

## An Empirical Review of the Relationship between Schooling and Demand for Children on the Basis of Quantity-Quality Interaction Model

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### I. Introduction

The literature on the demographic transition has often mentioned education as an important aspect of the transition process. Much attention has been paid to the existence of a negative relationship between parental education and fertility (Cochrane, 1979 ; Graff, 1979). One aspect operates through the education process by affecting the costs and benefits of children. The fertility behaviour of the parents and possibly child mortality in their families are influenced by the costs of educating their children and by the perceived benefits of that education(Caldwell, 1982. Ch.10).

The purpose of this essay is to evaluate the effect of schooling on fertility on the basis of micro-economic, household decision-making models which incorporate a quantity-quality trade-off in childbearing (Becker,1960,1981. Ch.5 ; Becker and Lewis, 1973 ; Becker and Tomes, 1976 ; Willis, 1973 ; De Tray, 1973) and to confirm the appropriateness of their basic logic by reviewing several empirical evidences.

### II. Quantity-Quality Model of Fertility

In the simplest type of economic model(Becker, 1981 : 103-104), the demand for number of children(quantity) and child quality depends both on the shadow prices of quantity, quality, and other commodities, and shadow income. Quantity and quality(the amount of human capital) of children interact inversely in demand functions, depending on market prices and income. That is, an increase in quantity decreases demand for quality, both through the shadow income constraint and by raising the shadow price of quality. An increase in quality decreases demand for quantity by a similar mechanism. Although quantity and quality need not be close substitutes(and indeed can't be if the system is to be stable in a range of plausible values), an increase in demand for one will decrease the demand for the other. This offers a probable reason for historical fertility decline in developed countries. A basic conclusion of this model is that economic development and modernization, which usually increase demand for skilled labor relative to unskilled labor, raises rates of return

on education and training, particularly in urban areas. This lowers the marginal cost (and hence the shadow price) of child quality. As a consequence, demand for child quality increases, which interacts with quantity to reduce fertility. In addition, reductions in child mortality can reduce the marginal cost of child quality, which can, in return, reduce fertility via the same mechanisms. For instance, an exogenous decline in childhood mortality caused by a public health program can free parental resources which had been devoted to child mortality prevention, while at the same time increasing the expected rate of return on child investments. This would lower the shadow price of child quality and increase the demand for child quality (and thus induce a decline of quantity). Consequently, mortality decline during the demographic transition would induce greater demand for schooling. As Becker (1981 : 109-110) points out, this model seems most appropriate for urban, high-income societies in which fertility is low or declining, and where investment per child is already high. Eva Mueller (1983) argues that in less developed, rural societies the relationship between children's education (and child quality generally) and fertility may be only weakly negative, null, or even positive. She notes that the quantity-quality trade-off assumes tastes (preferences) as given, and also that quality is more income elastic and more price elastic than quantity. This is true only when education is assigned a greater importance in the household utility function, which is a condition that is unlikely to be predominant at early stages of development in rural, agrarian regions. With high child mortality and with relatively low rates of return on education, price and income elasticities of demand for child quality may be relatively low. In addition, education costs may not be substantial, even including indirect costs of foregone labor. If children are sent to school for only 3-4 years, or even 6 years to complete

primary education, the direct costs may not be especially burdensome. Further, children attending school only up to ages 11-13 are not as much missed in terms of labor or income contributions to the family as would children aged 14 and over. School years may be short (several months only) and hence children may even be able to make significant economic contributions to the family while continuing to attend school. It would be possible that older siblings help pay for direct schooling costs of younger children, and so increased demand for quality might even have a positive relationship to the demand for quality. In general, Mueller notes that child quantity and quality could be positively related under a regime of natural fertility (e.g. if rising income might make increased fertility and increased children's education possible), if the opportunity cost of school attendance is seen as being lower in larger families than in smaller families; if net rates of return to parents from educating their children are perceived as positive; or if siblings or relatives assist in educating children. Even if the quantity-quality relation is negative, it may well be weak if the family does not accord a high priority to education and child quality.

