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GREATER EDUCATION OPPORTUNITIES FOR WOMEN RELATED TO POPULATION GROWTH

by

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Abstract: Previous research has supported the hypothesis that greater education of women reduces population growth. Increased education of women is hypothesized to depress fertility by raising the value of women's time in activities competing with childrearing. Also education is associated with an increased knowledge of, and an improved attitude toward using, more effective birth control techniques. In addition, education tends to delay the age of marriage. Schooling represents exposure to different types of experiences that may affect preferences and formation of tastes. The relationship between education and fertility, however, is likely to be quite complex and may not operate, at least with equal intensity, throughout the educational continuum. In low income settings where supply factors may constrain family size, more education may release supply constraints. Thus, the result will be better knowledge of health practices, enabling women to have more children and to avert child deaths. On the other hand, the impact of education on fertility through the participation of women in the labor force depends upon the fundamental assumption that the role of women as mother and worker are mutually exclusive and that there is a high cost of obtaining alternatives to the mother's time in the household.

This paper attempts to untangle some of these relationships using data from a large household survey in Belo Horizonte, Brazil. The model employed takes account of the relationship between raising a family and the allocation of women's time in the labor force. Child deaths are defined as an endogenous variable, since they are considered to be a proxy of supply constraints on family size. The estimation is undertaken by using the two-stage least squares regression estimation technique (TSLS).

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GREATER EDUCATION OPPORTUNITIES FOR WOMEN RELATED TO POPULATION GROWTH

Introduction

> In recent years, the recognition, crucial to the understanding of long-term growth, that much investment which occurs in the economy is made in human beings rather than in physical capital and that fertility itself is shaped in important ways in economic considerations had led to renewed interest in the economics of the household decisions. In that type of unit, not only decisions about fertility but also those related to investment in human capital, consumption and savings, migration, labor force participation, and, in a sense, marriage itself, are made.[1]

In the theory of household and choice, a household is viewed as a firm purchasing inputs (commodities and market services), and allocating its service and resources in a maximizing framework to produce utility.[2] In this framework children are home produced durable consumer assets from which parents derive a flow of services, and the full value of the household's children is postulated to be a function of both the number of children and the average quality per child. In this case, quality is viewed as deriving from the amount of resources devoted to raising children.

Household commodities, namely child quality, child quantity, and other goods and services, have no explicit market prices since these commodities are "produced" in the household. Thus, their shadow prices, which depend on the prices and quantities of the inputs used to produce the commodities and on the structure and technology of the household's own production may be derived in an optimization process.[3] Home produced goods are products resulting from inputs of time by the husband and the wife and market inputs. The household faces budget constraints, i.e., expenditures on market goods cannot exceed family income. Family income is defined as total monthly income earned in the labor market by members of the household plus non-wage income.

The household also faces a time constraint which is the time spent per period in the labor market plus the time spent per period producing home goods. Time can be converted into goods by using less time for consumption and children, and spending more time in the labor market. Furthermore, higher income will enable the family to consume a larger quantity of normal goods, including children.

The wage a woman can earn in the labor market represents the value of her time in labor activities, and, therefore, reflects the opportunity cost of her time spent in other ways (household and child care). An increase in the woman's wages could create a substitution effect away from earnings-intensive labor and toward goods-intensive commodities. Child-rearing, compared to other goods, demands much of the mother's time. Therefore, the "price" of children moves together with the price of women's time. We also have to consider that an increase in the value of a mother's time will cause an increase in the family's income which, in turn, will affect family size.

Nevertheless, the domination of the price effect over the income effect depends on the fundamental assumption that a woman's participation in the labor force and child raising activities are mutually exclusive and dependent on the cost of obtaining alternatives to the mother's time in the household. When a woman's earning activities can be combined with child raising, opportunity costs are minimal. In low income countries, the price of children, in terms of the opportunity cost of female participation, is relatively low, and the income effect is more powerful. Such an aspect is disregarded in the new home economics model with respect to the labor force participation of females and childbearing decisions. In addition, the participation of women in the economic life of the society is highly dependent on a set of complex social and cultural factors.

The Impact of Women's Education on Household Behavior

The level of women's education is associated with every aspect of family behavior and it is not easy to identify such influences empirically. In this paper we shall focus on the role of women's education in the family following the household economic approach, although we understand that there are limitations to its application in low income settings.

A part of the relevant role of the wife's education in household behavior is displayed in Figure 1.

