{(16.7)}{.60189}\ EW + \underset{(4.42)}{.18480}\ k + \underset{(4.60)}{.55955}\ LOC$$

$$\bar{R}^2 = .115, \qquad s = 3.296, \qquad sd(FYH) = 3.505$$

$$\text{(2')}\quad LPW = .1392 + \underset{(1.85)}{.13468}\ CN5 + \underset{(3.11)}{.22000}\ CN6 + \underset{(3.58)}{.25289}\ CN7$$

$$+ \underset{(4.27)}{.30167}\ CN8 + \underset{(3.78)}{.26904}\ CN9 - \underset{(-8.96)}{.15516}\ FYHN - \underset{(-1.09)}{.00273}\ FY$$

$$- \underset{(-5.59)}{.06311}\ EWN + \underset{(8.36)}{.08403}\ EWX - \underset{(-6.45)}{.01711}\ RUR$$

$$\bar{R}^2 = .077, \qquad s = .476, \qquad sd(LPW) = .496$$

$$(3') \quad FY = -2.4129 + \underset{(21.9)}{.84260}\ EW + \underset{(6.87)}{.30949}\ k + \underset{(5.45)}{.71260}\ LOC + \underset{(2.13)}{.25453}\ LPW$$

$$\bar{R}^2 = .182, \qquad s = 3.530, \qquad sd(FY) = 3.903$$

$$(4') \quad NB = 6.5051 + \underset{(3.73)}{1.16242}\ CN5 + \underset{(9.34)}{2.84412}\ CN6 + \underset{(14.6)}{4.43065}\ CN7 + \underset{(18.6)}{5.67672}\ CN8 + \underset{(20.5)}{6.31786}\ CN9 - \underset{(-31.4)}{.28469}\ AM + \underset{(5.50)}{.46106}\ FYN - \underset{(-0.85)}{.00850}\ FYX + \underset{(2.75)}{.13541}\ EWN - \underset{(-3.70)}{.16629}\ EWX - \underset{(-3.12)}{.24903}\ LOC - \underset{(-2.45)}{.17137}\ LPW$$

$$\bar{R}^2 = .437, \qquad s = 2.036, \qquad sd(NB) = 2.713$$

Coefficients of determination are on the low side, which is to be expected with disaggregated data. But regression coefficients have signs in accordance with the hypothesis and, with one or two exceptions that are not unexpected, are significant.

Eq. (1') is straightforward, with EW serving as proxy for the husband's education level and the woman's cohort number as proxy for her husband's age. We expect a man's income to vary with education, age and location.

In (2'), where as usual we now consider the dependent variable as a probability,[9/] we see that the effect of the husband's income on the wife's labor force participation is much greater at incomes below the threshold.

Further, the coefficient of FYHX is not significant. The education variable shows up in accordance with the hypothesis, interpreting this variable as proxy for earning power.[10] The lower the earning power, the more likely is the wife's participation in the labor market in order to reach the income target.[11] In the aggregate the unemployment rate has a discouragement effect on female labor force participation, though this may not be the case for some groups in the population.[12] Finally, in (2'), it appears that LPW is nonlinear with age, rising up to the age-group 35-39 and then declining slightly after that. This would be consonant with a decreasing probability of young children being present in the household as age increases, and it is possible that the dip at the end is due to early retirement when husband's incomes are sufficiently high.

The explanatory variables in (3') are the same as those in (1') except for the addition of LPW. Of course it is the wife's actual employment rather than her merely being in the labor force that adds to family income, but LPW seems to be the best single variable for incorporating the wife's (and other family members') contribution to family income.

The fertility equation (4') exhibits correctly-signed coefficients, though that of FYX is not significant. If the education variables EWN and EWX are suppressed, the significance level of FYX rises; see table 10. This is to be expected because of the correlation between FY and EW. It appears from all this that the fertility-reducing effect at higher SES levels is due not so much to income as such but to education, while at lower SES levels, the fertility-increasing effect of income is quite strong. As expected, LOC and LPW have negative coefficients.

Because of the recursiveness of the model, it is particularly easy to get the reduced form, and one has a set of reduced-form equations corresponding to each age-cohort. For age-group 15-19, for example, we put $k = 4$ and $CN5 = \ldots = CN9 = 0$; for age group 20-24, $k = 5$ and $CN5 = 1$, $CN6 = \ldots = CN9 = 0$; and so on.

