

DEMAND FOR CHILDREN

A MICRO ECONOMIC ANALYSIS OF HOUSEHOLD FERTILITY BEHAVIOUR

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Demand for Children: A Micro-economic Analysis of
Household Fertility Behaviour

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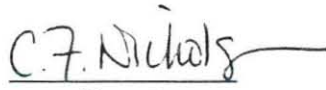


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ABSTRACT

A micro economic approach is employed in order to investigate the behaviour of households regarding demand for children. Two hypotheses, namely supply constrained and quality-quantity trade off, are tested. For the same purpose data from eight rural areas is used. The data was collected by the department of Economics of AAU with institutional support of the Institute of Development Research, in collaboration with the Centre for the Study of African Economies, University of Oxford. The results show that demand for children in rural areas of Ethiopia is supply rationed. Unlike markets for other commodities, consumers are not homogeneous regarding the supply. This is because children can not be bought and sold readily, so that every consumer (household demanding children) has to consume what it can produce. Thus, while some are supply constrained others may not. The implication of such finding is discussed, and possible trade off between child quality and quantity is also checked. If there is any observed trade off it operates through child labour: positively affecting quantity and negatively related with quality.



CHAPTER ONE

1.1 Background

According to the 1984 census (CSA 1984), the population of Ethiopia was 42 Million with a growth rate of 2.9 percent per annum (which gives a population estimate of around 53 Million in 1995). Such a growth rate would lead to double the population within 24 years, ranking Ethiopia among the fastest growing population in Africa (Hailemariam, 1990). Apart from its rate of growth, the age structure is changing: more and more are falling in the younger age groups (Hailemariam, 1990), which increases the dependency ratio.

As far as rural Ethiopia is concerned, almost half (49.2%) of the population is below the age of 15 out of which 53.3 percent are economically active (CSA 1992). This is in the face of the prevailing under/unemployment in the rural areas. This could be supported by the fact that there are some kind of activities (especially domestic chores and other productive ones) which are reserved for children. This, and the evidence that the greater participation of children than the aged (50 years and above), indicates that children are a source of current income, in addition to other source of satisfaction and possibly old age security¹.

¹ The old age security motive of demand for children is ambiguous. It is hypothesized (and evidenced in some areas) that it is the manipulative behavior of parents that matters than the mere possession of children (see Hoddinot 1992). However, having children could be a necessary condition.

The other interesting feature of the pattern of economic activity of children in Ethiopia is that as their level of education increases, the participation rate declines so that demand for children falls. This sheds some light on the possibility of quality-quantity trade off in demand for children in Ethiopia. However, this trade off operates through child labour than direct cost of child quality.

Usually surveys attempting to find the motive behind large families fail to achieve their intended goal (Resenzwieg 1993, Asfaw 1995). This is because people try to justify what they already have (i.e. post factum reasoning). This is further strengthened by the general notion that sexual intercourse in Ethiopia is the accessible source of entertainment (with rare any other alternatives) (Woldemariam 1972), so that people may not have the intention to produce children while they were doing the same.

In light of this, survey responses on the motive of having children will not reflect reality. Rather an in depth investigation of the determinants of demand for children is required to understand households' behaviour in this regard.

It is hypothesized that population growth is not exogenous to economic growth. Furthermore as families adjust to the changing economic condition, which could be the result of population growth, the effect of population growth is more obscure (Birdsall 1988). To identify this relation, a time series data could be more appropriate (Becker and Barro 1988), which could be hardly available and for which a cross sectional data is a poor substitute.

Neoclassical growth models, both one sector (Solow 1956) and two sectors (Lewis 1954), treated population growth as exogenous, having a negative impact on growth.

In the Solow model, the more rapid the increase in labour supply compared with capital formation, the lower the level of per capita consumption. With constant return to scale and constant rate of saving, a faster growth rate of the labour force decreases the capital-labour ratio and the productivity of labour. Hence rapid population growth is harmful even in the absence of diminishing returns (which was Malthus' argument). In steady state growth, where both population growth and saving rate are constant, the steady-state level of consumption is higher the lower the constant rate of population growth.

In Lewis' model surplus labour in the agricultural sector is absorbed into the manufacturing only if savings and thus capital accumulation grow faster than population. Alternatively this happens, if technological change in the 'dynamic' manufacturing sector offsets the combined effect of diminishing returns in agriculture and population growth.

However Coale and Hoover (1958) developed a model incorporating age structure and introducing a lag of 15 years for population growth to be equivalent to labour force growth. According to this model higher fertility reduces per capita income, as far as it increases the number of dependants, thereby reducing saving. This is because there is a lag of 15 years for increased fertility to induce a labour force growth thereby total income.



But The models discussed above, are criticized for their assumptions about substitution between labour and capital and the relation between saving and children, which are too strong:

i) limited substitutability between labour and capital, ii) negative impact of children (high dependency) on saving (i.e. children are considered as saving. They almost ignored child labour and the 'push' factor according to Cochrane; 1990). And iii) more importantly their treatment of fertility as exogenous.

Higher fertility discourages investment in both human and physical capital, because it increases the discount on per capita future consumption when intertemporal utility functions are considered (Becker 1992). Whereas increased stocks of capital reduces demand for children by raising the cost of time spent on child care (i.e. higher wage, since both higher human ,as well as, physical capital increases the opportunity cost of time, it induces substitution away from the time intensive child production and rearing) (Becker 1992).

As opposed to the above line of argument, others view population growth as a contributor for economic growth. This is because, they argue, large population brings economies of scale in consumption and production. Because of this it encourages technological innovation and by stimulating demand, it reduces the risk to investment (Birdsall 1988). These authors consider population growth (fertility) as endogenous, which is affected by economic growth and in turn affect the latter.

Others fall in between these two extremes as to the effect of high fertility on economic growth. According to them rapid growth in population is not a primary

impediment to economic growth, but interacts and exacerbates the effect of failings in economic policy. And the negative effects of population growth can be mitigated in the long run by family and social adjustments. This group also considers fertility and economic growth as having a two way interaction (Demeny 1986).

At the micro level (i.e. the household level) , the choice of fertility including children's education, consumption, and saving are simultaneous. And it is unlikely that these choices to depend on each other only but also on factors exogenous to the household. In poor countries where saving is too low, additional children may not change decision on saving but it may cause a decline in per capita consumption. More children may induce parents to work more and save more (in anticipation of the need of children) (Kelly 1980), which is a push factor according to Cochrane (1990).

However such line of argument sounds less realistic in countries such as Ethiopia, where most of the public services (including health and education) are provided free of charge or at a price which can not recover its cost. Moreover children are considered as saving for parents and even as a source of current income (Phananiramai 1979, Rosenzweig and Evenson 1977, Cochrane 1990, Asfaw 1995). In such cases, increase in fertility has a strong implication for public expenditure- imperfection of the market leading to exclusion of much of the cost of children from being an argument in the household decision on demand for children.

With the current pressure to make these public services at least to recover their cost, the burden of financing them will be on parents. The decision they make on the number of children they demand is most likely to be affected. Assuming the quality

quantity as a working hypothesis (see Becker 1973 1981, Willis 1973, Phananimamai 1979, Wolfe and Behrman 1986 and also chapter three of this paper), this will increase the number of children demanded. Even if the number of children they want to have is left unaffected, their capacity to finance the education and other investments on their children will be limited. Thereby decreasing the quality of the children, at least for those who are supply rationed (see Easterline and Crimmins 1985, Montgomery 1987 for supply constrained demand for children).

1.2 Rationale

Apart from the macro implications mentioned at the outset, high fertility has consequences at a household level (which is a micro foundation of the macro implications of population growth). Higher fertility will reduce the potential child quality measured either in terms of school participation or investment in child health. Moreover increased demand for children has a mixed effect on family labour supply. It increases the family labour supply due to direct participation of children in the labour force (Asfaw 1995). Furthermore, it increases labour supply by pushing other household members to supply more labour in order to increase the family income required to supplement increased household consumption due to additional members. On the other hand, since child production is a time consuming activity requiring much of mothers time, it will reduce female labour supply (Gurmu. 1994). Thus, the effect of increased fertility on household income is mixed and also depends on the age (and possibly sex) distribution of children (Cochrane 1990).