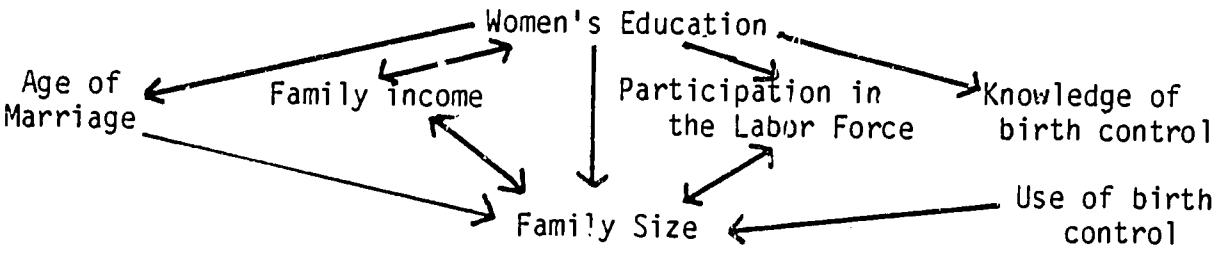

FIGURE 1

An increase in the schooling of the mother can be expected to raise household real wealth, to raise the price of her time in the household, and to increase the efficiency with which household production of commodities is undertaken. The increase in the price of women's time (due to an increase in her education and of the household's real wealth) will produce an income effect and price effect on the demand for children. Such effects on demand depend on the impact of education on the marginal productivity of the mother's time input at home and on the family income. This effect can be inferred from a change in the intensity of the factors of production allocated in children. Child-rearing, compared to the other goods, demands much of the mother's time. Therefore, the full price of children moves together with the price of the time of women. Education is related to the higher cost of the time of women, and, therefore, is related to a substitution effect

against children. Nevertheless, an increase in female education also is associated with higher full income. If the substitution effect dominates, one would expect a negative relation between fertility and female education.

Independent of its effect on the wage rate, education raises one's productive capacity in household production as well. It does so either by influencing the choice of productive techniques employed or by affecting the marginal productivity of the inputs used in a given production technique.[4]

An increase in education brings about other factors augmenting technical change. For example, the efficiency factor may be related to the wife's entrepreneurial capacity. Along these lines, it is useful to view the household in its productive capacity as a type of firm.

> In the business world, firms are often observed which have approximately equal physical inputs yet widely divergent quantities of outputs. This difference is sometimes assumed to arise from differences in entrepreneurial capacity and talent. It is argued that a simlar phenomenon takes place in household production. That is, households produce the commodities they consume with varying levels of efficiency. The efficiency is assumed to be strongly related to the formal education of the husband and wife.[5]

According to Robert Michael, education affects the level of contraceptive efficiency. Increases in education lower the expenditure on contraceptives necessary to reduce the risk of pregnancy to a given level. Also, formal education improves the individual's ability to acquire and assimilate information, to perceive and to understand changing conditions, and to respond actively to them.[6] In addition, female education increases age at marriage, resulting in reduced fertility.[7]

Schooling also represents exposure to different types of experiences. If experience affects preferences, then education may influence the formation of tastes. Thus, few economists and many sociologists have associated higher levels of education with systematic changes in preferences away from large numbers of children and toward fewer, but higher quality, children.[8] Unfortunately, neither economists nor other behavioral scientists have developed an acceptable theory of taste formation. Hence, while education may indeed affect tastes in some unspecified manner, to date it has not proven feasible to identify its influence empirically.

Women's Education and Family Size

Previous research applied to both developed countries and less developed countries supports a negative relationship between fertility and educational level, even when controls for age, rural-urban residence, age at marriage, and other variables are introduced into the

analysis.[9] However, the education and fertility relationship may not operate (at least with an equal intensity) throughout the educational continuum. Instead, according to the level of development of each country, this association may become effective at a different point on the continuum.[10] In addition, in low income settings, where supply factors may constrain family size, more education may serve to release supply constraints. More education results in better knowledge of health practices, enabling women to have more children and enabling families to avert child deaths.

To investigate some of these relationships, we undertook an empirical study using data from a large household survey in Belo Horizonte, Brazil's third largest and most rapidly growing city. The data used in this study were collected in 1972 by the PLAMBEL, a State government's planning agency in Belo Horizonte, Minas Gerais, in collaboration with CEDEPLAR (Center for Development and Regional Planning of the Federal University of Minas Gerais). Through a sophisticated geographic stratification scheme, a random sampling design was developed which was both efficient in data collection and effective in insuring a representative sampling of the population.

While the original data set contained a total of 3,612 households, we have worked with a subsample of 2,445 households with 8,079 individuals. The original sample included many types of households such as those with one family, those with many families, and collective households. We have considered only those with one family.

