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FEMALE LABOR-FORCE PARTICIPATION AND FERTILITY IN DEVELOPING COUNTRIES

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ABSTRACT

A model is presented which jointly determines wife's labor-force participation under assumptions relevant to the under-developed context. This model is tested using (a) household data from the 1970 Puerto-Rican Public Use Sample and (b) an intercountry cross-section sample. Evidence is obtained that female potential wages rising pari passu with each other will be positively associated with both labor force participation and fertility. However, it is shown that this pronatalist effect may not hold for potential wage rate rises limited to specific occupations because of differences in occupation child-rearing compatibility.

Is there an inverse relationship between the number of children a mother has and the amount of time she is economically employed (i.e., in an income-producing task)? Does the existence of such a conflict imply that increasing the economic employment of women will decrease the desired number of children in a society? These are the major questions to which we shall address outselves in this paper. While we do not hope to furnish conclusive answers, we do intend to provide a more rigorous methodology for dealing with these issues in the context of a particular developing country.

One of our main contributions is to show in what way evaluating the natalist impact of female employment-creating policies requires extreme care, especially in the case of less-developed countries (LDCs). In some respects, the choice variables available to a household in an LDC may be greater in number than those available to a household in an industrialized nation. For example, rather than being relegated essentially to the mother, as in the case in Europe and the United States, a great deal of the child-care responsibility will be accepted by relatives and older children in the LDCs. Unlike the industrialized nations, a large portion of the female labor-force in LDCs is employed in retailing and cottage-industry occupations in which on-the-job child care is commonplace.[1] In addition to specifying the options available to an LDC household, we also argue that the endogenous or choice variables

(e.g., desired family size, the hours the mother works and the compatibility of her occupation with child rearing) are jointly determined by a common set of exogenous variables. Among other things, the hypothesis that the choice variables are jointly determined allows for the possibility that changes in some exogenous variables will have the same qualitative effect on female labor force participation and fertility, even though the simple correlation between the latter two variables is negative.

In section I, the household production model is briefly reviewed and its application to the variegated economic environments of LDCs is evaluated. In section II, a method of empirically establishing those exogenous variables which jointly affect female labor-force participation and fertility decisions is rigorously presented. The joint determination approach is compared in section III with those taken by other researchers and a substantial portion of the empirical literature on the natalist effect of changes in female labor force participation is reviewed. In section IV, the methodology is applied to micro-data from Puerto Rico and intercountry regressions are presented which provide support for some of the hypotheses presented in section I. The final section consists of a summary of our main conclusions and policy implications.

I. Theoretical Framework

The framework adopted here for examining the relationship between female labor-force participation and fertility is based on the model described by Ben-Porath [3] and Willis [31]. This model of household choice assumes that there are two categories of service flows which provide satisfaction to the household: commodity services and child services adjusted for quality. These commodities are produced within the household from the application of the time inputs of the husband and wife and inputs purchasable in the market and are consumed only by the household itself and not traded in the market.

Part of the time of adult members of the household is assumed to be allocated to household and part to economic activity (e.g., formal employment) which yields market goods. The money prices of the three factor inputs (the wages of employed adult men and women and the price of market goods) are specified. Given household utility maximization and constant returns to scale, these specified factor prices will determine factor proportions in the two activities. The price of household-produced good j is equal to the sum of the money prices of the three factor inputs weighted by coefficients representing the amount of the respective factor input required to produce a unit output of good j. The "full" income of the household is equal to the "total" time of the wife (both market and household) multiplied by her money wage rate plus the "total" time of the husband multiplied by his money wage rate plus non-labor income. Hence, in this model a rise in wife's market wage rate has two effects: (1) it will increase (decrease) the price of children relative to commodity services if children are more (less) intense in the

wife's time than are commodity services;[2] and (2) it will increase the full income of the household. The first is essentially a substitution effect which may increase or decrease desired child services depending on the relative intensity of this good in the time of the wife. The second is an income effect which tends to increase the demand for children assuming the latter are normal goods.

The qualitative response of desired children to the wife's market wage rate thus depends on the relative intensity of the child services activity in the wife's time input. If child services are substantially more intense in the wife's time than are commodity services, there will be a substitution effect which will be opposite in sign to, and may outweigh, the income effect. On the other hand, if other commodities are more intense in the wife's time than child services, then an exogenous rise in the wife's wage rate will unequivocally increase desired child services.

The intensity of the wife's time in child relative to other commodity services depends on a number of technical factors which may vary more among low-income than among more developed countries. Factors affecting the relative inputs of the wife's time include the following:

1) The ability to substitute purchased inputs for wife's time in child-rearing relative to other activities.

2) the extent to which the rearing of younger children can be taken over by older children and/or adult relatives.

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3) the compatability of a particular female occupation with child-rearing.

These technical characteristics influencing the time-intensity of child-rearing may differ between societies and to a certain extent reflect the values and norms endemic to them. For instance, the length of the period of breast feeding, which may be partially a cultural phenomenon, will influence the substitutability between the wife's time in child-rearing and the purchased input domestic help.[3] However, given the technology of household production within a society, described in part by technical relations (1), (2), (3), the relative amount of the wife's time consumed in the production of a unit of child and other household commodity services will be influenced by the price of the wife's time relative to those (imputed) prices of market inputs and other children's time. Thus if the substitutibility between wife's and other person's time in child rearing is greater than that in non-child-services production then the ready availability (low imputed wages) of domestic servants and adult relatives to care for children, a characteristic of many developing countries, could result in child-rearing in these societies being relatively less intensive in the wife's time. In such cases, the net effect of a rise in female wage rates on desired child services will be small or even positive (the demand for domestic servants and/or relatives' time however, will increase).

The low rates of return to schooling and low probability of market employment of older children, which characterize some LDC s, may result in a significant substitution of older children's for wife's time in child rearing . This substitution may also lead to non-child commodity services becoming more intensive in the wife's time than child services.

The intensity of child services in the wife's time relative to that of commodity services will also tend to be less if the wife's occupation is

somewhat compatible with child rearing. In the usual model, designed for industrialized countries, the occupation of the wife is assumed to be totally incompatible with child rearing. Once time allocated to commodity services has been determined, wife's time available for child rearing is computed by subtracting time spent in economic activity from the total time remaining. Holding commodity service inputs constant, the partial derivative of the wife's time available for child rearing with respect to her time spent in economic activity is minus unity. Yet, in the case of some occupations, part of the time spent by the wife in market employment may be allocated to child-care without significantly affecting productivity. For example, women in Africa frequently carry children on their backs while they are engaged in retail or agricultural activities.[4] In this case, at least at the margin, children may not be very intensive in the wife's time in the following sense: With commodity time held fixed, the partial derivative between time spent in child-rearing and time spent in economic activity will be substantially greater than minus one and even positive. In the latter case, increases in the wife's market wage rate would decrease rather than increase the absolute price of children and thus, a fortiori decrease their relative price.