Considering the model for purposes of incorporation in some larger economic-demographic model, it seems preferable to determine the income variables FYH and FY in that larger model, especially since family income, number of families and national income have to satisfy accounting identities. A translation from cross-section results to causal sequences in time is always chancy when parameters are changing. Age patterns of marriage have been changing since the turn of the century (Smith 1972) and we are again reminded by Schultz (1973) of the problems in trying to use cross-section results for predictions through time.

8. Concluding Remarks

This paper has focused attention on income and education as major determinants of fertility and labor force participation. We find that at least in the aggregate, the latter variable has a negative effect on fertility, as usually expected. More interesting from our viewpoint, however, is the qualitative change in the effects of income and education when these variables fall short of certain threshold values. The implication is that, at the earlier stages of economic development when relatively large proportions of the population are below these thresholds, rising levels of income and education merely aggravate the population problem.

There is not much one can do with the income threshold value if it corresponds to some subsistence level. However, education is a complex affair and what one learns at the lower levels is what the teachers teach. From a policy viewpoint, it should be possible to stress family planning at the earliest levels of school equally with health education, so that conceivably, the education threshold with respect to fertility could be pushed down to zero.

University of the Philippines
August 1973

Table 1. Means of Variables

	Sample	Sample Size	AM	DM	EW	FY	FYH	LPW	NB
I.	All	3629	19.8	12.4	2.38	2.30	1.86	.44	4.60
II.	Urban	1953	20.4	12.3	3.04	3.20	2.54	.39	4.53
	Rural	1676	19.1	12.5	1.60	1.24	1.08	.49	4.69
III.	FY^-	1856	19.2	12.2	1.58	.72	.69	.47	4.51
	FY^+	1773	20.4	12.6	3.20	3.95	3.09	.39	4.70
IV.	Urban FY^-	577	19.6	12.1	1.94	.83	.75	.42	4.53
	Urban FY^+	1376	20.7	12.4	3.50	4.20	3.29	.38	4.53
	Rural FY^-	1279	19.0	12.3	1.43	.67	.67	.50	4.50
	Rural FY^+	397	19.3	13.5	2.18	3.10	2.40	.46	5.32
V.	Age 15-19	48	15.5	2.7		1.00	.94	.23	1.48
	Age 20-24	381	17.5	4.5		1.48	1.35	.32	2.11
	Age 25-29	770	19.0	7.6		1.86	1.62	.40	3.34
	Age 30-34	877	20.0	11.4		2.28	1.89	.45	4.62
	Age 35-39	861	20.5	15.7		2.63	2.01	.50	5.71
	Age 40-44	692	21.0	20.0		2.94	2.27	.47	6.21

Note: FY^- consists of observations where $FY < 1.5$, FY^+ those where $FY \geq 1.5$.

Table 2. Correlation Matrix - All Sample

	AM	EW	FY	FYH	LOC	LPW	NB
AM	1.0						
EW	.282	1.0					
FY	.134	.403	1.0				
FYH	.094	.324	.863	1.0			
LOC	.160	.424	.250	.208	1.0		
LPW	.027	-.052	.015	-.060	-.097	1.0	
NB	-.256	-.101	.015	.018	-.030	.015	1.0

Table 3. NB Equations From Various Subsamples

Sample	const.	AM	DM	DM^2	FY	EW	/ $\bar{R}^2$
All	1.22	-.0371 (-4.15)	.4182 (21.6)	-.0055 (-7.85)	-.0096 (-1.03)	.0183 (0.82)	.462
Urban	1.64	-.0432 (-3.57)	.4219 (15.2)	-.0059 (-5.88)	-.0080 (-0.78)	-.0396 (-1.35)	.445
Rural	.71	-.0314 (-2.37)	.4252 (15.4)	-.0052 (-5.25)	.0332 (1.18)	.1468 (3.51)	.490
FY^-	.69	-.0330 (-2.72)	.4060 (15.4)	-.0052 (-5.39)	.4923 (4.55)	.0833 (2.07)	.462
FY^+	1.55	-.0391 (-2.96)	.4286 (15.3)	-.0059 (-5.80)	-.0142 (-1.40)	-.0585 (-1.91)	.471
Urban FY^-	1.43	-.0519 (-2.40)	.3655 (7.37)	-.0038 (-2.10)	.4747 (2.31)	.0126 (0.19)	.448
Urban FY^+	1.62	-.0401 (-2.73)	.4342 (13.4)	-.0069 (-5.67)	-.0090 (-0.85)	-.0685 (-1.93)	.445
Rural FY^-	.35	-.0221 (-1.50)	.4180 (13.3)	-.0056 (-4.90)	.4943 (3.51)	.1328 (2.55)	.467
Rural FY^+	.75	-.0396 (-1.34)	.4791 (8.46)	-.0055 (-2.86)	-.0467 (-1.30)	.1194 (1.67)	.557