The main variables considered are defined as follows: (a) Women participating in the labor force are those who engage in any remunerated activities plus those women who are available for work and actively looking for a job; (b) Family income is defined as the total monthly earned income plus non-wage income; (c) Children ever born is used to represent family size; (d) Educational levels are measured by the number of years in school (formal education); (e) Age of women is grouped into three different categories, 15-29, 30-49, and 50 years and over to facilitate the graphic analysis.

Considering married women (a total of 1,777 in the sample), 29.3 percent had six children while only 9.2 percent had one child. However percentages vary with age and with the educational attainment of the women (see Table 1). An observation of the distribution of married women by educational level and age shows a trend of diminishing illiteracy from generation to generation, i.e., a higher level of education for the younger generation is observed. Such a finding suggests that, in this case, important cohort changes may have occurred through time in the study area. Therefore, the analysis of the results may be sensitive to generational differences since women over age 50 have many more children than the younger ones as shown in Table 2.

The association between education and family size does not operate (at least with an equal intensity) throughout the educational continuum.

TABLE 1

PERCENTAGE DISTRIBUTION OF MARRIED WOMEN IN SAMPLE BY AGE AND EDUCATIONAL LEVEL

EDUCATIONAL LEVEL	AGE					TOTAL		
	15-19	20-29	30-39	40-49	50+	%	ABSOLUTE	RELATIVE
Illiterate	2.8	10.2	24.3	25.3	37.4	100.0	265	14.9
Incomplete Primary	4.5	18.5	33.4	22.0	20.7	100.0	551	31.0
Complete Primary	4.7	25.6	27.5	23.3	18.9	100.0	488	27.5
Secondary	12.6	32.4	27.5	22.5	5.0	100.0	222	12.5
High School	2.0	33.8	29.9	15.7	18.6	100.0	204	11.5
College	--	44.7	44.7	6.4	4.2	100.0	47	2.6
							1,777	100.0

TABLE 2

DISTRIBUTION OF CHILDREN EVER BORN IN SAMPLE BY AGE OF MARRIED WOMEN

AGE	NUMBER OF CHILDREN 0		1		2		3		4		5		6+		TOTAL	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
15 - 29	186	36.2	98	19.1	99	19.2	59	11.5	35	6.8	18	3.5	19	3.7	514	100.0
30 - 49	40	4.4	54	5.9	116	12.8	141	15.5	142	15.7	95	10.5	319	35.2	907	100.0
50+	24	6.7	11	3.1	28	7.9	41	11.5	37	10.4	31	8.7	184	51.7	356	100.0
TOTAL	250	14.1	163	9.2	243	13.7	241	13.6	214	12.0	144	8.1	522	29.3	1,777	100.0

N = Absolute Number

% = Relative Percentage

Instead, it is seen in Figure 2 that after the attainment of a certain grade level (incomplete secondary level) there is no apparent difference in fertility. The greatest impact on family size reduction occurs with completed primary and secondary levels of education, and the reduction after the secondary level is relatively modest. Previous analyses seem to indicate that, in Belo Horizonte, the working role and mother role are incompatible, at least for upper income level families. Therefore, one can try to determine the extent to which lower fertility of better educated women is caused by their greater participation in the labor force. To answer this question, the average of children ever born for economically active women and non-economically active women in terms of their educational level is shown in Figure 3. For all levels of education, the fertility of economically active women is lower than that of non-economically active women.

Whether a woman chooses to participate in the labor market and at what points during her life she does is related to the size and composition of her family over time; the presence of a number of children in the household may reduce or preclude her participating in labor outside her home. Also it is clear that there are interactions among women's education, family income, age of women, and other variables. Since the spheres of family behavior investigated are interrelated and influence one another, we use multiple regression analysis as the basic estimation technique. Further, a simultaneous system is developed so that direct and indirect effects are captured by estimation of the endogenous variables that are discussed below.

The Empirical Model

The empirical model contains three endogenous variables of interest: children ever born (representing family size), female labor force participation, and infant mortality. The model estimated is summarized in the equations below and all variables are defined in Table 3.

Equations (1) $CEB = f(CD, LFP, E_i, A, FY)$

(2) $LFP = g(E_i, HY, CH_{0-6}, CH_{7-14}, EXTF, OY, WY)$

(3) $CD = h(FY, CEB, A, E_i, BP)$

Below we consider these variables in a brief discussion of the manner in which they are incorporated into an integrated statistical framework and their relationship to the model. To achieve a certain surviving family size, parents may take into account the possible incidence of child deaths. The evidence from some studies indicates that parents respond to child loss either in advance, by attempting more births than the number of surviving children desired, or after the fact, by attempting to replace children who die. We therefore expect a positive relationship between CD and CEB. The extent of child-replacement due to actual or expected mortality is an empirical issue (see Equation 1).

