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Demand for a Child in Bangladesh: A Multivariate Statistical Analysis

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DECLARATION

This dissertation entitled "**Demand for a Child in Bangladesh: A Multivariate Statistical Analysis**." Submitted by me in the Department of Statistics, University of Rajshahi for the award of the degree of Doctor of Philosophy is based on my research work carried out under the supervision of Professor **Dr. M. A. Basher Mian**, Department of Statistics, University of Rajshahi.

To the best of my knowledge, this work neither in part nor in full has been submitted to any other University or institution for the award of any degree.

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ABSTRACT

In Bangladesh, children especially sons are considered as an important part of standard of living as well as "poor man's capital". In this study an attempt is made to highlight some socio-economic and demographic factors, which are affecting the demand for a child. Based on the findings, recommendations are given so that policy makers may take remedial measures to strengthen family planning program efforts, for accelerating the rate of fertility decline to achieve replacement level as early as possible. It is observed that for achieving the replacement level fertility, the family planning program should be strengthened among the ever-married women under age 30 due to the population momentum. The probability of demand for an additional child is significantly higher in Chittagong and Sylhet division than that in Rajshahi and Khulna division. Demand for an additional child is lower among working women than among housewives. The findings indicate that whenever gender preferences would be eliminated, the percentage of women who did not demand more children would be increased approximately by 10 percent. The findings also suggest that further increase in the contraceptive prevalence rates in the country may become increasingly more difficult unless there is a decline in the latent demand for male children. Therefore, we conclude that further reduction of fertility to achieve replacement level is unlikely without considerable reduction in the demand for male children and policy makers should emphasize those policies that actively enhance women's status through education as well as involving them in the workforce in the country and change attitudes towards girl children.

ORGANIZATION OF THE STUDY

The study has been organized into seven chapters, including the introductory one.

* The first chapter is the introductory chapter, which deals with, socio-economic and demographic structure of Bangladesh, conceptualization of demand for a child, definition of demand for a child, the link between fertility and demand for a child, desire and demand for children, review of the literature and aim and objectives of the study.

* Chapter two presents the data and methodology which contains source and methods of collecting data, selection of the variables under study, limitations and justification of data quality, methodology generally used in the analytical parts of the study and description of some selected background characteristics used in the study.

* Chapter three reflects impact of some selected variables on demand for a child which contains introduction, possible suspected factors affecting the demand for a child, data and methodology related to the tentative model, description of the model variables, development of the model, empirical results and discussion and finally measuring the worth of the model.

* Chapter four shows a comparative study of ratio and logit models on demand for a child in Bangladesh which involves introduction, measurements of the variables, data, models and methodology for the analysis and results & discussion.

* Chapter five shows the effects of sex preference on demand for a child in Bangladesh involving the sections, introduction, types of sex preference and where they are observed?, why sex preference?, sex preference and fertility: what is the link?, data and methodology for the analysis and results & discussion.

* Chapter six provides influence of sex preference on demand for a child and its consequences on contraceptive use in Bangladesh having the sections, introduction, objectives of the study, data and methodology, results and discussion.

* Chapter seven gives concluding remarks and policy implications involving overview of the findings and some comments regarding policy implications.

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constitute less than 1 percent. The national language of Bangladesh is Bangla, which is spoken and understood by all.

Agriculture is the most important sector of the nation's economy. It accounts for 22.7 percent of the gross domestic product (GDP) and employs 60 percent of the workforce (World Development Indicators database, April, 2004). Jute is the main nonfood crop and the main cash crop of Bangladesh. Less than 20 percent of the cropped land area is used for crops other than jute and rice (BBS, 1997a: 187,188). Industry, although small, accounting for about 16 percent of GDP (Bangladesh Economic Review, 2004: GOB) is increasing in importance as a result of foreign investments. Prospects for mineral resources, gas, coal and oil appear to be bright. Extremely low savings and investment 24.49 percent and 23.58 percent of total GDP respectively (Bangladesh Economic Review, 2004: GOB) characterize the Bangladesh economy. However, the per capita income was only US$ 275 and half of the Bangladesh's population entered the 1990s with an income below the poverty line (GOB, 1994: 2; World Bank: xvii). But such key indicator as per capita income increases US$ 444 (Bangladesh Economic Review, 2004: GOB) and 35.6 percent of total population with an income below poverty line (2003 CIA World Fact Book). Unemployment/Under-employment is a serious problem and pressure on the land in rural areas has lead to movement of people from rural to urban areas. Unemployment including underemployment rate is 40 percent among total population in Bangladesh (2003 CIA World Fact Book).

The literacy rate of the population aged five years and older is 45 percent (48 percent for males and 40 percent for females in 1991, Khuda *et al.*,

1991). Although literacy continues to remain quite low in Bangladesh, it has shown some improvement over the years. Between 1973 and 2003, primary school enrolment increased by 1.5 times for boys (rising from 5060000 to 7768260) and for girls by over 2.9 times (2698000 to 7735649). During the same period, secondary school enrolment increased by about 2.5 times for boys and by over 5 times for girls (Bangladesh Economic Review, 2004: GOB). The school attendance rate of the population aged 5-24 years has increased with a considerable narrowing of gaps by gender.

The population of the area that now constitutes Bangladesh has grown from about 42 million in 1941 to 135.7 million in 2002 (World Development indicators data base, April 2004), making the nation the ninth most populous country in the world and one of the most densely (about 905/s.km) populated. The intercensal population growth rate peaked in the early 1970s at about 2.5 percent per annum, followed by a decline to 2.2 percent during the 1981-1991 period (BBS, 1997a; 149) and in 2002, the rate became 1.7 (World Development Indicators database, April, 2004). The relatively young age structure of the population indicates continued rapid population growth in the future; according to the 1991 census, 45 percent of the population is under 15 years of age, 52 percent are between 15 and 64 years and 3 percent are age 65 and above (BBS, 1997a: 139) but in the year 2003 the percentages became 34.1, 62.5 and 3.4 respectively (2003 CIA World Fact Book). This young age structure constitutes a built-in "Population momentum", which will continue to generate population increases well into the future, even in the face of rapid fertility decline.

Family planning introduced in the early 1950s through the voluntary efforts of social and medical workers. The government, recognizing the urgency of moderating population growth, adopted family planning as a government-sector program in 1965.

The policy to reduce fertility rates has been repeatedly reaffirmed since liberation in 1971. The first five-year plan (1973-1978) of Bangladesh emphasized "the necessity of immediate adoption of drastic steps to slow down the population growth" and reiterated that "no civilized measure would be too drastic to keep the population of Bangladesh on the smaller side of 150 million for sheer ecological viability of the nation" (GOB, 1994: 7). From mid-1972, the family planning program received virtually unanimous, high-level political support. All subsequent governments that have come into power in Bangladesh have identified population control as the top priority for government action. This political commitment is crucial in understanding the fertility decline in Bangladesh. In 1976, the government declared the rapid growth of the population as the country's number one problem and adopted a broad-based, multisectoral family planning program along with an official population policy (GOB, 1994: 9). Population planning was seen as an integral part of the total development process, and was incorporated into successive five year plans. Policy guidelines and strategies for the population program are formulated by the National Population Council (NPC), which is chaired by the Prime Minister.

Bangladesh population policy and programs have evolved through a series of developmental phases and have undergone changes in strategies, structure, contents and goals. In the mid 1970s the government instituted the

deployment of full time, local Family Welfare Assistants (FWAS)-community based family planning motivators and distributors who numbered almost 24,000 at the height of the program a few years ago. A social marketing program to promote the sale of birth control pills and condoms was also initiated in the mid 1970s. Another characteristic of the population program is the involvement of more than 200 nongovernmental organizations.

Since 1980, the program has stressed functionally integrated health and family planning programs. The goal is to provide an essential package of high quality, client centered reproductive and child health care, family planning, communicable disease control and limited curative services at a one-stop service point. The Fifth Five Year Plan (FFYP) has been formulated keeping in view the principles of the Health and Population Sector Strategy (HPSS) with a single sector for both health and population. The main objective of the FFYP is to ensure universal access to essential health care services of acceptable quality and to further slow population growth. The most important basis of the FFYP would remain the reduction of infant mortality and morbidity, reduction of maternal mortality and morbidity, improvement of nutritional status, and reduction of fertility to reach replacement-level fertility by the year 2005 (GOB, 1998: 7). But after the completion of FFYP, it is observed that the target in the field of demographic and health sectors were partially achieved.

The government's policy of providing health care is based on the principles of universal coverage and accessibility; optimum utilization and development of human resources for health; appropriate use of technology;

gender equity; improvement of the quality of life; priority service for the most vulnerable groups including women, children and the poor; and promotion of health as an integral part of overall socio-economic development. Although no comprehensive health policy has been formulated since independence, development of such a policy was a high priority of the previous administration and introduced it. Private-sector involvement in both health and population services is being encouraged.

Bangladesh has undergone a remarkable demographic transition over the last two decades. Numerous factors have contributed to increase in the contraceptive use during the mention period. The elements identified as having contributed to the success of the program are (i) strong political commitment to family planning programs by successive governments, (ii) successful promotion of a small family norm through information and educational activities and other multisectoral programs, (iii) establishment of a widespread infrastructure for delivering family planning and health services down to the village level, (iv) increased involvement of nongovernmental organizations (N.G.O's) to supplement and compliment the government's efforts, (v) flexibility to make policy and programmatic adjustments in response to emerging needs, and (vi) strong support of the program by the international aid community (GOB, 1994: 36).

Contraceptive prevalence has steadily grown in Bangladesh since 1975. In 1975, only 8 percent of currently married women reported using a family planning method, compared with 54 percent in the 1999-2000 BDHS survey-a sevenfold increase in the contraceptive prevalence rate for any method over the last 25 years. Also dominant change in contraceptive

prevalence since the late 1980s has been a large increase in the number of couples using oral contraception. The level of contraceptive use is higher in urban areas (60 percent) than in rural areas (52 percent). Contraceptive prevalence rate is highest in Khulna Division, closely followed by Rajshahi and Barisal divisions, while it is lowest in Sylhet Division. Contraceptive use varies by women's level of education.

The success achieved so far in the national family planning program is encouraging and has increased the confidence that it is possible to achieve further progress. But their remains several issues of concern, such as the tremendous growth potential built into the age structure as a consequence of past high fertility. Due to the increasing population entering child bearing age, the program will have to expand efforts substantially just to maintain the current level of contraceptive use. If demand for family planning also increases, that will put even more strain on the program. Other concerns are lack of a steady supply of contraceptives from external sources, which affects program performance; the need for further improvement in access to and quality of facilities and services; and the need for men to practice and participate more actively in family planning acceptance.

Among the remarkable demographic transition, the crude death rate (CDR) has fallen dramatically, from about 19 per thousand population in 1975 to 8 in 1995 (GOB, 1994: 4; BBS, 1997a: 144) and 8.63 in 2003 (2003 CIA World Fact Book). Although infant and under five mortality rates are declining, they are still high. The infant mortality rate was 150 deaths per thousand live births in 1975 and fell to 87 in the 1989-1993 period (GOB, 1994: 5; Mitra *et al.*, 1994: 92). In 2002 infant mortality rate is 48 per 1000

and under five mortality rate is 73 per 1000 live births (World Development indicators data base, April 2004). Maternal mortality has declined from 6.2 death per 1000 births in 1982 to 4.4 in 1995. This small but important decline is mainly attributed to increased availability of family planning and immunization services, improved antenatal and delivery care and a reduction in the number of births to high-risk mothers (GOB, 1994: 5; BBS, 1997a: 144). Because of the mortality decline, there is evidence of modest improvement in life expectancy during the past decade. Life expectancy at birth was 46 years for males and 47 years for females in 1974 (UN, 1981: 60). In 2003 it increased to 61.46 years for men and 61.2 years for women (2003 CIA World Fact Book).

The couples of Bangladesh have accepted the small family norm. About 60 percent of women prefer a two-child family, and another more than 20 percent consider a three child family ideal. Overall, the mean ideal family size among married women is 2.5 children and has not changed since 1993-1994. The total fertility rate (TFR) has declined from about 6.3 in the early 1970s (MOHPC, 1978: 73) to 3.3 in the mid 1990s (Mitra *et al.*, 1997: 31). The 1993-1994, 1996-1997 and 1999-2000 Bangladesh Demographic and Health Survey's results show that Bangladesh continues to experience a fairly rapid decline in fertility. At current fertility level an women of Bangladesh will have an average 3.3 children during her reproductive years. In general, urban women tend to have smaller families than rural women (2.5 and 3.5 children per women respectively). The low level of fertility is found in Khulna (2.7) and Rajshahi (3.0) divisions. Fertility differentials by women's educational status are notable; women who had no formal education have an average of 4.1 children, while women with at least some

secondary education have 2.4 children. However, the total fertility rate (TFR) has declined dramatically from 6.3 children per women in 1971-1975 to 3.3 in 1997-1999, a decline of 48 percent over a 25-years period. The pace of fertility decline has slowed in the most recent period compared to the exceptionally rapid decline during the late 1980s and early 1990s. The total fertility rate dropped almost imperceptibly from 3.4 for the period 1991-1993 to 3.3 in 1994-1996. But unfortunately, TFR remain stalled during the last two surveys (BDHS 1996-1997 and 1999-2000).

1.2 Conceptualization of Demand for a Child:

In bringing economics to bear on procreation and children, a new dialogue between data and theory has begun. Malthus assumed that the price of children would remain constant; the various studies argue that the cost of children increases with the rise in price of human time. It is observed that fertility is affected by price as well as by income and by the formation of human capital in children. It is also observed that human capital embodied in adults, especially in women, affects fertility and the supply of labor (Schultz, 1972).

Fertility means children, and children are an important part of the standard of living of most families. Most married couples want their own children, and they proceed to bear and rear them. It is clear is that parents derive satisfactions and productive services from their children and that the sacrifices made by parents in bearing children and in the investment they make in the care, health and education of their children are in substantial part deliberate family decisions. For example, investment in education is fully consistent in serving cultural purposes in acquiring future cultural

satisfactions along with the earnings associated with schooling and higher education. The same basic logic is applicable in this endeavor in explaining the sacrifices that parents make in acquiring the personal satisfactions and productive services that they derived from their children.

The reproductive behavior of parents is in large part a response to the underlying preferences of parents for children. Given the state of birth control technology and the various classes of uncertainty associated with contraception, infant mortality, the health and fecundity of the parents, and the income and wage rates parents expect to realize over their life-cycle, these preferences are constrained by the parent's resources and the associated alternative economic opportunities in using their resources. In turn, these resources imply sacrifices, measured in terms of opportunity costs that parents must be prepared to make in acquiring the future satisfactions and productive service they expect to realize from children.

It could, of course, be argued that parents are nevertheless indifferent to these and all other economic considerations when it comes to having children. On the grounds that children are in considerable part the unintended outcome of sexual activity, those parents in general do not engage in any practical family planning, and that the lifetime resource constraints are not known to parents with enough certainty to influence their decisions at the time they bear their children. Therefore, parents respond to economic considerations in the children they bear and rear and those parents equate the marginal sacrifices and satisfactions, including the productive services they expect from children, in arriving at the value of children to them. Thus, in thinking about the economics of fertility, social cost and

benefits aside, the analytical key determining the value of children to their parents is in the interactions between the supply and demand factors about children that influence these family decisions.

Investment in human capital, as we know, rest on the proposition that there are certain expenditures (sacrifices) that are made deliberately to create productive stocks, embodied in human beings, that provide services over future periods. These services consist of producer services revealed in future earnings and of consumer services that accrue to the individual as satisfaction over his lifetime.

Children are here viewed as forms of human capital. From the economic point of view, the sacrifices that are made in bearing and rearing them may be considered as expenditure or investment in human capital. Parents in rich countries acquire mainly future personal satisfaction from them, while in poor countries children also contribute substantially to the future real income of their parents by the work that children do in the household and on the farm and by the food and shelter they provide for their parents when they no longer are able to provide these for themselves. Children are in a very important sense the poor man's capital. It is becoming clear that the investment in children is in many ways akin to the investment in home grown trees for their beauty and fruit. A very young child is highly labor intensive in terms of cost, and the rewards are wholly psychic in terms of utility. As a child become a teen-ager, the additional cost borne by the parents involves less labor intensiveness and the rewards, especially in poor countries, consist in increasing part of useful work that the teen-ager performs.

The important parts of the changes in fertility over time, changes that are related to the rise in the expenditures on children, are consequences of long term development with respect to the economic value of education, job opportunities, the incentives to migrate toward better economic locations, the opportunities to reduce infant mortality, the improvements in contraceptive techniques and the decline in their cost, along with the secular rise in family income. The treatment of these and other secular developments, including the rate at which families adjust their fertility may be considered as the consequences of demand for a child.