Table 4. NB Equations - All Sample

const.	AM	DM	DM^2	FYNR	FYXR	FYNU	FYXU
1.76	-.0032 (-3.70)	.4204 (21.8)	-.0056 (-7.80)	.5572 (5.25)	-.0146 (-0.45)	.1765 (1.39)	-.0132 (-1.32)
1.54	-.0350 (3.92)	.4228 (21.9)	-.0057 (-8.12)	.3408 (4.06)	.0230 (0.75)	.3160 (2.64)	-.0178 (-1.80)
1.76	-.0339 (-3.79)	.4169 (21.7)	-.0055 (-7.85)	.5633 (5.31)	-.0142 (-0.43)	.1905 (1.51)	-.0139 (-1.38)
1.55	-.0356 (-3.99)	.4195 (21.8)	-.0056 (-7.99)	.3514 (4.20)	.0225 (0.73)	.3244 (2.71)	-.0183 (-1.84)

Table 4 (continued)

EWN	EWX	LPW	LOC	/ $\bar{R}^2$
.1476 (2.83)	-.1025 (-2.54)	-.1094 (-1.62)	-.3570 (-3.32)	.470
.1289 (2.48)	-.1262 (-3.17)	-.0938 (-1.39)		.468
.1570 (3.03)	-.1089 (-2.71)		-.3468 (-3.23)	.469
.1374 (2.67)	-.1312 (-3.31)			.468

Table 5. NB Equations for Age-Cohorts

k	const.	DM	FYN	FYX	LOC	$\bar{R}^2$
4	.612	.2974 (4.91)	-.0016 (-0.01)	.0574 (0.27)	.1609 (0.79)	.308
4	.721	.2915 (4.87)	.0462 (0.23)	.0724 (0.34)		.314
5	.447	.3644 (17.55)	.0927 (0.79)	-.0740 (-1.86)	.2442 (2.12)	.456
5	.630	.3633 (17.42)	.2167 (2.13)	-.0699 (-1.75)		.451
6	.926	.3225 (22.18)	.1049 (0.94)	-.0160 (-0.69)	.0233 (0.23)	.396
6	.944	.3222 (22.31)	.1144 (1.12)	-.0152 (-0.66)		.397
7	1.172	.3193 (21.22)	.3165 (2.24)	.0119 (0.66)	-.1551 (-1.15)	.349
7	1.033	.3222 (21.71)	.2547 (1.95)	.0101 (0.56)		.349
8	1.737	.2980 (17.22)	.7895 (4.23)	-.0490 (-1.94)	-.6052 (-3.43)	.276
8	1.248	.3022 (17.40)	.5361 (3.10)	-.0589 (-2.33)		.267
9	1.271	.2674 (13.13)	.5905 (2.29)	-.0288 (-1.63)	-.2506 (-1.03)	.210
9	1.040	.2693 (13.33)	.4765 (2.04)	-.0303 (-1.72)		.210

Table 6. LPW Equations From Various Subsamples

Sample	const.	FYH	EW	$\bar{R}^2$	F
All	.462	-.0068 (-2.74)	-.0106 (-2.06)	.004	8.60
Urban	.357	-.0069 (-2.50)	.0171 (2.58)	.004	5.00
Rural	.557	-.0060 (-1.07)	-.0396 (-3.90)	.010	9.34
FY^-	.575	-.0064 (-0.95)	-.0605 (-6.02)	.019	18.7
FY^+	.339	-.0071 (-2.61)	.0242 (3.56)	.008	7.95
Urban FY^-	.622	-.1631 (-5.24)	-.0388 (-2.45)	.056	18.0
Urban FY^+	.256	-.0056 (-2.01)	.0399 (5.11)	.018	13.5
Rural FY^-	.589	.0010 (0.14)	-.0647 (-4.86)	.017	11.8
Rural FY^+	.510	-.0310 (-2.80)	.0093 (0.55)	.015	3.98