FIGURE 2

AVERAGE NUMBER OF CHILDREN EVER BORN IN SAMPLE
BY EDUCATIONAL LEVEL OF THE MOTHER (N=1,777)

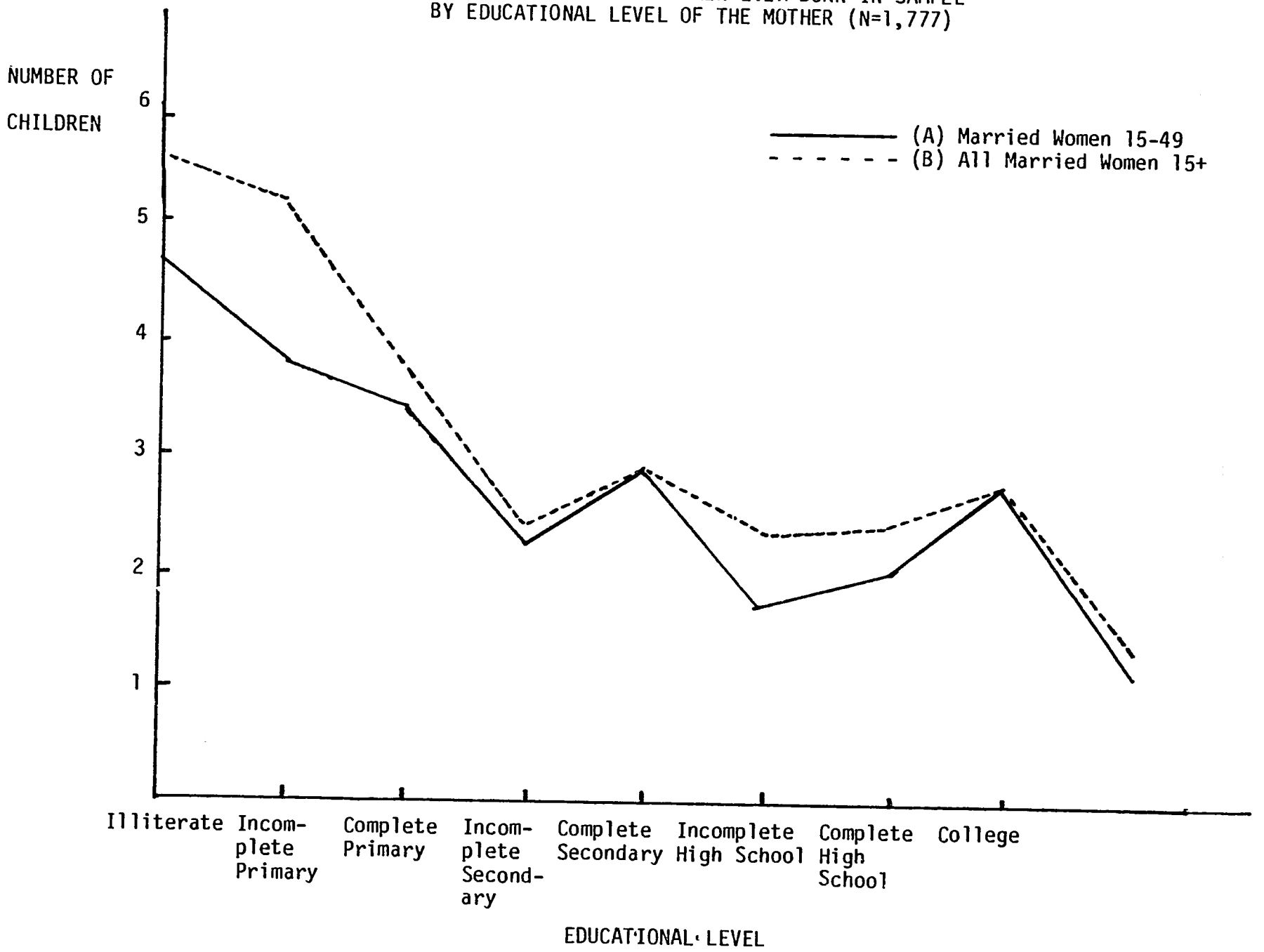

FIGURE 3

AVERAGE NUMBER OF CHILDREN EVER BORN IN SAMPLE BY EDUCATIONAL LEVEL AND WORK FORCE PARTICIPATION OF THE MOTHER (N=1,777)