The education of parents play a vital role on their family behavior and it influences fertility. The education of parents notably that of the mother, appears to be an omnibus. It affects the choice of mates in marriage. It may affect the parent's preferences for children. It assuredly affects the earnings of women who enter the labor force. It evidently affects the productivity of mothers in the work they perform in the household, including the rearing of their children. It probably affects the incidence of child mortality, and it undoubtedly affects the ability of parents to control the number of births. Also it is evident that the relationship between additional schooling (up to secondary level) of mothers and the numbers of children is strongly negative for the early years of schooling of mothers. But, this relationship is not continuing for additional education at the higher levels (Schultz, 1972).

One of the more important new insights pertains to the economics of the supply of and demand for contraception techniques. Would that we had estimates of the rates at which the superior and cheaper contraceptive

techniques are adopted. The indications are that this information will tell a story that is in many respects comparable to that of farmers in a number of poor countries in their adoption of new, superior varieties of wheat, rice and other crops that has set into motion called "green revolution". The responses of parents in adopting these contraceptive techniques is also further in support of the economic postulate that parents are not indifferent in their fertility behavior to changes in economic conditions. So birth of a child should not considered only a biological process of parents rather it should be considered in the economic point of view which is termed as demand for a child.

Becker (1965) proposed that children can be viewed as an economic good and that the demand for children be represented as a family decision process wherein the household chooses a family size that maximizes satisfaction, given the relative prices of commodities, tastes and total income. In simplified terms, the household derives satisfactions from 'commodities' which are not purchased in the market, instead they are produced within the family by combining the market-purchased goods and services and the time of the family members. Then, the family is treated as a producing unit; producing various kinds of benefits for its members. Hence fertility is viewed as an economically and socially constrained choice in which family income and price of children play an important role. Such fertility is termed as demand for a child.

1.3 Definition of Demand for a Child:

Reproductive behavior of parents is in large part a response to the underlying preferences of parents for children. Given the state of birth control technology and the various classes of uncertainty associated with contraception, infant mortality, the health and fecundity of the parents, and the income and wage rates parents expect to realize over their life cycle, these preferences are constrained by the parents' resources and the associated alternative economic opportunities in using their resources. In turn, these resources imply sacrifices, measured in terms of opportunity costs that parents must be prepared to make in acquiring the future satisfactions and productive service they expect to realize from children. It could, of course, be argued that parents are nevertheless indifferent to these and all other economic considerations when it comes to having children, on the grounds that children are in considerable part the unintended outcome of sexual activity, that parents in general do not engage in any practical family planning, and that the lifetime resource constraints are not known to parents with enough certainty to influence their decisions at the time they bear their children. In brief, when parents expect the "baby" with their family decision as well as with the view of their surrounding economic and social constraints is termed as demand for a child (Schultz, 1972).

In recent years, fertility has become an important subject of inquiry for economists. The decision to have children and their number and timing involve trade-offs which constrain the purchase and consumption of durables and other household items vying for the family's scarce resources. Moreover, resources are spent on products and services used in the

prevention of childbirth and in child-rearing. Both the bearing and rearing of children are costly activities; goods and services invested on children have to be purchased in the market by paying a price. In addition, the time of parents, particularly the mother's time, is an important input in childbearing and rearing, and has an opportunity cost. In return, parents derive pleasure from having their own children. This is termed as benefits' or utility from children. Parents allocate their resources among various items which yield satisfaction, including the number of children, such that they derive the maximum satisfaction. This is a typical choice problem. Thus the decision to have the children can be fruitfully modeled as an outcome of optimizing household production and consumption decision-making. In this process, important determinants of the demand for a child are household income and the cost of children. Many studies in both developed and developing countries indicate that childbearing and rearing have economic consequences for families and that economic factors exert a considerable influence on a couple's reproductive decisions. Thus, when parents desire a child considering their economic framework as well as social constraints is defined as demand for a child (T. Lakshmanasamy, 1991).

1.4 The link between fertility and demand for a child:

Growth economists, to the extent that they have dealt with fertility, have featured the gross economic effects of population growth, leaving to biologists, sociologists and human demographers the task of explaining the increases in the size of human population. This concentration on such gross effects is understandable in view of the fact that factors determining population growth have been a major unsettled part of economic theory. The

concept of an optimum population has not been fruitful. Modern growth theory, with some notable exceptions, treats increase in the size of the population as an exogenous variable, although in classical economics it was (following Malthus) an endogenous variable. The Malthusian assumption about bearing and rearing children in response to economic growth led, of course, to the long standing dismal economic perspective with respect to the population consequences of the accumulation of capital and of any advances in the techniques of production. While economist no longer accept the subsistence standard of living as invariant over time in view of the widely observed rise in standard of living that has occurred with the rise in real family income associated with economic growth, the recent proliferation of doomsday literature featuring the population bomb, produced mainly by a few biologists, rest basically on the early Malthusian notions of reproductive behavior.

Meanwhile, demographers have done much in clarifying the complexity of population data and in examining in depth particular differences among classes of parents in their fertility behavior (Ryder and Westoff, 1971, and others). Moreover, demographers know that the population projections that are based on their well standardized data are tenuous projections even for the short-run, for they know that these projections do not rest on any theory of population growth. Demographers asking key questions, however, on which the economist would be well advised to the ponder: what is the explanation of the rapid increase adoption of the contraceptives? What accounts for the fluctuations in the birth rates in countries in which the economy is highly developed? Also another most important question they are asking is: what is the explanation of the demographic transition, that is how do we explain the

economic and social processes and family behavior that accounts for the remarkable decline from very high birth and death rates to modern very low birth and death rates? It is obvious that the theory which treats population growth as an exogenous variable is of no help in answering these questions. The answer of these questions can be explained with the help of human fertility behavior as well as economic point of view. Hence there is some link between fertility and demand for children. That is fertility behavior of couples is partially regulated by demand for children.

1.5 Desire and demand for children:

When parents expect to have their own children according to their mental incitement and care for them emotionally ignoring the economic point of view of bearing and rearing them and without equating cost and benefits involved with children may be termed as desire for children. From the point of view of emotional well-being, parents often sees their desire to nurture their children as an intrinsically valuable impulse, and as an expression of what they subjectively as their authentic self. Such emotion produces extraordinary pleasures. There is the sensual, physical pleasure of caring for small children; the satisfaction of spending most of their walking hours with the people they love the most, taking care of their needs; the delight in being able to make their child happy and in being made happy by their child. There is the pleasure of being 'alone together' of doing things near one another, feeling comforted by the presence of the other while attending to their own activities. There are also the enormous gratifications of watching children develop, grow and changes and of being involved in the people become. Devoting time to caring for children, all about pleasure and good feeling

surrounds the parents. So, In brief, when parents expect their child with their family decision ignoring the view of their surrounding economic and social constraints is termed as desire for children.

On the contrary, the desire to parents is not only the desire to have children, but also desire to care for them. In order to care for children they must pay for something in terms of money, labor and time. The work of production moved outside the home and child rearing became parent's dominant focus. This shift in parental activity, prompted by economics, soon shaped standard ideology as well; raising their children was a good parent sacred calling. If they wanted something different or something more ignoring the social structure associated with them, something was surely wrong with them. Though, someone still try to minimize their desire only to give birth and nurture their child. But, today, parental desire is constrained by a contemporary model of self that has developed in response to more recent economic and social reality. When the parents' motives for having children considering the costs and satisfactions (lifetime plan for childbearing, for expenditures of time and money on children and other sources of parental satisfaction related to children) involved with bearing and rearing children is considered as demand for children.

1.6 Review of the literature:

Bangladesh has undergone a considerable decline in fertility despite the absence of conditions believed to be necessary for such reproductive changes. Indeed, Bangladesh is the only one among the world's twenty poorest countries where such a change has occurred.

According to Monica Das Gupta and D. Narayana (1996), Bangladesh is believed to have undergone a very dramatic fertility decline, which has been attributed primarily to the country's family planning program. They reviewed the evidence for the fertility decline and found that it is substantial, but not nearly as much as has been suggested. Both fertility decline and socio-economic development in Bangladesh have proceeded at roughly the same pace as in the central state of India, which are perceived to be undergoing a very slow demographic transition. Moreover, fertility decline in Bangladesh does not seem to have been driven essentially by the family planning program: many significant changes have taken place in Bangladesh's society and economy leading to reduced demand for children. A latent demand for fertility reduction was generated by growing pressure on resources, and this was sharpened in recent decades by the changing values and aspirations associated with increasing integration of the population with the modern economy. Family planning services have facilitated the fertility decline for which a demand had already been generated. Examining these data and comparing Bangladesh's experience with that of central India, they argued that Bangladesh's fertility decline is unremarkable compared with its surrounding region, and that it cannot be primarily attributed to the family planning program. They argued instead that Bangladesh's fertility decline has been driven by a reduced demand for children, due to the structural changes in that society, and that the family planning program has helped people implement their changing reproductive goals. This goes against the view currently held strongly by many that family planning program was the main driving force behind the decline.

Larson and Mitra (1992), Cleland *et al.* (1994), stated that the recent fertility decline in Bangladesh has generated much interest in academic and policy making circles. That interest arises from the belief that Bangladesh has achieved a remarkable reduction in fertility despite little improvement in levels of living, education, child survival, and other factors frequently associated with the demographic transition. The family planning program is credited with being the main driving force behind this decline, while the role of social and economic change is deemphasized.

Cleland *et al.* (1994), has performed a detailed and influential analysis of the fertility decline in Bangladesh, and reviewed the demographic and socio-economic trends in the country. Somewhat at odds with their evidence, they conclude that Bangladesh has been socio-economically static, but has had a strong commitment to develop a good family planning program. The demand for children has been altered less by changes in socio-economic conditions than by "An active family planning program (which) extends logistical and psychological support for fertility regulation that does not otherwise arise".

According to Cleland and Wilson (1987), Van de Walle and Knodel (1980), Caldwell (1980 and 1982), Knodel and others (1984), Freedman (1979), Knodel (1977), in recent years, in the absence of a clear association between socio-economic development and the timing of fertility decline, several different causal mechanisms have been proposed to explain the initiation of fertility decline. These mechanisms include modern ideas and aspirations, cultural factors, women's rights, transportation and communication

networks, modern systems of mass education, and the adoption and diffusion of contraception.

United Nations (1987), Freedman and others (1981), Knodel and Debavalya (1978), Zachariah and Newton (1983), Banister (1987), Hirschman and Guest (1990), observed that in Bangladesh the predominant role of family panning programes in the speedy adoption of fertility regulation has been noted in the literature. Greater emphasis seems to be placed on the facilitating role played by some levels of socio-economic development, a favourable status for women and administrative pressure towards the rapid adoption of fertility regulation.

Demeny (1975, 1979), Arthur and McNicoll (1978), Cain (1982), Caldwell and others (1980, 1984), Curtright and Hargens (1984), Caldwell and Cladwell (1987), Dyson and Moore (1983), Duza (1990) have focused on the social, economic and institutional circumstances that can work as barriers against the speedy adoption of fertility regulation in an impoverished and predominantly agrarian society.

In the response of the question, what is the lacking in the literature is evidence about how further significant decline in fertility can be achieved in Bangladesh, M. Kabir and others (1993), suggest that through female education and their better access to institutional credit and skill-training, female empowerment programes, particularly those promoting economic and social upliftment of poor women, enhance the prospects for contraceptive use and fertility decline. Thus the removal of the social, psychic and economic costs of contraception through improvements in the quality and coverage of family planning services, coupled with appropriate

efforts to "Crystallize" demand, would further accelerate the current reproductive changes that are taking place in Bangladesh and hastening its fertility transition even in the face of pervasive poverty and economic stagnation.

Cleland and others (1994), have been asserted that the main mechanism behind the fertility decline that has occurred in Bangladesh has been the increases in contraceptive use from 7 percent in 1975 to 54 percent by 2000. They claimed that in addition to making contraception available to couples already interested in regulating their fertility, the Bangladesh family planning program helped both to bring conceptual changes towards small families and to change couples attitude about the use of modern contraceptives supporting the above argument. They also contend that the changes in economic structure, urbanization, women's participation in economic activities and education in Bangladesh were sufficient but not necessary for the fertility transition that occurred in Bangladesh.

Carty and others (1993), have emphasized that Bangladesh has had strong and sustained political commitment to an effective family planning program. All governments in power since the country's independence (1971) have placed high priority on reducing the country's high rate of population growth, which was 3 percent per year during the 1970s. Since 1973, the government has received strong support from international donor agencies to intensify family planning program efforts.

Caldwell and others (1999), showed that there have been considerable social and economic changes in the country and contend that these have changed couple's attitudes about family size in such a way as to lead to a decline in

fertility though there has been debate about the role that socio-economic change has played in contributing to the fertility decline that has taken place in Bangladesh.

According to Islam and others (2001), fertility seems to have reached a plateau since 1992 in Bangladesh. The programmatic, social and economic determinants of this plateau are not understood yet, although part of the apparent plateau may be associated with measurement issues. This plateau raises a debate about what further changes are needed for Bangladesh to reach replacement level fertility.

Abdur Razzaque and others (2001), investigated whether there are particular socioeconomic groups that have already achieved replacement or nearly replacement- level fertility in Bangladesh. Using national data of Bangladesh, they found that women who have more than five years of education have almost achieved this level of fertility. They also found that female education is increasing rapidly in Bangladesh. According to their projection based on Matlab experience of educational improvement, virtually all women of reproductive age in Bangladesh will have at least some secondary education by 2025. By this time the country should reach replacement-level fertility. However, Matlab experience suggests that it may not be the case unless there is an improvement in family planning services that will lead to higher and efficient use of contraception. Therefore, their study indicated that improvements in both education and family planning services should receive priorities in policies. Education is important for reducing fertility (and also infant and child mortality) as well as in its own right for improving the human capital (and economic potential) of the

population. Family planning services can help women avoid unintended pregnancies and the abortions that sometimes follow them. They found that there is a substantial amount of fertility that is excess of desired fertility. Excess fertility is higher among women with no or little education. Their projection assumed that levels of education will change, but that education-specific fertility rates will not. However, education-specific fertility rates have declined in Bangladesh, in the future, other factors may also help to accelerate further decline in fertility by reducing fertility rates within education groups. Bangladesh already has very high population density, and high population growth will continue for years to come because of momentum. Rapid urban growth, shifts in agricultural structure, economic improvement, women's employment, and many other social and economic changes may accelerate the transition, meaning that replacement-level fertility may be reached before the time period they have projected. It may also, for example, be possible that women with secondary education will begin to have below replacement-level fertility, as indicated in their wanted fertility. In the future, more and more women will be in the secondary education category. This process may shorten the time required to achieve replacement-level fertility. According to the United Nations low variant replacement-level fertility may occur about 10 years earlier than the time frames the United Nations medium variant projects. That may indeed, be the case if social, economic, or other changes drastically affect the value or cost of children and reduces fertility rates within women's education groups. Improvement in family planning programs may hasten the transition to replacement-levels as well.

Schultz (1994), World Bank (1994), suggest that female education has emerged as the single most important variable affecting both contraceptive use and fertility regulation. Indeed, the powerful effect of education on reproductive behavior is undisputed. Data from the World Fertility Surveys and the Demographic and Health Surveys confirm the strong positive effect of education on reproductive behavior. Similar evidence is also available from other studies (Cochrane, 1979; Caldwell, 1980; Jejeebhoy, 1992).

Khuda *et al.* (1990), Khuda and Barkat (1992), observed that factors responsible for reproductive change in Bangladesh include female employment as well as access to safe drinking water, sanitation, and the media. The evidence indicated that improvement in women's status is a crucial determinant of fertility decline in Bangladesh. Most Bangladeshis and foreign observers agreed that during the past two decades women's status in terms of education, employment, mobility, and decision making power has undergone major changes. Also there are evidence that such changes have contributed to increased contraceptive use and consequent fertility decline.

Hossain, Khuda and Phillips (1995), observed the evidence from Bangladesh has, therefore, challenged conventional demographic transition theory, which generally associated fertility decline with economic development. Accordingly, population scientists are trying to understand the factors that have contributed to this change in Bangladesh.

Khuda and Hossain (1996), Khuda and others (2000), suggest, nevertheless, while vigorously pursuing family planning program efforts, the government should attach greater priority to development in the social

sector, including enhancement of women's status, especially through increased female education, employment opportunities and improved access to the media. Such efforts, in addition to their direct benefits, would accelerate the process of further fertility decline in the country.

Freedman (1995), suggested that the speed with which reproductive behavior changed in Bangladesh, especially in the absence of much parallel change in social and economic development in the country, strengthens the argument that the family planning program has had a considerable influence on fertility decline. The Bangladesh case has, no doubt, strengthened the argument that a strong family planning program can make a positive contribution to the ongoing process of demographic transition.

Khuda and others (1990), Khuda and Barkat (1992), observed that conceptual changes resulting from increased access to the media have fostered modern outlooks and attitudes, thereby lowering high fertility norms, even among the poor. Furthermore, landlessness and impoverishment have altered the economic value of children, especially sons.

Potter (1977), Bairagi *et al.* (1991), isolated the main problems in measuring fertility in Bangladesh is that of backward displacement of births, leading to overestimation of past fertility and underestimation of recent fertility. They investigated this by comparing reported ages of children with accurate birth registration data where this was available, and found the discrepancies from over statement of children's ages. Moreover, this displacement effect is difficult to distinguish from a genuine fertility decline except with the benefit of hindsight. This means that the usual direct estimates of fertility

from recent births are invalid and rougher estimates have to be made using indirect techniques of estimation.