### III. Empirical Evidence on the Relationship between Child Quantity and Quality

The empirical evidence on the relationship between quantity and quality is mixed, with some studies showing positive, others negative, and still others no relationship. Table 1 is the summary of the results of some recent studies on the quantity-quality model of fertility. In the three African case studies listed, the relationship between number of children and per child investment is positive in five of six regressions cited. For Botswana, Chernichovsky (1981) noted that

"The larger the number of school age children in

Table 1. Some Empirical Studies of the Quantity-Quality Model of Fertility

Authors	Country	Year	Sample Characteristics	Regression Variable Definitions		Relationship bet. q and n	Statistical Significance
				Quantity (n)	Quality (q)		
Chernichovsky (1981)	Botswana	1974	national sample of 1,000 rural households	No. of children aged 7~14	(1) child in school dummy	+	5%
					(2) level of child education of those who stopped	-	n. a.
					(3) level of schooling of those currently enrolled	+	5%
					(4) time spent in school	+	n. a.
DeTray (1978)	USA	1967	subsample of 1163 white households drawn from the National Longitudinal Survey	No. of children living at home and elsewhere as reported by husband	average educational level of children not living at home, this is assumed to be completed level of schooling	-	5%
Snyder (1974)	Sierra Leone	1966~1968	subsample of 717 urban households from the Western Area Household	No. of live births fathered by household head	educational attainment of the oldest child	+	5%
Rosenzweig and Wolpin (1980)	India	1969~1971	1,633 rural households from the additional Rural Incomes Survey of 2939 households	multiple births per pregnancy	age standardized schooling index	-	n. a.
Birdsall (1980)	Colombia	1967~1968	1,433 households in 4 major cities	(1) No. of children of wife currently alive	ratio of current actual household expenditure on education to its predicted expenditures based on sex and age of enrolled children	+	n. a.
				(2) fertility measure on children ever born standardized for age-fertility relationship using a natural fertility schedule	-	5%	
Sahota and Sahota (1980)	India	1964	combined time series and cross section data from 18 districts and 30 villages	birth rate	(1) total school enrollment as percent of total population	+	10%
					(2) pupils spending 1 year or less in a class/ total pupils in the class	-	10%
					(3) mean age of pupils in each class	-	10%

Table 1. (Continued)

Authors	Country	Year	Sample Characteristics	Regression Variable Definitions		Relationship bet. q and n	Statistical Significance
				Quantity (n)	Quality (g)		
Kelley (1980)	Keyna	1968~1969	401 households from three urban areas	No. of surviving children	total household expenditures on education (school fees, books, etc.)	+	10%

the household, the higher the probability of their school enrollment and the higher their levels of education. This finding can be in part explained by the falling productivity of labor in the household with any given amount of assets that reduce the indirect cost of schooling”.

Snyder's study of Sierra Leone demonstrates a positive and statistically significant relationship between quantity and quality. According to Snyder (1974), tropical African parents seek both large families and high education per child, educating the children under the extended family system; relatives, friends, and older children, and expecting from them more earning power and hence more “social security value” than uneducated ones.

Evidence for a third African country comes from Kelly's (1980) analysis of the economic and demographic behaviour of household in urban Keyna. Although his study does not deal directly with the quantity-quality trade-off question, his data and regression results offer some implications. In particular, household investment in education increases as the number of children in the household increases, but the per child investment tends to decline (In all his regressions,  $dI_e/dC_s$  is statistically significant at the .05 level and ranges from 6.3 to 8.9 shillings, where  $I_e$  is household investment in education, and  $C_s$  the number of surviving children. Even standardizing for age and sex profiles, the per child investment in large families is likely to be lower than in smaller families).

In a study of India using district and village level data, Sahota and Sahota (1980) show an interesting relationship between schooling and fertility. If investment in child quality is measured simply by the enrollment rate, the relationship is positive, contrary to theory's prediction; on the other hand, if it is measured by schooling quality (termed as ‘proportion of non-repeaters in class’ in their study), the relationship is negative. In a situation in which tuition is free, out-of-pocket expenses are low, and opportunities for child labor have been declining, as happened in the Punjab in the period under review, the family bears a relatively small cost to keep a child in school. However, the cost to the family increases as the quality of schooling desired for the child rises. Thus, one is more likely to observe a negative relationship between fertility and child investment when the latter is related not only to enrollment, but also to schooling quality. Birdsall (1980) presents some data for Colombia which show the inverse relationship between number of children and investment in their schooling. For other Latin American countries, evidence on the quality-quantity trade-off comes indirectly from Musgrove's (1977) analysis of household expenditure on education in 11 cities.

In general, the share of education in total family expenditure increases as the number of children in the family increases, but the relative rates of increase imply that investment per child is probably lower in larger families than in smaller families.

ler families.