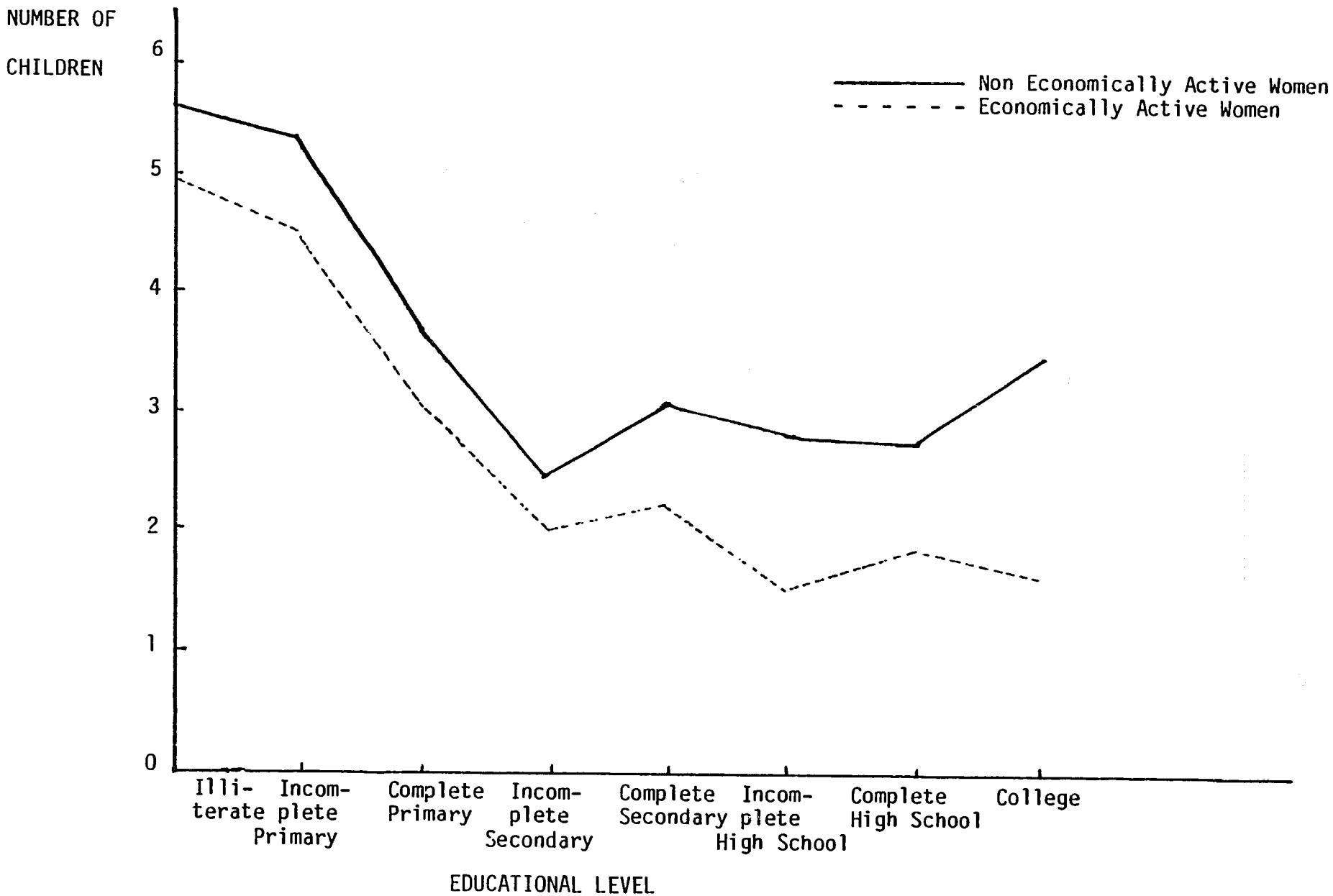

TABLE 3

MEANS AND STANDARD DEVIATIONS OF THE VARIABLES EMPLOYED

Variable Name	Variable Symbol	Mean	Standard Deviation	Percent in Indicated Categories
Age of Woman	A	38.3	13.3	
Adult Females in Household[1]	EXTF			19.5
Birth Place of Woman[2]	BP			15.8
Child Deaths	CD	0.46	1.2	
0				77.7
1				12.4
2				4.5
3				2.5
4+				2.9
Children Aged 7 to 14 Years	CH_{7-14}	1.31	1.45	
Children Ever Born	CEB	4.14	3.33	
Children Younger than 6 Years	CH_{0-6}	0.87	1.10	
Family Income	FY	1,447.60	2,029.21	
Female's Education				
Illiterate	E_0			14.8
Incomplete Primary	E_1			31.5
Complete Primary	E_2			27.8
Incomplete & Complete Secondary	E_3			11.8
Incomplete & Complete High School	E_4			11.5
Incomplete & Complete College	E_5			2.6
Head of Household's Earnings	HY	1,249.34	1,777.73	
Labor Force Participation of Married Women	LFP			21.2
Non-wage Income	OY	198.40	762.20	
Surviving Children	CEB-CD	3.68	2.83	
Wife's Income	WY	96.32	134.15	