The consequence of increased number of children on saving is also mixed. Since children are supposed to support parents in old age, it decreases saving because they serve as a substitute of financial saving. Whereas in anticipating increased number of children and their needs, parents may save more- increased household savings (Cochrane 1990). Moreover the externalities involved (eg. tragedy of the commons, increased labour force etc.) (see Bereket 1995) also warrants a good deal of attention. The difference between private and social costs of children justifies the government intervention. Absence of property rights (eg. right to sell or transfer land) or existence of commonly owned properties may encourage households to have many children; and at the same time sharing the costs with others (in the form of creating scarcity of the commonly owned goods, more pressure on public expenditures so that reducing the amount of human capital available per worker.

In rural areas increase in demand for children (especially together with child labour) pushes down wages relative to rent. Thus, though the decision of each household in its perspective as a strategy for maximizing income sounds rational, it imposes costs on its peers. Such movements may help poverty to escalate so that households respond by demanding more children to argument the fall in income. This gives a self perpetuating capability for higher fertility and calls for external (to the household) intervention.

Therefore a micro economic analysis of determinants of fertility will undoubtedly provide a new insight to the economic explanation of fertility in rural Ethiopia - which is the aim of this paper.

1.3 Objective

The general objective of this thesis is to investigate the effect of micro-economic decisions on the demand for children, specifically to improve an understanding of the economic factors that underlie fertility behaviour at the household level.

1.4 Limitation and scope of the study

The models that are used in this paper assume the existence of a utility function representing the utility of a household with a single taste. By so doing, it assumes a unitary utility model (as opposed to collective) so that the problem of disagreement (or bargaining) within the household is assumed away. However, the relative bargaining position (power) of husband and wife could be more important in decision involving demand for children.

Owing to non-existence of time series data at household level, this paper considers static models as opposed to dynamic ones. This limits the scope of the paper in explaining motivation behind the micro-level decisions of timing and the marginal decisions (decision about to add the next child or not) involved in the demand for children.

1.5 Hypothesis

In the literature of demand for children, there are two prominent approaches: i) the household demand and ii) supply constrained approaches. The former focuses on

quality-quantity trade off where both are arguments in the parental utility function, and are substitutes. While the latter emphasises on biological factors and endogenous tastes.

This work is, therefore, an attempt to test these two hypotheses; namely the quality-quantity trade off and the supply constrained demand for children.

1.6 Organization of the paper

Objective and scope of the study together with the background and rationale are exposed in the first chapter. The second chapters deals with the review of the literature. The method employed and the results of the empirical estimation are included in chapter three and four respectively. The last chapter is about the conclusion and implications of the study.

CHAPTER TWO

REVIEW OF THE LITERATURE

Until the 60's economists tended to believe that fertility differentials are largely explained by non economic factors or the analysis of such differentials is outside the realm of economic theory (Willis 1973). This was partly due to i) the conflict of neo-Malthusian proposition (that the increase in income tend to stimulate fertility) with the fact that income growth has been accompanied by decline in fertility, ii) that family income and fertility are inversely related across households in cross sectional data of developed nations (Willis 1973) and, iii) partly it is attributed to the difficulty of incorporating fertility behaviour into traditional theory of consumer choice. However the extensions of economic theory to cope with human capital, allocation of time and non market household behaviour now make possible the analysis of fertility as well as others such as health, nutrition and schooling along with more conventional economic variables including income, saving and labour force behaviour within a unified choice-theoretic framework (see Becker 1965 1973 1981 1992, Willis 1973, Rosenzweig and Evenson 1977, Fleisher and Rhodes 1979, Wolfe and Behrman 1986).

There are different approaches in analyzing the demand for children in the context of value and cost of children. These can be grouped, according to Fawcett (1977), into four:

i) Socio-demographic approaches where emphasis is given to demographic transition resulting from long term social, cultural and economic changes which change the value and cost of children thereby the demand for children.

ii) *Social-cultural approach* emphasising the roles, values and opportunity structures as they affect the value and cost of children, especially to women. This distinguishes between familial and non-familial role within a society, through the cost and value of children, in determining the demand for children. It recognizes the opportunity to assume one or the other role as a key factor.

iii) *Social-Psychological approach*, focuses on individual needs that are satisfied by having children. It considers alternative ways of meeting those needs, and the interaction of social cultural, economic and emotional values and cost of children in determining demand for children.

iv) *Economic (Micro) approach* assumes that households try to maximize their utility given a number of goods, their prices, the household taste and income (though different types of household utility function can be assumed: unitary or collective) (see Pierre-Andre Cheappori *et al* 1993). Here children are assumed as one kind of good and fertility is a response of the household (consumers and suppliers) to the demand for children relative to other commodities.

Within the micro economic approach, there are different analytical frameworks for analyzing the demand for children (this is discussed in detail in the next chapter). Some argue that there is quantity-quality trade-off (Becker 1973 1981, Willis 1973, Phananimamai 1978, Fleisher and Rhodes 1979). While for others it is more of the question of supply and demand interaction exactly as it operates in other markets (Easterline and Crimmins 1985, Montgomery 1987).



Becker is among the first who tried to give an economic explanation to fertility. He argued that fertility can be analyzed within the economic framework and emphasized the connection between income and fertility. According to him, these two variables are positively related (the causation being from income to fertility) if knowledge about contraception is equalized across income class (Becker 1960). However latter efforts made to understand such relations overtime and cross sectionally depicted that the result is rather mixed: no consistent positive or negative effects of income on fertility and the magnitude of the effect also was not that large in some studies (Anker 1985, Okojie 1990, Farooq 1985, Ainsworth 1989, Guilkey and Cochrane 1993, Thomas and Maluccio 1994, Shapiro and Tombassu 1994).

Mincer's (Mincer 1963) work shifted the emphasis from income effects to the effects of variation in the cost of children by showing that the opportunity cost of wife's time as measured by the wife's wage rate was negatively related to fertility. A formal theory of time allocation between home and market and within home was provided by Becker (1965) which influenced the subsequent models of fertility, child quality and related aspects of household behaviour by Schultz (1967) and Sanderson and Willis (1971). Empirical findings of these studies are in line with Mincer's proposition that increase in cost of wife's time is inversely related to fertility. In Becker and also Willis framework, family is treated as a social institute which strives to maximize its utility in which the interdependent and overlapping life cycle behaviour of the family unit as a whole is determined by the interaction of the preference and capacity of its members with the social and economic environment they face currently and expect in the future.

Thus, the reviewed are economic works attempted to model fertility in household economic context. These are approaches that explain fertility outcomes as the result of economic decision making, as opposed to non economic approaches.

Willis (1973) and Phananimamai (1979), using a static unitary household utility model, investigated the fertility behaviour of American and Thai households respectively (for the mathematical treatment see Becker 1973). They found that there is a trade-off between child quality and quantity (number) that the family produces and consumes as well. According to them, the ultimate demand of the household is for child service, which is total child quality (a product of child quality and quantity), so that different mix of these two components yields a given level of child service. This will make quality and quantity substitutes as far as demand for children is concerned. Thus, for them demand for children (i.e. number of children) is dependant on parents demand (or desire) for child quality and vice versa. Therefore a rise in the price of quality (say school fee) has own price effect and also substitution effect (through that of quantity). It will increase quantity demanded due to induced reduction in its price (resulting from reduced demand for quality). There is also substitution of quantity for quality in the household demand. The basic implication of this altruistic model is that children are recipients and parents transfer resources to children. And since the resource endowment of parents is supposed to be much greater than that of each child and also than that of any pooled resources of children, so that the rotten-kid theorem will hold (see Pierre-Andre Cheappori *et al* 1993 for more on rotten kid theorem).

Authors, including Ben-Porath (1973) and Ainsworth *et al* (1995), gave much more emphasis to education of women as a determining factor in demand for children

either directly or indirectly through intermediaries. Both of these studies either assume a unitary household utility (Ben-Porath) or did not assume any kind of household utility (Ainsworth).

Ainsworth and colleagues (1995) argue that schooling of women lowers demand for children through various ways including: i) *wage effects*, by raising the opportunity cost of time spent at home (i.e. increasing the price of children) ii) and also by increasing the probability of participating in the labour force; iii) through changing the taste of parents in favour of child quality relative to quantity; iv) by lowering child mortality; and lastly v) through increase in the likelihood of effective use of contraception (Ainsworth *et al* 1995). They reported a negative impact of education on demand for children in fourteen Sub-Saharan countries, but different intensity for primary, secondary (and above) levels. Similarly, Fleisher and Rhodes (1979) estimated the demand for number of children together with child quality, women market wage and women labour supply decision. They found that all the later tend to decrease demand for children.