Evidence on the effect of educational subsidies on fertility has become available recently (Rosenzweig, 1982). In related studies, educational subsidies are proxied by a variable indicating the presence or availability of schooling facilities; this variable is a valid proxy in so far as the presence of a school implies a reduction in the price of schooling for that village. Presumably this price reduction is associated with reductions in the time and travel cost of attending school (Rosenzweig, 1982). The empirical results provide partial support for a positive relationship between educational subsidies and schooling on the one hand; and a negative relationship between subsidies and fertility on the other. In other studies which focus more on the determinants of school attendance, the effect of educational subsidies on attendance turns out to be statistically insignificant in a surprisingly large number of regressions; and in some of those regressions for which the effect is statistically significant, the sign of the coefficient is negative rather than positive.

A study of families in the rice farming areas of central Thailand by Ron and Shutjer (1982) also finds a negative relationship between quantity and quality within a simultaneous equations framework. The income elasticity of expected children's education is also greater than the income elasticity of children born, which is also in accord with the Becker model. 'The value of child studies' conducted at the East-West Center, based on surveys in the U.S., the Philippines, and the Republic of Korea, found that financial costs, including schooling, prominently induce couples to limit their family size (Bulatao and Arnold, 1977). Earlier research by Eva Mueller (1972) on Taiwan, China in 1969 concluded that economic considerations associated with costs and benefits of children, rising education and income levels, and availability of new

consumer goods all led to smaller family size preferences and increased use of contraception.

For developed countries, the conclusion seems to be that the quantity trade-off is negative and significant. This accords with the evidence cited in Becker (1981: 111). One of those studies, by Dennis DeTray (1978), is noted in Table 1. Using the data were drawn from the 1967 round of the National Longitudinal Survey, it found a significant negative coefficient relating average educational level of children at home to number of living children in the family.

Some historical evidence for the presently developed countries indicates that this negative trade-off was true once significant development and structural change had occurred. Francine van de Walle (1980) studied Switzerland in 1870, 1888, and 1910, and found a strong negative correlation by cantons between marital fertility and the literacy (and schooling) level of military recruits from those cantons.

Peter Lindert (1978, 1980) argues that the fertility decline in the U.S. since 1800 was brought about partly by increased relative costs of children including educational costs.

Hashimoto (1980) in a study of the fertility decline in Japan between 1900 and 1962, showed that child quality, as measured by the proportion of primary school graduates going on to secondary school, was negatively related to the birth rate. The regression coefficients were significant, however, only for a cross-sectional analysis of prefectures in 1920 and 1935, and not for the time series equations. While the historical record on the relation of schooling to fertility is ambiguous (e.g. Easterlin, 1976; Graff, 1979; Knodel and van de Walle, 1979), there is an evidence of an increasingly strong quantity-quality trade-off in accordance with societal development.

As Eva Mueller (1983) concludes, the Becker type quantity-quality trade-off applies more to industrial societies than to low-income, rural,

agrarian developing groups of regions. When education is extensive and prolonged, and when incomes are high, the negative trade-off can be found (e.g. DeTray, 1978). But in less developed rural areas, the relation may be only weakly negative, zero, or even positive. The same conclusion was also found at a study by Birdsall and Cochrane (1982).

#### IV. Conclusions

With paying much attention to the quantity-quality interaction model, we have discussed some empirical findings to examine the relationship between schooling and fertility on the assumption that parents' decision to educate their children is a voluntary one, motivated largely by the attractiveness of private returns to schooling. However, the assumption leaves room for some argument in the sense that compulsory schooling laws are enforced for primary education in most less developed countries, although these laws have general enforcement problems particularly in rural areas where people are dispersed. In any event, it is probably true that legal provisions speed up existing trends in school enrollment and child employment. Under a compulsory education law, some parents would be forced to school their children beyond the level they would have chosen. The increase in child quality investment would, however, have not clear effect on parent's fertility. If the economic burden is thus shifted away from parents, would they still balance quantity against quality? Since parents nevertheless still bear some cost, the trade-off probably exists, but is likely to be weak. As for laws against employing children, the main mechanism by which they have an effect is through reduction in the economic value of children to parents, which in turn might lead to the decline of fertility.

Another thing to be noted is that the relation-

ship between schooling and fertility should be analyzed by sex, particularly for some LDSs (Chinese- culture-influenced countries and Muslim countries). Strong son-preference in these countries might result in some significant variations in predicting the impact of schooling on fertility as a whole in terms of quantity-quality interaction. That is to say, in the societies with patriarchal structure being prominent, the shadow price of quantity and quality in a given budget constraint will differ by sex, and thus generate different demand for children by sex. Based on WFS data analysis, Mead Cain (1984 : 48) argues that there is no relationship between literacy and fertility at individual level in patriarchal societies.

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