The relative time-intensity of child-rearing and the compatibility of certain occupations with the household production of child services (the extent to which joint production of money income and child services with respect to the wife's time is possible) are crucial determinants of the relationship between female labor-force participation and fertility. Both the quantity of child services and the amount of time spent in the market by women are household choice variables which are influenced by an identical set of parameters. The wage rate of women, for instance, has been shown to have a positive

effect on female labor-force participation rates.[5] Whether or not a wage rise will have a similar influence on fertility; i.e., whether the labor-force participation of women and family size move in the opposite or same directions, will depend on the relative time intensities of the two types of household activities, which will in turn depend on the variety of societal and market characteristics identified broadly above. Thus it is not surprizing to find in the literature that the simple relationship between female labor-force participation rates and fertility differs among countries.[6] In the next sections, we develop a more rigorous framework for examining empirically the relationship between female labor-force participation and fertility, and then critically evaluate selected empirical studies of this relationship within that framework.

II. Empirical Testing

We have just shown that the household production model is perfectly consistent with a number of conditions prevalent in LDC s which may tend to make child services less intense in the wife's time than commodity services and to produce an ambiguous association between female employment and fertility. In this framework, it is clear that the wife's labor-force participation and her fertility are jointly determined by a common set of exogenous variables including the wife's and husband's market wage rates. Such a system contrasts sharply with the models developed by Schultz [27] and others in which somewhat different exogenous variables affect labor-force participation and fertility and each of these endogenous variables enters the equation determining the other.

The impossibility of finding exogenous variables which influence female labor-force participation and do not influence fertility and vice versa means that the model suggested by Schultz is generally underidentified. For example, changes in the wife's market wage rate have a separate effect on fertility other than through labor participation to the extent that fertility is sensitive to changes in the total income of the household. By the same token, even with completed fertility constant, such wage rate changes will influence female labor-force decisions. With no other exogenous variables, the influence of a change in the wife's wage rate with her labor-force participation held fixed cannot be separated from the total effect of this variable on fertility.

Exogenous estimates of the wife's market wage rate and the husband's wage rate are crucial to any empirical test of a joint determination model. Clearly one cannot simply look at the relationship between actual current wages and labor-force participation rates in order to measure the effect of an exogenous increase in wage rates on female employment and fertility; how much one works (and family size choice) influence the level of the wage. Thus, one might observe a negative relationship between women's wages and their fertility simply because the women who choose to have more children will work less, have less labor-force experi ence, and thus will have lower earnings currently than women who choose smaller families.[7]

One procedure, utilized in section IV, to correct for this simultaneity with a micro data set is the following: The log of the hourly wage rate of single women is regressed against a number of exogenous variables including age, age squared, and years of education. This provides an exogenous predicted value of the potential wage rate for married women (i.e., the wage

rate they would earn if they bore no children).[8] This technique has the additional advantage that age, readily available in most data sets, can be used as a proxy for an important earnings determinant, work experience, for single women. Age and the labor-force experience of married women are not a simple linear transform so that no reliable predicting equation for married women's wages based on their characteristics can usually be obtained. An exogenous predictor of the husband's wage rate may be obtained in a similar manner, but can be estimated from data pertaining to all males. Thus in its simplest form our model may be depicted as follows:

Notation:

$\hat{W}_f$ = the predicted wage rate of the wife

$\hat{W}_h$ = the predicted wage rate of the husband

I_m = non-earnings income of the husband

I_f = non-earnings income of the wife

E_m = years of completed schooling of the husband

E_f = years of completed schooling of the wife

N = completed fertility

LFP_w = labor-force participation rate of wife

In general, it is difficult to predict the signs of the individual coefficients in these equations.

$$LFP_w = a_{20} + a_{21}\hat{w}_f + a_{23}\hat{w}_m + a_{24}E_f + a_{25}E_m + a_{26}I_f + a_{27}I_m \qquad \text{II.1}$$

$$N = a_{10} + a_{11}\hat{w}_f + a_{13}\hat{w}_m + a_{14}E_f + a_{15}E_m + a_{26}I_f + a_{17}I_m \qquad \text{II.2}$$

For instance, the sign of a_{11} will depend on the relative time intensity of child-rearing and the magnitude of the income effect. If the production of child services is female time-intensive and if the resulting negative substitution effect outweighs the (presumed) positive income effect of a wage change, then $a_{11} > 0$. Similarly the sign of a_{21} depends on the magnitude of income and substitution effects.

Education also influences the wife's ability to utilize domestic servants and relatives for child-care purposes--her "efficiency" in the production of child services. To the extent this is true, we would expect at least certain kinds of education to be positively associated with completed fertility and labor-force participation.

Given the importance of female occupational choice and the use of servants and relatives as surrogate mothers in the labor force-fertility nexus, the number of endogenous variables in the system should be increased. One example of a general system may be written in the form

$$\begin{bmatrix} N \\ L_f \\ CI \\ H \\ S \\ R \end{bmatrix} = \begin{bmatrix} a_{10} & a_{11} & \cdots & a_{17} \\ a_{20} & a_{21} & \cdots & a_{27} \\ & & & \\ & & & \\ & & & \\ a_{60} & a_{61} & & a_{67} \end{bmatrix} \cdot \begin{bmatrix} 1 \\ \hat{W}_f \\ \hat{W}_m \\ E_f \\ E_m \\ I_f \end{bmatrix} \qquad \text{II.3}$$

where CI (compatibility index) is the average completed fertility associated with the occupation chosen by the wife, H is a dichotomous variable having a value of 1 if the wife's occupation is carried on outside the home and 0 otherwise, S is the number of servants employed by the households, and R is the number of relatives living in the household. The exogenous variables

included in the vector at the extreme right-hand side of (II.3) are those used in equations (II.1) and (II.2). This list may be expanded depending on the comprehensiveness of the data that is available. In cases where a household sample encompasses a large number of different commodity and labor markets, experiments should be made with the wage rate of domestic servants, and the price of animal milk relative to that of other commodities. These exogenous variables may well interact with those presently in the system. If, for example, the wage rate of domestic servants is low, the effect of an increase in wife's wage rate on completed fertility is, under certain conditons, more likely to be positive. The same may be said about the relative price of milk, i.e., the lower this relative price the more likely is a positive effect of the wife's wage rate on fertility and labor-force participation.

The enlargement of the model allows the specification of some a priori relationships between the qualitative responses of different endogenous variables to the same exogenous variable. Suppose the wife's predicted wage rate is positively associated with both completed family and labor-force participation. Then it should be positively associated with at least one of the variables CI, H, S, or R, assuming that the household production activities have the property of constant returns to scale.[9] An increase in one of these variables represents a means by which the effective time available for household activities can be increased. This can be accomplished either by the wife seeking occupations more compatible with child rearing or by the purchase of time from relatives or servants.