Table 7. LPW Equations - All Sample

const.	FYH	EWN	EWX	RUR	LOC	/ $\bar{R}^2$	F
.484	-.0076 (-3.10)	-.0870 (-7.71)	.0877 (8.61)	-.0194 (-7.05)	-.0367 (-1.96)	.048	38.0
.473	-.0079 (-3.24)	-.0914 (-8.27)	.0851 (8.43)	-.0209 (-7.95)		.048	46.5
.356	-.0086 (-3.49)	-.0971 (-8.61)	.0847 (8.27)		-.0747 (-4.15)	.036	34.6
.310	-.0095 (-3.87)	-.1088 (-9.95)	.0784 (7.73)			.031	40.2

Table 8. Other LPW Equations - All Sample

const.	FYHN	FYHX	EWN	EWX	RUR	LOC	NB	/ $\bar{R}^2$
.354	-.1538 (-8.58)	-.0020 (-0.79)	-.0767 (-6.14)	.0815 (8.75)	-.0165 (-5.99)	-.0038 (-0.20)	.0046 (1.54)	.064
.352	-.1546 (-8.87)	-.0020 (-0.79)	-.0770 (-6.21)	.0812 (8.80)	-.0166 (-6.24)		.0046 (1.55)	.065
.240	-.1688 (-9.47)	-.0022 (-0.89)	-.0840 (-6.72)	.0790 (8.45)		-.0321 (-1.74)	.0038 (1.29)	.056
.217	-.1774 (-10.35)	-.0023 (-0.90)	-.0875 (-7.09)	.0765 (8.30)			.0039 (1.30)	.055

Table

	const.	FYHN	FYHX	EWN			
(k = 4)							
.113	.0910 (0.71)	-.0135 (-0.10)	-.2633 (-2.98)	.0696 (0.43)	[illegible]		
.099	.0852 (0.68)	-.0173 (-0.13)	-.2656 (-3.06)	.0649 (0.41)	-.0137 (-0.64)		
.034	.0871 (0.68)	-.0190 (-0.14)	-.2636 (-3.00)	.0752 (0.47)		-.040 (-0.31)	
.011	.0792 (0.64)	-.0242 (-0.18)	-.2667 (-3.09)	.0694 (0.44)			
(k = 5)							
.294	-.1783 (-3.12)	-.0068 (-0.33)	-.0638 (-1.73)	.0582 (1.68)	-.0177 (-2.19)	-.0250 (-0.42)	.082
.281	-.1870 (-3.51)	-.0066 (-0.32)	-.0668 (-1.85)	.0560 (1.64)	-.0184 (-2.34)		.084
.160	-.2006 (-3.55)	-.0052 (-0.25)	-.0760 (-2.07)	.0582 (1.67)		-.0539 (-0.92)	.072
.119	-.2223 (-4.33)	-.0046 (-0.23)	-.0841 (-2.36)	.0529 (1.54)			.077
(k = 6)							
.353	-.2090 (-5.04)	.0192 (1.79)	-.0559 (-2.01)	.0830 (3.87)	-.0207 (-3.36)	.0037 (0.09)	.075
.354	-.2082 (-5.14)	.0192 (1.79)	-.0556 (-2.01)	.0833 (3.92)	-.0205 (-3.48)		.077
.206	-.2289 (-5.54)	.0185 (1.71)	-.0682 (-2.45)	.0755 (3.51)		-.0343 (-0.86)	.063
.185	-.2380 (-5.96)	.0180 (1.67)	-.0720 (-2.62)	.0722 (3.41)			.063