1. EXTF = 1 if there is no other adult female in the household: EXTF = 0 otherwise

2. BP = 1 if the woman was born in Belo Horizonte: BP = 0 otherwise

The relationship between female workforce participation and family size is complex, especially in a low-income setting. In relation to the family size decision, the wage a woman can earn in the labor market represents the value of her time in market activities, and therefore the opportunity cost of her time spent in home production (household and child care). An increase in the woman's wage creates a substitution effect away from household time-intensive activities, that is, it raises their relative price. Childrearing demands much of the mother's time. Therefore, the price of children rises with the price of the mother's time. On the other hand, an increase in the family's income because of an increase in the value of the mother's time (as it is devoted to childrearing) will also produce an income effect. Which effect (price or income) dominates is an empirical issue. Important to assessing the role of the wife's workforce participation is the extent to which her non-household employment is compatible or competitive with childrearing. If her non-household employment can more or less be combined with raising children, then the opportunity costs of children may be small.

On the other hand, it is not possible to provide a strong a priori judgment on the relationship between income and family size, especially in a low-income setting. Increase in family income may release supply constraints due to low nutritional and health standards, and provide a stimulus to expand family size. Opposing these positive effects of income is the possibility that if the costs of rearing children rise with income, then larger incomes will be associated with smaller desired family sizes. Moreover, if children are employed in the productive process at an early age, or if they represent a provision for old-age security, then higher-income families will have less need for children as a source of income and security.

Family size is strongly affected by the age of the wife. Family size increases with age and converges on an upper limit in the middle to later years of life, due to the onset of female sterility.[11]

We expect a negative relationship between education and family size. On the other hand, higher education raises the relative value of the wife's time outside the household, and provides greater opportunities and earning power. A positive relationship between LFP and E_i is therefore expected (see Equation 2).

Since the presence of children in the household, especially young children who require more care, exerts a demand on the wife's time, the number of children, by age cohort, is incorporated into the model. It is expected that the deterrent effect of children on the wife's workforce participation will be greater for the younger cohort. Attenuating this deterrent effect will be the existence in the household of female adults from the "extended family" (EXTF). A positive relationship between LFP and EXTF is expected.

The adequacy of the earnings of other family members will plausibly influence the likelihood that a woman will work. The less adequate the income of a woman's husband (HY) or the smaller the magnitude of other

household income (OY), the more likely she or her children will work to supplement family income. The wife's income is postulated as positively associated with her workforce participation.

Under conditions of high mortality, parents may take into account the risk of child deaths in deciding upon the number of children to be born into the household. A growing body of evidence indicates that improvements in child nutrition and local health facilities may reduce infant and child mortality, with the secondary effect of reducing births.[12] While child deaths are certainly not planned, they can indeed be influenced by factors that are partially under the control of the household.

We expect that an increase in the educational level of the wife, as well as family income, will reduce child deaths (CD). More education will provide the mother with information on nutrition and health care, thereby facilitating child survival. In addition, higher income provides resources for acquiring a better diet and health care for mother and children. A non-linear relationship of declining child mortality to increasing education and income is hypothesized (see Equation 3).

Child deaths are likely to decline as the age of the mother increases, reaching a minimum at some specific age and then increasing thereafter. The declining portion of such a "U" shaped relationship can be justified by behavioral factors for younger women. That is, CD declines at first because of the greater ability of the older mother to care for children. The positive relationship between CD and the age of the mother for older women is justified on biological grounds. In particular, the incidence of congenital malformation and genetic disease increases with age and parity. Both A and A_2 terms are therefore incorporated into the statistical model.

A dummy variable for birthplace (BP = 1 if the wife was born in Belo Horizonte; BP = 0 otherwise) takes into account environmental influences on child deaths. Some studies indicate that in urban areas, the infant mortality rate is more erratic, but systematically lower than in rural areas. This can be explained in part due to better urban health facilities and more access to health information in urban areas. Because most women in the sample who were not born in Belo Horizonte were born in rural areas, we expect BP to have a negative relationship with CD (see Equation 3).