Feyisetan and Casteline (1999) have argued that in general, contraceptive use increases as a direct response to a decrease in the demand for children.

M. Shahid Ullah and Chakraborty (1993) suggested that, husband-wife discussion about family planning and a more equal status relationship between husband and wife are important intervening variables through which demographic and socio-economic factors affect fertility. They also suggested that a more systematic approach to family planning service delivery programs could increase contraceptive prevalence rates in Bangladesh. Improvement of the status of women in the family and society in general, and enhancement of contraceptive supply through visits by field workers to the couple's home in particular would make the Bangladesh family planning program more effective and successful to achieve replacement-level fertility.

M. Asaduzzaman Khan and Parveen A. Khanum (2000) observed that son preference has a moderately adverse effect on contraceptive use among women at lower parities and could be a significant barrier in reducing further country's fertility rate. The most important policy implication from the findings of the study is that future fertility would decline if son preference were diminished at the earlier stages of family formation. As son preference is largely socio-cultural, its effect should not be underestimated in a traditional, poor society such as in Bangladesh where women are considered to be of low status. Short-term and narrowly defined population control activities may be ineffective in reducing the influence son preference on

fertility. Nonetheless, an integrated effort is essential to decrease gender inequality as well as to increase the status of women, which potentially could help to decrease further the country's fertility rate.

Amin *et al.* (1993) established a way to draw poor women out of their traditional female confinement within the households and providing opportunities of female income-generating activities, has lead to increased contraceptive use and desire for decreased family size. These effects were much higher than have been achieved by the existing family planning program of Bangladesh.

J. chowdhary *et al.* (1994) observed that the income-generating projects have achieved remarkable success among a population that has been ignored by conventional development programs. This success has been achieved by a self-sustaining approach of repayable loan programs as well as population education components of the projects through small group meetings, helped the women by providing face to face information about fertility regulation. The requirement of group formation, lead to pressure for members to employ to the group's norms of smaller family size. The possibility that the demand for additional child by a member will reduce a member's ability to repay loans, for which the group is jointly liable, may reinforce the group influence on fertility regulation. Finally, education and skill-training may inadvertently influence fertility regulation by changing their client's ideas and perspectives. This approach of joint rural development and population control would also raise the standard of living of the large population which are close to or below the subsistence level. Bangladesh appears to be on its

way towards achieving an economically, as well as socially sustainable fertility rate.

R. Bairagi (2001) found that the effect of sex preference on childbearing is becoming stronger as fertility declines, because couple's must achieve their desired number of sons within a smaller overall number of children.

T. Leone *et al.* (2003) observed that sex preference is an important barrier to the increase of contraceptive use and subsequent fertility decline to achieve replacement-level.

R. Hussain *et al.* (2000) suggested that in order to make any substantial impact on the strong son preference in patriarchal societies, there is a need to broaden the focus beyond recommendations about improving female education, and undertaken a critical examination of the existing social structures.

1.7 Aim and objectives of the study:

The rapid decline of fertility, from over 6.5 births per woman to 3.3 births, in the last two decades in Bangladesh is, indeed, a historic record in demographic transition. The program efforts have been largely facilitated by major changes over the past two decades, both positive and negative. Positive changes include female education, female empowerment, female mobility and access to the media. Negative changes include increasing landlessness and rising unemployment and underemployment. Also, other changes have taken place such as change in the family size norm and a decline in infant and child mortality. In addition, fertility decline is due to the various proximate determinants besides contraceptive use. Although, the extent and rapidity of the decrease in fertility have been very impressive by

international standards, continued fertility decline is desirable, as population crowding, environmental deterioration, massive migration from rural areas to unplanned urban settings and rapid depletion of resources are becoming acute. Unfortunately, recent statistics suggest that, despite a continuing increase in contraceptive use, the fertility decline in Bangladesh has stalled. The three successive Demographic and Health Surveys show that the total fertility rates were 3.4, 3.3 and 3.3 in 1991-1993, 1994-1996 and 1997-1999 respectively. The aim of the study is to explore the possibility of further fertility decline in Bangladesh, particularly, we attempt to find under what conditions, it should take for Bangladesh to reach replacement-level fertility (2.1 children per woman). The medium-variant scenario of the United Nations population projection indicates that Bangladesh will achieve replacement-level fertility around 2025 (United Nations, 2001). Finally, we would like to highlight some possible future challenges to further fertility decline to achieve replacement-level fertility. The objectives of the study are as follows,

1. To isolate some factors which are influencing the demand for a child.
2. To provide the basis for drawing out some policy implications and making recommendation with the aim of achieving a further decline in fertility.
3. To highlight some socio-economic factors where policy makers should pay their attention to strengthen its family planning program efforts, to accelerate the rate of fertility decline to be able to achieve replacement level by the year 2005. For example, the government should attach greater priority to development in the social sector,

including enhancement of women status, especially through increased female educational and employment opportunities; and improved access to the mass media. Such efforts, in addition to their direct benefits would accelerate the process of fertility decline in the country.

4. To identify the income-generating projects like BRAC, Grameen Bank, BRDP, Mothers club etc. that have independent effect on the demand for a child as well as fertility regulation.

5. To establish a way to draw poor women out of their traditional female confinement within the households and providing opportunities for female income generating activities which would lead to increased contraceptive use and desire for smaller family size.

6. To examine and isolate the major factors affecting contraceptive use and its effects on fertility.

There is some criticism about BDHS data. This data exhibit the pattern of overestimating past fertility as compared to previous surveys that is suggestive of backward displacement of births (Mitra *et al.* 1994). It would also suggest a steeper decline than China was able to achieve despite being far better placed politically and administratively to ensure rapid fertility decline. This seems very unlikely, and probably reflects data errors (Monica Das Gupta *et al.* 1996). Recent fertility may be even more underestimated in the BDHS than in other fertility surveys in Bangladesh like sample registration system (SRS) operated by the Bangladesh Bureau of Statistic (BBS) and SRS itself underestimates fertility (Cleland *et al.* 1994). There seems every reason to believe that the BDHS fertility estimates are too low. This results from specific problems of collecting fertility history data in Bangladesh, and does not affect the quality of the other data collected by the DHS (Arnold, 1990). Finally, the low BDHS estimate of recent fertility receives apparent support from a validation check conducted in 1994 (Bairagi *et al.* 1995). However, the method of validation has major problems, many of which are discussed the analysts themselves.

2.4 Methodology:

2.4.1 Logistic Regression:

The logistic regression model has been used epidemiologic research and in biostatistics. Now a days in demographic and health survey data, logistic regression model as well as odds ratios are widely used to identify the risk factors which are significantly affect the dependent variables. Cox (1958) is the pioneer of logistic regression model. Subsequently this model illustrated by Walker and Duncun (1967) and Cox himself (1970). More recently Lee

CHAPTER-TWO
Data and Methodology

2.1 Source and Methods of Collecting Data:

The Bangladesh Demographic and Health Survey (BDHS) is part of the worldwide Demographic and Health Surveys program, which is designed to collect data on fertility, family planning, and maternal and child health. The Bangladesh Demographic and Health Survey is intended to serve as a source of population and health data for policymakers and the research community.

The 1999-2000 BDHS was conducted under the authority of the National Institute for Population Research and Training (NIPORT) of the ministry of Health and Family Welfare. The survey was implemented by Mitra and Associates, a Bangladeshi research firm located in Dhaka. Macro International Inc. of Calverton, Maryland, provided technical assistance to the project as part of its international Demographic and Health Surveys program, and financial assistance was provided by the U. S. Agency for International Development (USAID), Bangladesh.

The 1999-2000 BDHS employed a nationally representative, two-stage sample that was selected from the master sample maintained by the Bangladesh Bureau of Statistics (BBS) for the implementation of surveys for the census 2001. The master sample consists of 500 primary sampling units (PSUs) with enough PSUs in each stratum except for the urban strata of the Barisal and Sylhet divisions. In the rural areas, the primary sampling unit was the mauza, while in urban areas, it was the mahalla. Because the

primary sampling units in the master sample were selected with probability proportional to size from the 1991 census frame, the units for the BDHS survey were selected from the master sample with equal probability to make the BDHS selection equivalent to selection with probability proportional to size. A total of 341 primary sampling units were used for the BDHS survey (99 urban and 242 rural).

Mitra and Associates conducted a households listing operation in all the sample points from September to December 1999. A systematic sample of 10,268 households was selected from these lists. Every third household was selected for the men's survey. In addition to men all ever-married women age 10-49 also interviewed from those households. It was expected that the sample would yield interviews with approximately 10,000 ever-married women age 10-49. A total of 10,268 households were selected for the sample, of which 9,854 were successfully interviewed. The shortfall is primarily due to dwellings that were vacant or in which the inhabitants had left for an extended period at the time they were visited by the interviewing teams. Of the 9,922 households occupied, 9,854 (99%) were successfully interviewed. In these households, 10,885 women were identified as eligible for the individual interview (i.e., ever-married and age 10-49) and interview were completed for 10,544 (97 percent) of them.

The technical review committee (TRC) was composed of members with professional expertise from government, non-government and international organizations as well as researchers and professionals working in the health and population sector program, who contributed their valuable comments in major phases of the study. In addition, a Technical Task Force (TTF) was

formed with representatives from NIPORT, Mitra and Associates, USAID/Dhaka, ICDDR, B, Dhaka University and ORC Macro for designing and implementing the survey.

The women's questionnaire was used to collect information from ever-married women age 10-49. These women were asked questions on the following topics:

* Background characteristics (age, education, religion etc.)
* Reproductive history
* Knowledge and use of family planning methods
* Antenatal and delivery care
* Breastfeeding and weaning practices
* Vaccinations and health of children under age 5
* Marriage
* Fertility preferences
* Husband's background and respondent's work
* Height and weight of children under age 5 and of their mother
* HIV and AIDS.

2.2 Selection of the Variables under Study

In Bangladesh Demographic and Health Survey 1999-2000 there are three types of questionnaires i) household's questionnaire ii) women's questionnaire iii) men's questionnaire. The informations obtained from the field are recorded mainly in their respective data files.

In my study the informations corresponding to the women's data file are used. The variables age, place of residence, geographic region (division), religion, level of education, involvement of income-generating project like BRAC, Grameen Bank etc. , access to the media like radio, television etc. are selected from the section background characteristics of the respondents. The informations corresponding to the variables age, place of residence, geographic region, level of education, religion, involvement in NGO's as Grameen Bank, BRAC, BRDP, Mother's Club, Other's Organizations, access to the media as radio and television are obtained from the responses corresponding to the women's questionnaire.

Total number of living children, expected number of children (just after marriage), birth order of living children and their sex, total number of sons as well as daughters and current status of pregnancy are selected from the section reproductive history of respondents.

The informations corresponding to the total number of living children, expected number of children, birth order of living children and their sex, total number of sons, total number of daughters and current pregnancy are collected from same data file.

The current practices of contraceptives are selected from knowledge and use of family planning methods and the required information is obtained through the variable noted in women's questionnaire.

The information about marital status of respondents and their future demand for children are obtained from the variable from the section marriage and fertility preference respectively. But in the analysis, only married women are considered for future demand for children. The variable involving responses

corresponding to the questions i) would you like to have (a/another) child ? ii) would you prefer not to have any (more) children ? After some modifications the response corresponding to the above questions is considered as demand for a child which is the dependent variable in the analysis.

The variable husband's educational and working status of respondents is selected from the section husband's background and respondent's work. The information corresponding to the husband's educational level and working status of respondents are obtained from the same data file.

2.3 Limitations and justification of data quality:

The data of Bangladesh demographic and Health Survey 1999-2000 are affected by two types of errors i) non-sampling errors and ii) sampling errors. Non-sampling errors are the results of mistakes made in implementing data collection and data processing, such as failure to locate and interview the correct household, misunderstanding of the questions on the part of either the interviewer or the respondent, and data entry errors. Although numerous efforts were made during the implementation of the 1999-2000 Bangladesh Demographic and Health Survey (BDHS) to minimize this type of error, non-sampling errors are impossible to completely avoid and difficult to evaluate statistically.

Sampling errors, on the other hand, can be evaluated statistically. The sample of respondents selected in the BDHS is only one of many samples that could have been selected from the same population, using the same design and expected size. Each of these samples would yield results that differ somewhat from the results of the actual sample selected. Sampling

errors are a measure of the variability between all possible samples. Although the degree of variability is not known exactly, it can be estimated from the survey results.

A sampling error is usually measured in terms of the standard error for a particular statistic (mean, percentage etc.), which is the square root of the variance. The standard error can be used to calculate confidence intervals within which the true value of the population can reasonably be assumed to fall. For example, for any given statistic calculated from a sample survey, the value of that statistic will fall within a range of plus or minus two times the standard error of that statistic in 95 percent of all possible samples of identical size and design.

If the sample of respondents had been selected as a simple random sample, it would have been possible to use straightforward formulas for calculating sampling errors. However, the BDHS sample is the result of a two-stage stratified design, and consequently, it was necessary to use more complex formulae. The computer software used to calculate sampling errors for the BDHS is the ISSA Sampling Error Module (SAMPERR). This module used the Taylor linearization method of variance estimation for survey estimates that are means or proportions. The jackknife repeated replication method is used for variance estimation of more complex statistics such as fertility and mortality rates. The results are summarized in APPENDIX B in BDHS 1999-2000. From the results it is observed that in general, the relative standard error for most estimates for the country as a whole is small, except for estimates of very small proportions and it is evident that the quality of the data is appreciable.

(1980) and Fox (1984) have further illustrated the Cox's model. The logistic regression model can be explained as follows:

Let Y be the binary response dependent variable which takes on values 1 and 0 with probability π_i and $1-\pi_i$ respectively so that

$$\pi_i = E\{Y_i = 1|X_i\} = \frac{1}{1+e^{-(\beta_0+\beta_1 X_i)}}$$, where X_i is explanatory variable and

$$1-\pi_i = E\{Y_i = 0|X_i\} = 1 - \frac{1}{1+e^{-(\beta_0+\beta_1 X_i)}}$$

$$= \frac{e^{-(\beta_0+\beta_1 X_i)}}{1+e^{-(\beta_0+\beta_1 X_i)}}$$

Therefore, we can write,

$$\frac{\pi_i}{1-\pi_i} = \frac{1+e^{(\beta_0+\beta_1 X_i)}}{1+e^{-(\beta_0+\beta_1 X_i)}} = e^{(\beta_0+\beta_1 X_i)} \quad \text{.....(2.1)}$$

Now if we take the natural log of the equation (2.1) we have,

$$\log_e\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 X_i \quad \text{.....(2.2)}$$

Here, $\frac{\pi_i}{1-\pi_i}$ given in equation (2.1) is known as odds ratio and $\log_e \frac{\pi_i}{1-\pi_i}$ given in equation (2.2) is known as log odds.

Instead of single explanatory variable we can use two or more explanatory variables. Let X_{i1}, X_{i2}, ...X_{ik} be the vector of k independent explanatory variables for the ith response. The natural logarithm of the ratio π_i and $1-\pi_i$ gives the linear function of X_{ij} and the model (2.2) becomes,

$$\log_e\left(\frac{\pi_i}{1-\pi_i}\right) = \sum_{j=0}^{k} \beta_j X_{ij} \quad \text{.....(2.3)}$$

where in general we consider $X_{i0}=1$ and β_j is the parameter relating to X_{ij}.

The function (2.3) is the linear function of both the variables X and the parameters β and the left side of the equation is known as logit transformation and the whole relationship is called logistic regression model.

Interpretation of Parameters:

Interpretation of parameters in logistic regression model is not so straightforward as in linear regression model. Therefore, it is obvious that a brief discussion is necessary to explain parameters in logistic regression model. Since logit transformation $\log_e \frac{\pi_i}{1-\pi_i}$ is linear in parameters, we can interpret the parameters using the arguments of linear regression. Thus the interpretation may be introduced as follows:

We have, $\pi_i = \frac{e^{\beta_0+\beta_1 X_1+.....+\beta_k X_k}}{1+e^{\beta_0+\beta_1 X_1+.....+\beta_k X_k}}$ is a linear in parameters.

i.e. $\log_e\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0+\beta_1 X_1+\beta_2 X_2+.....+\beta_k X_k$, so arguing analogously as in the case of linear regression model we can explain that β_j (j =1, 2, ...k) represent the rate of change in $\log_e \frac{\pi_i}{1-\pi_i}$ for one unit change in X_j considering other explanatory variables remaining constant.

