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ECONOMIC FACTORS AFFECTING HUMAN FERTILITY IN THE DEVELOPING AREAS OF SOUTH AFRICA: A POLICY PERSPECTIVE[1]

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Abstract

The World Bank has expressed concern over high population growth rates in sub-Saharan Africa. South Africa's annual population growth rate in the traditional sector is 3,5%. This study identifies economic factors affecting family size choice to provide policy makers with a strategy for reducing fertility. A neoclassical utility framework was used to analyse linkages between family size decisions and socio-economic variables. Household utility for "child services" and "standard of living" was maximised subject to the resource constraints of time, labour and income. A demand curve for children was specified within a simultaneous model of family decision making. A stratified sampling technique was used to collect household data from Ulundi and Ubombo in KwaZulu. One hundred and seventy five women in three equal occupational strata were interviewed. The simultaneous model was estimated by two-stage least squares regression analysis. Dummy dependent variables were estimated by probit analysis. Child education, women's opportunity cost of time and formal market participation were negatively related to fertility, reflecting substitution from numbers of children (time intensive goods) to fewer, more educated children(less time intensive) as opportunity costs rise. Child labour was positively related to fertility. Strategies to reduce population growth rates should therefore include improvements in women's education and employment opportunities to raise their time costs, and time saving devices to reduce demand for child labour.

Uittreksel

Ekonomiese faktore wat die fertiliteit van mense in die ontwikkelende gebiede van Suid-Afrika beïnvloed: 'n Beleidsperspektief.

Die Wêreldbank het sy kommer uitgespreek oor die hoë bevolkingsgroeikoers in Afrika suid van die Sahara. Suid-Afrika se jaarlikse bevolkingsgroeikoers in die tradisionele sektor is 3,5%. Hierdie studie identifiseer ekonomiese faktore wat die keuse van gesinsgroottes beïnvloed ten einde beleidmakers te voorsien van 'n strategie om fertiliteit te verlaag. Die Neo-klassieke utiliteitsraamwerk is gebruik om die koppeling tussen besluite oor gesinsgrootte en sosio-ekonomiese veranderlikes te analiseer. Huishoudelike utiliteitswaarde van "kinderdiens" en "lewenstandaard" is gemaksimeer onderworpe aan die bronbeperkings van tyd, arbeid en inkomste. 'n Behoeftekurwe vir kinders is gespesifiseer binne die gepaardgaande model van gesinsbesluitneming. 'n Gestratifiseerde toetstegniek is gebruik om huishoudelike data uit Ulundi en Ubombo in KwaZulu te verkry. Onderhoude is gevoer met een honderd vyf en sewentig vroue uit drie gelyke beroepslae. Die gelyklopende model is beraam deur die twee-stadium kleinste kwadrate regressieanaliese. Dummie-afhanklike veranderlikes is geskat deur "probit" analiese. Kinderopvoeding, vroue se geleentheidskoste van tyd en formele markdeelname was in negatiewe verhouding tot fertiliteit, en dit weerspieël vervanging van aantal kinders (tydsintensiewe ware) met minder, meer opgevoede kinders (minder tydsintensief) namate die geleentheidskoste styg. Kinderarbeid is in positiewe verhouding met fertiliteit. Strategieë om die bevolkingsgroeikoerse te verlaag, moet gevolglik verbetering van die vroue se opvoeding en indiensnemingsgeleenthede insluit ten einde hulle tydskoste te verhoog, en ook tydsbesparingsmiddele om die vraag na kinderarbeid te verminder.

1. Introduction

High population growth has been a major factor inhibiting economic development in third world countries. Africa has been the focus of world attention in recent years because of high growth rates. Rates exceeded 4% in Kenya and Mozambique between 1970-1982 (The World Bank, 1984). South Africa's traditional sector faces a similar growth rate which is estimated as being 3,5% (de Graaff, 1987), and 46% of the population of 15 650 000 are younger than 15 (Development Bank of Southern Africa, 1987).