III. Existing Studies[10]

Many empirical investigations of the relationship between female labor-force participation and fertility involve simple comparisons of the parity levels or age specific fertility rates of active and non-active women. Sometimes these comparisons are made within socio-economic groups designated by such variables as the education of the wife or the husband's income. These intra country cross section studies, e.g. [7] [8], generally show that economically active women have lower birth rates according to the various criteria used than do non-economically active women. There are, however, some important exceptions. For example, the inverse association between female economic activity and fertility does not seem to be nearly as strong in rural as it does in urban areas [9][22]. In fact, in some rural studies, birth rates are positively correlated with female economic activity.[11]

It should be clear, from our discussion in section II, that this approach involving simple correlation has a number of serious drawbacks. In particular, classifying fertility measures by degree or presence of female economic activity can never conclusively support the following hypothesis: that an exogenous increase in the number or attractiveness of jobs for women will, other things constant, decrease the birth rate. Even if women who have children are less able to work than women who do not, this opportunity cost of having children may not influence a woman's fertility decisions. At the same time, it is clear that, given some incompatibility between child-bearing and work, either differences in the taste for children or simply random variation in parity across households will lead to an inverse association between birth rates and economic activity. Under these circumstances,

the birth rate could be considered the exogenous and the female labor force participation the endogenous variable. Thus, an increase in the number of female job vacancies or an increase in the female wage rate may well lead to a rise in female labor-force participation but not to a decrease in fertility.

There are two more sophisticated empirical studies which purport to isolate the effect of purely exogenous changes in female labor force participation on fertility [24] [18]. These studies generally show a negative coefficient for predicted female labor-force participation in the fertility equation, although in the latter study of Thailand the female labor-force participation variable, i.e., the ratio of urban economically-active women to total adult population including rural, is not well defined. In the Schultz and Nerlove study of Puerto Rico, data for individual municipios are collected for a large number of variables including crude birth rates, death rates, and female labor-force participation rates. The sample involves a pooling of time series and cross-section data and, in the process of estimation, a correction was made for omitted variables which are serially correlated. A predicted value for the female labor-force participation rate in each municipio is obtained from three instruments: unemployment (male and female), adolescent schooling, and an index of the demand for female labor services based on output composition.

The crucial assumption embodied in this approach is that the instruments.[12] affect the crude birth rate only through female labor force participation. Howeve these variables either have a separate direct effect on fertility or are themselves affected by fertility and labor-force participation decisions. Consequentl one can not conclude from their results that an exogenous increase in female labor participation brought on by a previously unobserved policy will decrease fertility.

IV. Implementation of the Proposed Methods

To show how the methodology proposed in section II may alter existing results, we shall estimate equations for a number of household choice variables using some readily available data sets. This exercise will involve both a large individual household sample for Puerto Rico and an intercountry, cross section sample.

a. The Case of Puerto Rico

One of the best existing sources of micro data pertaining to a developing country is the 1970 1:100 Public Use Sample for Puerto Rico, which contains detailed characteristics on approximately 3000 households with both spouses present. The empirical model described in section II is applied to this data set in order to illustrate the concepts discussed and to better understand the female employment-fertility nexus in one LDC.

The dependent variables utilized are the number of children ever born [CEB], the number of annual hours worked [FHRS],[13] and the child-bearing compatibility of the occupation [OCC] (as measured by the average CEB of all married women in the occupation over age 35 and reported in Table I) of married, spouse-present, non-farm women aged 35-44 along with the annual hours worked of their husbands [MHRS], the presence of adult relatives [REL] in the household and the location of employment [HOME](1 if working outside the home, 0 otherwise). The independent variables used in each equation are the predicted wage [PWAGEF] of married women, based on regression III.1, involving all non-married working women over 18 years of age,
the predicted wage of the husband [PWAGEM], estimated from equation III.2, which was run on all married men over 18, and the non-earnings income and

Table 1

Female Occupations Ranked by Children Ever Born to All Married Women over 35

Puerto Rico 1970

Occupation	Average CEB	No. in Sample
Receptionists	1.00	5
Housekeepers, not private household	1.20	5
Craftsmen and Kindred Workers	1.40	5
Typists	1.63	8
Telephone Operators	1.67	3
Misc. Clerical Workers	1.77	35
Bookkeepers	2.00	9
Secretaries	2.18	49
Hairdressers	2.20	10
Registered Nurses	2.26	23
Laboratory Technicians	2.33	3
Vocational Counselors	2.33	3
Physicians	2.33	3
Health Administrators	2.33	3
Private Household Workers	2.36	11
Librarians	2.40	5
Secondary School Teachers	2.45	22
Dressmakers and Seamstresses-except factory	2.50	22
School Administrators, elem. and second.	2.58	12
Restaurant, Bar Managers	2.60	10
Cashiers	2.64	11
Elementary School Teachers	2.66	58
College Teachers	2.67	6
Personnel and Labor Relations Workers	2.67	6
Professional, Technical Kindred Workers	2.70	10
Foremen	2.76	21
Child Care Workers	2.83	6
Sales Clerks-Retail Trade	2.89	35
Managers and Administrators (non-farm)	2.90	21
Demonstrators	3.00	3
Meat Cutters and Butchers in Manu.	3.00	5
Food Counter and Fountain Workers	3.00	4
Social Workers	3.10	10
Checkers, Examiners, Inspectors	3.13	8
Misc. Sales Workers	3.14	7
File Clerks	3.20	5
Chambermaids, Maids- not Private Household	3.38	8
Practical Nurses	3.44	9
Clothing Ironers and Pressers	3.47	17
Food Service Workers	3.62	29
Sewers and Stitchers	3.70	166
Assemblers	3.80	5
Child Care Workers- not Private Household	3.86	7
Laundry and Dry Cleaners	3.86	7
Machine Operators	4.00	54
Dishwashers	4.00	3
Packers and Wrappers	4.10	10

Table 1

Female Occupations Ranked by Children Ever Born to All Married Women over 35

Puerto Rico 1970

Occupation	Average CEB	No. in Sample
Laundresses	4.14	7
Nursing Aids, Orderlies	4.33	9
Maids and Servants	4.33	46
Service Workers- not Private Household	5.05	20
Cooks- Private Household	5.17	52
Not Employed	5.29	2822
Freight, Material Handlers	5.33	3
Housekeepers	5.33	6
Janitors	5.44	34
Misc. Laborers, non-farm	5.83	6
Cleaners, Charwomen	6.20	5
Farm Laborers, wage workers	7.00	10
Tailors	7.03	3
Farmers	7.25	4
Mean for employed women	3.43	982
Mean for all women	4.81	3804

Source: 1970 Public Use Sample 1:100

number of years of schooling completed of the husband and wife [NEIM, NEIF, EDM, EDF], as well as control variables including wife's age [AGEF] and household location.

$$\ln PWAGEF = -1.4054 + .07641EDF + .04108AGEF - .00050AGEF^2 \qquad \text{III.1}$$
$$(.0088)^{***} \quad (.0203)^{**} \quad (.0002)^{**}$$

$$R^2 = .146 \quad F(3,477) = 27.23$$

$$\ln PWAGEM = -1.0648 + .06563EDM + .03685AGEM - .00036AGEM^2 \qquad \text{III.2}$$
$$(.0028)^{***} \quad (.0078)^{***} \quad (.0001)^{***}$$

$$R^2 = .187 \quad F(3,2622) = 200.47$$

** Significant at the 5 percent level (two-tailed test)

***Significant at the 1 percent level (two-tailed test)

The log-linear specification for the predicted wage equations was chosen because the distribution of wages tends to approach the log-normal density function in most societies. Moreover, Mincer [19] and others have shown that the specification used can be derived from human capital investment theory and has been successful in tracking movements in income inequality over time (see Mincer and Chiswick [35]). The predicted wages were introduced in the second-stage regressions in linear form, however, so that the schooling and age variables enter those equations both exponentially, through the wage, and linearly, as controls for demographic and educational influences.