Using a non-linear specification for women's age and schooling, Anker's (1985) study revealed that mother education (considered as continuous) has a negative effect on the demand for children in Kenya. While husband education and land ownership have positive relation, but household income has a negative impact (Anker 1995). Similarly Farooq (1985) indicated that the relative level of education matters more than the absolute level. He found that only higher education has a significant negative coefficient (those below 12 years of schooling are not significant for the urban sample). But opposed to Anker (1985), Farooq (1985) and Ainsworth (1990) reported a positive

effect of household income. And these results are robust to choice of models: Tobit as well as OLS estimates gave similar results (Ainsworth 1990). According to Guilkey and Cochrane (1993) the only significant variables are schooling of women greater than 7 years (negative), husband education (negative), presence of commercial farm (negative). But once age is controlled and simultaneity for contraceptive use is allowed, schooling of women and also that of husbands will be significant only for young women (Thomas and Maluccio 1994). While ownership of assets has no effect, general economic index has a negative coefficient (Shapiro and Tambasha 1994).

Education of women has a consistently negative effect (considered either as a continuous or categorical variable), once age, ethnic origin, and region of residence are controlled (Ainsworth 1990 and 1995, Anker 1985, Farooq 1985, Okojie 1990, Guilkey and Cochrane 1993, Thomas and Maluccio 1994). Employment status has a negative impact showing that price of children is higher for those who are employed (Gurmu 1994). Education is supposed to capture this effect, but practically it may not, since there is no one to one correspondence between education and employment. However education does explain the difference in contraceptive use, taste for higher child quality and efficiency in child production.

Using demand equation derived from quantity-quality type household production function, Rosenzweig and Evenson (1977) estimated a simultaneous system of equations for number of children, child labour and child quality. The idea behind the inclusion of child labour equation is the economic contribution of children (apart from serving as a source of old age security and other satisfactions) which is an important motivation of demand for children, which in turn is affected by the number of children. Accordingly

they reported that land holdings, land productivity and child wage have a negative effect on child quality. While these variables have positive relation with demand for children and child labour force participation (Rosenzweig and Evenson 1977). This is because they are positively associated with the economic contribution of children thereby reducing the net cost of children.

Results for Colombia show that increase in subsidy for social services including health and education increase child quality, by lowering the shadow price of quality, so that the number of children demanded falls (Jee Peng Tan *et al* 1984)

However, Eva Mualer (1984) argued that this trade off is observed for developed countries only. But for developing countries the relation may only be weakly negative or none or even positive. She based her conclusion on the fact that the quality quantity model assumes a given preference for a family and also high income and price elasticities for quality than quantity, which is true when education assumes an important role in the household utility function. According to her, the latter is most unlikely in LDCs, where there is high child mortality and returns to education is low.

Chernichovsky (1981) reported a positive relation between number of children and quality (proxied by either school enrolment status or level of schooling of those enrolled). This could be due to the fact that older siblings help in the payment of direct school costs of children.

The relationship for Sierra Leone is as presumed by the model (Synder 1974). He reported a negative relation between number of children and average level of child

schooling. For Rosenzweig and Wolpin (1980), the result is not significantly different from zero, though negative. They used Indian twins in their study and age standardized schooling index as quality variable. Sahota and Sahota (1980) reported inconsistent result for India. Their result is sensitive to the variables used as a proxy for quality: i) positive relation with quality, when total school enrolment as a percentage of total population is used as a proxy, ii) but, negative relation when both ratio of pupils spending one year or less in a class to total pupils in the class and mean age of pupils in various classes is used as a proxy.

Montgomery (1987) reported that education of women has a consistent negative impact for all levels (when used categorically) and the same is true for husbands education (proxy for household income). These results are the same for both Sri Lanka and Colombia. However, Cochrane *et al* (1995) reported that, using a multinomial probit model and simultaneous equation system, the education of women has no effect on the demand for children (proxy by either number of living children so that 2SLS is used, or by fertility intention where multinomial probit is used) in Tunisia. According to her it is rather the schooling of the husband, which has significant negative effect. This indicates the relative role of wife and husband in the study area².

Available literature on Ethiopia show that the approaches used are non-economic or lack analytical framework which could enable them to explain the household fertility behaviour in a micro-economic context (Hailemariam 1990, CSA 1993, Gurmu 1994, Alemu 1995).

² In muslim communities as in Tunisia, household decisions are made by the male. Thus, unless a bargaining utility function is assumed, the effect of attributes of women (e.g. her wage, schooling etc) can not be picked. Since a unitary model assumes the presence of a single household taste represented by that of the economically strong (socially/culturally assigned) member of the household (see Andre Cheappori for more on the rotten kid theorem), usually husband in Muslim societies, the husbands' attribute is pronounced as in cochrane's study.

Hailemariam argues that in late 19th century demand for children, in Ethiopia, was supply constrained. This was attributed to early marriage and prevalence of venereal diseases. However the introduction of modern medicine has significantly relaxed the constraint (Hailemariam 1990).

Assuming a one way causation from employment to fertility, Gurmu (1994) reported a negative relation between number of children born and labour force participation. Though this result is in line with the theoretical hypothesis, it has a major methodological problem. There is no a priori ground to assume fertility as a dependant and labour force participation as an explanatory variable as given in Gurmu. It is possible that the number of surviving children, which is partly exogenous, to affect labour force participation. A system of equations which allow for this simultaneity would have explained much better.

CHAPTER THREE

METHODOLOGY AND DATA

3.1 MODELS

Within the micro economic approaches to demand for children, two broad analytical categories are considered in this paper: quality-quantity trade off (through prices and incomes- Chicago-Colombia model) and supply rationed demand, through endogenous tastes and biological supply factors (Pennsylvania model). Based on different assumptions, each of these approaches pose different hypotheses and policy implications. The two approaches that are the basis for the models used in this paper are presented before discussing the data and variables used in the next chapter.

3.1.1 Supply constrained demand

Theoretical framework

Easterline and Crimmins (1985) formally introduced a 'supply-demand' model into the literature of fertility determinant. Their basic model was an extension of the proximate determinants approach. The latter is essentially more of a biological theory that tries to explain fertility outcomes through mainly two structural relationships: first it was believed that there exists a direct causal relationship from a set of biological states (proximate determinants of fertility) of an individual to her lifetime fertility levels. These determinants include the characteristics of the individual that are relevant to her expected reproductive capacity. Secondly, this approach holds that socio-economic conditions and behaviour influence fertility through the proximate determinants of the individual.

What Easterline and Crimmins did was to emphasise the second point by including behavioural factors, derived from the economics tradition, into the framework. They identified three determinants of deliberate fertility control: supply of children (number of surviving children a couple would have in the absence of deliberate fertility control), demand for children (the number of surviving children parents would want if fertility regulation were costless) and the cost of regulating fertility.

Demand is treated differently from its usual definition. According to them demand for children is a consequence of household utility maximizing behaviour (where they maximize a household utility consisting lifetime consumption of goods, expected number of surviving children and contraceptive effort) under the hypothetical situation where monetary and non monetary costs of regulation are zero (Easterline and Crimmins, 1985). Thus their demand concept is not defined for regulation costs greater than zero, as a result of which the maximizing behaviour of individuals looks partial. This is one of the major drawbacks of this model. Even assuming a survey could evidence that life time family size preferences for children are independent of costs, this will not provide a strong ground for their argument. This is because demand functions take prices as one of their arguments, though direct utility does not take prices as such (see Gravel and Rees 1992 , Varian 1994 on direct and indirect utility).

Owing to its assumption of zero prices it is virtually impossible to test the elasticity of demand for children with respect to regulation costs. If one at all is to use this model, he/she has to either assume that individuals are non maximizers or demand for children is inelastic with respect to the cost of regulation.

This model defines supply of children in the same way as that of demand with regard to regulation costs. Since it is not observable, they use the proximate determinants approach to estimate supply as a linear function.

In addition, some authors, especially Schultz (1986), criticized this model on the basis of its estimation strategy. He argues that simple OLS on the supply equation give inconsistent estimates of the true coefficients. This is because the independent variable in that equation, especially the variable that proxies contraceptive use, will generally be correlated with the equation error term which includes unobserved variables on individual fecundity. Though they treated the correlation of contraceptive use with the error term, the possible correlation of other variables with the error term remains untreated.

The other possible area of mis-specification is the treatment of demand for children as exogenous. Since they measure the demand for children by asking survey respondents a direct question, it might be taken as exogenous. But, what if the observable data is the equilibrium outcome of supply and demand for children, in this case the equations have to be solved using 2SLS, not OLS. The possibility of such simultaneity is quite apparent if one considers an exogenous shock which brings about a greater benefit to labour participation of women, thereby negative shock to demand for children. At the same time such shock may bring about a change in contraceptive use in a way not explained by any of the included variables³.