This study examines how the economic conditions of traditional households may be manipulated to encourage smaller family sizes; thus facilitating fertility decline and the raising of living standard potentials. The approach to family size decision-making emphasizes the theory of opportunity costs of time (Mincer, 1963), the quantity-quality trade off (Becker, 1960, 1965) and child investment theory (Schultz 1973, 1981). Data were collected from Ubombo (rural) and Ulundi (urban) in KwaZulu. One hundred and seventy five women were interviewed. They were classified into three equal occupational strata to maximise variability in women's education and shadow price of time variables. Two-stage least squares regression and probit analyses were used to estimate the demand functions for family size and child quality (education), and women's work participation. Lifetime measures of total family income and the shadow price of women's time were also estimated.

2. Theoretical issues

Schultz (1974, p.7) postulates that although fertility appears to be "beyond the realm of economic calculus,...parents respond to economic considerations in the children they bear and rear and that parents equate the marginal sacrifices and satisfactions, in arriving at the value of children to them. Thus the analytical key in determining the value of children to their parents is in the interactions between the supply and demand factors that influence these family decisions". Two approaches to the study of fertility have evolved, the neoclassical Chicago School, and the behaviourial approach which endogenises the "taste" effect by proposing that socio-psychological factors can be used as proxies for taste determinants (Ron, 1980). The Chicago school paradigm was adopted because it is rigorous and has empirical support.

The model maximises household utility from "child services" and "standard of living" subject to resource constraints of time, labour and income. From these demand curves for quantity and quality of children, and women's leisure can be derived

(Willis, 1973). Major components of these demand curves include the constraining set of resources and the prices of both complementary and substitutionary goods to numbers of children. These relationships form the theoretical basis of the Chicago school approach.

Mincer (1963) introduced the concept of opportunity cost of time for child care as a major constraint to the household; it is linked to women's labour and thus wages. Using wages as a proxy for opportunity cost he showed that as women's wages rise they desire fewer children and substitute to less time intensive goods; explaining the paradox that although children are normal goods fewer are desired as incomes rise. Becker (1960) added that "child services" were composed of two components, numbers of children and child quality, substitutes which vary directly with expenditures of time and money. The income elasticity of child quality is greater than that of numbers of children; indicating that higher income earners will have fewer but higher quality children. Mincer's (1963) and Becker's (1960) propositions imply that as opportunity costs of child care rise quality (less time intensive) is substituted for quantity, and higher average utility per child is derived from higher expenditures per child.

Children are seen as both consumption goods and investment options. Parents may invest in more rather than fewer children in expectation of future support as their children mature. Schultz (1973) believes child benefits are a motivating factor in fertility behaviour, chiefly in developing areas where it has become an important economic rationalisation for large family size (Cadwell, 1976).

3. Survey areas and sampling techniques

Ubombo magisterial district, the rural area, lies between latitudes of 27^0 and 28^0 South. Two villages Jozini and Ubombo provide most of the community's required services including communication and employment; the Mjindi Cotton Scheme near Jozini and Bethesda Hospital in Ubombo being the principal employers of women. Cotton production, introduced by the Mjindi scheme and subsistence agriculture are major activities. The area has little infrastructure, is typically rural and representative of a rural KwaZulu community.

Ulundi is situated inland in the Mahlabathini magisterial district and is the administrative capital of KwaZulu. It is typically urban being well serviced by road, rail and air, has shopping complexes, schools, a hospital, and other small enterprise although there is little industrial production. Services here are more easily available than in rural areas, market work rather than subsistence agriculture is the major occupation, and water and electricity facilities are available. From these areas a stratified sample of 175 women was interviewed. Respondents were grouped into three occupational strata:

i. Professional workers eg. nurses, clerks, and teachers, etc.
ii. Semi-skilled industrial workers including tractor drivers, gardeners, cleaners, kitchen staff and irrigation workers
iii. Respondents not formally employed like pensioners, housekeepers, subsistence farmers and the self employed.

In Ubombo a list of all female employees of child bearing age (15-49 years) from Mjindi and Bethesda was compiled, from which the first two strata were identified. Each employee was numbered in her stratum, and 30 women were randomly chosen from each. The third stratum was difficult to sample as a list of unemployed women was unavailable for Nkosi Myeni's ward. Therefore the ward was divided geographically into eight identifiable blocks, two of which were selected by proportional probability sampling (PPS). Within these blocks households were approached systematically until women fulfilling the criteria were found and interviewed.