Results

The results of the model summarized above are presented in Table 4. Since the primary objective of this study has been to untangle the relationship between education and household behavior, we will not analyse all variables.[13] Instead, we focus on the impact of education on family size (see Table 4). We have two ways to present the impact of education on family size: the total and the indirect impacts. The total impact takes into account all endogenous variable interactions, while to calculate the indirect effect all exogenous variables other than education are held constant, as well as all endogenous variables other than the family size.[14]

TABLE 4

IMPACT OF EDUCATION ON FAMILY SIZE

	Total Impact	Indirect Impacts, via:	
		LFP	CD
$E_0 - E_1$	0.238	-0.016	-0.053
$E_0 - E_2$	-0.997	-0.006	-0.561
$E_0 - E_3$	-1.506	-0.037	-0.697
$E_0 - E_4$	-2.166	-0.096	-0.692
$E_0 - E_5$	-2.154	-0.068	-0.645

Women's educational attainment negatively affects family size. However, the effect of education on family size does not operate with equal intensity throughout the educational continuum (see Equation 2 and Table 5). The depressing effect of education on family size holds only after women have completed elementary school. At lower educational levels, family size is reduced largely through the impact of education in lowering child mortality. At somewhat higher education levels, the effect is likely to operate through providing information about and raising the receptivity toward using contraceptives. There is a relatively small impact of education on female labor force participation. Evidently only relatively high education levels are likely to bring women out of the household and into market employment (see Equation 3 and Table 5).

The negative relationship between female education and family size could well represent a price-substitution effect as well as birth control knowledge and contraceptive efficiency.[15] In addition to this direct effect of education on CEB, there are also indirect effects via LFP which can increase this negative impact or offset it.

The indirect effect of education on CEB via LFP (representing the opportunity costs of the mother's time), although negative, is relatively small. The total effect of higher education of the female is typically to decrease family size, and this total negative impact of education on CEB tends to increase with the educational level. However, at the margin, the intensity of the impact of education on CEB varies for different levels of education. For instance, moving from incomplete primary to complete primary education has a noticeable marginal impact on CEB, while moving from high school to college has a very small marginal impact on CEB (see Table 4).

Another beneficial effect of increased education is the reduction of child mortality. Increasing the educational level of women from illiteracy to incomplete and complete primary school would reduce child

REGRESSION RESULTS FOR CHILDREN EVER BORN, CHILD DEATHS AND FEMALE LABOR FORCE PARTICIPATION EQUATIONS[1]

EQUATIONS	CONST	CEB	CD	LFP	FY	1/FY	WY	OTHER Y	HY	A	A_2	A.D	U	E_1	E_2	E_3	E_4	E_5	CH_{0-5}	CH_{7-14}	EXIP	BP
1) Children ever born (CEB)	-3.179	--	1.809	-0.627	0.0007	--	--	--	--	0.220	--	-0.233	8.238	0.183	-0.444	-0.745	-1.257	-1.244	--	--	--	--
	(-6.837)	--	(3.116)	(2.322)	(1.693)	--	--	--	--	(11.811)	--	(-13.131)	(12.922)	(0.980)	(-1.570)	(-2.056)	(3.486)	(-2.658)	--	--	--	--
2) Children Death (CD)	0.032	0.059	--	--	--	41.850	--	--	--	-0.003	0.000	--	--	-0.027	-0.246	-0.314	-0.309	-2.288	--	--	--	-0.103
	(-0.089)	(0.839)	--	--	--	(2.432)	--	--	--	(-0.115)	(0.475)	--	--	(-0.321)	(-1.991)	(-1.836)	(-1.490)	(-1.108)	--	--	--	(-1.375)
3) Female Labor Force Participation (LFP)	0.916	--	--	--	--	--	0.001	-0.0001	-0.0002	--	--	--	--	0.028	0.011	0.067	0.150	0.118	0.002	0.005	0.078	--
	(4.062)	--	--	--	--	--	(27.531)	(-1.724)	(-3.464)	--	--	--	--	(1.157)	(0.451)	(2.103)	(4.387)	(2.006)	(0.237)	(1.846)	(1.943)	--

[1]This table shows regression coefficients. The figures in brackets are t values ($t \geq 1.64$ are significant at 0.05 level-one tail).

mortality by 0.053 and 0.56, respectively. That is, child mortality tends to decrease with increasing education.[16] On the other hand, the indirect effect of education via child mortality is to decrease family size (see Table 4).