Also the parameters in logistic regression model can be interpreted through odds ratio. In order to describe the situation, let us consider that the explanatory variable X_j is dichotomous one. This situation is not only the simplest but also it gives the conceptual foundation for all other situations. The explanation is given below:

We have, $\log_e\left(\frac{\pi_i}{1-\pi_i}\right) = \beta_0 + \beta_1 X_1 + \ldots\ldots\ldots\ldots + \beta_k X_k$, here we consider X_j is a dichotomous variable taking values 0 and 1, then the odds ratio 'O' (say) for $X_j=1$ against $X_j=0$ (taking all other X's are fixed) is given by

$$O = \frac{\Pr\left(Y_i = 1 \middle| X, X_j = 1\right) \Big/ \left\{1 - \Pr\left(Y_i = 1 \middle| X, X_j = 1\right)\right\}}{\Pr\left(Y_i = 1 \middle| X, X_j = 0\right) \Big/ \left\{1 - \Pr\left(Y_i = 1 \middle| X, X_j = 0\right)\right\}}$$

$$= \frac{e^{\beta_0 + \beta_1 X_1 + \ldots\ldots + \beta_j + \ldots\ldots + \beta_k X_k}}{e^{\beta_0 + \beta_1 X_1 + \ldots\ldots + 0.\beta_j + \ldots\ldots + \beta_k X_k}}$$

$$= e^{\beta_j}$$

Hence $\log_e O = \beta_j$ so, we can directly estimate the coefficients of a logistic regression model as $\log_e \hat{O}$ and hence and can be interpreted. Here the interpretation of β_j is naturally somewhat different from the interpretation in the linear regression and it is obviously represents the amount by which the log odds change per unit change in X_j. It is somewhat more meaningful, however, to state that a one-unit increase in X_j increases the odds by the multiplicative factor e^{β_j}. If a qualitative independent variable has m categories, we introduce only (m-1) dummy variables and the rest one is taken as reference category.

Computation of Probability (π_i):

We can compute the probability π_i from the estimated odds ratio. This calculation is not complicated and also obtained from various software like SPSS 10.0 version. Suppose we have a data set of X variables in equation (2.3), where obviously β_j's are estimated from the fitted model, then we have

$$\log_e \frac{\pi_i}{1-\pi_i} = c \text{ (Say, some constant)}$$

$$\Rightarrow \frac{\hat{\pi}_i}{1-\hat{\pi}_i} = \frac{p_i}{1-p_i} = e^c \quad \text{.....(2.4)}$$

From this equation π_i can be computed easily.

Maximum Likelihood Estimation of the Parameters:

In order to estimate the unknown parameters we are not able to utilize the standard Ordinary Least Square method because in that case we must face some problem about non-normality condition, heteroscedastic variance among error terms, non-fulfillment of the axiom $0 \le \pi_i = E(Y_i|X) \le 1$ and questionable value of R^2 as a measure of goodness of fit.

To eliminate the problem, Cox suggested the maximum likelihood estimation method instead of OLS method and proposed the following likelihood function:

$$L(\beta_0, \beta_1, \ldots\ldots\beta_k) = \frac{\prod_{i=1}^{n} \exp\left(Y_i \sum_{j=0}^{k} \beta_j X_{ij} \right)}{\prod_{i=1}^{n} \left\{ 1 + \exp\left(Y_i \sum_{j=0}^{k} \beta_j X_{ij} \right) \right\}}$$

$$= \frac{\exp\left\{ \sum_{i=1}^{n} \left(Y_i \sum_{j=0}^{k} \beta_j X_{ij} \right) \right\}}{\prod_{i=1}^{n} \left\{ 1 + \exp\left(Y_i \sum_{j=0}^{k} \beta_j X_{ij} \right) \right\}}$$

$$= \frac{\exp\left\{ \sum_{j=0}^{k} \beta_j \sum_{i=1}^{n} Y_i X_{ij} \right\}}{\prod_{i=1}^{n} \left\{ 1 + \exp\left(Y_i \sum_{j=0}^{k} \beta_j X_{ij} \right) \right\}}$$

$$= \frac{\exp\left\{\sum_{j=0}^{k}\beta_j t_j\right\}}{\prod_{i=1}^{n}\left\{1+\exp\left(Y_i\sum_{j=0}^{k}\beta_j X_{ij}\right)\right\}}, \text{ where } t_j = \sum_{i=1}^{n} X_{ij}Y_i, \text{ j=0, 1, ...k;}$$

Then the log-likelihood function is given by

$$\log_e L(\beta_0,\beta_1,.....\beta_k) = \sum_{j=0}^{k}\beta_j t_j - \sum_{i=1}^{n} \log_e\left\{1+\exp\left(Y_i\sum_{j=0}^{k}\beta_j X_{ij}\right)\right\} \text{.....(2.5)}$$

Now taking partial derivatives of (2.5) with respect to β_j's and put them equal to zero and solving the equations simultaneously and iteratively so as to produce $\hat{\beta}_j$, j=0, 1,.....k. Iteration would continue until certain convergence criteria are met. For simplicity, the readymade results after some iteration are obtained through software SPSS for windows version 10.0 for large sample size.

2.4.2 Determining the worth of the individual regressors:

In the following section we have discussed various statistics that have been suggested for assessing the worth of each individual regressor. The results can be generalized to the situation in which more than one regressor is added to an existing model.

Wald Test:

In linear regression, t-statistics are used in assessing the value of individual regressors when other regressors are in the model. In logistic regression, $W = \frac{\hat{\beta}_i}{s_{\hat{\beta}_i}}$ is called a Wald statistic. First, it should be noted that W does not have a t-distribution, even though it does have the same form as a t-statistic. Rather, W is asymptotically normally distributed, with a large sample size n.

It should be noted that there is no agreement as to the general form of what is being called a Wald statistic. The definition given herein is that given by Hosmer and Lemeshow (1989) and Hauck and Donner (1977). But $\frac{\hat{\beta}_j^{\,2}}{s^2_{\hat{\beta}_j}}$, written in a different but equivalent form, is termed as Wald statistic by Rao (1973), Cytel Software Corporation (1993), and also by Wald (1943). If the latter definition is used, the statistic would be regarded as approximately a chi-square random variable with one degree of freedom. Also there is some criticism about Wald statistic discussed by Hosmer and Lemeshow (1989), Hauck and Donner (1977) and they found that Wald statistic performed poorly, and Jennings (1986) also questioned the use of $\frac{\hat{\beta}_j}{s_{\hat{\beta}_j}}$.

Likelihood Ratio Test:

The likelihood ratio test is based on the ratio of two likelihood function. The comparison among the observed and predicted values using the likelihood function is based on the following equation:

$$D = -2\ln\left[\frac{L(\hat{\beta})}{L(0)}\right] \quad \text{.....(2.6)}$$

Where $L(0) = \prod_{i=1}^{n} Y_i^{Y_i}(1-Y_i)^{Y_i}$ is known as likelihood for null model.

$L(\hat{\beta}) = \prod_{i=1}^{n} \hat{\pi}_i^{\,Y_i}(1-\hat{\pi}_i)^{1-Y_i}$ is known as likelihood function that would result when $\hat{\pi}_i$ replaces π_i. Then equation (2.6) can be written as follows

$$D = -2\sum_{i=1}^{n}\left\{Y_i \ln\left(\frac{\hat{\pi}_i}{Y_i}\right) + (1-Y_i)\ln\left(\frac{1-\hat{\pi}_i}{1-Y_i}\right)\right\} \quad \text{.....(2.7)}$$

The statistic D in equation (2.7) is called the deviance by McCullagh and Nelder (1983) and plays a very important role in case of goodness of fit test. Under the null hypothesis the statistic D will follow approximately chi-square distribution with single degree of freedom. In (1989) they stated that the chi-square approximation is usually quite accurate for differences of deviances even though it is inaccurate for the deviances themselves.

2.4.3 Odds Ratio:

Goodman and Kruskal (1954, 1959) present a great many measures of association for 2×2 tables that are not function of χ^2 and give their statistical properties in their research work named odds ratio. The odds ratio is a way of comparing whether the probability of a certain event is the same for two groups. The odds ratio takes values between zero and infinity. One is the neutral value and means that there is no difference between the groups compared; close to zero or infinity means a large difference. An odds ratio larger than one means that group one has a larger proportion than group two, if the opposite is true the odds ratio will be smaller than one. In other words, an odds ratio of 1 implies that the event is equally likely in both groups. An odds ratio greater than one implies that the event is more likely in the first group. An odds ratio less than one implies that the event is less likely in the first group.

For more details, let us consider the following typical 2×2 table:

Table 2.1

2×2 Contingency table

	X^-	X^+	Total
Y^-	a	b	a + b
Y^+	c	d	c + d
Total	a + c	b + d	a + b + c + d

In the above table, the odds for row Y^- are a/b. The odds for row Y^+ are c/d. The odds ratio (OR) is simply the ratio of the two odds given by

$OR = \frac{a/b}{c/d}$, which can be simplified as $OR = \frac{ad}{bc}$, hence it is clear that if the odds are the same in each row, then the odds ratio is 1.

The odds themselves are also a ratio. To explain this we will take an example with probability. Let's say that the probability of success is p=0.8, then the probability of failure is q=1-p=0.2, then the odds of success is defined as 'odds (success)' = p/q = 0.8/0.2 = 4, that is, the odds of success are 4 to 1. Then the odds of failure would be 'odds (failure)' = q/p = 0.2/0.8 =0.25, that is, the odds of failure are 1 to 4. Next, let's compute the odds ratio by

OR = odds (success)/odds (failure) = 4/0.25 = 16, the interpretation of this odds ratio would be that the odds of success are 16 times greater than for failure. Now if we had formed the odds ratio the other way around with odds of failure in the numerator, we would have gotten something like this,

OR = odds (failure)/odds (success) = 0.25/4 = 0.0625, interestingly enough, the interpretation of this odds ratio is nearly the same as the one above. Here

the interpretation is that the odds of failure are one-sixteenth the odds of success. In fact, if we take the reciprocal of the first odds ratio we get 1/16 = 0.0625.

2.4.4 Relative Risk:

A more direct measure comparing the probabilities in two groups is the relative risk, which is also known as the risk ratio. The relative risk is simply the ratio of the two conditional probabilities. The risk ratio takes on values between zero and infinity. One is the neutral value and means that there is no difference between the groups compared, close to zero or infinity means a large difference between the two groups on the variable concerned. A risk ratio larger than one means that group one has a larger proportion than group two, if the opposite is true the risk ratio will be smaller than one. For the table 2.1 the relative risk for the event X^- can be defined as

$RR = \frac{a/a+b}{c/c+d}$, similarly relative risk for the event X^+ is given by $RR = \frac{b/a+b}{d/c+d}$,

the relative risk or risk ratio gives us the percentage difference in classification between group one and group two. For example, 8% of freezers produced without quality control have paint scratches. This percentage is reduced to 5% if quality control is introduced. The risk ratio RR=8/5=1.6 and its interpretation as 60% more freezers are damaged if there is no quality control.

2.4.5 Multi-way Factorial Analysis of Variance:

We know that a factorial experiment with unequal number of levels of involved factors is called a mixed factorial or asymmetrical factorial experiment. In theory, there is no limit to the number of factors that might be analyzed simultaneously, but the number of possible interactions to be dealt with soon becomes unwieldy as larger analyses are considered, and interpretation becomes very difficult for interactions of more than three or four variables.

Once the sums of squares for all factors and interactions have been computed, the degrees of freedom and mean squares are readily determined. However, most available computer programs also provide the degrees of freedom and mean squares. If all factors are fixed, then the required F to test each null hypothesis is obtained by dividing the appropriate mean square by the error MS. If, however, any of the factors represent random effects, then the analysis becomes considerably more complex, and in some cases impossible. In the present study four factors are considered one of which are involved in replication. All the effects corresponding to the selected factors are assumed to be fixed and perform ANOVA through software SPSS for windows version 10.0.

2.4.6 Arnold's index for impact of sex preference:

In order to quantify the overall impact of sex preference for children on fertility and family planning behavior, the method proposed and used by Arnold (1985) is known as Arnold's index. This method assumes that in the complete absence of gender preferences, at any given parity all the couples would behave in a similar fashion as those at the same parity who were most

satisfied with the current sex composition of their living children, that is, at the maximum rate within that parity. This technique is fairly flexible and can be used with a fertility and family planning measures.

Suppose P_0 be the actual percentage of couples who do not demand any more children irrespective of the sex composition of their living children in a certain parity and P_1 be the maximum percentage of couples those are most satisfied with the current sex composition of their living children in that parity and not demanding any more children, that is, there is complete absence of sex preference. Then Arnold's index (I_A, say) of impact of sex preference on demand for children is given by

$$I_A = P_1 - P_0 \text{ , or equivalently, } I_A = \frac{P_0 - P_1}{P_1} \times 100 \text{.....(2.8)}$$

In the present study, the first expression which gives the absolute difference is used to calculate the impact of sex preference on the demand for additional children as well as on practice of contraception.

2.4.7 Chang's index for son preference ratio and balance ratio:

In order to compare gender differences in gender preference an attempt was made to quantify these preferences by using the technique proposed by Chang *et al.* (1981) and may be termed as Chang's index. The method of Chang *et al.* can be used to compute son preference and desire-for-balance ratios for respondents with two children. These ratios have computed for the respondents with two living children only and who do not demand any more children.

According to Chang *et al.*, the son preference ratio may be obtained by dividing the percentage of respondents with two sons who do not demand

any more children by the percentage of respondents with two daughters who do not demand any more children.

Mathematically, suppose, at parity two, P_0 be the percentage of respondents having two daughters and P_1 is the percentage of respondents having two sons who do not demand any more children, then Chang's index (I_C, say) for son preference ratio is given by

$$I_C = \frac{P_1}{P_0} \times 100 \quad \text{.....(2.9)}$$

The index $I_C > 1$ indicates that there is an evidence of son preference among the couples and $I_C < 1$ indicates the daughter preference among the couples.

Similarly, the desire-for-balance ratio may be computed by dividing the percentage of respondents with two children of the opposite sex who do not demand any more children by the percentage of respondents with two children of the same sex who do not demand any more children. Mathematically, at parity two, suppose that P_b be the percentage of respondents having one son and one daughter and P_s is the percentage of respondents having two sons who do not demand any more children and then Chang's index (I_{CB}, say) for desire-for-balance ratio is defined as

$$I_{CB} = \frac{P_b}{P_s} \times 100 \quad \text{.....(2.10)}$$

The index $I_{CB} > 1$ indicates that there is an evidence of balance preference of sex composition of the living children and $I_{CB} < 1$ indicates the preference for sons. Hence $I_C > I_{CB}$ indicates the evidence of son preference. That is son preference is dominant than daughter preference among the couples.

2.4.8 Paired t-test:

Paired t-test or correlated sample test is used to determine if two population means are equal. For paired t-test, the data is dependent, i.e. there is a one-to-one correspondence between the values in the two samples. For example, initial weight and final weight for a growth hormone, we have observations (x_i , y_i). They are very highly correlated. So if we want to test that the hormone has no effect, we should form the difference $d_i = (x_i - y_i)$ and test for the mean of d_i's to be zero. This is now a simple t-test as follows:

$$t = \frac{\bar{x} - \bar{y}}{s_d} \sim t_{n-1} \quad \text{..... (2.11), under null hypothesis}$$

Where $s_d = \sqrt{\frac{\sum_{i=1}^{n} d_i^2 - \frac{\left(\sum_{i=1}^{n} d_i\right)^2}{n}}{n(n-1)}}$.

2.4.9 Test of significance for difference of Proportions:

Suppose that we have two independent random samples of sizes n_1 and n_2 are obtained from two independent binomial populations of which x_1 and x_2 are the number of individuals possessing certain characteristic. The observed proportions of the two samples being p_1 and p_2 respectively. We want to test the null hypothesis

$$H_0 : \pi_1 = \pi_2 ,$$
$$\text{Vs.} \quad H_1 : \pi_1 \neq \pi_2$$

In order to test the null hypothesis we have calculated $p_1 = \frac{x_1}{n_1}$ and $p_2 = \frac{x_2}{n_2}$, the combined proportion $p = \frac{n_1 p_1 + n_2 p_2}{n_1 + n_2}$ and $q = 1 - p$. Hence the required test statistic is

$|d| = \frac{p_1 - p_2}{\sqrt{pq\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}} \sim$ N(0, 1) variate under null hypothesis and the test is approximate and the sample should be large enough (n_1, $n_2 \geq 30$) to justify the normal approximation of binomial. The similar conclusion can be drawn through t-test for the significance of a difference between two proportions or percentage under the assumption of unequal variances by statistical software SISA. In the study, most of the tests are concluded by the software SISA.

Degrees of freedom for t-statistic used by SISA:

There are various ways in which the number of degrees of freedom for the two sample t-test can be calculated. The calculation of the t-value itself is based on n_1+n_2-2 degrees of freedom. In case of equal variance assumption this number of degrees of freedom is correct. However, in case of the unequal variance assumption, if the variance of the first proportion is different from the variance of the second proportion, this number of degrees of freedom is too large. Using the n_1+n_2-2 number of degrees of freedom leads to a difference being declared statistically significant too easily and a higher chance of Type I error. Wonnacott and Wonnacott, among others, therefore suggest using n_1-1 or n_2-1, whichever is smaller. Unfortunately, using this formula makes it too difficult to declare a difference statistically significant, an increased chance of a Type II error, which is just as bad.