In Ulundi, the first two strata were selected as in Ubombo, from a list of women employees from all possible employment sources. The third stratum was selected with the aid of town plans. One of Ulundi's four suburbs Unit A, was chosen using PPS. Within Unit A, the lots were numbered and 30 randomly selected. If chosen households lacked a suitable respondent, neighbouring households were visited until 30 respondents were found. A post hoc stratification was imposed on stratum 3, reclassifying the group into entrepreneurs and the unemployed. Differences between the group means were tested by t-tests. It was found that the groups only differed significantly on wife's current income (WINC), the ratio of child to family earnings (CFAM), and child education (EDCD) variables. This suggested that splitting the stratum for further statistical analysis was unnecessary.

4. Model specification

The research objective was to derive a demand function for quantity of children. Theory suggests that within a household, the decision to have children is simultaneously determined with the decisions to educate children, achieve a desired standard of living and the woman's decision as to the extent of her market participation. These competing goals must be achieved within the family's limited resources. Therefore maximisation of the utility function subject to both income and time constraints allows derivation of the demand curves for quantity and quality of children, and mother's labour force participation. The system is completed by a lifetime measure of income, and the woman's opportunity cost of time equation which is solved from the first order conditions of the maximisation. The full model is specified below:

NOC = f(CLAB, PWT, EDCD, PART, TOTY, INVEST; v^i)
EDCD = e(NOC, PWT, PART, REL, TOTY; v^{ii})
PART = p(TOTY, NOC; v^{iii})
PWT = w(NOC, PART, EDW, EMPW, INT11)
TOTY = y(AGEH, AGEW, MSD1, INT11, EDW, EMPW, NOC)

where:

NOC number of living children.
EDCD a dichotomous variable measuring child "quality" as a substitute to quantity of children. EDCD equals one if parents favour child education, and zero otherwise.
PART a dummy variable scoring one for women's labour market participation and zero otherwise.
TOTY permanent family income (Rand/annum)
PWT woman's opportunity cost measured by time spent in market and household labour, each weighted by the value of the marginal product in that activity, as a fraction of total time available (Rand)
CLAB total child labour input into the household (hrs/annum)
INVEST measures the ratio of child to total family earnings
EDW woman's level of formal education (yrs)
EMPW woman's years of employment experience (yrs)
REL number of adult relatives within the household
INT11 an interaction term between husband's education (EDH), and the dummy, MSD1, representing married couples.
v^i control variables including ages of husband (AGEH), respondent (AGEW), and the latter squared (AGEWSQ)
v^{ii} taste control variables including a household status component (STAT), a measure of husband's education (INT11), and the use of creche facilities (CREC)

v^{iii} control variables including respondent's age (AGEW, AGEWSQ), education (EDW) and marital status dummies: (MSD1 = married and MSD2 = common law status)

4.1 Fertility demand equation

The quantity of children demanded depends on the costs and benefits of children to parents, and the household's lifetime income stream. These aspects are discussed below.

In addition to social and psychological qualities, children provide economic benefits. The first being a productive resource to the household, where children are substitutes for women's time in subsistence and household work. Parents desire children as a labour source to release their mother's time for leisure or more productive employments. Child labour, measured by CLAB, is expected to have a positive relationship with numbers of children.

Secondly children are considered an investment option (Schultz, 1973). Parents will invest in more rather than fewer children in expectation of future economic stability. The variable, INVEST, measuring the extent of financial help from children, was expected to have a positive relationship with fertility.

Child costs enter the model in the form of lifetime expenses on children and in terms of time dedicated by parents into child bearing and rearing. Difficulties in measuring and discounting lifetime expenses persuaded neoclassical theorists (Becker, 1965; Willis, 1973; De Tray, 1973 and others) to use a proxy of expenditure, namely "quality" of children measured by the level of formal education acquired by the offspring. This measure is considered to be a substitute good for numbers of children and is interrelated with the other cost effect namely parents' opportunity cost of time. As parents' opportunity cost of time increases, they substitute quality for quantity of children as it is less time costly. Therefore when specifying the simultaneous model endogenous estimates for quality of children (EDCD) and price of women's time (PWT) must be included in the fertility demand function as a substitute good and cost respectively (negatively related) to numbers of children.