Table 9 (continued)

const.	FYHN	FYHX	EWN	EWX	RUR	LOC	$\bar{R}^2$
(k = 7)							
.380	-.1746	.0035	-.0486	.0648	-.0017	-.0305	
	(-4.61)	(0.62)	(-1.90)	(3.47)	(-2.08)	(0.80)	.049
.366	-.1810	.0034	-.0513	.0629	-.0125		
	(-4.89)	(0.60)	(-2.02)	(3.40)	(-2.27)		.050
.296	-.1894	.0032	-.0512	.0620		-.0455	
	(-5.09)	(0.57)	(-2.00	(3.33)		(-1.22)	.045
.266	-.2010	.0030	-.0557	.0587			
	(-5.58)	(0.54)	(-2.20)	(3.18)			.045
(k = 8)							
.491	-.0874	-.0114	-.0848	.0758	-.0198	.0010	
	(-2.41)	(-1.72)	(-3.24)	(4.03)	(-3.48)	(0.02)	.055
.491	-.0872	-.0114	-.0847	.0758	-.0197		
	(-2.46)	(-1.72)	(-3.27)	(4.05)	(-3.60)		.056
.351	-.1058	-.0120	-.0930	.0740		-.0350	
	(-2.92)	(-1.81)	(-3.54)	(3.91)		(-0.91)	.042
.325	-.1142	-.0122	-.0970	.0721			
	(-3.27)	(-1.84)	(-3.76)	(3.83)			.047
(k = 9)							
.404	-.1692	-.0044	-.0698	.0736	-.0166	.0008	
	(-4.43)	(-1.30)	(-2.42)	(3.66)	(-2.65)	(0.02)	.063
.404	-.1690	-.0044	-.0698	.0737	-.0165		
	(-4.54)	(-1.30)	(-2.45)	(3.70)	(-2.75)		.065
.248	-.1756	-.0047	.0792	.0751		-.0308	
	(-4.59)	(-1.38)	(-2.75)	(3.72)		(-0.72)	.055
.260	-.1825	-.0046	-.0832	.0732			
	(-4.93)	(-1.36)	(-2.95)	(3.66)			.056

Table 10. Alternative NB Equations - All Sample

const.	CN5	CN6	CN7	CN8	CN9	AM
6.391	1.1754 (3.76)	2.8484 (9.34)	4.4617 (14.5)	5.6612 (18.5)	6.2941 (20.4)	-.2879 (-32.6)
6.359	1.1521 (3.69)	2.8073 (9.20)	4.3661 (14.3)	5.5998 (18.3)	6.2388 (20.2)	-.2882 (-32.6)
6.263	1.1752 (3.76)	2.8603 (9.36)	4.4215 (14.5)	5.6640 (18.5)	6.2970 (20.4)	-.2910 (-33.1)
6.240	1.1536 (3.69)	2.8214 (9.24)	4.3741 (14.3)	5.6066 (18.3)	6.2454 (20.2)	-.2911 (-33.1)

Table 10 (continued)

FYN	FYX	LOC	LPW /	$\bar{R}^2$	s
.4634 (5.72)	-.0174 (-1.84)	-.2558 (-3.32)	-.2052 (-2.95)	.435	2.040
.4853 (6.01)	-.0190 (-2.00)	-.2410 (-3.13)		.434	2.042
.3545 (4.78)	-.0202 (-2.14)		-.1902 (-2.74)	.433	2.042
.3807 (5.18)	-.0215 (-2.28)			.432	2.044

FOOTNOTES

1. Thanks are due the International Labour Office's World Employment Programme for research support. I received helpful comments on an earlier draft from Richard Blandy, Cristina P. Parel, T. Paul Schultz and Peter C. Smith. Discussions with Romeo M. Bautista, Mercedes B. Concepción, Mahar Mangahas, Vicente Paqueo, Theodore K. Ruprecht and especially my wife Patricia, were very useful. Porfirio Sazon, Jr. did the computations at the University of the Philippines Computer Center, and Francisco Josef provided research assistance.

2. While the presence of young children in the household and the availability of domestic help are, for example, obvious determinants of the decision to enter the labor force, it is difficult to incorporate these two variables in an aggregative economic-demographic model. They are therefore not considered in this paper.

3. Research findings at the University of the Philippines Population Institute are similar: rising marital fertility over time as health levels improve (Smith 1972 and Flieger 1972) and a direct relationship between SES measures and fertility (Pullum 1971).