Table 2 presents the second-stage household regressions. The set of independent variables in each equation contributes significantly to explaining the variance of each dependent variable. More importantly, however, the female wage and schooling attainment variable coefficients provide a consistent and informative picture of the relationship between female labor-force participation and fertility.

The first three equations indicate that an exogenous rise in the wage rates of women increases family size at the same time that it increases the amount of work performed both in total and outside the home. The positive fertility-wage effect appears to be an economic rather than a demographic phenomenon since the age and age squared of the wife are contained in the equations. (Both the age variables contribute significantly to the explanatory power of the equations [5 percent level] but their coefficient variances are high because of the marked degree of collinearity between them). This finding also appears consistent with Carlton's Puerto Rico results [6] based on 1960 Census data in which he found that college-educated women had larger families than wives receiving only a secondary education even though the latter group had lower fertility than women who had not gone beyond the primary grades. The inclusion of the wife's predicted wage along with her schooling level in the specification used here provides one possible explanation for Carlton's results: female educational attainment appears to have a direct negative linear effect on fertility, perhaps because of its association with contraceptive knowledge, but has an exponentially positive influence through the wife's wage. Thus at high levels of wife's education, the positive education (wage) effect on fertility would tend to dominate.

Table 2

Household Regression Coefficients - Puerto Rico
Women 35-44 (Married, Spouse Present)

	CEB	FEHRS	ATHOME	OCC	REL	MHRS
PWAGEF	1.8183	776.449	.30115	3.1864	.83952	-208.883
	(.9495)*	(203.25)***	(.1209)***	(2.339)	(.8996)	(324.937)
EDF	-.29891	-38.687	-.01150	-.05082	-.02374	38.9522
	(.0854)***	(20.713)*	(.0109)	(.0692)	(.0266)	(29.231)
AGEF	-.47274	-81.497	.02182	.18392	.01458	381.378
	(.9087)	(220.35)	(.1157)	(.3777)	(.1452)	(310.976)
$AGEF^2$	.00651	.85854	-.00037	-.00214	-.00001	-4.8213
	(.0115)	(2.792)	(.0015)	(.0048)	(.0018)	(3.9406)
PWAGEM	3.1088	-222.055	-.14282	.55048	.10045	113.1675
	(.8708)***	(211.151)	(.1109)	(.3439)*	(.1323)	(297.988)
EDM	-.44954	26.1515	.01606	-.06919	-.00810	32.0610
	(.0969)***	(23.489)	(.0123)	(.0383)*	(.0147)	(33.150)
NEIF	-.00004	- .28534	-.00010	-.00032	-.00007	- .10047
	(.0005)	(.1131)***	(.00006)*	(.00018)*	(.00007)	(.1597)
NEIM	-.00002	- .00581	-.00001	-.00002	.00001	- .29449
	(.0001)	(.0241)	(.00001)	(.00004)	(.00002)	(.0339)**
EDF^2	-	-	-	-.01780	-.00299	-
				(.0078)**	(.0030)	
R^2	.228	.320	.453	.365	.028	.197
F(11,964)	25.85	41.15	72.69	46.14	2.31	21.50

Other variables: metropolitan residence, residence 5 years ago, location of work (SMSA or non-SMSA)

* Significant at 5% level (one-tailed test)
** Significant at 5% level (two-tailed test)
*** Significant at 1% level (two-tailed test)

The positive relationships of the female wage with both completed fertility and labor-force participation is possible according to the enlarged household production framework if child-rearing is at least no more time-intensive than other household activities and if mother s can find substitutes for their time or engage in occupations which are more compatible with raising children when the value of their time increases. The OCC equation indicates that the latter is indeed the case in Puerto Rico--wives with high wages, and thus with high fertility levels, tend to enter occupations with higher compatibility indices. The positive wage coefficient in REL equation is consistent with the notion that substitution of relatives' for mother's time also occurs when wages rise, but the effect is not significant by conventional standards. One important possible explanation for the insignificance of the REL wage-effect is that an exogenous rise in all female wage rates raises both the potential wage of the mother and of adult (female) relatives, leaving unaltered the female relative/mother wage ratio.

Two important roles of female education in the context of fertility and employment determination are 1) a positive association between education and contraceptive knowledge; which may tend to reduce desired and "excess" children, and 2) the household effeciency effect of education, which may tend to increase the productivity of women's time in household production and thus decrease the time spent in the home. The set of equations shows that both these educational roles may be important. Female schooling is indeed negatively related to completed family size, controlling for the female wage,

which is consistent with the birth control hypothesis. The negative association between female schooling and hours worked is consistent with the household production efficiency argument: Given the market productivity of women, as reflected in their wage rates, those with higher levels of schooling are more productive at home and thus tend to work less outside the household. This relationship also appears in the other equations--husbands work more when their wives are more educated,as more efficient women's time is substituted for that of their husbands in household production, less relatives are used in the household when women are more efficient at home, and more educated women, who bear less children, enter occupations with lower childbearing compatibility.

The policy implications of these results are not encouraging: inducing women to work by means of a general female wage subsidy may not lead to a reduction in family size as long as occupational mobility is relatively high, as in the Puerto Rico context. However, such a subsidy would not, at least in the context of Puerto Rico, significantly reduce the labor force participation of males. A policy of encouraging female schooling has ambiguous effects on family size and female employment since such a scheme will result in higher wages for women (pro-natalist in Puerto Rico) as well as an increase in contraceptive knowledge (anti-natalist) and will tend to increase both market and non-market efficiency.

b. Intercountry Results

From an intercountry cross-section sample, additional evidence may be obtained that some exogenous variables are related to both female labor-force participation and fertility; but the main value of these data is that they indicate that factors affecting the composition, as well as the overall level, of female labor-force participation are crucial in determining urban and to some extent aggregate fertility. In Table 3, data on the ratio of female to total labor force are shown by less-developed regions, along with aggregate crude birth rates. Based on the available intracountry household data, one would not expect the aggregate ratio of women to total persons in the labor-force to be as important a determinant of the aggregate birth rate as the share of women in the non-agricultural labor force. Non-agricultural activities appear on the whole to be more competitive with child rearing than do agricultural activities, as already indicated.[14] Hence, it is not particularly surprising that sub-Saharan Africa, with a relatively high share of women in the overall labor force (mainly due to a high female agricultural participation rate), has the highest crude birth rate. See Table 3, columns 1 & 2.What is surprising, however, is the situation that appears in Table 4. Here Northern Latin America has both the third highest regional crude birth rate (above the 58 country mean) and the highest share of women in the non-agricultural labor force in a reduced sample of countries for which non-agricultural labor force data is avaliable.