The cost effect is completed by introducing a variable representing woman's participation in the labour market. This variable, PART, was measured as a binary variable scoring one for participation and zero otherwise, which divided the sample into those who had a fairly high opportunity cost, their potential market wage exceeded the benefits derived from household production, drawing them into the market place. Non-participants however, had low potential market earnings, either from insufficient education or labour market experience; consequently their time was more productive in household or informal sector work. Although the variable PWT, accounts for earnings from the informal sector, PART distinguishes participants and non-participants on the basis of time for child rearing because informal sector work is usually more compatible with child rearing. Thus labour market participation is expected to exert a negative effect on fertility.

Economists have suggested a number of different effects of income on fertility. The neoclassical view is that husband's income is regarded as a pure income effect, being positively related to number of children; while wife's income reflects a substitution effect between having children and partaking in the market place. Thus total permanent family income (TOTY), may be negatively or positively related to fertility depending whether the substitution or income effect dominates.

The control variables, v^{i}, account for the supply aspect of children. Ages of parents allow comparison between families at similar stages of the life cycle. As women age (AGEW), numbers of children increase but at a decreasing rate. In regression analysis this should be captured by a negative AGEWSQ. Husband's age(AGEH) is a proxy for his desired family size and is therefore important. A positive relationship is anticipated.

4.2 Child quality demand equation

As mentioned, child quality is a substitute for numbers of children and must be endogenously determined within the model. The explanatory variables include substitutionary and complementary goods to quality, income and controls for the family's tastes for education. The quantity/quality trade off for children has been discussed, therefore complementarity and tastes will be considered below.

As suggested by the fertility demand equation both woman's work participation and high opportunity costs of time would induce her to replace numbers of children with better quality ones. Therefore a positive relationship is expected with both of these variables and child quality.

The demand for child education may be reduced if attending school causes a shortage of household labour. In this situation, the number of adult relatives in the household (REL) may act as a complement to quality by allowing children to attend school without sacrificing household activities or drawing mothers from more productive employments. Therefore REL and EDCD should be positively associated.

Control variables (v^{ii}) are necessary to account for various facets of parent's tastes for child quality. They include an estimate of standard of living of the family (STAT), their financial commitment to education for children measured by their use of creche facilities (CREC), and finally the father's formal education level (INT11) which reflects the family's desire for education.

The behaviourial models propose that within a society different status levels exist and that society determines the standard of living within a status group. As families move from low to high status groups their cost of living increases causing a shift to fewer children as more utility is gained by expenditures on children than on larger families. Within a status group however, it is hypothesised that as incomes rise, a normal income effect causes more children to be demanded (Ron, 1980). The variable STAT was used to control for the different status groups, suggesting that is would be positively related to EDCD.

Creche usage, especially in rural areas, was associated with good performance at school and was therefore considered as preprimary education rather than a substitute for mother's time. Whichever interpretation of CREC is accepted however, it should be positively related to quality.

Husband's education (INT11), a proxy for family's tastes for education, was an interaction term between his formal education (EDH) and the dummy representing married couples (MSD1). An increase in the probability of educating children is anticipated with higher levels of education.

4.3 Woman's labour market participation

Woman's labour market participation depends primarily on her age, education and marital status because these exogenous variables describe her eligibility for participation. As women age their participation should increase, reaching a peak, and then decrease (negative AGEWSQ) as women retire from the labour market. Higher education is expected to be positively related to participation as it increases opportunity costs of time. Both commonlaw and married status should be negatively related to participation as household demands increase. Given these however, participation will vary depending on total household income and family size. Participation is expected to be negatively related to total family income as the need for in-

come is reduced. Larger numbers of children should reduce the probability of labour market participation by women as household demands increase.

4.4 Opportunity cost of woman's time

Woman's price of time (PWT), like participation is derived from the full income constraint in the simultaneous model. It is anticipated that any increase in the household's stock of human capital will increase her price of time. Consequently both husband's and wife's education, and the latter's employment experience should increase her opportunity costs. Labour force participation which distinguishes formal from informal market work is also expected to positively influence opportunity costs. Children, being time intensive for mothers, should be negatively associated to woman's shadow price of time.

4.5 Permanent family income

A lifetime utility function is maximised, therefore it is important to measure income excluding transitory components which are irrelevant for making lifetime decisions (Ainsworth, 1989). The method chosen was to estimate permanent family income which adjusts for age and other socio-economic characteristics. Ages of parents (AGEH, AGEW), their education (EDW, INT11), marital status and number of children were included. A constraint of no intercept was imposed since if all the explanatory variables are zero so to will be family income by definition (Ron, 1980). Income should increase with ages of parents but at a decreasing rate as they retire. Husband's age is expected to be less important because his contribution to income was underestimated. Higher education should raise income but married or common law unions are expected to be negatively related to income. Increasing numbers of children should also be associated with a reduction in family income.