SISA uses a complex formula, which considers the difference in variance between proportion one and proportion two. The resulting number of degrees of freedom will be between n_1+n_2-2 and minimum of n_1-1 and n_2-1 rule. The SISA formula gives a number of degrees of freedom very close to

the true number of degrees of freedom in the unequal variance assumption case. Also, comparing SISA with standard statistical packages showed that standard statistical packages give less precise estimates of significance levels.

2.4.10 Fisher's Exact Test for 2×2 Table:

For use in the analysis of the difference between two proportions, the Fisher's exact test procedure calculates an exact probability value for the relationship between two dichotomous variables, as found in a 2×2 crosstable. Basically, the data structure at the basis of a t-test for a difference between two proportions is a 2×2 crosstable. The Fisher procedure calculates the probability of the difference between the data observed and the data expected, considering the given marginal and the assumptions of the model of independence. It works in exactly the same way as the Chi-square test for independence; however, the Chi-square gives only an estimate of the true probability value, an estimate which might not be very accurate if the marginal is very uneven or if there is a small value (less than five) in one of the cells. In such cases the Fisher exact test is a better choice than the Chi-square.

The single-sided p-value is the summed probability of all more extreme or similar tables compared with the given table {notation p (Observed>= Expected)}. There is also a p-value of the relationship going in the other direction. We should not take too much notice of this p-value; it is not so important. There are a number of theories about how to present double-sided p-values (Agresti, 1992). Data on the basis of two of these theories are presented. First, the sum of small p-values, for the sum of small p-values, all

tables are generated which are possible for the given the marginal total. All p-values of the same size or smaller than the point probability are added up to form the cumulative p-value. The result is relevant to the notation p (O>=E |O<=E). Statisticians usually recommend this method. Another method of estimating the double-sided p-value is to take twice the single-sided probability.

2.5 Some selected Background characteristics:

2.5.1 Residence of respondents:

It is assumed that the permanent place of residence of the respondents play a vital role on demand for a child, practicing contraception and overall on sex preferences. Because availability of the material and attitude toward the sex of the living children and the practice of contraception for controlling birth are important for practicing the method. In this respect, permanent place of residence of the respondents is classified as 'Rural" and 'Urban' for the comparative study about contraception.

2.5.2 Education:

Education is a key determinant of the lifestyle and status an individual enjoy in a society. It affects almost all aspects of human life, including demographic and health behavior. Studies have consistently shown that educational attainment has strong impact on reproductive behavior as well as contraceptive use. Education has become more widespread over time in Bangladesh. A steadily decreasing percentage of both males and females have never attended school in each younger age group. For men, the proportions who have never attended school decreases from 51 percent in the oldest age group to 13 percent among those age 10-14. For women, the

decline is more striking, from 85 percent to 11 percent. So it is assumed that level of education play a vital role on demand for a child and hence on contraceptive use. For the purpose of comparison the levels of education of respondents are classified as "below secondary" level and "secondary and higher" level.

2.5.3 Religion:

More than 85 percent respondents under study are Muslim and about 15 percent are non- Muslim. Socially and culturally the Muslim and non-Muslim are almost same in Bangladesh. But in Bangladesh, peoples are still driven mostly by the reluctance to accept the scientific methods of family planning due to religious prejudices and male chauvinism. So, in order to compare the practice of contraception and acceptance of family planning program, the respondents are classified as "Muslim" and "non-Muslim".

2.5.4 Employment status:

In Bangladesh, there has been an increase in the number of female in the workforce, nationally as well as rural areas. More than one million of young women now work in garment factories in the countries two largest cities (Dhaka and Chittagong). There is evidence of poverty-driven female employment, resulting from poor household economic conditions, high rates of female headship as a result of temporary male out-migration (Safilios-Rothschild and Mahmood, 1989) and higher incidence of female headship among the poor and landless households (BIDS, 1990; Rahman and Hossain, 1991). Rahman (1986) found that between 8 and 24 percent of households send women out in search of wage employment and the proportion is much higher among poorer households (50-77 percent). The same study also found

that there has been a rise in female employment since the mid-1970s. Under the assumption, demand for a child is lower and contraceptive use is higher among working women, the respondents are classified as "working" and "not-working" according to the employment status.

CHAPTER -THREE

Impact of some selected variables on Demand for a Child in Bangladesh.

3.1 Introduction:

The 1974 world population conference in Bucharest, the 1984 international conference on population in Mexico and the 1994 international conference on population and development in Cairo have stressed the integration of population policies with development policy. Population control, as a means of sustainable development in Bangladesh, has become a major issue.

Bangladesh is the ninth most populous country in the world. According to the 1991 population census, it had a population of over 111 million people, increasing at an annual growth rate of around 2% (Govt. of Bangladesh 1991). Today, the country has an estimated population of 135.7 million people. Except for some Island States, Bangladesh has the highest population density in the world. Resource scarcity and subsistent-level economic conditions characterize the Bangladesh economy (Khuda 1991). Bangladesh is predominantly dependent on land, with agriculture as its primary industry. Increasing population pressure on the land is continually decreasing the land-man ratio: from 49 decimals in 1951 to 20 decimals in 1991. Although high-yielding variety technology has expanded since the early 1960s, covering over one-quarter of cultivable land area, the per hectare yield is among the lowest in the world (Khuda, Barkat and Helali,

1991). Socio-economically, Bangladesh is comparatively disadvantaged in terms of such key indicators as per capita income (US$ 220 in 1991, World Bank 1993) and proportion living below the poverty line (78% of total population and 86% of rural population, UNDP 1994). Consequently, the Bangladesh economy is characterized by extremely low savings and investments. Both the per capita food production index and daily calorie supply as percentages of requirements (83%) are quite low in Bangladesh. The overall literacy rate is only 37%: males 49% and female 23%. Female school attendance is low, and there is an uneven ratio of male to female school enrolment, especially beyond the primary level (Khuda and Barkat 1992).

Life expectancy in Bangladesh continues to be quite low. Bangladesh is one of the few countries in Asia where female life expectancy remains lower than that of males. This is due in part to multiple high-risk pregnancies. Continued high infant and childhood mortality result from relatively weak prenatal and postnatal services, less than optimal birth spacing and wide spread malnutrition among children.

Despite pervasive poverty and underdevelopment, however, Bangladesh has achieved a considerable decline in fertility. Indeed it represents an apparent anomaly for its decline in fertility, despite the absence of conditions believed to be necessary for such reproductive changes. Bangladesh is the only country among the world's twenty poorest countries where such a change has occurred. The recent decline in fertility in Bangladesh from a total fertility rate of 6.3 children per women in 1975 to 3.5 in 1995 (MHPC,

1978; BBS, 1996) has created interest among researchers, policy makers and academicians.

3.2 Factors affecting the demand for a child:

1. The most important among various developments in economic analysis is the investment in human capital. Investment in human capital, as we know, rests on the proposition that there are certain expenditures (sacrifices) that are made deliberately to create productive stocks, embodied in human beings, which provide services over future periods. These services consist of producer services revealed in future earnings and of consume services that accrue to the individual as satisfactions over his lifetime.

2. Children are here viewed as forms of human capital. From the point of view of the sacrifices that are made in bearing and rearing them, parents in rich countries acquire mainly future personal satisfactions from them, while in poor countries children also contribute substantially to the future real income of their parents by the work that children do in the household and on the farm and by the food and shelter they provide for their parents when they no longer are able to provide these for themselves. Children are in a very important sense are the "poor man's capital". It is becoming clear that the investment in children is in many ways akin to the investment in home grown trees for their beauty and utility.

A very young child is highly labor intensive in terms of cost and the rewards are wholly psychic in terms of utility. As a child becomes a teen-ager the additional cost borne by the parents involves less labor intensiveness and the

rewards, especially in poor countries, consists in increasing part of useful work that the teen-ager performs.

3. Children are considered as an important part of the standard of living of most families in our elite society. Also most of the couples in our society expect children to preserve the successor as well as new generation. Most married couples want their own children, and they proceed to bear and rear them. It is clear that parents derive satisfactions and productive services from their children and that the sacrifices made by parents in bearing children and in the investment they make in the care, health and education of their children are in substantial part deliberate family decisions. (Schultz, 1972)

4. It may proceed on the postulate that parents respond to economic considerations in the children they bear and rear and those parents equate the marginal sacrifices and satisfactions including the productive services they expect from children, in arriving at the value of children to them. Thus, in thinking about the economics of fertility, social cost and benefits aside, 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.

5. Demand for a child can also be influenced by the value of time of women as well as sufficient manpower associated with them to bear and rear the expected children. Because sound economic status, enough time and manpower is essential to grow up and establish a baby, by the availability of

the above mentioned constraints, the couple may be influenced to demand for a child.

3.3 Data and Methodology:

The study has utilized data from the 1999-2000 Bangladesh Demographic and Health Survey (BDHS) based on a nationally representative, two-stage sample that was selected from the master sample maintained by the Bangladesh Bureau of Statistics (BBS) for the implementation of surveys for the census. A total of 10,268 households were selected for the sample, of which 9,854 were successfully interviewed. In these households, 10,885 women were identified as eligible for the individual interview (i.e. ever-married and aged (10-49) and interviews were completed for 10,544 (97%) of them. But my analysis covered only 8759 eligible women who are able to bear children. The women under sterilization, declared infecund, divorced, widowed etc. are not involved in the analysis.

The logistic regression model is being used in many different areas and has become the standard method of analyzing models in which the dependency of a binary response variable is being tested on a number of explanatory variables. Suppose that a response (dependent) variable Y can take one of the two values "0" or "1" i.e. occurrence or nonoccurrence of an event such as demand for a child. Variables of this type are often called binary or dichotomous variables. For dichotomous variables such as Y, one object is to develop a method for estimating π, where π is the probability of occurrence of an event as a function of a number of independent variables. It has been shown, theoretically and empirically, that when the dependent

variable is dichotomous, the shape of the response function is frequently curvilinear. The logistic regression model is a curvilinear response function, which has been found to be appropriate in many cases involving a binary dependent variable. This response function assures that the estimated value of π (Probability of occurrence of an event) is always between 0 and 1.

3.4 Description of the model variables:

1. Age of ever-married women:

From the data we observed that the demand for a child is affected by the age variation of ever-married women, which inspired me to include this variable in the model analysis. To compare the differential of various ages of ever-married women we have divided it into six sub-divisions as age group

i) 10-14.

ii) 15-19

iii) 20-24

iv) 25-29

v) 30-39

vi) 40-49.

Each of this sub-division is incorporated in the model through indicator variable one and zero indicating the presence and absence of a particular woman in a particular sub- division. The median age group 25-29 is considered as reference category. Because the trend of demand for a child

can be identified about median age group and it may be attributed to population momentum.

2. Geographic Division:

In my analysis I suspect that demand for a child can vary over different geographic region. Thus administrative divisions are considered in the model. There are six administrative divisions in Bangladesh.

i)Dhaka

ii) Chitagong

iii) Rajshahi

iv) Khulna

v) Barisal

vi) Sylhet

Each of this division is considered as an indicator variable assuming two values one and zero indicating the presence and absence of a particular woman in a particular division. Dhaka division is considered as reference category under the assumption that Dhaka is the capital of Bangladesh and 24% respondents of the sample are from this division and the population of this division is the combination and interaction of all other divisions.

3. Level of education:

Education is necessary for accumulate knowledge. Education level seems to be an important factor, which influence women to demand for a child. Thus level of education is sub-divided into four groups.

i) No education

ii) Primary level

iii) Secondary level

iv) Higher

Each level of educations considered as an indicator variable assuming two values one and zero indicating the presence and absence of a particular woman in the particular level. Secondary level of education is considered as reference category because in this stage a girl becomes mature gradually and she may achieve sufficient knowledge about the positive impact of family planning program.

4. Religion:

I think in our society ritual sentiment of women can affect the demand for a child in Bangladesh. Hence in our country the four important religions are considered in the model.

i) Islam

ii) Christianity

iii) Hinduism

iv) Buddhist

Each category of religion is considered as an indicator variable, which assumes two values one and zero corresponding to the presence and absence of a particular woman in a particular category of religion. Islam is considered as a reference category under the assumption that most of the

people in Bangladesh are Muslim and about 87% of the selected sample covered by the Muslim respondents.

5. Pregnancy status:

Current pregnancy status can also influence women to demand for a next issue. Therefore current pregnancy is considered as an indicator variable having two values one and zero indicating the presence and absence of current pregnancy respectively. Absence of current pregnancy is considered as reference category.

6. Number of living children:

Total number of living children can influence the demand for a child. Total number of children is classified into three groups.

i) Below 2

ii) Exactly 2

iii) Above 2

Each of this group is incorporated in the model via indicator variable having values one and zero indicating the presence and absence of particular number of children in a particular group. Number of children is exactly 2 is considered as reference category because in order to achieve the replacement level fertility the total number of children should not exceed two.

7. Working status:

Apparently if seems demand for a child is affected by the working status of ever-married women which inspired me to include this variable in this model analysis. To compare the impact of work on demand for a child with reference to without work or housewife of a woman, we divide the ever-married women into two categories.

i) Currently working

ii) Not working or simply housewife

The variable working status is considered as an indicator variable having two values one and zero corresponding to the currently working and not working respectively. Since 82% respondents are mainly housewives not working or simply housewife is considered as reference category.

8. Expected number of children:

Expected number of children may also influence women to demand for a child in Bangladesh. Therefore the variable expected number of children is included in the model analysis. For achieving the replacement level fertility we consider expected number of children should be two. So the expected number of children is divided into two categories.

i) Number of children up to 2.

ii) Number of children above 2.

Each of the two categories is incorporated in the model through indicator variable one and zero indicating the presence and absence of particular number of children in this particular category. Expected number of children up to 2 is considered as reference category.

9. Access of mass media:

It seems to me access of mass media can affect the demand for a child of ever-married women in Bangladesh. Therefore the variable 'Access of mass media' is inspired me it to include in the model analysis. To compare the differential of mass media we have divided it into two categories.

a) Radio

b) Television

Each of the mention media is considered as an indicator variable having two values one and zero indicating listens or watches regularly and irregularly respectively. For each category listens or watches irregularly is considered as reference group.

10. Involvement in N.G.O's:

In our country various type of N.G.O are working since last three decades for the development of our society particularly in the rural women. Therefore the ever-married women who are involved in the N.G.O's may conscious about the demand for a child. To compare the differential of various N.G.O we have divided it into five categories.

i) Grameen Bank

ii) BRAC

iii) BRDP

iv) Mother's club

v) Others Organization

Each of these categories is incorporated in the model through indicator variable, one and zero indicating the involvement and not involvement of a particular woman in a particular N.G.O. Here BRDP is considered as reference category. BRDP is the development program governed by the Government of Bangladesh and it is the logic behind the reference category.

3.5 Development of the model:

In my problem the dependent variable is demand for additional child (Y) which is taken to be dichotomous one. It indicates the demand for a child of ever-married women in Bangladesh. It takes on the value one (Y=1) with probability π (say) if the respondent demands one or more children and zero (Y=0) with probability $1-\pi$ if she does not demand any more. Most of the explanatory variables in our analysis are qualitative.

In order to interpret the qualitative independent variable, age of ever-married women has been taken into an interval scale, such as age group 10-14, 15-19, 20-24, 25-29, 30-39 and 40-49 and the corresponding variables are denoted by X_{11}= age group 10-14, X_{12}= age group 15-19, X_{13}= age group 20-24, X_{14}= age group 25-29, X_{15}= age group 30-39 and X_{16}= age group 40-49 respectively. Each of the age group is considered as an indicator

variable i.e. the respondent belongs to a particular age group has the value 1 and 0 otherwise.

The geographic region is also a qualitative variable and we denote these regions by X_{21}= Dhaka, X_{22}= Chittagong, X_{23}=Rajshahi, X_{24}= Khulna, X_{25}=Barisal and X_{26}=Sylhet. Each of the sub variables is an indicator variable.

The level of education is taken as qualitative and has been expressed into interval scale and denoted by X_{31}= No education, X_{32}=Primary level, X_{33}= Secondary level, X_{34}= Higher. Each of the sub variables is an indicator variable.

Next, religion is a qualitative variable and various religious groups are denoted by X_{41}= Islam, X_{42}=Christianity, X_{43}= Hinduism and X_{44}= Buddhist respectively. Each of the religious groups is considered as an indicator variable.

The variable current pregnancy is qualitative as well as dichotomous one and it is denoted by X_5.

The variable total number of living children is quantitative but for the comparison we convert it into qualitative variable of interval scale. We denote them by X_{61}= Number of children is below 2, X_{62}= Number of children is exactly 2 and X_{63}= Number of children is above 2. Each of the sub variables is an indicator variable.

The variable working status is qualitative and dichotomous one and it is denoted by X_7.

The variable expected number of children is a quantitative variable and for the purpose of comparison we convert it into qualitative variable of interval scale and denote by X_{81}= Expected number of children is up to 2 and X_{82}=Expected number of children is above 2. Each of the variables is an indicator variable.