³ Note also that survey response on demand for children has a defect in that people usually tend to justify what they already have (so that demand and supply interact), rather than revealing the 'true' demand which they would aspire at the start of their marriage.

Montgomery's (1987) attempt can be viewed as a considerable revision of the Easterline and Crimmins' model. By avoiding the problem with Easterline and Crimmins' definition of demand, it allows the demand for children to depend on regulation cost in the conventional way that economic demand schedules are defined. However, this is at the cost of losing the former's advantage of one way causal relationship.

Here too the household is supposed to maximize a household utility of the form:

$$U(X,S,E) \dots\dots\dots[3.1]$$

subject to

$$X+pb\mu=\Omega\dots\dots \text{ budget constraint}$$

$$b\leq B\dots\dots \text{ inequality constraint}$$

where

X expected lifetime consumption

S expected number of surviving children (μb)

E expected contraceptive effort (B/b)

B maximum number of births a couple can expect

b the expected number of births

p indicator of resource parents must devote to a surviving child

μ survival probability

Ω life time wealth

While X and S have a positive contribution, E has a negative effect on the household utility.

If $b > B$ there will be supply rationing, so that demand is equal to the maximum number of births a couple can have; otherwise there will be no supply constraint.

The interesting feature of Montgomery's (1987) attempt is that it uses the concept of rationing (which is quite a possibility) in demand. Exogenous shock (like change in maximum number of expected births), for example, may affect both fertility levels and consumption. And this kind of 'spill-over' effect are considered in multi-market disequilibrium models where imposition of rationing in one market has an influence on quantity supplied or demanded in another market (Branson, 1989).

In empirical estimation, since the maximum number of births (i.e. B) (in order to compare this with the desired number of children thereby determining whether there is supply rationing or not) is not observable, Montgomery employed an identification criteria: If a household ever used a contraception, it is to be classified in regime where there is no supply ration; if not, it is a draw from regime where there is supply rationing. Because of truncation of the sample (not more than the maximum expected number of births) a Tobit procedure was employed.

Adopting a switching regression method in estimating the demand for children, Montgomery (1987), attempted to accommodate the possible presence of supply rationing. However, the variable he used as a switching criterion ("regime indicator"), namely whether contraceptive was ever used, is most inappropriate and misleading in the Ethiopia context; because the importance of the spread of knowledge about contraception was ignored and it is assumed to be the same across the board. And also

the existence of unmet need for contraception is ignored. However this is so important in Ethiopia to be overlooked (see Ayalew *et al* 1995).

The basic assumption of this approach is that for those who do not consciously limit their fertility, their effective demand is the supply. However this assumes away ignorance about contraception. Because of this, instead of looking at the households' action regarding limiting their fertility; and concluding that most LDCs are supply rationed as far as demand for children is concerned, based on households' practice of contraception (for such conclusion see Wolfe and Behrman, 1986), one has to design a way of checking the very existence of supply rationing. With the same theoretical framework, this paper is such an attempt in Ethiopia's context.

Specification of the model

Estimating the empirical models proxies are used to represent variables in the theoretical model. Accordingly expenditure on food together with child labour is used to proxy resources that parents devote to a surviving child, while land area and livestock are used to proxy wealth and current income which is also proxied by mothers schooling and the relative position of the household in the community.

The probit model

In order to capture those households who are supply constrained, a two stage probit estimation which adjusts for such selection (following Heckman 1979 and Greene 1990) is adopted. Accordingly stage one in the 'Heckit' estimation method is estimating the probit equation:

$$\Phi \left(-\frac{X\beta}{\sigma} \right) = \int_{-\infty}^{\frac{-X\beta}{\sigma}} \frac{1}{(2\pi)^{1/2}} e^{-\frac{t^2}{2}} dt \quad [3.2]$$

Where Φ is the cumulative distribution of the standard normal.

X vector of explanatory variables (affecting supply of children) defined in Exhibit A.

β vector of parameters to be estimated

Thus the likelihood (L) is

$$L = \prod [1 - \Phi \left(\frac{-X\beta}{\sigma} \right)]^{y_i} [\Phi \left(\frac{-X\beta}{\sigma} \right)]^{1-y_i} \quad [3.3]$$

Where y_i is dummy, 1 for prob ($y=1$) and 0 otherwise.

(see Maddala, 1983 for the detail on how to get the probabilities)

After estimating this stage two follows, the estimates of β are used to construct inverse Mills ratio (λ) for each observation

$$\frac{\psi(X\beta)}{\phi(X\beta)} \quad [3.4]$$

where Φ as defined in [3.3] and ψ is the density function of the standard normal.

Then the constructed ratio is used as a Right Hand Side (RHS) variable in estimating the demand equation so that the existence of rationing will be checked⁴. The statistical significance of the IMR indicates presence of selection bias. The important

⁴ See Heckman, 1979 and Greene, 1993 for Heckit estimation method. λ being a monotone decreasing function of the probability that an observation is selected into the sample. i.e.

$$\lim_{1 - \Phi \left(\frac{-X\beta}{\sigma} \right) \rightarrow 1} \lambda = 0$$

, if the coefficient of the Mills ratio is not significant it implies that it is impossible to substantiate the presence of supply rationing.

thing is what is causing the selection, in this case it is the supply. Hence the probit equation is estimated for the supply (adopted from Easterline and Crimmins 1985). The probit equation is constructed in such a way that the dependant variable is the current fecundity status (1 for currently fecund, 0 otherwise). Therefore selection here indicates the significance of those households who cannot produce even if they are willing to do so (i.e. they demand children). The advantage of taking the current fecundity status is that it captures both households who are constrained either from above (want children more than they can produce) or from below (do not have children but want to have).

The demand equation will be

$$NC = Z\alpha + \epsilon \quad [3.5]$$

variables as defined in Exhibit A.

Exhibit A. Variables included in the supply constrained model and their definitions

Variables	
<u>Dependant</u>	
Y -	dummy, 1 for fecund, 0 otherwise
NC -	number of surviving children
<u>Explanatory</u>	
variables included in the probit equation	
MDURA -	duration of marriage in years
WSTPRG -	proportion of pregnancy wastage
MORTAL-	proportion of child mortality
AGTMRG-	age at marriage
MOTHAGE	age of the mother
MOTHSCH	schooling of the mother
variables included in the demand equation	
CHILDLAB	child labour
MOTHSCH	schooling of the mother
LANDARE	land area
LANDSD-	area of land as a deviation from mean
NTWN-	number of livestock not owned but cared for
LIVSD-	value of livestock owned as a deviation from mean
FOOD -	household expenditure on food
IMR-	inverse mills ratio

* Though at a glance there seem to be a collinearity among these variables, there is no such problem. This is because it is the sum of MDURA, AGTMRG and the time elapsed between marriages and/or separations which give MOHAGE. Therefore, since the time between separations and/or marriages is not included in the regression there is no problem of collinearity.

3.1.2 Household demand model (Quality-Quantity trade off)

Conceptual framework

This is a framework where husband and wife of a given age and characteristics are considered, at the outset of marriage, to use a utility -maximizing life time plan for child bearing, for expenditure of time and money on children; and for other sources not related to children, of parental satisfaction (Becker 1973, Willis 1973, Phananiramai 1978, Fleisher and Rhodes 1979, Wolfe and Behrman 1986).

Each of these commodities are produced according to the household production function with inputs of a vector of market goods and services and vector of time inputs of the family members (especially that of wife). Those characteristics of children that provide satisfaction/ dissatisfaction to their parents are commodities produced with time and goods using the household production functions. These *utility- generating* characteristics of the child can be summed up into commodity Q which are called *quality* of the child and is produced according to the household production function of the form:

$$Q_i = f(t_i, x_i) \dots\dots\dots [3.6]$$

$$i= 1,2,\dots,N$$

Where

N - the maximum number of children that a couple choose to have.

Q quality of children

t_i time of the parents

x_i market purchased goods and services

and $MP_{t_i}, MP_{x_i} > 0$.

This production function implies that a given level of child quality Q is obtained with alternative combination of time and goods, the least cost combination being dependant on the relative price of time of the parents (t_i) and that of market purchased goods and services (x_i).

The quality function depicted in [3.6] is heterogeneous because parents may apply lessons learned from the previous child and there may be jointly productive inputs for the previous and new children. This heterogeneity has an implication to the marginal cost of increasing quality for child based on its birth order. The effect of changes in the price of time and market goods or in available resources of the family will have an effect in the input mix to produce a given quality, in the relative and absolute level of quality of each child and even in the number of children demanded.