4. To the extent that the 1968 GNP might have been an overestimate, however, the degree of underreporting of family income in the NDS would be correspondingly reduced. I am indebted to my colleagues M. Mangahas and V. Paqueo for these data comparisons.

5. For definitions of labor force concepts (which follow standard ones) and labor force statistics in the Philippines, see the comprehensive survey by Mijares and Tidalgo (1971).

6. The regional unemployment rate RUR averages 7.36 percent for the ten regions into which the country is divided:

I.	Manila and suburbs	12.43 percent
II.	Ilocos - Mountain Provinces	6.28
III.	Cagayan Valley - Batanes	1.64
IV.	Central Luzon	10.48
V.	Southern Luzon and Islands	7.36
VI.	Bicol	7.10
VII.	Western Visayas	7.26
VIII.	Eastern Visayas	4.92
IX.	Northern Mindanao	4.61
X.	Southern Mindanao	2.96

7. All these LPW regressions ignore the problem arising from the fact that the dependent variable is dichotomous; see (Theil 1971, p. 628 ff).

8. Apparently it is commonly assumed that age at marriage is a function of education level and completed fertility, though such a relationship is obviously not a causal one. If AM is made a function of EW and other exogenous variables only, the recursiveness of the system is not affected.

9. Of course $0 \leq LPW \leq 1$ to make sense, so that if, for a given set of values of the explanatory variables, LPW turns out negative or exceeds one, we can adopt the rule that LPW is 0 or 1 respectively. Certain transformations (Theil 1971, p. 628 ff) would obviate this artificiality but did not seem worth the effort for present purposes.

10. The simple correlation between EW and wife's income, FYW, is actually only moderate (.36). From the subsample of 1387 women with FYW positive, we find that

$$FYW = -.152 + \underset{(14.4)}{.2173}\ EW \qquad \bar{R}^2 = .130$$

However, FYW is not necessarily full-time earnings, which would be the appropriate variable.

11. This statement is supported, though rather weakly, by a regression on the subsample of 801 women where $FYH < 1.5$, $EW < 2.75$ and NHW (number of hours worked by the wife during the week) is positive. We have

$$NHW = 34.0 - \underset{(-2.04)}{2.68}\ FYH - \underset{(-1.78)}{1.30}\ EW + \underset{(1.54)}{.34}\ RUR + \underset{(2.98)}{3.62}\ LOC$$

with $\bar{R}^2 = .019$ and $F = 4.93$. The coefficient of EW is significant at the 5 per cent level using a one-tailed t-test.

12. In the regression equation for the low-income subsample considered in the preceding footnote, for instance, RUR has a positive coefficient. This result is consistent with the hypothesis that low income families aim at target levels: with greater overall unemployment, hence more husbands unemployed, wives have to work longer hours.

REFERENCES

Bowen, W.G. and Finegan, T.A., The Economics of Labor Force Participation, Princeton University Press, 1969.

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

Encarnación, J., "On Independence Postulates Concerning Choice," International Economic Review, vol. 10, no. 2, June 1969, pp. 134-40.

Harman, A.J., "Fertility and Economic Behavior of Families in the Philippines," RAND Corporation RM-6385-AID, September 1970.

Flieger, W., "Fertility Levels and Fertility Trends in the Philippines," Population Institute, University of the Philippines, March 1972 (mimeo).

Jones, G.W., "Effect of Population Change on the Attainment of Educational Goals in the Developing Countries," in Rapid Population Growth, Johns Hopkins Press, 1971.

Malinvaud, E., Statistical Methods of Econometrics, 2nd rev. ed., North-Holland, 1970.

Michael, R.T., "Education and the Derived Demand for Children," Journal of Political Economy, vol. 81, no. 2, part II, March/April 1973, pp. 128-64.

Mijares, T.A. and Tidalgo, R.L., "Labor Absorption in the Philippines," paper read at the Conference on Manpower Problems in East and Southeast Asia, held at the University of Singapore, May 22-28, 1971.

Mincer, J., "Labor Force Participation of Married Women," in Aspects of Labor Economics, National Bureau of Economic Research, 1962.

__________, "Labor Force Participation and Unemployment: A Review of Recent Evidence," in Prosperity and Unemployment, ed. R.A. Gordon and M.S. Gordon, Wiley, 1966.