The variable access of mass media is also a qualitative variable. The media radio and television are denoted by the variables X_{91} and X_{92} respectively. Each of the variables is an indicator variable.

Similarly the variable involvement in N. G. O's is also a qualitative one. The mentioned categories of N. G. O's are denoted by $X_{10.1}$= Grameen Bank, $X_{10.2}$=BRAC, $X_{10.3}$=BRDP, $X_{10.4}$= Mothers' Club and $X_{10.5}$= other organizations. Each of the variables is an indicator variable.

Now the expression π_i is given by

π_i= E $[Y_i=1 | X_{11}=x_{11}, X_{12}=x_{12}, X_{13}=x_{13}, X_{14}=0, X_{15}=x_{15}, X_{16}=x_{16}, X_{21}=0, X_{22}=x_{22}, X_{23}=x_{23}, X_{24}=x_{24}, X_{25}=x_{25}, X_{26}=x_{26}, X_{31}=x_{31}, X_{32}=x_{32}, X_{33}=0, X_{34}=x_{34}, X_{41}=0, X_{42}=x_{42}, X_{43}=x_{43}, X_{44}=x_{44}, X_5=0, X_{61}=x_{61}, X_{62}=0, X_{63}=x_{63}, X_7=0, X_{81}=0, X_{82}=x_{82}, X_{91}=0, X_{92}=0, X_{10.1}=x_{10.1}, X_{10.2}=x_{10.2}, X_{10.3}=0, X_{10.4}=x_{10.4}, X_{10.5}=x_{10.5}]$.

(Here the values of the variables corresponding to the reference category are considered as "0")

That is $\pi_i = \frac{1}{1+e^{-(\beta_0+\sum\beta_j X_j)}}$

And $1-\pi_i = \frac{e^{-(\beta_0+\sum\beta_j X_j)}}{1+e^{-(\beta_0+\sum\beta_j X_j)}}$

Therefore, $\frac{\pi_i}{1-\pi_i} = e^{\beta_0+\sum\beta_j X_j}$

Hence multiple binary logistic regression model is given by

$$Log_e \frac{\pi_i}{1-\pi_i} = \beta_0 + \beta_1 X_{11} + \beta_2 X_{12} + \beta_3 X_{14} + \beta_4 X_{15} + \beta_5 X_{16} + \beta_6 X_{22} + \beta_7 X_{23} + \beta_8 X_{24} + \beta_9 X_{25} + \beta_{10} X_{26} + \beta_{11} X_{31} + \beta_{12} X_{33}$$
$$+ \beta_{13} X_{34} + \beta_{14} X_{42} + \beta_{15} X_{43} + \beta_{16} X_{44} + \beta_{17} X_5 + \beta_{18} X_{61} + \beta_{19} X_{63} + \beta_{20} X_7 + \beta_{20} X_{82} + + \beta_{22} X_{91} + \beta_{23} X_{92}$$
$$+ \beta_{24} X_{101} + \beta_{25} X_{102} + \beta_{26} X_{104} + \beta_{27} X_{105} \quad \text{.....(3.1)}$$

For age of the eligible women, let

X_{11} =1, if age of the respondent belongs to the age group 10-14

=0, else

X_{12} =1, if age of the respondent belongs to the age group 15-19

=0, else

X_{13} =1, if age of the respondent belongs to the age group 20-24

=0, else

X_{15} =1, if age of the respondent belongs to the age group 30-39

=0, else

X_{16} =1, if age of the respondent belongs to the age group 40-49

=0, else

For geographic region of respondent, let

X_{22} =1, if the respondent is in Chittagong division.

=0, elsewhere

X_{23} =1, if the respondent is in Rajshahi division.

=0, elsewhere

X_{24} =1, if the respondent is in Khulna division.

=0, elsewhere

X_{25} =1, if the respondent is in Barisal division.

=0, elsewhere

X_{26} =1, if the respondent is in Sylhet division

=0, elsewhere

For level of education of respondent, let

X_{31} =1, if the respondent has no education

=0, otherwise

X_{32} =1, if the respondent education is in primary level

=0, otherwise

X_{34} =1, if the respondent education is in higher level

=0, otherwise

For the variable religion, let

X_{42} =1, if the respondent religion is Christianity

=0, otherwise

X_{43} =1, if the respondent religion is Hinduism

=0, otherwise

X_{44} =1, if the respondent religion is Buddhism

=0, otherwise

For the variable current pregnancy, let

X_5 =1, if the respondent is currently pregnant

=0, otherwise

For the variable total number of children, let

X_{61} =1, if the respondents have less than two children

=0, otherwise

X_{63} =1, if the respondents have more than two children

=0, otherwise

For the variable working status, let

X_7 =1, if the respondent is in work other than housewife

=0, if housewife

For the variable expected number of children, let

X_{82} =1, if the expected number of children of respondent is more than 2

=0, otherwise

For the variable access of mass media, let

X_{91} =1, if the respondent listens to radio regularly

=0, if the respondent listens to radio irregularly

X_{92} =1, if the respondent watches TV regularly

=0, if the respondent watches TV irregularly

For the variable involvement in N. G. O, let

$X_{10.1}$ =1, if the respondent involves in Grameen Bank

=0, otherwise

$X_{10.2}$ =1, if the respondent involves in BRAC

=0, otherwise

$X_{10.4}$ =1, if the respondent involves in Mothers Club

=0, otherwise

$X_{10.5}$ =1, if the respondent involves in others organization

=0, otherwise

Here an attempt has been made to examine the relationship between a dichotomous dependent variable (demand for a child) and a set of explanatory variables as selected and discussed earlier. The main feature of the analysis is to identify the factors that affect demand for a child of a respondent that is ever-married women of age 10-49. In order to get the solution of the above problem, a well-known and now-a-days widely used statistical technique (multiple binary logistic regression model) is used.

The regression coefficient β_j can be obtained with the help of maximum likelihood estimation from the log-likelihood function suggested by Cox and is given by

$$Log_e L(\beta_0, \beta_1, \beta_2, \ldots\ldots\beta_k) = \sum_{j=0}^{k} \beta_j t_j - \sum_{i=1}^{n} \log_e \left\{ 1 + \exp\left(Y_i \sum_{j=0}^{k} \beta_j X_{ij} \right) \right\} \ldots\ldots\ldots\ldots (3.2)$$

Where $t_j = \sum_{i=1}^{n} X_{ij} Y_i, j = 0,1,2\ldots\ldots\ldots\ldots k$, and n is the number of respondents.

But we utilize the Computer package SPSS (Statistical Package for Social Sciences) for windows base 10.0 version and the binary logistic regression parameters β_j's were iteratively solved with the help of this package program.

Since the dependent variable Y_i is coded as '1' if the respondent wants one or more children and '0' if the respondent does not want any more, positive coefficient indicates that the respondent is likely to demand one or more children; one the other hand negative coefficient indicates that the respondent does not expect any more. In order to obtain the increment of the

regressor we have calculated odds ratio of the j^{th} regressor which is the anti-log of the j^{th} slop coefficient.

Table: 3.1

Logistic regression estimates of the odds ratios [Exp (β)] of background characteristics of ever-married women of reproductive age 10-49 in Bangladesh: Data from BDHS 1999-2000.

Background characteristics (variable)	Estimated regression coefficient	Odds ratio [Exp (β)]
1. Age		
10-14	2.261 *	9.590
15-19	0.967 *	2.631
20-24	0.443 *	1.558
25-29 r	-	1.000
30-39	-0.750 *	0.472
40-49	-2.688 *	0.068
2. Geographic region (Division)		
Dhaka r	-	1.000
Chittagong	0.402 *	1.494
Rajshahi	-0.244 ***	0.783
Khulna	-0.380 *	0.684
Barisal	-0.057	0.944
Sylhet	0.390 **	1.477
3. Level of education		
No education	-0.014	0.986
Primary level	0.060	1.062
Secondary level r	-	1.000
Higher	0.224	1.251

Background characteristics (variable)	Estimated regression coefficient	Odds ratio [Exp (β)]
4. Religion		
Islam[r]	-	1.000
Christianity	-0.349**	0.705
Hinduism	-1.122**	0.326
Buddhist	0.842	2.321
5. Current pregnancy		
Not pregnant[r]	-	1.000
Pregnant	-2.399*	0.091
6. Number of living children		
Below 2	3.194*	24.374
Exactly 2[r]	-	1.000
Above 2	-1.718*	0.179
7. Working status		
Not working[r]	-	1.000
Working	-0.335*	0.715
8. Expected number of children		
Exactly 2[r]	-	1.000
Above 2	1.943*	6.977
9. Access of mass media		
a) Listen to radio irregularly	-	1.000
Listen to radio regularly	0.151	1.163
b) Watch TV Irregularly[r]	-	1.000
Watch TV regularly	-0.251**	0.778

Background characteristics (variable)	Estimated regression coefficient	Odds ratio [Exp (β)]
10. Involvement in N G O's		
Grameen Bank	0.041	1.041
BRAC	-0.262****	0.769
BRDP[r]	-	1.000
Mothers Club	-0.477	0.620
Others organization	0.032	1.032
Intercept	-1.306*	
-2log likelihood	5536.052	
Cox & Snell R^2	0.511	
Nagelkerke R^2	0.691	
Model χ^2	6270.112	
df	27	

r =Reference category, '*' Significant at P<0.001, '**' Significant at P< 0.01, '***' Significant at P<0.05, '****' Significant at P<0.10

3.6 Empirical results and discussion:

The estimated binary logistic regression model is given by

$$Log_e \frac{\pi_i}{1-\pi_i} = 1.306 + 2.261X_{11} + 0.967X_{12} + 0.443X_{13} - 0.750X_{15} - 2.688X_{16} + 0.402X_{22} - 0.244X_{23} - 0.380X_{24} - 0.057X_{25} + 0.390X_{26} - 0.014X_{31} + 0.060X_{32} + 0.224X_{34} - 0.349X_{42} - 1.122X_{43} + 0.842X_{44} - 2.399X_5 + 3.194X_{61} - 1.718X_{63} - 0.335X_7 + 1.943X_{82} + 0.151X_{91} - 0.251X_{92} + 0.041X_{10.1} - 0.262X_{10.2} - 0.477X_{10.4} + 0.032X_{10.5} \quad \text{.....(3.3)}$$

The logistic regression coefficients of ever-married women for the age group 10-14, 15-19, 20-24, 30-39 and 40-49 are calculated. Considering median age group 25-29 as reference category the regression coefficients of eligible

women corresponding to age group 10-14, 15-19 and 20-24 are 2.261, 0.967 and 0.443 respectively and these are positive in sign, but for the age group 30-39 and 40-49, the coefficients are –0.750 and –2.688 respectively and negative in sign. The results illustrate that the ever-married women under age 30 are likely to demand more children and above age 30 are less likely to demand any more children and the results are statistically significant as compared to the reference age group 25-29. The odds ratio corresponding to the age group 10-14, 15-19 and 20-24 are 9.590, 2.631 and 1.558 respectively. It indicates that the ever-married women of age group 10-14, 15-19 and 20-24 have 9.590, 2.631 and 1.558 times higher risk to demand for additional children than that of age group 25-29 (reference category). On the contrary, the odds ratio corresponding to the age group 30-39 and 40-49 are 0.472 and 0.068 respectively. It indicates that the women of age group 30-39 and 40-49 have (1-0.472)×100=52.8%, (1-0.068)×100=93.2% lower risk to demand for additional children as compared to the age group 25-29. So for achieving the replacement level fertility the family planning program should be strengthened among the ever-married women under age 30.

The regression coefficients of ever-married women under different geographic region are calculated. Considering Dhaka division as reference category the coefficients corresponding to Chittagong and Sylhet division are 0.402 and 0.390 respectively and positive in sign, but for the divisions Rajshahi, Khulna and Barisal the coefficients are –0.244, -0.380 and –0.057 respectively and negative in sign. Except for Barisal division all the results are statistically significant. The odds ratio corresponding to Chittagong and Sylhet division are 1.494 and 1.477 respectively. The results indicate that the

demand for additional children among ever-married women under Chittagong and Sylhet division are 1.494 and 1.477 times higher than that of Dhaka division. On the contrary, the odds ratio corresponding to Rajshahi, Khulna and Barisal division are 0.783, 0.684 and 0.944 respectively. It indicates that the demand for additional children among women under Rajshahi, Khulna and Barisal divisions are (1-0.783)×100=21.7%, (1-0.684)×100=31.6% and (1-0.944)×100=5.6% less than that of Dhaka division. It is evident from data of BDHS 1996/97 that there are regional variations in contraceptive use, with Rajshahi and Khulna divisions having the highest prevalence and Chittagong and Sylhet divisions the lowest prevalence. That is from the data of BDHS 1996/97 the percentage of women currently using any contraceptive methods by the regions of Dhaka, Chittagong, Rajshahi, Khulna, Barisal and Sylhet are 50.4, 39.0, 50.8, 62.7, 59.5 and 21.3 respectively. This result is consistent with that of mine. It may be the impact of ritual sentiment. Therefore, in order to achieve our target the family planning program as well as adult education should be strengthened in Chittagong and Sylhet division.

The regression coefficient of women corresponding to different levels of education is obtained but the coefficients are not statistically significant even except primary level they do not show the expected sign. Considering secondary level of education as reference category, the coefficients corresponding to no education, primary level and higher are –0.014, 0.060 and 0.224 respectively. It is general convention that demand for a child reduces as level of education raises up to secondary level. It is also observed from the data that the overall literacy rate is significantly lower in

Chittagong and Sylhet divisions as compared to other divisions. Data from the world fertility surveys and the demographic and health surveys in Bangladesh and worldwide confirm the positive effect of education on reproductive behavior (Schultz, 1994; World Bank, 1994). Since the results are not consistent as our desire, the economic condition of the respondent should be investigated and a further analysis is required.

The regression coefficients of ever-married women under different religion are computed. In my analysis 87% of the respondent is in the religion Islam and it is evident from data of BDHS 1996/97 that the proportion of women currently using any contraceptive method between Muslim and non-Muslim are 48.6 and 58.5 respectively. That is probability of contraceptive use is higher among non-Muslims than Muslims. Therefore, considering Islam as a reference category the coefficients corresponding to Christianity, Hinduism and Buddhist are –0.349, - 1. 112 and 0.842 respectively and first two are negative in sing. Except for Buddhist the remaining results are statistically significant. The odds ratio corresponding to the religion Christianity and Hinduism are 0.705 and 0.326 respectively. The results indicate that the demand for additional children among women under religion Christianity and Hinduism are (1-0.705) ×100 = 29.5% and (1-0.326) ×100 =67.4% less than that of Islam. The odds ratio corresponding to the religion Buddhist is 2.321 which indicate that demand for children among ever-married women under Buddhist is 2.321 times higher than that of Islam. It may due to the fact that many of the male population among Buddhist are "Bhikku". They are life long bachelor. Also it is observed that the growth rate in many Buddhist countries like China, Japan etc. are negative. So the women among

Buddhist are likely to demand more children for their social security. Though the result is not significant the activities of family planning program should be enhanced among the Buddhist women.

The logistic regression coefficient of currently pregnant women is –2.399 and statistically significant. Non-pregnant women are considered as reference category. The odds ratio corresponding to the coefficient is 0.091. The result indicates that the demand for an additional child is too much lower i.e. (1-0.091) ×100 =90.9% lower among the currently pregnant women than that of non-pregnant women. It may due to complicacy of pregnancy. Therefore the field worker of family planning program should explain the complicacy of pregnancy among the eligible women and discourage them for further issue. The interpretation of the result become more meaningful if is possible to identify the parity at which the pregnancy is occurred. But initially the birth order of living children was not considered in the data. Therefore, further analysis is required.

The logistic regression coefficient corresponding to the total number of children below 2 and above 2 are 3.194 and –1.718 respectively each has expected sign. Also the results are statistically significant. Therefore total number of children exactly 2 is considered as reference category the odds ratios are 24.374 and 0.179 respectively. The results indicate that the eligible women having less than two children are likely to 24.374 times higher as well as the women having more than 2 children are likely to the (1-0.179) ×100=82.1% lawer the demand for additional child than that are prevailing among the women having two children. Therefore, the family planning

program should be strengthened and widely acceptable especially among the women having less than two children. The field worker may explain the positive impact of single child and discourage them for further one. Government has already declared many opportunities for the family of single child.

The logistic regression coefficient of working women other than housewives is –0.335 with expected sign and statistically significant. Here 82% of the respondent is non-working i.e. housewives and non-working women are considered as reference category because it is evident from data of BDHS 1996/97 that the proportion of women currently using any contraceptive method among working and housewives are 56.0 and 46.3 respectively. That is contraceptive use is higher among working women than among housewives. The odds ratio corresponding to the working women is 0.715. The result indicates that the demand for a child among working women is (1-0.715)×100=28.5% less than that among housewives. Also it is evident from the data that the percentage of working women is significantly lower in Chittagong and Sylhet divisions as compared to other divisions though the scope of work is much in those divisions as compared to Rajshahi and Khulna divisions. Therefore, in order to get more effective and fruitful responses from family planning program that is achieving replacement-level fertility female empowerment through education, as well as service is necessary.