Thus, the family utility function is written as:

$$U = u(N, Q, S) \dots \dots \dots [3.7]$$

Where

N and Q as defined in [3.6] and Q is defined, for empirical purpose, as produced in a linearly homogeneous production function

$$Q = f(t_c/N, x_c/N), \quad t_c, x_c \text{ are the total amount of time and goods devoted to all children during parents life time.}$$

S includes all sources of satisfaction, other than from children quality and quantity. It is produced in a linearly homogeneous household production function:

$S = g(t, x_s)$ subscripts indicating that the resource are devoted to the production of S .

And total amount of child quality (C) is child service, Where $C = NQ$.

The maximization of the household utility subject to full income constraint yields Q, N and S as a function of shadow prices, income and fixed prices.

As a result the utility of the household is a function of number and quality of children, which together give child service, and other sources of satisfaction. It is important to note that parents could increase the child service, thereby utility, through either child quality or number of children or both. Depending on their relative shadow prices, parents substitute between quality and quantity in their maximizing decisions regarding number of children, investment on children and other consumption of the household. This interaction of quality and quantity, in the face of full income constraint, means that the shadow price of quantity depends on quality and vice versa.

Ultimately, the demand for child service, in this model, is determined by the couples' initial endowments in terms of the husband's life time labour and non-labour income, the time available to the wife after marriage and her initial stock of human capital, which determine her wage rate that in turn is the terms of trade between market goods and wife's time (which can be used for producing child service directly).

The basic modification by Phananimai (1979), are meant to enable the model take into account the situation of developing countries, since it was developed to study the demand for children in developed countries. Accordingly the modifications are:

i) the motive of having children as a source of security to parents was accommodated, rather than considering children as a consumer good and overlooking their importance as an investment good in developing countries.

ii) unlike the parent model's presumption, employment of mothers may not conflict with care for children. This is because mother may be self-employed or unpaid family worker, so that they may take care of their children while working. This make the shadow price of children, that mothers face, lower.

iii) the assumption that parents base their decision of demand for child service on their own income and wealth could be relaxed to allow for the presence of extended family, where relatives live with a couple is a common practice. It is illogical to confine parents to the wealth and income belonging to the couples only. This is because there is a transfer of income among the members of the household including relatives and even the relatives devote some of their time in the production of home produced commodities. As a result this affect the value of wife's time and even the shadow price of home produced commodities.

The terms of trade between wife's time and market goods is determined by the price index of market goods and marginal productivity of her labour in family business or market wage which are determined by the household initial stock of capital and her initial human capital respectively. Whereas the terms of trade between children time and market goods are determined by price index of market goods and marginal productivity of child labour in the family business.

In this approach, the number of children demanded will increase the price of quality (i.e. for a given child quality the higher the number of children demanded, the higher the cost of increasing quality). Conversely the higher the parental expectation of child quality, the higher the price of adding an additional child if all children are treated alike (Fleisher and Rhodes, 1979, Wolfe and Behrman, 1986). This, together with the fact that parents demand child service (the product of quality and quantity) will indicate the substitutability of quality and quantity, with no assumption about the household production function (Becker, 1973)⁵.

Model specification

Based on the models assumption of simultaneity in demand for child quantity and quality, equations for both is included. Moreover, to take into account the prevalence of child labour especially in rural Ethiopia, (see Asfaw 1995), a third equation representing children contribution is included. Therefore the model consists three structural equations in a simultaneous system.

$$Y = \beta X + \gamma Z + \epsilon \quad [3.8]$$

Y- vector of dependant variables

X vector of endogenous variables

Z vector of exogenous variables

variables as defined in Exhibit B.

⁵ One can further argue that because quality and quantity of children strive for the same household's resources, increase in one will induce a decrease in the other so that a trade-off is expected. For formal treatment see appendix B.

Exhibit B. Variables included in the household demand model and their definition

Variables	
<u>Dependant</u>	
NC-	number of surviving children
MSCH-	mean schooling of children
CHILDLAB	mean no. of weeks per year that children involved in farm or/and other household activities including income generating ones
<u>Explanatory</u>	
PRODU-	productivity of land (dummy for <i>lem</i>)
INCOME-	household income (expenditure is used as a proxy)
FINC-	earning of adult female*
LANDSD	land area as a deviation from mean
LANDARE	land area
MOTHAGE	age of the mother
MOTHSCH	education of the mother
FATHAGE	age of the father
MAGE	mean age of children
MORTAL	proportion of child mortality
LIVLU	value of livestock owned
LIVNO	number of livestock owned
SPN@	shadow price of quantity
SPQ#	shadow price of quality

* This is estimated value.

@ This is the product of FINC and MSCH

This is the product of CHILDLAB and NC

3.2 DATA AND VARIABLE DEFINITION

The rural survey data collected during 1994 by the Department of Economics, in collaboration with the Centre for the Study of African Economies of University of Oxford (with institutional support of the Institute of Development Research of Addis Ababa University) is used for empirical analysis. The data set includes fertility measures and has extensive data on consumption, expenditure, saving, investment, background characteristics of the interviewed households, business ownership including its value etc.

3.2.1 Survey area and sampling

The survey sites were selected so that it incorporates different farming systems. Both drought prone and relatively richer areas were also represented (see Bereket and Shukri, 1995). Accordingly these include: a) cereal producing, b) commercialized and coffee producing, c) those using irrigation and modern inputs and rich in relative terms, d) enset producing, and e) areas where seasonal migration (and also permanent) is a main source of income (see summary table in Appendix A). Areas covered by IFPRI (International Food Policy Research Institute) were included in order to generate panel data.

The sample was set to be a total of 1500 households, half of which were those covered by IFPRI (however, only half of this was available for the study). The rest were distributed among the eight sites in proportion to their woreda population (Bereket and

Shukri, 1995). After the population is stratified based on male headed, female headed and landless, simple random sampling procedure was used to select households.

3.2.2 Variable definition

All variables in the specified model are included. However, those variables where ambiguity seems to occur, are described below. Others not mentioned here are taken at their face value.

Quantity

The family and fertility survey conducted by the C.S.A. revealed that using ideal number of children that a family want as a revealed demand for children has drawbacks (C.S.A. 1993). Among these, data quality is the major: i) more than three fifth of the respondents were unable to give specific number, ii) higher demand among those who are childless which result from self selection, iii) also the reported ideal number of children has the flavour of the result of interaction of demand and supply (rather than genuine demand alone). This is revealed, to some extent, by the fact that the number of wanted children decline as the number of living ones rises. Therefore using number of living children as a dependant variable is justified as far as the selectivity problem related to those who are supply constrained is accounted for.

Quality

The unit of analysis being the household, the data (which is at the individual level) necessitates the quality variable to be aggregated at the unit of analysis level. Due to this and also to account for incomplete schooling for younger children, the mean schooling level of children per household together with mean age of children in the household is used. It is obvious that there are other inputs to child quality including health, nutrition and genetic endowments. However studies (Wolfe and Behrman, 1986) show that the correlation between these inputs and child schooling is so high that child schooling can serve as a good proxy.

Income

Considering the fact that earning power (and actual earnings) of women versus other members of the household have different effect on demand for children, effort was made to separate women's income from other household income. Using the conventional earning function (see appendix A) for women, the predicted income was included as Right Hand Side (RHS) variable. This was meant to take advantage of representing life time full income than measure of current income. Furthermore, the opportunity cost of women's time is much more represented this way than by mere schooling alone.

CHAPTER FOUR

RESULTS

The expected signs of the variables in the selection model are: $LANDARE >_< 0$, since both income and substitution effects operate so that the exact sign cannot be determined a priori. $NTWN$ and $CHILDLAB > 0$ while $MOTHSCH$ and $FOOD < 0$.

As for the simultaneous equation system the expected signs are as presented in Table 1, below.