Conclusions

Policies to bring about smaller family sizes are common in developing countries. These policies generally involve little more than the establishment of family planning clinics and the distribution of birth control devices. However, these policies may fail if they do not take into account the motivation for having children. In particular, parents may have already decided to have families smaller than possible and may be practicing some form of contraception, albeit possibly an inefficient form. Except for the possibility of excessive family sizes would, of necessity, reduce the household's total welfare. Thus, at most family planning clinics will be able to be effective only in reducing the margin of error in effective family planning. This assumes that the family size decision is not primarily biologically determined, but rather the result of rational motives where economic considerations impinge on fertility. Thus, public policy measures designed to lower family sizes must strike directly at the basic economic motives for having children. This primarily implies altering public policies in ways which lower the benefits of children, or which raise their costs.

Examples of such policies might include social measures aimed at supplementing family income in old age, or the imposition of child labor laws. Both policies would lower the benefits of children. A measure which would raise child costs is the provision of greater educational opportunities for women. Here, women's opportunity costs rise with education, as does the corresponding cost of children. The provision of greater education, as a public policy to reduce population growth, has quite diverse impacts over the educational continuum. At lower levels, the increase in education will reduce mortality. Since reduced mortality induces smaller family sizes, education will reduce family size as a result. At intermediate education levels, the impact is likely to provide more information on contraceptive techniques, as well as influence attitudes toward the use of these techniques. Finally, the impact of education at very high levels operates largely through the opportunity cost of the woman's time, since it is at these levels that the rate of return to education rises most rapidly in the sample area. However, it is important to note that at these levels there is also a positive income effect of increased education on fertility, and thus the benefits of more education for women past the high school level is relatively small.

The results of our analysis suggest that the government should encourage the education of women through the complete elementary and secondary levels if the policy is to reduce fertility in the study area. Moreover, policies that improve health conditions and reduce death rates will, with some lag, also lead to lower fertility rates as parents adjust to higher survival rates.

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11. Because the best specifications of this relationship are non-linear in parameters, causing very notable estimation problems, we have linearized this relationship in variables by defining two straight line segments, with a kink in the function at the mother's age where additional childbearing is unlikely to occur. The linear specification is obtained by defining a dummy variable D which takes on a value of zero below a specified age A*, and a value of unity thereafter.

12. David M. Heer and Dean O. Smith, "Mortality Level, Desired Family Size, and Population Increase," Demography 5(1): 104-121, 1968; David M. Heer and Dean O. Smith, "Mortality Level, Desired Family Size and Population Increase: Further Variations on a Basic Model," Demography 6(1): 191-219, 1969; T. P. Schultz, "An Economic Model of Family Planning and Fertility," Journal of Political Economy 77(2): 153-180, 1969; Samuel Preston, "Health Programs and Population Growth," Population and Development Review 1 (20): 189-199, 1975.

13. A complete analysis is in da Silva, Léa Melo, "Family Size and Female Labor Force Participation in Brazil," Unpublished Ph.D. Dissertation. Durham, N.C.: Duke University, 1976. See also Kelly, A. and da Silva, Léa, "The Choice of Family and the Compatibility of Female Workforce Participation in the Low-Income Setting," Revue Economique, 31(6): 1081-1104, 1980.

14. The total impact represents $\frac{(dCEB)}{(dE_i)}$ which holds constant all variables other than E_i, and allows the remaining endogenous variable to adjust to the change in E_i. This total impact is calculated by computing relevant reduced form parameters of the structural system. To calculate the indirect impacts, we must compute $\frac{\partial CEB}{\partial E_i}$. These impacts are obtained from the chain rule where, for example, $\frac{\partial CEB}{\partial E_i}$ via LFP equals $\frac{(\partial CEB)}{(\partial LFP)} \times \frac{(\partial LFP)}{(\partial E_i)}$. The first term in the product is obtained from the estimated parameters in the structural equations, and the second term is obtained from the estimated parameters in the reduced form equations. For more details see da Silva, op. cit. p. 150-152; Kelley, A. C. "Interactions of Economic and Demograpnic Household Behavior," (mimeographed) Duke University, 1976, p. 20; and Kelly and da Silva, op. cit., p. 1100.

15. This finding does not mean that contraception is taught in schools in Belo Horizonte. Here we can only confirm Michael's hypothesis (see page 3) that formal education improves the individual's ability to acquire and assimilate information, perceive changing conditions, and respond actively to them. Contraception information in Brazil is available in magazines, newspapers, and special publications. Television programs also are shown that convey information on contraception. Such information is better assimilated by women with higher education levels.

16. Only biology and nutrition are formally taught in elementary schools in Brazil. However, there is a lot of information on child health care which is conducive to child survival. More education is likely to result in better knowledge of health practices, enabling women to avert some child deaths.

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