Pullum, T.W., "An Overview of Differentials in Philippine Marital Fertility," Population Institute, University of the Philippines, December 1971 (mimeo).

Schultz, T.P., "Explanation of Birth Rate Changes over Space and Time: A Study of Taiwan," Journal of Political Economy, vol. 81, no. 2, part II, March/April 1973, pp. 238-74.

Simon, J.L., "The Effect of Income on Fertility," Population Studies, vol. 23, no. 3, November 1969, pp. 327-341.

Smith, P.C., "The Timing and Incidence of Marriage in the Philippines: Temporal Change and Sub-Group Differentials in 1968," Population Institute, University of the Philippines, February 1972 (mimeo).

Theil, H., Principles of Econometrics, Wiley, 1971.

Appendix. -- Labor Force Data and Definitions

The Bureau of the Census and Statistics publishes the BCS Survey of Households Bulletin which gives labor force and other data based on nationwide sample surveys. See in particular Series No. 25--Labor Force, May 1968. which gives results (including standard errors of the more important estimates) of the labor force aspects of the 1968 NDS. In their monograph, Mijares and Tidalgo (1971) summarize much useful information from the Bulletin through 1969. The latest available number is Series No. 30--Labor Force, August 1971.

The May 1968 number defines urban areas to include the Cities of Baguio, Cebu and Quezon, and those areas falling under any of the following four categories:

(i) municipal jurisdictions having population densities of at least 1,000 persons per square kilometer;

(ii) in the case of municipal jurisdictions with population densities of at least 500 but less than 1,000 persons per square kilometer, the poblacion, adjacent barrios having populations of at least 1,000, and other barrios with populations of at least 2,500;

(iii) in the case of municipal jurisdictions having populations of at least 20,000, the poblacion and also adjacent barrios with populations of at least 2,500;

(iv) poblacions with populations of at least 2,500.

The following definitions are direct quotes from the May 1968 number (pp. viii-ix):

A. The Household. -- For purposes of the survey, only family households usually living in a selected precinct, poblacion or barrio, as the case may be, have been listed. The family household is composed of the members of the family forming the nucleus of the household and also resident domestic servants and other persons who may be living with the family. The household of a person living alone or together with persons not related to him is considered a separate family household. It is possible for more than one household to live in the same dwelling unit.

B. Survey Week. -- All information relate to the survey week, which is the calendar week (Sunday to Saturday) preceding the visit of the interviewer. The survey week is not the same for all respondents, because not all of them were interviewed during the same week.

C. Population. -- The population estimate refers to the non-institutional population (only persons found in households) and excludes the population found in diplomatic and consular residences, ships, asylums, penitentiaries, army barracks, and similar institutions.

D. Age. -- The age refers to completed years at last birthday. People are prone to give their ages in numbers ending in 0 or 5; hence, the age groupings particularly in the older ages are subject to inaccuracies resulting from this particular respondent bias in reporting ages.

E. Labor Force. -- The labor force refers to the population 10 years old and over who are either employed or unemployed in accordance with the definitions set forth below. It includes members of the armed forces who, at the time of the interview, were living with their families in households.

1. Employed. -- Employed persons include all those who were reported:

   (a) at work -- those who were working for pay or profit, or without pay on the farm or enterprise operated by a member of the same household related by blood, marriage or adoption;

   (b) with a job but not at work -- those who had a job or business but did not work because of temporary illness, vacation, strike, or other reasons. Also included are persons who were supposed to report for work within 30 days from the date of the interview. If it is reported that an employed person worked 40 hours or more during the survey week, he is considered as working full time; otherwise, he is considered as working part time.

   Employed persons at work reported as wanting additional work are considered as underemployed -- visibly underemployed if they are part-time workers or invisibly underemployed if they are full-time workers.

2. Unemployed. -- Unemployed persons include all those who were reported as wanting and looking for work. The desire to work must be sincere and the person must be serious about working. Also included are persons reported as wanting work but not looking for work because of belief that no work was available or because of temporary illness, bad weather, or other valid reasons.

F. Persons Not in the Labor Force. -- Persons reported as not at work and without jobs and not wanting work, or wanting work but not looking for work for reasons other than those stated above are excluded from the labor force. These include housewives, students, disabled or retired persons and seasonal workers who were not working and not looking for work during the survey.