Table 1. Expected signs of the variables

Variable	Equations		
	Quality	Quantity	Child labour
NC	-		+
CHILDLAB	-	+	
MSCH		-	-
INCOME	NK	NK	NK
LANDARE	-	NK	
LANDSD	+	-	
LIVNO	-	NK	+
MAGE	+		+
MOTHSCH	+	-	-
SPN	+	-	-
SPQ	-	+	+
PROD	-		+
MORTAL		+	
MOTHAGE		-	
FATHAGE			+

NK= not known a priori

Table 2. Estimates of the probit model

Log likelihood	-240.03			
Restricted (slopes=0) Log L.....	-299.67			
Chi-square.....	119.27			
Significance	0.0000			
Count R ² =	0.8216			
variable	Coefficient	Standard error	t- ratio	Prob/t/≥x
MDURA	-0.3453E-02	0.1594E-02	-2.166	0.0331
AGTMRG	0.3368E-01	0.4584E-02	7.257	0.0000
WSTPRG	0.20613	0.1082	1.904	0.05685
MOTHAGE	0.7400E-02	0.1832E-02	4.038	0.0005
MORTAL	-0.53074E-01	0.8082E-01	-0.657	0.51137
MOTHSCH	0.7568E-03	0.3152E-01	0.024	0.98084
Constant	-1.4832	0.1233	-12.027	0.0000

Table 2 presents the result of the probit regression for the supply of children. This table basically is a by-product, yet deserves some explanation. Longer duration of marriage reduces likelihood of the women being physically capable of having children. Age at marriage has a positive impact on women physical capability. This is because early marriage (the mean is eight years) thereby pregnancy may lead to physical incapability of the mother. Also it operates through reducing mortality, Because early marriage is one of the causes of child/infant mortality in Ethiopia (The national report on population and development, 1994).

To the extent that age at marriage captures this effect, it has a positive contribution. A positive effect of wasted pregnancy reflect its discouraging impact on production of children. Thus, frequent wasted pregnancy may discourage parents and induce them to reduce production of children. The higher the mothers age the less likely that there will be supply shortage. Mothers schooling is considered as a proxy for contraceptive knowledge and use. Though it has the expected sign, its coefficient and that of mortality are not significantly different from zero. Household expenditure on food is taken as a proxy for nutritional status, but was not significant (not reported here).

Table 3. Estimates of the selection model

Adjusted R ² = 0.17				
Significance (F) = 0.02				
variable	Coefficient	Std.error	t-ratio	prob/t/≥x
LANDAREA	0.09318	0.04413	2.112	0.0347
LANDSD	0.1345	0.1974	0.681	0.49568
LIVSD	0.16418E-02	0.1865E-02	0.881	0.37859
NTWN	-0.41748	0.1992	2.095	0.03613
MOTHSCH	0.30409	0.1263	2.408	0.01605
CHILDLAB	0.43294	0.1798	2.407	0.01607
FOOD	-0.44131E-02	0.2142E-02	1.479	0.04421
IMR	3.0545	0.8273	3.692	0.00022
constant	2.2361	0.9883	2.2620	0.02367

The selection model estimate is reported in Table 3. All the variables in this equation have the expected sign, except that of schooling of mothers and *number of livestock not owned but cared for*. To the extent that both of these variables reflect the relative income of the household, the signs are justified on the basis of a positive income effect on the number of children demanded. Higher level of schooling reflect higher earning potential, so that more demand for children. And more livestock not owned but cared for indicates the relatively low level of income of the household, with insignificant substitution effect, so that demand less children. Price of children has a negative effect on demand, recognizing food expenditure as a proxy for price of children.

Thus, both the price and income effects indicate that in rural Ethiopia, with the presence of supply rationing, children are normal good, This is when simultaneity is not considered.

The other important feature of these households is the importance of child labour. It is so significant that even controlling for resources complementary to it (i.e. land area and number of livestock) it has a significant role in determining demand for children. Of course, access to complementary resources will augment its significance.

According to the method employed in this paper, the demand for children in rural Ethiopia is supply constrained (see Table 3 and footnote 4). And their demand is governed by the supply. This finding is consistent with other works (see Frank, 1983, Abate *et al* 1986) where the variation in fertility of Sub-Saharan Africa and rural Ethiopia is attributed to the supply difference. Even the current increase in fertility is attributed to a decline in childlessness (Hailemariam, 1994). This means demand for

children in rural Ethiopia is so high that it is the ability to produce them which limits it. Economic rationale for such high demand includes old age security, economic contribution of children and direct/indirect costs of children. Each of these is taken up latter in this chapter.

Though the presence of supply rationing is reported, still there are households whose demand is not constrained by the supply. This is because children cannot be readily bought and sold so that every household has to confine its consumption (i.e satisfy its demand for children) to own production.

To test the quantity-quality hypothesis a system of simultaneous equation consisting three equations, each for quantity, quality and child labour, is estimated. The result is reported in Table 4.

Table 4.1 Estimates of the Equation for child quality

variable	coefficient	std. error	t-ratio	prob/t/≥x
NC	0.412418	0.093455	4.413	0.0000
CHILDLAB	-0.009548	0.013035	-0.732	0.4655
INCOME	-0.000253	0.000448	-0.566	0.5728
LANDAREA	-0.003689	0.033282	-0.111	0.9119
LANDSD	0.321429	0.168636	1.906	0.0593
LIVNO	-0.007604	0.081611	-0.093	0.9259
MAGE	0.057187	0.021379	2.675	0.0086
MOTHSCH	0.254675	0.110879	2.297	0.0235
SPN	0.030539	0.004648	6.571	0.0000
SPQ	-0.012092	0.002198	-5.501	0.0000
PROD	-0.024530	0.276630	-0.089	0.9295
constant	-0.954518	1.106867	-0.862	0.3904
$\overline{R^2}=0.2496^*$				

* Of the reduced form

In the quality equation, the coefficient for quantity is positive and highly significant (Table 4.1). This is contrary to the hypothesized relation. The possible reasons behind this include: i) direct cost of education is almost zero (it is government

financed), ii) older children cofinance the meagre direct cost involved in educating younger ones, and iii) with limited household asset increase in number of children causes a decrease in productivity so that decreasing the opportunity cost of sending the children to school. When the number of children increases, role assignment within the household is observed (some children assigned to the role of attending school) so that the average level of schooling of such households will be higher than otherwise. Moreover, once the effect of child labour is controlled for, the opportunity cost of educating children will decline further. This is what is observed here. Child labour has a negative impact on quality. Its coefficient is not significant because its influence is reflected in shadow price for quality. When this multicollinearity is controlled (i.e. SPQ is excluded) the coefficient for child labour will become significant (not reported here).

The positive coefficient of schooling of mother reflects preference for quality and efficiency in producing child quality which needs much of mothers' time. And also mothers with higher level of schooling are more likely to be successful in helping their children to attain the same. Since land area is complementary to child labour and gives more opportunity for children to work in the field, return from child labour rises with increase in area of land. As a result it has a negative effect on child quality but positive on demand for children.

The shadow prices have the expected sign. SPQ has a negative while that of quantity has a positive. Increased land productivity increases the return from child labour so that has the same effect as that of land area.

Table 4.2 Estimates of the Equation for child quantity

variable	coefficient	std. error	t-ratio	prob/t \geq x
CHILDLAB	0.0549950	0.032898	1.670	0.0976
MORTAL	1.037684	3.038327	0.342	0.7334
SPQ	0.0259980	0.005417	4.800	0.0000
INCOME	-0.002469	0.001331	-1.854	0.0663
LANDAREA	0.145979	0.068276	2.138	0.0347
LANDSD	-1.112992	0.308387	-3.609	0.0005
LIVNO	-0.276247	0.157362	-1.755	0.0819
MOTHSCH	0.196787	0.220975	0.891	0.3751
MOTHAGE	-0.023088	0.018639	-1.239	0.2181
SPN	-0.000149	0.001324	-0.112	0.9107
MSCH	-2.119012	1.616773	-1.311	0.1927
constant	12.684906	3.199434	3.965	0.0001
$\overline{R^2}=0.2279^*$				

* Of the reduced form

Child quality has no significant effect on the number of children (Table 4.2).

This is attributed, among other things, to the fact that students are required to pay only



a nominal fee, if at all. This reduces direct cost of schooling to a greater extent that it is not felt by parents. This coupled with deliberate government policy to encourage enrolment, weakens the hypothesized trade off. As the level of schooling rises beyond primary level, the trade off may start to appear, due to increase in direct as well as opportunity costs. But for the rural areas where this study is confined, the level of schooling of children is well below primary level, so that no trade off is observed.

The observed pattern of weak (and even the unexpected) relation between quality and quantity reflects the characteristics of schooling at primary and secondary levels. In public schools, students pay a nominal fee, reflecting the government's deliberate policy of encouraging enrolment. This payment is much lower for primary schools. In addition the opportunity cost in terms of lost labour hours is also lower for primary level students. This is because the latter are younger and lack physical strength and spend few hours working therefore, requires relatively small sacrifice. This is consistent with what Mauler (1981) reported for Botswana.