5. Estimation techniques

The model has simultaneous relationships, therefore estimation by ordinary least squares regression analysis (OLS) provides inconsistent and biased parameter estimates (Gujarati, 1982). Two-stage least squares (2SLS) regression analysis was used to estimate the simultaneous model because, although not efficient, estimators are consistent (Pindyck and Rubinfeld, 1981).

Dummy dependent variables are problematic in 2SLS estimation because when estimated in both stages by OLS, regression assumptions are violated. These violations include nonnormality of residuals, heteroscedasticity and the fact that predicted probabilities are not guaranteed to lie within the (0,1) range. Probit analysis is appropriate because the transformation of data using the standardised, cumulative normal distribution function corrects for these violations.

6. Results

Multicollinearity was encountered during 2SLS estimation causing insignificant t-values and incorrect and unstable signs. Therefore unstable variables were dropped and proxies were used where possible. Usually when forming 2SLS instruments, endogenous variables are regressed on all exogenous variables in the system (Gujarati, 1982). Kelejian and Oates (1981), however, suggest using an "adequate set" of predetermined variables to form instruments; as long as it includes exogenous variables from the structural equation. Using this technique in estimation helped reduce multicollinearity, as did computation of the endogenous, dichotomous variables by probit analysis. The final equations are reported in Table 1. Results support the neoclassical approach. Table 1 shows that parents consider the economic costs and benefits of children when deciding on the number and quality of children to bear.

Equation 1 reports the demand function for quantity of children. The adjusted coefficient of variation ($\bar{R}^2$) is 69% with all t-values except INVEST and EDCD, being significant to at least the 5% level. All variables, however, have the expected signs and were included for theoretical reasons. The improvement in $\bar{R}^2$ over other studies, (Mincer's and Willis' $\bar{R}^2$ range from 35% to 47%), is due to the fact that data were stratified by occupation thereby allowing maximum variation in women's education and opportunity costs.

The most significant variable was the estimate of child labour (CLAB) which was positively related to fertility. Cost precluded collection of an accurate measure of child labour data, which meant that an average measure of time children spent in specific activities had to suffice. These chores included cooking, cleaning, fetching water and firewood, helping in the fields, tending the animals and shopping errands; but collection of water and firewood made up a major portion of the work effort. Therefore provision of water and electricity facilities would help reduce family size.

The other measure of child benefits INVEST, which is a proxy for future economic benefits, is less important. This proxy is an interaction variable between the ratio of earnings from children to total family earnings (CFAM) and women's age (AGEW). As such its significance may be reduced because of the effects of multicollinearity. Nevertheless it shows that as women age they tend to rely more on the support of their children. Improved knowledge on and accessability to pension and social security investment schemes may reduce their dependability on children.

Husband's age (AGEH) controls for household's tastes for children and as expected, is positively related to numbers of children. Woman's age variables have the expected theoretical signs, both being significant at the 1% level. The positive sign shows that older women have greater parities (number of children already born); but there is a peak in the life cycle which is captured by the negative AGEWSQ term.

Price of woman's time (PWTI) is negatively related to quantity of children and significant at the 5% level. As expected increasing opportunity costs of time for women cause a substitution away from numbers of children because child rearing is time intensive. Labour market participation (PARTI) is also significantly, negatively related to fertility because it competes with child rearing. The negative coefficient for EDCDI proves that as opportunity costs rise, numbers of children are replaced with better quality children. It is this trade off that suggests a policy for reducing long term fertility. Increasing opportunity costs by improving education and employment opportunities will cause quantity of children to be replaced by quality as woman's time becomes more costly.