While it has a slightly negative but insignificant simple correlation with the aggregate crude birth rate in this second sample of countries, the female share of the non-agricultural labor-force is negatively correlated at the one percent level with the urban child-woman ratio. Thus, part of the anomalous behavior of Northern Latin America is attributable to the high rural relative to urban birth rate in this region discussed in [16,22]. But it

Table 3

Aggregate Crude Birth Rates and the Proportion of Women in the Total Labor Force, Major Less-Developed Regions, 1960

	Aggregate crude birth rate (per thousand)	Proportion of women in total labor force
	(1)	(2)
1. Subsaharan Africa	46.5 (25)	.32 (21)
2. North Africa	45.7 (4)	.17 (5)
3. Middle East	36.7 (7)	.14 (7)
4. Asia	38.2 (17)	.30 (14)
5. Northern Latin America	40.6 (14)	.23 (14)
6. Southern Latin America	39.1 (12)	.23 (12)
7. Total	41.6 (79)	.26 (73)

Notes: All the underlying data are from International Bank for Reconstruction and Development, World Tables, January, 1973, Table 2.
The ratios presented in columns 2-3 represent arithmatic means of the individual country rates.

The number of countries appear in parentheses beside each arithmetic mean. In some cases there are birth rate estimates for countries for which the World Tables do not offer female labor participation estimates, and vice-versa.

Table 4

Aggregate Crude Birth Rates, the Proportion of Women in the Non-Agricultural and Agricultural Labor Forces, and the Ratio of Service to Total Female Non-Agricultural Labor, Major Less-Developed Regions (Reduced Sample), Late 1950's and Early 1960's

	Aggregate Crude Birth Rate (per thousand) (1)	Urban child-woman ratio (2)	Proportion of women in Non-Agricultural Labor Force (3)	Ratio Service to Total Female Non-Agricultural Labor Force (4)
1. Subsaharen Africa	44.5 (10)	.66 (5)	.19 (10)	.48 (10)
2. North Africa	45.2 (6)	.81 (4)	.14 (6)	.41 (6)
3. Middle East	40.8 (6)	.70 (6)	.12 (6)	.44 (6)
4. Asia	41.2 (12)	.65 (7)	.24 (12)	.34 (12)
5. Northern Latin America	42.5 (13)	.60 (13)	.35 (13)	.56 (13)
6. Southern Latin America	38.8 (11)	.59 (9)	.29 (11)	.55 (11)
7. Total	42.0 (58)	.64 (44)	.24 (58)	.47 (58)

Notes: Number in parentheses represents number of countries used to compute mean. For sources and countries, see Appendix.

should also be noted that many women living in rural areas in Northern Latin America are employed in the non-agricultural sector, whereas relatively few women living in urban areas are employed in agriculture. The average ratio of women in the non-agricultural labor force to the urban adult female population is extremely high (.99), and in some countries it exceeds one.[15] The latter could only be true if the rural non-farm female labor force exceeded the urban female labor force associated with agriculture. For this reason, we would expect the share of women in the non-agricultural labor force to affect both urban and rural birth rates. Hence, the high rural birth rate in Northern Latin America may be inconsistent with an inverse association between female non-agricultural labor force participation and non-farm rural birth rates.

There are several additional explanations for the Northern Latin America case. One is that size distribution of income is more unevenly distributed in this region than it is in others.[16] If fertility rises more than proportionally with decreases in household income, then we would expect a rise in aggregate income inequality to lead to a fall in the birth rate. Indeed, Repetto [23] has shown using a large cross section sample of both developed and underdeveloped countries that there is a satistically significant positive association between summary measures of income inequality and aggregate birth rates. Another explanation, not unrelated to income inequality is that the relatively high availability of female domestic servants in urban areas in Latin America [32] has meant, in effect, that some purchased inputs are highly and cheaply substitutable for wife's time in household production.

In addition, an increase in the ratio of servants and day-care workers to other female laborers may mean that the overall female occupational mix is more compatible with child rearing as evidenced in our Puerto Rican sample . (See Table1 , particularly the categories "maids and servants" and "child-care workers-not private household".) But, since domestic servants have been shown to have relatively low fertility in some developing countries, e.g., Guatemala [9], we shall assume that this occupational composition effect if it exists is second-order in comparison to the effect associated with changes in the relative cost of children for households employing servants.

It is impossible to obtain estimates of the number of female domestic servants for a significant sample of developing countries. Boserup [5] provides estimates of the number of female service workers about 2/3 of whom are domestic servants for a sample of 29 developing countries. The ILO provides a sample of female service workers for much larger numbers of countries. However, female domestic servants account for a smaller percentage of these totals than they do in the case of Boserup's estimates. We experiment with predicted values of both these variables as proxies for the wage rate of domestic servants.

The proportion of women employed as domestic servants both affects and is affected by birth rates. To get around this problem of two-way causality, we use instrumental-variable estimation. First, the ratio of female domestic servants to total women employed in the non-agricultural sector is regressed against a number of exogenous variables: (1) the female share of the total agricultural labor force,[AGFM], (2) the ratio of the urban adult population not employed in industry to the total urban adult population [POT], (3) female adult literacy rate[FMLIT], (4) total adult literacy rate [ADLT] (5) per capita Gross National Product [GNPCAP], and (6) a dummy variable [MOSLEM]. The first variable, which is determined by such exogenous factors as the prevalent customs and relative land scarcity [5], represents an important "push" factor in female migration, expected to be negatively associated with the supply of female domestic servants in urban areas. The second exogenous variable indicates the proportion of the

adult urban population potentially available for service-sector employment. By contrast, the female literacy rate is hypothesized to have a negative effect on the proportion of women in service-sector employment; the higher the female literacy rate, the more likely that the average woman would be qualified for skilled industrial employment. Total adult literacy is expected to be negatively associated with the dependent variable; it is inversely related to the cost of industrial relative to that of service-sector production, the latter being relatively intense in uneducated labor. Holding education constant, a rise in per capita GNP should cause the derived demand for female service workers to increase relative to that for females in other non-agricultural sectors. The induced rise in the wage rate of educated labor, assumed scarce, would be expected to increase the price of industrial goods relative to that of services. Finally, the dummy variable controls for the preference on the part of husbands in Moslem countries against their wives being employed as domestic servants.