One of the major determinants of demand for children in the study areas is child labour. This is shown by the positive coefficient of child labour. Increase in income reduces the demand for children. This is because the importance of child labour in determining demand for children falls to a greater extent with increased income; substitution away from consumption of child service to other commodities. And also as income increases the leverage of old age security motive will decline. Moreover, within an extended family framework, as household's income rises the latter's obligation (in terms of expenditure) to help other households within the same extended family and even their children rises. This induces parents to lower their own demand for children.

The negative sign could be attributed to the proxy used for income (expenditure which includes income from female activities). Since expenditure is used to proxy income rise in expenditure (here reflecting higher income) may generally mean increase in the price of children. Moreover, the negative effect of income is to a greater extent, attributed to female income, which makes up part of the household income. When shadow price of quantity is excluded and replaced by female income, the negative effect is solely due to the latter. Land areas as expressed in deviation from mean has the same effect.

Though child quality is responsive to own price, demand for number of children is not that much (also shown in Table 5). Schooling of the mother has no direct effect on the number of children demanded, once the value of her time is controlled for (although it could be a proxy for contraceptive knowledge and use). This could be due to the fact that there is supply rationing in demand for children so that supply management (through contraceptives) may not bring substantial change. Also this is because education affects the proximate determinants thereby supply of children significantly (Appleton, 1994). The other important point here is that quality has no, what so ever, effect on the number of children demanded.

Table 4.3. Estimates of the Equation for child labour

variable	coefficient	std. error	t-ratio	prob/t/≥x
NC	0.834984	0.502626	1.661	0.0990
MSCH	-0.003576	0.112549	-0.032	0.9747
MOTHSCH	-1.230663	0.640655	-1.920	0.0570
PROD	3.099918	1.697468	1.826	0.0701
FATHAGE	0.020271	0.020734	0.978	0.3300
INCOME	0.0005699	0.002421	2.354	0.0201
SPN	-0.001760	0.004302	-0.409	0.6831
SPQ	0.000467	0.011674	0.040	0.9682
MAGE	0.043015	0.134279	0.320	0.7492
LIVNO	-0.279365	0.384678	-0.726	0.4629
constant	-7.740992	4.164021	-1.859	0.0653
$\overline{R^2}=0.10^*$				

* Of the reduced form

The negative effect of schooling of mother in child labour equation is consistent with its sign in the quality equation (Table 4.3). Trade off is observed between quality and child labour (see the sign of the former in the equation for the latter and vice versa). Being the link between quality and quantity, child labour plays an important role in

determining both. If at all trade off is observed, between the former two, it is through child labour. When land productivity is controlled the coefficient for area of land turns out to be non-significant in determining child labour. Increase in father age has a significant impact in pushing children to the field. The coefficient for livestock indicate the negative impact of wealth. This is because livestock is the major form of capital and wealth in rural Ethiopia, even safer than land (FAO 1986). It is safer because the farmers has no right to sell their land and also there is a possibility of losing some of his land during redistribution.

Table 5. Price and Income Elasticities from Mean

Variables	Income	Shadow price of children	Shadow price of child quality
Number of children	-0.2514	-0.00205	0.4987
Child labour	0.0873	-0.0365	0.0135
Child quality	-0.0444	0.7256	-0.3998

The price and income elasticities of demand for children, their quality and child labour are presented in Table 5. The income elasticity for Number of children is more elastic than both quality and child labour. This could be due to the proxy used for income, since expenditure for quality is marginal (almost no direct cost of educating children). As a result quality may not respond to expenditure as much as the number of children. From the same result it is evident that there is no trade off between quality and number of children. However in terms of prices, quality and quantity look substitutes.

Contrary to the income effects, quality is more responsive to both own and cross prices than number of children.

The magnitude of all the elasticities is well below one (inelastic). This hints the importance of family structure in analyzing demand for children. Such effects could be captured if an intrahousehold bargaining model is used. Instead of looking at the household as a single unit having a single household utility (represented by that member contributing much to the household resource), a bargaining framework which allow for disagreement within the household may give a better picture (see Fapohunda *et al* 1988). Cognizant of the fact that the extended family structure weakens the leverage of price and income effects may help to articulate the observed inelastic figures.

Nested equation results also confirm the above observations that rural households in Ethiopia are supply constrained regarding their demand for children. And also there is no trade off between quality and quantity in the household demand for children. Therefore based on either separate equation and/or nested equations results, the conclusions drawn are valid.

The economic rationale for such high demand (as observed by supply shortage) in rural Ethiopia is explained by anticipated and actual benefits and cost of children. These include, old age security, contribution of children to current household income and costs of children. Except the old age security motive the others are addressed in the previous paragraphs, thus only the former is discussed below.

There are contrasting evidences as to the importance of old age security motive (see Liebenstein 1975, Lindert 1980, 1983). For rural Ethiopia it is observed that 74 per cent of the households need large families in anticipation of current as well as future income transfer from children. Although, due to data limitation, it is not possible to do an in depth analysis here, one can use characteristics of the rural household economy to substantiate the observed role of the old age security motive. The following is an attempt to do so:

Reliance on children: In Ethiopia, especially in rural areas, children are supposed to support their parents when they get old. 84.7 percent of the surveyed households have such expectation. There is a cultural norm which implicitly (some times explicitly) compel children to adhere to this expectation. Even if actual transfer of resource is low, as far as the expectation is there, there is a good reason to consider the old age security motive. However this expectation falls as parental discretion over inheritance increases (see also Hoddinot 1992). This partly explains the negative impact of income on demand for children (see Table 4).

Thus what is observed is the outcome of the interaction of the impact of education of children⁶ and that of resources in the hands of parents that children could inherit. Moreover the economic importance of children to the father and mother could be analyzed satisfactorily way if a game theoretic approach was used. Such direction is recommended for further research in the area.

⁶ The intensity of breaking the cultural norm increases with increased formal education. Thus, to secure a given level of resource transfer from children to parents, increase in education of children goes together with increased demand for children. This is in contrast to the quality-quantity trade off hypothesis. Such results are reported in other studies also (see Mauler, 1972).

Capacity to accumulate for old age: Having a very low income, it is extremely difficult for Ethiopian rural households to accumulate for old age. Even maintaining their consumption throughout the year consistently is difficult (Ayalew, 1995). This is observed, especially in times of drought. It should also be noted that accumulation serve only as a poor substitute for insurance that parents anticipate to get (79.7 per cent of the households have such motive)

Insurance: Insurance in the form of social security is available only for urban residents and especially for government and some other formal sector employees. It is virtually non-existent in rural areas. Its absence is attributed to several factors ranging from the underdevelopment of insurance market to the low level of per capita income of the rural households and high risk and transaction costs involved in exchanging from kind (livestock, grain, etc) to money (in order to buy insurance) and from money (after getting the annuity) back to kind. Absence of information on the part of the rural and all other sorts of insurance problem (see Varian, 1990) are also contributing factors. In an effort to mitigate such gap, if compulsory participation is to be attempted, it is likely to fail in the face of the rural peoples scepticism regarding government actions. This is due to a long history of broken promises on the part of the government, (for example in one of the study sites they were promised to get more land if they register what they had in their respective peasant associations. But what they got in response to their compliance was a new tax burden). Resorting to another alternative, namely demanding more children will fill the gap of absence of insurance on the side of the parents.

Capital market: If there is a profitable (or at least which keep the value in real terms constant) and reliable capital market in rural areas, where people can save/invest their

assets, then the old age security motive would be negligible. These kind of markets are non-existent (see Ayalew, 1995) in rural Ethiopia (Except *Ekub*, *Idir*, *mahiber* etc from which short term credit could be obtained). The common kinds of saving accessible to rural areas are livestock, land (to some extent), grains and currency, if possible (see Ayalew, 1995). All these assets are less likely to be retained till old age. This is due to their nature and most importantly they require (except currency) labour. Thus even if these assets are accessible and are assumed to stay (which is less likely) to old age, they need children as a complementary input.