Equation 2, the demand function for child quality was estimated by probit analysis. The mean deviance (residual deviance/residual degrees of freedom) of 1,1 shows the function is a good fit. In probit analysis t-values are an asymptotic measure so significance is difficult to assess; their magnitudes however, are informative. Household social status, STAT, is an important explanatory variable. As families move to higher social brackets through increased income, fewer, higher quality children are desired proving that the income elasticity with respect to quality is greater than that with respect to quantity of children. The negative coefficient for NOCI confirms this substitution. Woman's opportunity cost of time PWTI, and her labour market participation PARTI,are also positively associated with quality. These relationships confirm that high opportunity costs are associated with higher quality children. The number of adult relatives in the household (REL) is a complement to quality. Presence of adult relatives reduces the dependence on child labour allowing children to attend school without forfeiting household labour supply.

Table 1. Results of the Simultaneous Model

NOC = - 2,6322 + 9,35x10^{-4} CLAB - 0,8234 PWTI - 0,9724 EDCDI - 1,6554 PARTI + 0,0146 INVEST +
(-1,79) (5,39) (-2,03) (-1,02) (-1,91) (0,811)
0,3369 AGEH + 0,3013 AGEW - 3,34x10^{-3} AGEWSQ
(3,32) (3,06) (-2,58)
R^2 = 69,3% F-value = 36,6** df = 127

EDCD = - 1,5339 - 0,0373 NOCI + 0,5962 PWTI + 1,7184 PARTI + 0,1067 REL + 0,2575 STAT +
(-2,06) (-0,43) (0,92) (1,70) (1,15) (2,41)
0,8227 CREC + 0,0499 INT11
(1,77) (1,20)
Residual Deviance = 130,8 Residual df = 119

PART = - 5,6847 - 0,3066 NOCI + 0,3733 AGEW - 0,0043 AGEWSQ + 0,0725 EDW - 1,0369 MDS1
(-3,52) (-2,08) (3,77) (-3,63) (1,99) (-3,27)
- 0,3066 MSD2
(-2,65)
Residual Deviance = 190,7 Residual df = 145

PWT = - 0,1582 - 0,0202 NOCI + 0,2725 PARTI + 0,0330 EDW + 0,0667 EMPW + 0,0115 INT11
(-1,34) (-1,13) (1,51) (3,62) (12,61) (2,06)
R^2 = 77,4% F-value = 87,3** df = 127

TOTY = - 28,9260 AGEH + 240,5431 AGEW - 2331,8211 MSD1 + 246,2271 INT11 + 154,5924 EDW
(-0,70) (4,68) (-1,76) (1,83) (1,63)
+ 386,722 EMPW - 1867,3852 NOCI
(4,69) (-3,34)
R^2 = 69,9% F-value = 43,0** df = 127

a. NOCI, EDCDI, PARTI, PWTI are instrumental variables.
b. t-values are in parenthesis
c. ** $p < 0.01$

Husband's education, a proxy for tastes for education, is positively related to quality. Multicollinearity necessitated its use in place of woman's education as the latter was very highly correlated with PWTI, PARTI and STAT.

Finally the use of creche facilities (CREC) has a positive association with quality. Like REL, creche reduces demand for household labour, in particular mother's time. Creche is also viewed as a good preparation for school and therefore may be regarded as a proxy for the household's tastes for child education.

The third equation representing mother's labour market participation was again estimated by probit analysis. A mean deviance of 1,3 shows a good fit and all t-values are greater than one. Woman's participation increased with age, reached a peak and then decreased. Higher education was associated with a greater probability of market participation, and more children with reduced participation as household demands increased. Married women and those in common law unions also have increased household commitments and are thus negatively related to participation.

The opportunity cost of time equation reports that any increase in the household's stock of human capital is associated with an increase in woman's opportunity cost. The positive coefficients for parents' education (EDWand INT11) and woman's work experience confirms this. Work experience is measured by the respondent's market participation and years of experience in her current job (EMPW); the latter is the most important. More offspring reduce opportunity costs because time taken to bear and rear children competes directly with time spent in the market place.

Multicollinearity precluded the use of permanent family income in the simultaneous model. Equation 5 is reported for completeness. Variables have expected theoretical signs, parents' education, woman's work experience and age are all positively related to income. Husband's age, marriage and number of children are negatively associated to income. The goodness of fit statistics report that it is a fair estimate of permanent family income.

7. Discussion and conclusions

Results support the underlying assumptions of the Chicago School. The simultaneous model indicates that mothers are responding to economic and social constraints by adjusting fertility to opportunity cost and social benefits (of children). By manipulating these constraints policy makers can provide incentives to parents to reduce their desired family size, thus facilitating population growth rate declines.