The regression equations predicting the proportion of women employed in services are shown below.

$$\text{FMSERV1} = .20017 - \underset{(.11407)***}{.42565}\ \text{AGFM} + \underset{(.17218)*}{.29633}\ \text{POT} - \underset{(.011407)***}{.042565}\ \text{MOSLEM} \qquad \text{III.3}$$

$$R^2 = .494 \qquad F\ (3,26) = 8.12$$

$$\text{FMSERV2} = .31341 - \underset{(.10915)**}{.26183}\ \text{AGFM} + \underset{(.13843)**}{.32882}\ \text{POT} - \underset{(.08923)}{.10558}\ \text{ADLIT} + \underset{(.00012)**}{.00026}\ \text{GNPCAP} - \underset{(.04781)**}{.10363}\ \text{MOSLEM} \qquad \text{III.4}$$

$$R^2 = .383 \qquad F\ (5,47) = 5.72$$

* = Significant at 5% level (one-tailed test)

** = significant at 5% level (two-tailed test)

*** = significant at 1% level (two-tailed test)

where

FMSERV1 = proportion of service workers in female non-agricultural labor force (Boserup's data).

FMSERV2 = proportion of service workers in female non-agricultural labor force (ILO data).

AGFM = Female proportion of total agricultural labor force

POT = (adult urban population less total industrial labor force)/ adult urban population

GNPCAP = 1960 per-capita GNP in 1964 US$s

ADLIT = adult literacy rate

MOSLEM = Dummy variable with a value of 1 if country is predominately Moslem and 0 otherwise.

For data sources and countries used in these regressions, see Appendix.

Here only those variables whose t-statistics exceed unity in absolute magnitude are included as independent variables in the regressions shown. Since the ILO data involves a larger number of observations than Boserup's, it is not surprising that adult literacy and per capita GNP are significant when the ILO data is used but insignificant when the Boserup estimate of the dependent variable is used. Female literacy was excluded from both equations because of statistical insignificance. All the variables presented in the final equations have the hypothesized signs.

The predicted values of the share of domestic service in total female non-agricultural employment are then used as an independent variable in second-stage regressions. These regression equations are intended to explain the urban child-woman ratio (a measure of urban fertility), the aggregate crude birth rate, and female non-agricultural labor force participation, the latter being measured by the ratio of female to total non-agricultural workers.

Aside from the predicted share of female service workers in the total non-agricultural labor force, we experimented with five other exogenous variables in these equations. These included per-capita GNP, the total adult literacy rate, the female literacy rate, and a dummy variable representing whether or not a country was predominately Moslem. These variables are used frequently to explain female labor-force participation and/or fertility in inter-regional cross-section samples [1,28], except possible for the Moslem dummy (indicating a cultural preference against female employment). Thus, the hypothesized effect need not be explained. The regression results for the aggregate birth rate and urban child-woman ratio equations and the equation predicting the female share of non-agricultural labor force are presented in Table 5. Only those variables which were statistically significant in

Table 5

Labor-Force Participation and Birth Rate Regressions

(Standard errors in parentheses under coefficients)

INDEPENDENT VARIABLES	DEPENDENT VARIABLE: Urban Child-Woman Ratio (1)	(2)	Crude Birth Rate (3)	(4)	Female proportion of total non-agricultural labor force (5)	(6)
1a) Predicted proportion of service workers in the female non-agricultural labor force based on Boserup data.	.50029 (.22313)**		23.20979 (10.14450)**		-.03582 (.16940)	
1b) Predicted proportion of service workers in female non-agricultural labor force based on ILO data.		.73031 (.29137)**		30.63456 (13.12771)**		-.14732 (.21866
2) 1960 per capita GNP at factor cost in 1964 US$	-.00010 (.00011)	-.00030 (.00014)**	-.01947 (.00499)***	-.02742 (.00646)***	-.00013 (.00008)	-.00009 (.00011
3) Female adult literacy rate	-.23595 (.09424)**	-.16449* (.08520)	-4.56112 (4.22505)	-1.12834 (3.92712)	.25661 (.07055)***	.25159 (.06541
4) Dummy variable indicating whether country is Moslem with value 1 if population is Moslem, 0 otherwise	.07228 (.04791)	.11705 (.05029)**	1.28824 (2.26847)	3.22634 (2.42294)	-.05841 (.03788)	-.06800 (.04036
R^2	.48143	.49800	.40635	.40893	.51245	.51704
F statistic	7.65917	8.18424	7.35823	7.43745	11.29916	11.50877
Number of observations	38	38	48	48	48	48

* Significant at 5% level (one-tailed test).
** Significant at 5% level (two-tailed test).
*** Significant at 1% level (two-tailed test).

For sources and countries, see Appendix.

at least one of the regression equations were used in the final runs shown in this table.

The most significant result which the regressions in Table 5 bring out is that the predicted ratios of service to total female non-agricultural laborers is a very important variable explaining differences in aggregate crude birth rates and urban child-woman ratios across countries. They are statistically significant at the same critical level in all of the birth rate and child-woman ratio regressions, indicating that our main result is not highly sensitive to which fertility measure or which measure of female service worker is used (Boserup's or the ILO). On the other hand, in the regressions explaining the share of women in the non-agricultural labor force, they do not have the hypothesized positive sign and are insignificant by conventional statistical standards. Here is an example of instruments (i.e., those predicting the share of female service workers) which influence fertility through the composition of female employment, without being associated with its overall level.

Still, some of the exogenous variables significantly associated or almost significantly associated with overall female labor force participation (as measured by the female share of the non-agricultural labor force) are correlated to some degree with urban child-woman ratios and aggregate birth rates. In the case of the aggregate birth rate, this is most apparent when the predicted ratio of service to total female non-agricultural labor is based on Boserup's definition. See columns (3) and (5) in Table 5. In this situation, per-capita gross national product is almost significantly negative at the five percent level using a one-tailed test in the labor force participation regression and significantly negative using a two-tailed test in the crude birth rate regression. This indicates that a country with a relatively high per-capita GNP, other independent variables fixed, would be more likely to have both a birth rate and female share of the non-agricultural labor force which are relatively low. On the other hand, a relatively high female literacy rate may be associated with a relatively high female labor-force participation rate and relatively low birth rates, particularly in urban areas. The female literacy variable is positive and highly significant in the female labor-force participation equation; it is negative and significant in the urban child-woman ratio equations and negative but insignificant in the aggregate crude birth rate equations in Table 5.

While we have in the regressions a crude proxy for the ratio of domestic service to overall female money wage rates, we do not control for variation in the ratio of the female to overall labor wages. A proxy variable, positively correlated with this ratio, is the predicted ratio of the female to the total non-agricultural labor force.