The logistic regression coefficient among the eligible women with expected number of children above 2 is 1.943, which is statistically significant. Expected number of children up to 2 is considered as reference category

because for replacement level fertility number of children up to 2 is tolerable. The odds ratio corresponding to the coefficient is 6.977. The result indicates that the demand for additional children among the women with expected number of children above 2 is 6.977 times higher than that among the women with expected number of children up to 2. Therefore, in order to enhance the continual success of family planning program the field worker should identify the women with expected number of children above 2 and motivate them in favor of replacement level fertility.

The regression coefficient of mass media listens to radio regularly and watches TV regularly are 0.151 and -0.251 respectively. But the impact of radio on demand for a child does not show the expected result. The impact of television on demand for additional children has shown the expected sign and statistically significant. In order to identify the positive impact of access to mass media, irregular access to mass media is considered as reference category. The odds ratio corresponding to the media watches TV regularly is 0.778. This result indicates that the demand for additional children among the eligible women who watch TV regularly is (1-0.778)×100=22.2% less than that among the women who do not watch TV regularly. That is women having access to mass media specially television has a statistically lower probability of demand for additional children than those without access. Therefore it should ensure the women have easy access to mass media specially television in rural as well as urban areas. Also family planning program with its positive impact should broadcast in television.

The logistic regression coefficient of eligible women under the activities of N. G. O's Grameen Bank, BRAC, Mothers Club and Others Organization

are 0.041, -0.262, -0.477 and 0.032. The coefficients corresponding to Grameen Bank and Others Organization do not show expected sign and the results are not statistically significant but for BRAC and Mothers Club the coefficient show expected sign and the result corresponding to BRAC is significant. Considering BRDP as reference category the odds ratio corresponding to BRAC is 0.769. The result indicates that the women under the activities of BRAC have (1-0.769)×100=23.1% lower demand for additional children than that obtained from the women under the activities of BRDP. Now there are hundreds of N. G. O's are working in Bangladesh. If it is possible to attach the activities of family planning program with their traditional activities, the replacement level fertility may be achieved soon.

3.7 Measuring the worth of the model:

There are various statistics that have been proposed for assessing the worth of a logistic regression model, analogous to those that are used in linear regression. We examine two of the proposed statistics in the following.

3.7.1 R^2 in logistic regression:

The worth of the linear regression model can be determined by using R^2, but R^2 computed as in linear regression should not be used in logistic regression, at least not when the possible values of Y are zero and one. It is evident that R^2 can be dropped considerably for every misfitted point, so R^2 can be less than 0.9 even for near-perfect fitting. Cox and Wermuth (1992) also conclude that R^2 should not be used when Y has only two possible values, and show that frequently $R^2 \approx 0.1$ when good models are used.

Various alternative forms of R^2 have been proposed for the binomial logit model. Maddala (1983) and Magee (1990) proposed using

$$R^2 = 1 - \left\{L(0)/L(\hat{\beta})\right\}^{\frac{2}{n}} \quad \text{.....(3.4)}$$

with L(0) denoting the likelihood for the null model (i.e., with no regressors) and L($\hat{\beta}$) representing the likelihood function that would result when π_i is replaced by P_i in the following equation

$$g(Y_1, Y_2, Y_3, \ldots\ldots Y_n) = \prod_{i=1}^{n} \pi_i^{Y_i} (1-\pi_i)^{1-Y_i} \quad \text{.....(3.5)}$$

Essentially the same expression, except that $\frac{2}{n}$ was misprinted as $\frac{1}{n}$, was given by Cox and Snell (1989). [Equation (3.4) is motivated by the form of the likelihood ratio test for testing the fitted model against the null model. It can be shown that R^2 as defined in linear regression is equivalent to the right hand side of equation (3.4). Hence, this is a natural form for R^2 in logistic regression.] Since the likelihood function $L(\hat{\beta})$ is a product of probabilities, it follows that the value of the function must be less than 1. Thus, the maximum possible value for R^2 defined by equation (3.4) is $\max R^2 = 1 - \{L(0)\}^{\frac{2}{n}}$. In linear regression $\hat{Y} = \bar{Y}$ is used for the null model. Similarly, in logistic regression we would have $\hat{\pi} = \gamma_1$ for the null model, with γ_1 denoting the percentage of 1's in the data set. It follows that $\max R^2 = 1 - \left\{\gamma_1^{\gamma_1 n}(1-\gamma_1)^{n-\gamma_1 n}\right\}^{\frac{2}{n}}$. For example, if $\gamma_1 = 0.5$, then max R^2=0.75. This is the largest possible value of R^2 defined by equation (3.4). When the data

are quite sparse, the maximum possible value will be close to zero. Therefore, Nagelkerke (1991) suggests that $\overline{R}^2$ be used, with $\overline{R}^2 = R^2 / \max R^2$.

For the above fitted model the Cox and Snell R^2=0.511 and Nagelkerke $\overline{R}^2 = 0.691$. It is observed that when the value of $\overline{R}^2$ exceeds 0.5 the data fit the binary logistic regression model well. Therefore the model can be used for the significance prediction about the demand for a child in Bangladesh.

3.7.2 Correct Classification Rate (CCR):

We may criticize any statistic that is a function of the $\hat{\pi}_i$ when Y is binary. Each $\hat{\pi}_i$ and its closeness to Y_i depends on more than the worth of the model. If our objective is to predict whether a subject will or will not have the attribute of interest, a more meaningful measure of the worth of the model would be the percentage of subjects in the data set that are classified correctly. Accordingly, we will use the correct classification rate (CCR) as a measure of the fit of the model. In order to find the CCR we have the following table.

Table: 3.2

Observed classification table [a, b]

Demand for a child		Predicted		Percentage Correct
		No more	Have another	
Observed	No more	5235	0	100
	Have another	3524	0	0
	Overall percentage			59.8

a. Constant is included in the model b. The cut value is 0.5

Table: 3.3
Predicted classification table [a]

Demand for a child		Predicted		Percentage Correct
		No more	Have another	
Observed	No more	4859	376	92.8
	Have another	616	2908	82.5
	Overall percentage			88.7

a. The cut value is 0.5

If we use 0.5 as the threshold or cut value, we have from Table: 3 CCR=0.89. Since a model that affords better classification should be judged superior by a goodness-of-fit test that indirectly assesses the classification performance of the model. Through classification performance we conclude that our fitted model may be used for prediction.

CHAPTER -FOUR

A comparative study of Ratio and Logit models on Demand for a Child in Bangladesh.

4.1 Introduction:

The fertility decline in developing countries that began in the 1960s and 1970s and that picked up speed in the 1980s continued through the 1990s, according to the recent surveys. Among 38 developing countries including Bangladesh with more than one survey since 1990, the total fertility rate (TFR) fell in almost all. Among the 60 developing countries surveyed since 1990, the total fertility rate varies from 2.3 children per woman in Vietnam to 7.2 in Niger. The average is 4.5 children per woman for these 60 countries as a whole. The trend of TFR in Bangladesh corresponding to the survey periods 1975-76, 1993-94, 1996-97, and 1999-2000 are 6.1, 3.4, 3.3 and 3.3 respectively. Behind fertility declines is the continued increase in contraceptive use, particularly use of modern methods. The United Nations Population Reports estimates that in 2000 about 55% of married women of reproductive ages 10-49 in developing countries were using a contraceptive method. In Bangladesh 39% of women reported initiating contraceptive use when they had fewer than 3 children in 1993-94, the proportion rose to 46% in 1996-97 and to 54% in 1999-2000. Such or more than the above mention level of contraceptive use generally considered to be necessary to achieve replacement- level fertility.

Replacement-level fertility is the fertility rate at which each generation has required number of children to replace it and thus is the level at which the population eventually stops growing. As a global average, every couple should have 2.1-2.5 children. In industrialized countries, where mortality is lower than in most developing countries, the replacement fertility level is a TFR of about 2.1. In developing countries, higher mortality levels, particularly among children, can push replacement level fertility higher. Thus the number is slightly higher than 2 in developing countries to account for infant mortality. Reproduction at this level is called replacement level fertility.

According to The UN Population Report, 75% of developing countries are expected to reach below replacement level-fertility by the year 2050. Bangladesh is not excluded from the report. For the first time, The United Nations Population Division projects that future fertility levels in most developing countries will likely fall below 2.1 children per woman, the level needed to ensure the long-term replacement of the population, at some point in the twenty-first century. By 2050, the medium variant of the 2002 Revision projects that three out of every four countries in the less developed regions will be experiencing below replacement fertility. The medium variant scenario of the United Nations projection indicates that Bangladesh will achieve replacement level fertility around 2025 (UN, 2001).

The rapid decline of fertility, from 6.1 births per woman to 3.3 births, in the last 25 years in Bangladesh is indeed, a historic record in demographic transition. The country is poor and has remained traditional and conservative. Although the extent and rapidity of the decrease in fertility

have been very impressive by international standards, continued fertility decline is desirable, as population crowding, environmental deterioration, massive migration from rural areas to unplanned urban settings, and rapid depletion of resources are becoming acute. However, recent statistics suggest that, despite a continuing increase in contraceptive use, the fertility decline in Bangladesh has stalled. In order to achieve the replacement level fertility it is necessary to identify the impact of specific level of the variables as well as interactions of the selected variables which are influential and significantly affect the aspiration for more children. The target of this chapter is to analyze the demand for additional children using the data of BDHS 1999-2000 where 8781 respondents (eligible women of age 10-49) are used to single out the specific and joint contribution of the determinants. Ratio and Logit, two probable models are used in analyses for comparison.

4.2 Measurement of variables:

4.2.1 Expected Number of Children (Just after marriage):

It is observed that expected number of children (just after marriage) significantly influence women to demand for a child in Bangladesh. So the variable expected number of children is divided into two categories (i) Number of children up to 2 which is indicated by E_1 (ii) Number of children more than 2 which is indicated by E_2. The corresponding levels of the variable are indicated by the dummy variable1 and 2.

4.2.2 Geographic Region:

It is observed in chapter three that demand for a child can vary over different geographic region. The demand is higher among Chittagong & Sylhet

division and lower among Rajshahi & Khulna division as compared to Dhaka division. Therefore the variable geographic region is partitioned into three categories (i) Dhaka & Barisal which is indicated by R_1 (ii) Chittagong & Sylhet which is indicated by R_2 (iii) Rajshahi & Khulna indicated by R_3. The three levels of the variable are indicated by the dummy variables 1, 2 and 3 respectively.

4.2.3 Age of respondent:

It is observed in chapter three that the demand for a child is significantly affected by the age variation of ever married women, which inspired me to include this variable in the analysis. Age of ever-married women are divided into three levels as (i) age group 10-29, which is indicated by A_1 (ii) age group 30-39, indicated by A_2 (iii) age group 40-49, indicated by A_3. The age levels 10-29, 30-39 and 40-49 are indicated by the dummy variables 1, 2 and 3 respectively.

4.2.4 Location:

The respondent's place of residence is divided into two categories (i) the respondents who are living in capital, large city, town etc. i.e. municipal areas are considered as urban indicated by L_1 (ii) the respondents who are living in countryside are considered as rural indicated by L_2. The levels corresponding above two categories are denoted by the dummy variable 1 and 2 respectively.

4.2.5 Demand:

Proportion of respondent aspirant for more children from a particular classification is considered as demand for a child in that classification. Let n_{ijkl} be the total number of respondents in the ith level of expected number of children (just after marriage), jth level of age, kth level of location and lth level of geographic region of which n'_{ijkl} expressed aspiration for more children. Then $Y_{ijkl} = \frac{n'_{ijkl}}{n_{ijkl}}$ is taken as a measure of demand for a child in the (ijkl)th classification.

4.3 Data, Models and Methodology:

It is observed that the factors Age, Geographic Region, Residential Area, Expected Number of Children (just after marriage), etc. are found to significantly affect the demand for a child in Bangladesh. The three levels of variable geographic region are considered as replication in three-way ANOVA. Data from BDHS 1999-2000 is used. Out of 10,544 women 8,781 respondents i.e. eligible women aged 10-49 furnished the required information. The women under sterilization, declared infecund, widowed, divorced etc. are not included in the analysis.

Andrews, Morgan and Sonquist (1967) showed that for multiple classifications, if proportions lie between 0.2 - 0.8, then the variance p (1-p) of the proportion π is approximately constant. In that case they recommended ordinary least square when dependent variable is a proportion. About 70% of the demand proportions lie between this limit. Hence, a multiple regression model with demand proportion as dependent variable

and dummy independent variables defined for each level of each factor and their interactions may be used. Thus the ratio multiple regression model for analyzing demand for a child is defined as

$$Y_{ijkl} = m + a_i + b_j + c_k + (ab)_{ij} + (ac)_{ik} + (bc)_{jk} + (abc)_{ijk} + e_{ijkl} \quad \text{.....(4.1)}$$

$$i = 1,2; \quad j = 1,2,3; \quad k = 1,2; \quad l = 1,2,3;$$

which is a standard three way analysis of variance model with equal number of observations per cell. Here m is a general mean effect, a_i is the effect due to ith level of the factor Expected Number of Children (just after marriage), b_j is the effect due to jth level of the factor Age, c_k is the effect due to kth level of the factor Residential Area, $(ab)_{ij}$, $(ac)_{ik}$, $(bc)_{jk}$, $(abc)_{ijk}$ are the interaction terms and e_{ijkl} is the error term. The above model is assumed to follow all the standard assumptions of ordinary least squares. Cox (1970) and Snell (1970) suggested logit transformation as $\log_e = \frac{\pi_i}{1-\pi_i}$ to use as dependent variable instead of proportion π for ordinary least square estimation when the proportion π varies between 0 and 1. A multiple regression model with logits as dependent variable and dummy independent variables defined as in the previous model may also be used for analyzing demand for a child. Therefore the logit multiple regression models is defined as

$$\log_e \frac{Y_{ijkl}}{1-Y_{ijkl}} = \mu + \alpha_i + \beta_j + \gamma_k + (\alpha\beta)_{ij} + (\alpha\gamma)_{ik} + (\beta\gamma)_{jk} + (\alpha\beta\gamma)_{ijk} + \varepsilon_{ijkl} \quad \text{.....(4.2)}$$

$$i = 1,2; \quad j = 1,2,3; \quad k = 1,2; \quad l = 1,2,3;$$

The parameters of the above model bear usual meaning, mentioned in the earlier model. It is also assumed that this model conforms to least square principles. The data are shown in the following table 4.1.

Table 4.1:

Data showing demand for a child in Bangladesh by level combinations of variables

Expected Number of Children (Just after marriage)	Geographic Region	Age	Demand for a Child 0=No, 1=Yes	No. of respondent		Ratio		Logit transformation	
				Urban	Rural	Urban	Rural	Urban	Rural
1	1	1	0	106	410				
			1	178	561	0.6268	0.5778	0.5185	0.3137
		2	0	77	360				
			1	22	45	0.2222	0.1111	-1.2529	-2.0796
		3	0	36	162				
			1	1	2	0.0270	0.0122	-3.5845	-4.3940
	2	1	0	67	282				
			1	91	328	0.5779	0.5377	0.3060	0.1511
		2	0	73	233				
			1	13	42	0.1512	0.1527	-1.7252	-1.7136
		3	0	27	117				
			1	2	10	0.0690	0.0787	-2.6022	-2.4601
	3	1	0	109	605				
			1	132	747	0.5477	0.5525	0.1914	0.2108
		2	0	77	403				
			1	21	51	0.2143	0.1123	-1.2992	-2.6675
		3	0	27	180				
			1	1	3	0.0741	0.0164	-2.5254	-4.0939
2	1	1	0	15	160				
			1	37	264	0.7115	0.6226	0.9027	0.5006
		2	0	26	210				
			1	10	51	0.2778	0.1954	-0.9554	-1.4153

Expected Number of Children (Just after marriage)	Geographic Region	Age	Demand for a Child 0=No, 1=Yes	No. of respondent		Ratio		Logit transformation	
				Urban	Rural	Urban	Rural	Urban	Rural
		3	0	16	173				
			1	1	6	0.0588	0.0335	-2.7730	-3.3621
	2	1	0	10	186				
			1	44	428	0.8148	0.6971	1.4815	0.8335
		2	0	25	294				
			1	11	85	0.3143	0.2249	-0.7801	-1.2373
		3	0	19	163				
			1	2	6	0.0952	0.0355	-2.2517	-3.3021
	3	1	0	10	161				
			1	36	256	0.7826	0.6139	1.2809	0.4637
		2	0	22	218				
			1	11	30	0.3333	0.1210	-0.6933	-1.9830
		3	0	23	165				
			1	1	5	0.0435	0.0294	-3.0905	-3.4969

4.4 Results and Discussion:

Fitted constants and comparative analysis of variance corresponding to the ratio and the logit models of demand for a child is shown in the following table 4.2. The results are obtained from SPSS version 10.0.

Table 4.2:

Fitted constants and ANOVA table for Age×Expected Number of Children×Residential Area.