One strategy would be to provide the services which parents gain from their children. The model showed that child labour was the most important determinant of fertility demand. Provision of water and electricity, especially to rural people, would dramatically reduce demand for child labour and at the same time improve living standards. Better access to and information on pension and social security investments may reduce the investment benefits of children, and parents dependability on them.

In extended households adults' and child's time are substitutes in production. Reducing the supply of child labour by introducing legislation on and providing for compulsory schooling would cause a shift to child labour substitutes including mother's and other adult family members' time. This shift increases the time costs of the affected family members. The effect of raising opportunity costs of time for mothers is an important strategy open to policy makers. The model shows that there are a number of ways in which it can be achieved. The first, as suggested, is through compulsory schooling for children. Another approach may be to improve both the quantity and quality of education. Equations 3 and 4 report that education affects both measures of time costs; directly increasing the variables PART and PWT, which induce the substitu-

tion between quantity and quality of children. The fertility equation reports significant effects for both variables which shows that opportunity costs affect women who have high potential market earnings and those who have a low shadow price of time, and are not yet formally employed. Improving education will therefore cause women in all economic strata to substitute child quality for numbers of children as their opportunity costs rise. This change in tastes as opportunity costs rise can be facilitated by training women to develop marketable skills for employment in expanding trades and professions. Equation 4 shows that woman's current labour market experience is an important factor increasing opportunity costs; consequently provision of employment for those entering the labour market is critical for fertility reduction.

Therefore the policy options are clear. Increases in both quantity and quality of education is a prerequisite for reducing family size desires and population growth rates. The strategy should be combined with investments in job creation, provision of services, improved pension schemes and investment options.

Note

1. Financial assistance from the Human Sciences Research Council is gratefully acknowledged.

References

AINSWORTH, M. (1989). Socioeconomic determinants of fertility in Côte d'Ivoire. Washington, The World Bank.

BECKER, GS. (1960). An economic analysis of fertility. In Universities - national bureau of economic research(Eds). Demographic and Economic Change in Developed Countries. Princeton, Princeton University Press:209-231.

BECKER, GS. (1965). A theory of the allocation of time. The Economic Journal, Vol 75:493-517.

CADWELL, J. (1976). Fertility and the household economy in Nigeria. Journal of Comparative Family Studies,Vol 7, No 2:193-253.

DEVELOPMENT BANK OF SOUTHERN AFRICA, (1987). Statistical abstracts on Self-governing territories in South Africa. Sandton, Development Bank of Southern Africa.

DE GRAAF, J. (1987). The current state of urbanisation in the South African homelands: rethinking the concepts and predicting the future. Development Southern Africa, Vol 4, No 1:79-92.

DE TRAY, DN. (1973). Child quality and the demand for children. Journal of Political Economy, Vol 81, No 1 supplement:S70 - S95.

GUJARATI, D. (1982). Basic econometrics. London, McGraw-Hill.

KELEJIAN, HH. and OATES, WE. (1981). Introduction to econometrics. Principles and applications. New York, Harper and Row.

MINCER, J. 1963 Market prices, opportunity costs, and income effects. In Christ, C (Ed). Measurement in economics: studies in mathematical economics in memory of Yehuda Grunfeld. Stanford, Stanford University Press:67-82.

PINDYCK, RS and RUBINFELD, DL. (1981). Econometric models and economic forecasts. New York, McGraw-Hill.

RON, Z. (1980). Agricultural variation and household behaviour: a microeconomic analysis of human fertility among Thai rice farm families. Unpublished Ph.D. Thesis, The Pennsylvania State University.

SCHULTZ, TW. (1973). The value of children: an economic perspective. Journal of Political Economy, Vol 81, No 1 supplement:S2-S13.

SCHULTZ, TW. (1974). Fertility and economic values. In Schultz, TW (Ed). Economics of the family. Marriage, children and human capital. Chicago, The University of Chicago Press:3-22.

SCHULTZ, TW. (1981). Investing in people: the economics of population quality. Berkeley, University of California Press.

WILLIS, RJ. (1973). A new approach to the economic theory of fertility behaviour. Journal of Political Economy, Vol 81, No 1 supplement:S14-S64.

THE WORLD BANK, (1984). World development report 1984. New York, Oxford University Press.