This variable was obtained from the estimated equation

$$\text{NAGRIFEM} = .28707 + .23804\ \text{LITRATIO} - .29673\text{POT} - .05193\ \text{MOSLEM} \qquad \text{III.5}$$
$$(.04916)^{***} \qquad (.09589)^{***} \quad (.03268)$$

$R^2 = .607, \qquad F(DF = 3, 44) = 22.7$

*** significant at 1% level (two-tailed test)

where

NAGRIFEM = Female proportion of total non-agricultural labor force,

LITRATIO = Female adult literacy rate divided by total adult literacy rate

POT = (adult urban population less total industrial labor force)/ adult urban population

MOSLEM = dummy variable with a value of 1 if the country is predominately Moslem and zero otherwise.

Including the variable determined by this equation [PNAGRIFEM] in the fertility regressions does not alter our main result, i.e., that the crucial policies are those affecting the composition, not the overall level, of female labor-force participation. In Table 6 the predicted female service share variables [PFMSERV1 and PFMSERV2] are significant by conventional standards in all four regressions. On the other hand, the predicted ratio of female to overall non-agricultural labor force participation [PNGRIFEM] though it has the hypothesized negative sign, is less statisically significant than these variables. The greater statistical significance of PFMSERV1 based on Boserup's than PFSMSERV2 based on the ILO data, which did not occur in fertility regressions in Table 5, is consistent with the hypothesis that exogenous increases in domestic-service participation have more of a pro-natalist effect than do

Table 6

Fertility Effects Associated with Level and

Composition of Female Labor Force

	URBANCWR		BIRTHRT	
PFMSERV1	.46411 (.22280)**		24.61136 (10.36904) **	
PFMSERV2		.49570 (.28029)*		25.07193 (12.59206)*
PNGRIFEM	-.64482 (.38767)	-.73160 (.39196)*	10.63360 (15.84147)	6.64780 (15.87836)
GNPCAP	-.00012 (.00011)	-.00024* (.00014)	-.01829 (.00510)***	-.02428 (.00630)***
FMLIT	-.13055 (.13728)	-.07263 (.13278)	-9.25325 (5.96533)	-6.17938 (5.68290)
(CONSTANT)	.75112	.68597	40.29869	37.08439
R^2	.48853	.47141	.40810	.38706
F Statistic	7.88013	7.35767	7.41176	6.78839
# of Cases	38	38	48	48

Notes:

* Significant at 5% level (one-tailed test)

** Significant at 5% level (two-tailed test)

*** Significant at 1% level (two-tailed test)

For sources and countries, see Appendix.

exogenous increases in non-domestic service participation.

Summary and Conclusion

We have postulated a model in which a common set of exogenous household and market variables influence a number of endogenous variables pertaining to the behavior of families in LDCs. Such a model appears in particular to be useful in understanding the important relationship between female labor-force participation and fertility based on evidence derived from micro-data pertaining to Puerto Rico and an intercountry cross-sectional sample of as many as 58 LDCs.

Two important policy conclusions seem to emerge from the empirical results 1) The evidence calls into question the argument that policies designed to increase female employment in urban areas will reduce aggregate birth rates. Such policies, which will have the effect of raising the real wage of urban women, do not appear to reduce urban fertility because of a) the availability of a significant supply of adult relatives to substitute for mother's time in child-rearing and b) the possibility of shifting among occupations according to their compatability with child-rearing. 2) Exogenous changes in variables affecting the composition of female employment do have an important influence on fertility in urban areas. A reduction in the proportion of women employed in the urban service sector, which may be associated with decreased rural-urban migration, appears to lead to a decline in urban birth rates because service sector jobs tend to be more compatible with children and because of the associated decrease in the supply of women available for child care. Thus, a policy of increasing the rural employment of women and reducing the flow of migration to cities may be a more successful means of bringing down the urban birth rate. However, more knowledge of the natalist effect of female employment creation in rural areas is needed to properly evaluate such a scheme.

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APPENDIX

Notes on Sources

Dependent Variables

1) Urban Child-woman ratio. Data are drawn from United Nations, Demographic Yearbook 1965 and 1969, Table #8. The numbers represent the ratio of children under 5 years of age to women 15-49 years of age. Data for Zaire, Iran and Israel were computed on a denominator of women 15-54 years of age.

2) Crude Birth Rate. Data represent our estimation of reasonable figures close to 1960 and are drawn from IBRD, World Tables, January, 1971, Table 2, with the following exceptions:
estimates for Ghana, Libya, and Nepal are based on data in UN, Demographic Yearbook, 1965 and 1969; estimates for Angola, Bostswana, Liberia, and Sudan are taken from H.J. Page and A.J. Coale, "Fertility and Child Mortality South of the Sahara" in S.H. Ominde and C.N. Ejiogu (eds.),Population Growth and Economic Development in Africa; the estimate for Turkey is drawn from G. Farooq and B Tuncer, "Fertility and Economic and Social Development in Turkey: A Cross-Sectional Time Series Study," April 1973, Yale Economic Growth Center Discussion Paper No. 175; and the estimate for Syria was especially computed by the authors through the backward projection method from the 1960 aggregate proportion of the population under 5, (UN Demographic Yearbook, 1970, Table 6) using a survival ratio for the children 0-4 of .84 and the 1968 intercensal rate of natural increase of 2.9% (UN Demographic Yearbook, 1969, Table 3).

3) Proportion of women in the non-agricultural labor force. Data are drawn from ILO, Yearbook of Labor Statistics, 1966 and 1969, Table 2A. The non-agricultural labor force was computed as the total economically active population minus persons employed in agriculture.

4) Ratio of Female Service workers to total female non-agricultural labor force. Data are drawn from ILO, Yearbook of Labor Statistics, 1966 and 1969, Table 2A. ILO data for the number of women in the service sector and women in the non-agricultural labor force (including those under 15) were used except for countries where comparable data for women 15 and over are provided in United Nations, Demographic Yearbook 1972, Table 10.

Independent Variables

5) Adult literacy. The data underlying this variable were drawn from United Nations, Demographic Yearbook, 1970, Table 11, and supplemented with data drawn from International Bank for Reconstruction and Development, World Tables, January, 1971, Table 2.

Independent Variables continued

6) Female adult literacy rate. The data underlying this variable were drawn from United Nations, Demographic Yearbook, 1970, Table II.//

7) 1960 per capita GNP at factor cost in 1964 US$. All data were drawn from IBRD, World Tables, January, 1971, Table 4. The figure for Sierra Leone is for 1965, rather than 1960.

8) (Adult urban population-total industrial labor force)/(adult urban population). a) Adult Urban Population. The data underlying this variable were drawn from United Nations, Demographic Yearbook, 1970, Table 6, defining an adult as a person 15 years of age and older. Where UN data was not available for urban areas, an estimate was constructed by applying an urbanization percentage taken from IBRD, World Tables, January 1971, Table 2, to UN figures for the total adult population.

b) Total industrial labor force. Data were drawn from International Labor Organization (ILO), Yearbook of Labor Statistics, 1966 and 1969, Table 2A. We define the industrial labor force to include the following ILO categories: 1. Mining and Quarrying, 2-3 Manufacturing, 4. Construction, 5. Electricity, gas, water, and sanitary services 6. Transport, storage, and communication.