CHAPTER FIVE

CONCLUSION AND IMPLICATIONS

As mentioned in the previous chapters, generally demand for children in rural Ethiopia is supply rationed. Policies aimed only at reducing supply of children (i.e. disseminating methods of fertility control and even making these methods accessible) is likely to be of little use. However, the importance of such interventions cannot be overlooked as far as there are households that are not supply constrained. Unlike markets for other commodities, consumers are not homogeneous regarding supply. This is because children can not be bought and sold readily, so that every consumer (household demanding children) has to consume what it can produce. Thus while some are supply constrained, others may not be. Recognizing this fact has a paramount importance for policy making. Addressing households whose demand is supply constrained, needs a demand side management. If fertility is to be reduced, as implied in the Policy Framework Paper (PFP) (see PFP 1993/94-1995/96), the focus has to be in reducing the demand for children. Insisting to promote the 'famous' fertility control measures only, in such areas, may not bring a significant change. Even attempts to increase child enrolment may further increase the demand for children. In order to send some of the children to school, parents need some others who can replace them, they demand for more children (reduce the opportunity cost). This is observed in the relation between quality and number of children. However compulsory schooling, which weakens their labour involvement, may reduce demand for children. This is through child labour reduction effect than quality-quantity trade off.

In the surveyed area, the residents view the government as the major provider of education and health. This can help the effort to implement compulsory education, by giving the government the upper hand in the bargain.

In this study, one of the major determinants of demand for children is child labour (also observed in other studies, see Aredo, 1989). Since it is shown that schooling of mother is negatively related to child labour, increase in the schooling of mother will reduce demand for child labour thereby demand for children. This operates through changing preference of the parents in favour of quality. Therefore even without creating any employment opportunity, the mere provision of schooling to mothers has a significant input in reducing demand for children, as far as this is what is intended (see PFP 1993/94-1995/96). Such intervention further operates through giving the women a better bargaining position in the household decision about child production.

The other area of intervention is directly weakening the importance of child labour in rural areas. This could be done, for instance, through increasing access to safe water supply and energy sources. Such intervention has a multifold effect: i) by reducing mortality it directly push down the demand for children (see Table 4.2) ii) it reduces the time required to fetch water and fuel wood (In the survey areas, on average it takes about an hour and half to get to fuel source and more than three quarter of an hour to get to water sources. And these activities are mainly task of children). This diminishes the importance of child labour for such activities. Introducing new technologies in the peasant agricultural sector will decrease the demand for children. This operates either by curtailing the demand for child labour directly. If not, it entails increase in child quality in terms of higher level of schooling thereby a fall in demand for child labour.

It is the poverty of the family which makes child labour so important. Obviously poverty has to be the direct target. But apart from this there is still a room for reducing the prevalence (and even the importance) of child labour through appropriate schooling. The existing system failed to equip school drop outs and graduates with the necessary tool to earn their living. Both parents and children see the experience of others in this regard and think that going to school is a waste of time. The solution at the household level is sending children to work so that they can face the reality earlier and also get the experience for their future life. Therefore even without directly addressing poverty, redesigning the schooling system to produce marketable output, at least above some level of schooling, will contribute a lot.

Policies aimed at augmenting income of the rural household, especially through female income generating activities, may reduce the demand for children. Since the observed negative effect of income on demand for children is attributed, to a greater extent, to that part of household income coming from female activities.

In redistributing land one of the criteria determining the amount to be given for a particular household is the number of children in that household (personal communication with interviewers). This is incompatible with the effort being made to lower fertility in the rural areas (either through the supply or demand side). Thus such policy inconsistency have to be sorted out starting from the grassroots level.

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APPENDIX A

Female earning function

$$\ln w = \alpha_0 + \alpha_1 \text{age} + \alpha_2 \text{sch} + \alpha_3 \text{age}^2 + \alpha_4 \text{HHI} + \alpha_5 \text{HUSage}$$

where

Age & age² - age of wife and its square

HHI - household income

SCH - schooling of wife

HUSage - age of husband

lnw - log of earning

Note that adjustment was made for the selection.

Summary table describing the Study areas

socio econ/site	Adado, Bule	Adele Keke, Kersa	Aze Deboa, Kedida Gamela	Domaa, Daramalo
Total no. of households	365	1300	643	---
Female-headed households	20	---	60	---
Dominant ethnic group	Gedeo	Oromo	Kembata	Gamo/Wolaita
Dominant religion	Protestantism	Islam	Protestantism	---
Estimate of landless households	100	---	300	---
More important crops	coffee and <i>enset</i>	<i>chat</i> , maize, sorghum	<i>enset</i> , <i>teff</i> , wheat	---
Climate	<i>woyena dega</i>	<i>woyena dega</i>	<i>woyena dega</i>	<i>kola</i>
Use of fertilizer	none	yes	yes	---
Affected directly by war	no	yes	no	no
School	primary	1-4	1-6	---
Health service	clinic	hospital, Alemaya	health facilities in Durame	---
Marriage	some polygamy	polygamy practised	some polygamy	---

continued

socio econ/site	Imdibir, Cheha	Sirbana Godeti, Aadaa	Turufe Kechema, Shashemene
Total no. of households	542	174	449
Female-headed households	30	35	39
Near-by towns	Imdibir	Debre Zeit, Mojo	Shashemene
Dominant ethnic group	Gurage	Oromo	Oromo
Dominant religion	Orthodox Christians/Catholics	Orthodox Christian	Islam
Villagisation or resettlement	no	yes	yes
Estimate of landless households	no	11	---
More important crops	<i>enset, chat</i> , coffee	<i>teff</i> , wheat, barley	wheat, barley, maize, potatoes
Climate	<i>woyena dega</i>	<i>woyena dega</i>	<i>woyena dega</i>
Use of fertilizer	no	yes	yes
Affected directly by war	no	no	no
Main source of water	river	solar and hand pumps	river and stream
Main source for lighting	<i>kuraz</i>	kerosine	<i>kuraz</i>
Main source of fuel for cooking	wood/twigs	dung	wood
School	primary, junior secondary and secondary in Imdibir town	elementary and junior secondary in a neighbouring PA	1-6
Health service	clinic in Imdibir	clinic in Debre Zeit	Kuyera hospital
Soil erosion	no	no	no
Marriage	some polygamy	monogamous	some polygamy

continued

socio econ/site	Yetmen, Enemay
Total no. of households	350
Female-headed households	60
Near-by towns	Bichena, Dejen
Dominant ethnic group	Amhara
Dominant religion	Orthodox Christian
Villagisation or resettlement	yes
Estimate of landless households	---
More important crops	<i>teff</i> , wheat, chick peas, <i>guaya</i>
Climate	<i>woyena dega</i>
Use of fertilizer	yes
Affected directly by war	no
Main source of water	well and river
Main source for lighting	<i>kuraz</i>
Main source of fuel for cooking	dung cakes, wood and twigs
School	1-8 in the town of Yetmen
Health service	private pharmacy in Yetmen town; hospital in Debre Markos
Soil erosion	no
Marriage	some polygamy

Source: Pre- survey questionnaire and Rural research workshop, July 18-20, 1995.

Summary of Descriptive statistics

Variable	Mean	Std. Dev.
MDURA	18.527	38.716
AGTMRG	8.5556	14.181
WSTPRG	0.11894	0.48964
LANDARE	0.38	3.79
LIVNO	4.4726	5.4533
LIVLU	1515.4	1892.9
NTWN	0.52426	2.2380
NC	3.8748	3.1806
MOTHAGE	34.634	38.464
MOTHSCH	0.69014	1.9519
MORTAL	0.32707	0.79046
CHILDLAB	2.5747	6.1093
MAGE	11.731	7.7331
FATHAGE	53.53	50.91
FATHSCH	2.05	4.05
FOOD	316.9	328.45
INCOME	394.6	390.46



APPENDIX B

Formal exposition of the quality-quantity trade off

The family is supposed to maximize

$$U(n,q,z) \dots\dots\dots[1]$$

subject to

$$I = P_c qn + P_z Z \dots\dots\dots[2] \text{ (budget constraint)}$$

Where n number of children

q child quality per child

Z commodities (composite commodity)

I full income

qn total child quality

P_c price of a unit child quality

P_z price of Z

maximizing [1] subject to [2] yield the following usual F.O.Cs.

$$\delta u / \delta n = MU_n = \mu P_c q = \mu \pi_n$$

$$\delta u / \delta q = MU_q = \mu P_c n = \mu \pi_q$$

$$\delta u / \delta Z = MU_z = \mu P_z = \mu \pi_z$$

where π_n , π_q and π_z are shadow prices of n, q and z respectively. Thus the shadow price of n depends on the quantity demanded and the shadow price of quality is a function of number of children. This means that increase in quality will induce a rise in the shadow price of number of children, so that number of children demanded will fall; and vice versa. Therefore $\delta n / \delta q < 0$ because $\delta \pi_n / \delta q > 0$ and $\delta n / \delta \pi_n < 0$.

DECLARATION

This thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

NAME Tekabe Ayalew Belay

SIGNATURE 