9) Female proportion of total agricultural labor force. Data were drawn from ILO, Yearbook of Labor Statistics, 1966 and 1969, Table 2A.

10) Dummy variable. A value of 1 was assigned to countries with strong Moslem cultural influence and a value of 0 to other countries. The following countries in the sample were classified as having strong Moslem cultural influence: Algeria, Egypt, Libya, Sudan, Tunsia, Indonesia, Pakistan, Iran, Iraq, Jordan, Syria, Turkey.

11) Ratio of female adult literacy to total adult literacy. For sources see Notes 5 and 6.

Sample Base

Country	Census Date	Table and column numbers in which data from a given country are excluded, i.e. 4:(1) means Table 4,col.1					Equation numbers from which data from a given country are excluded		
SubSaharan Africa									
Angola	1960	4:(2)	6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3		III.5
Botswana	1964						III.3		
Gabon	1960		6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3		III.5
Ghana	1960		6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)		III.4	III.5
Liberia	1962	4:(2)	6:(1-2)		8:(1-2)				
Mauritius	1962	4:(2)	6:(1-2)		8:(1-2)				
Niger	1965	4:(2)	6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3		III.5
Sierra Leone	1963	4:(2)	6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3	III.4	III.5
South Africa	1960		6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3		III.5
Zaire	1955-57						III.3		
North Africa									
Algeria	1966						III.3		
Egypt	1960								
Libya	1964						III.3		
Morocco	1960								
Sudan	1956	4:(2)	6:(1-2)		8:(1-2)		III.3		
Tunisia	1956	4:(2)	6:(1-2)		8:(1-2)		III.3		
Middle East									
Iran	1956								
Iraq	1957								
Israel	1961						III.3		
Jordan	1961						III.3		
Syria	1960								
Turkey	1960								

Country	Cenus Date	Table and column numbers in which data from a given country are excluded.				Equation numbers from which data from a given country are excluded		
Asia								
Hong Kong	1961	4:(2)	6:(1-2)	8:(1-2)		III.3		
India	1961							
Indonesia	1961					III.3		
Khmer Republic	1962							
Republic of Korea	1960							
Nepal	1961					III.3		
Pakistan	1961							
Philippines	1960	4:(2)	6:(1-2)	8:(1-2)				
Singapore	1957	4:(2)	6:(1-2)	8:(1-2)				
Sri Lanka	1963							
Taiwan	1956	4:(2)	6:(1-2)	8:(1-2)		III.3		
Thailand	1960	4:(2)	6:(1-2)	8:(1-2)				
Northern Latin America								
Barbados	1960		6:(1-2)	6:(3-6)	8:(1-2) 8:(3-4)	III.3	III.4	III.5
Belize	1960					III.3		
Costa Rica	1963							
Dominican Republic	1960							
El Salvador	1961							
Guatemala	1964					III.3		
Honduras	1961							
Jamaica	1960					III.3		
Mexico	1960							
Nicaragua	1963							
Panama	1960							
Puerto Rico	1960							
Trinidad & Tobago	1960		6:(1-2)	6:(3-6)	8:(1-2) 8:(3-4)	III.3	III.4	III.5

Country	Census Date	Table and column numbers in which data from a given country are excluded.					Equation numbers from which data from a given country are excluded		
Southern Latin America									
Argentina	1960	4:(2)	6:(1-2)		8:(1-2)		III.3		
Brazil	1960						III.3		
Chile	1960								
Colombia	1964								
Ecuador	1962								
Guyana	1960		6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3	III.4	III.5
Paraguay	1962						III.3		
Peru	1961						III.3		
Surinam	1964	4:(2)	6:(1-2)	6:(3-6)	8:(1-2)	8:(3-4)	III.3	III.4	III.5
Uruguay	1963						III.3		
Venezuela	1961								

FOOTNOTES

[1]See Boserup [5] for information on the extent of this type of female employment in LDCs. Jaffee and Azumi [13] among others, have demonstrated that cottage industries are highly compatible with child rearing.

[2]Intensity is measured by the ratio of the particular factor input valued at its price to the price of the household commodity.

[3]Factors affecting the age of weaning are examined by Nag [23].

[4]See McCabe [17], p. 18.

[5]The empirical studies showing a positive association between the female wage rate and labor-force participation are reviewed by Ben-Porath in [2].

[6]For example, Bindary, Baxter and Hollingsworth [4] find a positive association between female employment and fertility in urban Egypt; whereas Collver and Langlois [7] find a negative association in urban areas for a number of other countries.

[7]See Mincer and Polachek for empirical evidence on the depreciation of women's earning potential due to non-participation in the work force.

[8]See Gronau [11] for a discussion of some of the shortcomings of this approach. Random errors in the computed predicted wage should bias the wage coefficient towards zero.

[9]With increasing returns and non-homotheticity in the production of child services, it is possible for the intensity in the wife's time of these services to decrease with output. It may not require twice as much of the wife's time to take care of 2.n children as it does to take care of n. Under these conditions, the marginal intensity of child services in the wife's time will decrease more rapidly than the average. It can be shown that if, given non-homothetic production functions, child services become less intense in the wife's services than do commodity services at the margin; then increase in the wife's wage rate will unequivocally increase family size. Moreover, this can happen even though there has been no variation in the levels of inputs of servants and relatives into child-care and even though the woman's choice of occupation has not become less competitive with child-rearing.

[10]For an excellent review of the literature on female labor-force participation and fertility, see McGreevey et al. [34], especially pp. 20-23.

[11] See, for instance, Bindary, Baxter, and Hollingsworth [4], Goldstein [10], and Pinnelli [25].

[12] The level of unemployment influences the crude birth rate directly in a number of ways; e.g., it is a measure of total wage income uncertainty which may well affect fertility decision even though labor force participation rates remain constant. Hence, it remains to be seen why Schultz and Nerlove did not include unemployment as a separate independent variable in the fertility regression. Further, the index of the demand for female labor based on industrial composition is not exogenous. The remaining "exogenous" instrument determining predicted female labor force participation--adolescent schooling--also appears in the fertility equation. For these reasons, the Schultz-Nerlove system is not really identified.

[13] The use of a lifetime labor-force participation variable rather than the available current one would be a more appropriate test of the theoretical model. However, Ben-Porath [2] provides evidence that there is a high positive correlation between the participation of women in the labor force at any two points in their life cycle--women who work more currently tend to be employed more throughout their lifetime.

[14] See Footnote 10.

[15] The countries in which this ratio exceeds unity are Guyana, Jamaica Barbados and Trinidad.

[16] See estimates of income inequality compiled by the World Bank in [14].

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