Independent variable	Ratio model	Logit model
1. Age (V_1).		
A_1	0.342166	1.929104
A_2	-0.0937	-0.100633
A_3	-0.248442	-1.828467
$SS(V_1)$	2.2510	84.898
d. f	2	2
F-cal	281.5*	876.451*
2. Expected Number of children (just after marriage) (V_2).		
E_1	-.037375	-0.228578
E_2	0.037375	0.228578
$SS(V_2)$	0.05029	1.881
d. f	1	1
F-cal	39.158*	10.936*
3. Residential Area (V_3).		
L_1	0.033758	0.285544
L_2	-0.033758	-0.285544
$SS(V_3)$	0.04103	2.935
d. f	1	1
F-cal	31.947*	17.066*

Independent variable	Ratio model	Logit model
4. Interaction ($V_1 \times V_2$).		
$SS(V_1 \times V_2)$	0.02741	0.251
d. f	2	2
F-cal	10.672*	0.730
6. Interaction ($V_1 \times V_3$).		
$SS(V_1 \times V_3)$	0.008187	0.196
d. f	2	2
F-cal	3.187***	0.569
7. Interaction ($V_2 \times V_3$).		
$SS(V_2 \times V_3)$	0.006992	0.107
d. f	1	1
F-cal	5.444**	0.621
8. Interaction ($V_1 \times V_2 \times V_3$).		
$SS(V_1 \times V_2 \times V_3)$		
d. f	0.002747	0.123
F-cal	2	2
	1.069	0.357

* indicates p<0.01, ** indicates p<.05, *** indicates p<.10

For ratio model $R^2 = 0.987$ and $\overline{R}^2 = 0.981$, for logit model $R^2 = 0.956$ and $\overline{R}^2 = 0.936$.

It is evident from the analysis that main effects for Expected Number of Children, Age and Residential Area are statistically significant for both the models. Two factor interaction effects for Expected Number of Children

(just after marriage) × Age, Expected Number of Children (just after marriage) × Residential Area and Age× Residential Area are statistically significant for ratio model but insignificant for logit model. The three factor interaction is insignificant for both the models. In order to analyze the data the regional effects (geographic region) are considered as replication. Also it is observed that demand effect is positive in chittagong and sylhet division as compared to other divisions for both the models. Including all effects, sum of squares explained are 98.7 and 95.6 percent respectively for the ratio and logit models respectively. Of the total variation in demand, 93.05, 2.08, 1.70 and 1.87 percent are explained respectively by Age, Expected Number of Children, Residential Area and their various interactions in the ratio model. The corresponding figures for logit model are 89.82, 1.99, 3.11 and 0.72 percent.

As indicated by paired t-test, all the levels of Age, Expected Number of children, Residential Area differs from each other significantly with respect to demand for both the models. At each level of Age demand decreases with increasing age. Whereas within each level of Expected Number of Children (just after marriage), demand increase with increasing level of expected number of children. But for the Residential Area, it is observed that demand is higher among the urban women with respect to rural women. It may due to the fact that urban women start childbearing later than rural women; the median age at first birth is 19.0 for urban women and 17.8 for rural women, which probably reflects longer education and later marriage of women in urban areas. The total fertility rate still higher in rural areas (3.5 children per woman) than in urban areas (2.5 children per woman). It is also noted that

there has been a tremendous growth of urban infrastructure in the country including roads, commercial places, housing and others and most of its labor forces are from slam dwellers. The demand for a child is higher among slam couples. Therefore, the size of the urban population grew by 5 percent annually compared to 1 percent rural population growth. As a result, in 1997, 20 percent of the population lived in urban areas, as compared to 13 percent in 1985.

In order to achieve replacement level fertility the results are intended for use by program manager and policy makers to evaluate and family planning program should be strengthened and widespread among the women under age 30 and the women who have expected number of children is more than 2 are motivated and explain them that more and more people in the world want smaller families and importance of standard family norm for replacement level fertility.

CHAPTER -FIVE

Influence of Sex Preference on Demand for a Child in Bangladesh

5.1 Introduction:

In 1992, China held an "International Seminar on China's 1990 Population Census," at which many foreign scholars and a group of Chinese scholars presented papers on the 'missing girls' problem seen in China's 1990 census and previous enumerations and surveys. From these papers came the growing awareness that the death of girls in cohorts of children was not just a Chinese problem, but was an increasing phenomenon in other countries of East Asia as well as South Asian countries (Banister, 1994). Therefore, Chinese and foreign scholars proposed that the United Nations should sponsor an Asia-wide symposium on the ever-worsening imbalance between the number of boys and girls and the causes and possible solutions to this perceived problem. After some location problems and postponement until after "The International Conference on Population and Development" (Cairo, September 1994), the "International Symposium on Issues Related to Sex Preference for Children in the Rapidly Changing Demographic Dynamics in Asia" was held in Seoul, South Korea, in November 1994. It was sponsored by the United Nations Population Fund and the Government of the Republic of Korea, and hosted by the Korean Institute of Health and Social Affairs (KIHASA). The sponsors invited scholars and a few officials

from South Korea, Mainland China, Taiwan, India, Sri Lanka, Pakistan, Bangladesh, Thailand and Indonesia. A paper from Vietnam was later added.

In the symposium some countries of Asia including Bangladesh exhibit very strong son preference (Chaudhury, 1994; Alam and Bairagi, 1994). The decline in the total fertility rate (TFR) of Bangladesh from more than six lifetime births per woman in the mid-1970s to slightly more than three births per woman in the early 1990s is remarkable. But total fertility rate remained relatively static (3.3) in Bangladesh between 1993 and 2000. In the past, the generalization has been made that strong son preference would slow fertility decline or prevent fertility from falling as low as it might otherwise go. But the papers presented in the symposium confirm that some areas, in spite of very strong son preference, have achieved fertility at or below replacement level such as South Korea, Taiwan, Mainland China and that other areas now experience rapid fertility decline in spite of strong son preference such as North India, Vietnam (Leete, 1994) where sex selective abortion is very common. Evidence suggests that couples in Bangladesh would definitely like to have one son but not more than that, an observation suggesting that son preference should not greatly slow fertility decline (Chaudhury, 1994). But this observation is controversial and it seems that there is negative impact of sex preference on fertility decline. Because in Bangladesh induced, abortion is illegal except to save the life of a pregnant woman.

Looking at the number of male live births per 100 female live births (sex ratios at live birth) is often an appropriate way to assess whether there is son (or daughter) preference in a certain country. There are variations across countries in sex ratios at birth but in general sex ratios at birth range between

103 and 108 in developing countries and between 104 and 107 in developed countries. This means that for every 100 female babies born, there are about 103 to 108 male babies that are born. The fact that there are more male births than female births is biological (Waldron, 1998). However, if the sex ratio at birth is much higher than the expected rate, we can suspect that non-biological factors are contributing to the abnormally high ratio. One of these factors is the use of prenatal sex screening technologies followed by sex selective abortion due to couple's preference for sons. The evidence is sustained of the case of China, Korea and Taiwan. China, Korea and Taiwan are particularly known to have strong son preference. But in Bangladesh such prenatal sex screening technologies are far beyond the reach of rural couples. Also there is so far no convincing evidence of substantial use of prenatal sex detection followed by abortion of females.

A number of recent studies have documented evidence to show that couples have a decided preference for a particular sex combination of children. For example, in many south Asian countries, including Bangladesh there is a strong preference for sons over daughters. In fact, son preference has been considered to be one of the factors responsible for the high fertility in these countries and it is argued that such gender preferences for children may act as a major constraint in the implementation of family planning programs, particularly in countries which are beginning to experience a fertility transition.

The impact of gender preference on fertility has usually been investigated by examining data relating to the sex composition of living children of couples who do not want any more children, the assumption being that if son

preference has an impact on fertility, couples who have sons are much more likely to not want more children and to practice contraception. Such an impact has been documented and empirically demonstrated in several south Asian countries. Some of the earlier studies (before 1990) conducted in Bangladesh did not find any association between son preference and higher fertility. The recent surveys conducted in Bangladesh found that the desire for additional child was largest among couples who had daughters only. In another study from Bangladesh, Jordan and India, Repetto (1972), observed that the fertility decisions of couples were not fully influenced by the desire to have sons. One the contrary, they were motivated by the economic advantages associated with having children, regardless of their sex. Finally sex preference is thought to be one of the reasons for plateauing of fertility.

Most fertility surveys, which seek to measure the demand for a child and gender preference are confined to currently married women and hence assume that the women response reflects the preference of the couple. Previous research on sex preferences for children reveals that couples who have more sons among their surviving children are more likely not to desire additional children (knodel and prachuabmoh, 1976; Park, 1978; Malhi, 1993; Rahman and Da Vanzo, 1993; Pong, 1994; Malhi and Sing, 1995). Son preference has also been reported to be an important reason for use of prenatal sex identification tests and sex specific abortions (Pandhya, 1988; Yi et all, 1993).

Although most studies conducted in south and East Asian countries indicate a general preference for sons over daughters, many investigators have noted a co-existing preference for a daughter among couples with several sons. For

example, Chowdhury and Bairagi (1990) found in Bangladesh among couples with three or four living children, those with no living daughter were more likely to have an additional birth than those who had a living daughter.

The literature suggests that in a society with a strong preference for boys, couples with more girls would continue childbearing till they have achieved their desired number of male children. In the past, however, not much empirical evidence was available to support this contention. Arnold (1985, 1987) developed a quantitative method to estimate the impact of sex preference on fertility behavior and applied the method on collected data during 1965-84 from 22 countries all over the world. Arnold (1987) found that the proportion of respondents who did not want more children would increase on an average by 4.5 percentage point in the absence of gender preferences.

5.2 Types of sex preference and where they are observed:

Gender preference for children can be classified into three types: son preference, daughter preference and preference for balance in the number of sons and daughters. The most common preference in developing countries is to have at least one son and a daughter (balance preference). In general, son preference is widespread in countries in North Africa, Middle East, South Asia and East Asia (Arnold, 1997). Daughter preference is not very common but has been observed in some matrilineal societies (Williamson, 1976). In Bangladesh such type of matrilineal society is observed in the north-eastern tribal 'Garo'. It is noted that daughters are the successors of the properties and liabilities of the 'Garo'family. So daughter preference may prevail among the tribal Garo.

5.3 Why sex preference?

Different people have different reasons for wanting a child of a particular sex. Arnold and Kuo (1984) and Arnold (1997) have identified some of these reasons as follows –

Reasons for wanting sons:

- Continuity of the family name
- Financial and practical help
- Companionship, especially for fathers
- Old age support (Financial)

Reasons for wanting daughters:

- Need help with house work or childcare
- Companionship, especially for mothers
- Old age support (Emotional)

5.4 Sex preference and fertility: what is the link?

Scholars are concerned that sex preference for children may produce negative demographic consequences in many developing countries. One of their major concerns is that sex preference can be an obstacle to fertility decline if couples continue to have children until they have a child of a certain sex. The impact of sex preference on fertility behavior in fact appears to be different between societies where small family size has become the norm and where larger family sizes are still the norm. The case from China, Korea and Bangladesh seem to be good examples of the consequences of sex preference on fertility behavior in two distinct settings.

5.4.1 The case of China and Korea (Low fertility):

Despite the prevalence of a strong desire for sons, China and Korea were successful in reducing their fertility. Both countries now have a total fertility rate below the replacement level and have small family norms. However, as couples began to restrict family size they became more conscious about having a child of the right sex at earlier births. This phenomenon led to the increase in sex ratio at birth and altering the natural sex ratio (Park and Cho, 1995).

5.4.2 The case of rural Bangladesh (High fertility):

Researchers have found that in rural Bangladesh, people have a strong preference for several sons and at least one daughter (Muhuri and Preston, 1991; Rahman et al. 1992; Rahman and Davanzo, 1993). Since couples may continue having children until they have the preferred sex composition of children, rural Bangladesh may sustain high fertility.

5.5 Data and Methodology:

Bangladesh is one of the economically backward countries with a minimum per capita income in the south Asia. Although income levels have been increasing for the last two decades with the help of domestic output, foreign aid and continuous development works of NGO's.

With regard to the status of women gender inequalities with respect to access to education, employment and health care are very pronounced. Although the female literacy rate has been steadily, increasing over the last two decades, it remains still markedly lower than the male literacy rate.

Bangladesh Demographic and Health Survey 1999-2000 data are used in this study. The ever-married women aged 10-49 are considered here. The sample comprises 8782 respondents out of 10,544 eligible women. The respondents under sterilization, divorced, widowed etc. are excluded from the sample because they are not able to bear any more children. In order to find the differentials of sex preference on demand for a child the background characteristics place of residence, religion and level of educations of respondents are considered. In the sample 6154 respondents are in rural areas and 2628 respondents are from urban areas according to their place of residence. 7655 respondents are from Muslim and 1127 are from non-Muslim according their religion. 6068 respondents are from below secondary level and 2714 are from secondary and higher according to their level of education.

Cross tabulation of data pertaining to the demand for an additional child with the number of living sons and living children was done for rural & urban, Muslim & non-Muslim, Below secondary & secondary and higher level of education according to the selected background characteristics and examined to see whether the sex composition of surviving children influences future fertility intentions. Further, in order to compare the mentioned background characteristics on sex preference an attempt was made to quantify these preferences by using the techniques proposed by Chang et al. and Arnold. The method of Chang et al. can be used to compute son preference and desire for balance ratios for respondents with two or more living children. In this chapter, these ratios were computed for respondents with two living children only who demand no more children because in Bangladesh two children is still standard family norm. The son

preference ratio was obtained by dividing the percentage of respondents with two sons who did not want any more children by the percentage of respondents with two daughters who did not want any more children. The desire-for-balance ratio was computed by dividing the percentage of respondents with two children of the opposite sex who did not want any more children by the percentage of respondents with two children of the same sex who did not want any more children. In my study, percentage of respondents having two daughters is used for balance ratio.

In order to quantify the overall impact of sex preference for children on fertility and family planning behavior, the method assumes that in the complete absence of gender preferences, at any given parity all the couples, would behave in a similar fashion as those at the same parity who were most satisfied with the current sex composition of their children, that is, at the maximum rate within that parity. This technique is fairly flexible and can be used with a fertility and family planning measures. In the present study, it was used to calculate the impact of sex preference on the demand for additional children.

Table 5.1: Percentage distribution of currently married women aged 10-49 not demanding any more children by parity and sex of birth order of children.

Parity	Birth order			% of respondents who did not demand any more children	Number of respondents not demanding any more children	Difference between proportion of respondents having all sons and all daughter	Total no. of respondents and overall % of respondents not demanding any more children
	1	2	3				
2	Male	Male	-	65.6	366	0.161*	2059 (69.7)
	Female	Male	-	79.1	408		
	Male	Female	-	80.0	455		
	Female	Female	-	49.5	206		
3	Male	Male	Male	81.0	149	0.199*	1486 (85.1)
	Female	Male	Male	92.6	187		
	Male	Female	Male	92.6	176		
	Female	Female	Male	82.8	140		
	Male	Male	Female	94.7	178		
	Female	Male	Female	85.1	143		
	Male	Female	Female	86.7	189		
	Female	Female	Female	61.1	102		

* indicates significant at $p < 0.01$

Source: BDHS data 1999-2000.

Table 5.1.1: Percentage distribution of currently married women aged 10-49 not demanding any more children by sex of the last child at 2nd and 3rd parity.

Parity	Sex of the last child.	Percentage of respondents not demanding any more children.	Number of respondents.	Difference between proportion having last child male and female.	Total number of respondents not demanding any more children.
2	Male	53.9	774	0.078*	1435
	Female	46.1	661		
3	Male	51.6	652	0.032	1264
	Female	48.4	612		

* indicates significant at $p < 0.01$

Source: BDHS data 1999-2000.

Table 5.2: Percentages of female respondents corresponding to the selected background characteristics, not wanting additional children by the number of living children.

Number of living children	Percentage of respondents not demanding additional children									
	Bangladesh	Types of place of residence		Difference	Religion		Difference	Educational level		Difference
		Rural	Urban		Muslim	Non Muslim		Below secondary level	Secondary and higher level	
0	05.2	04.8	06.1		05.4	04.2		05.2	05.3	
1	19.2	17.2	23.1		18.2	25.1		19.2	19.1	
2	69.7	66.4	76.6	10.2*	66.9	84.0	17.1*	65.7	76.9	11.2*
3	85.1	84.1	87.5		83.9	92.8		83.7	89.8	
3+	95.9	95.3	97.8		96.0	95.8		95.8	96.7	

* indicates significant at $p<.01$

Source: BDHS data 1999-2000.

Table 5.3: Percentages of female respondents corresponding to the selected background characteristics, not wanting additional children by number of living children and living sons.

No. of living children	Percentage of respondents not demanding additional children										
	No. of living sons	Bangladesh	Types of place of residence		Difference	Religion		Difference	Educational level		Difference
			Rural	Urban		Muslim	Non Muslim		Below secondary level	Secondary and higher level	
0	0	05.2	04.8	06.1		05.4	04.2		05.2	05.3	
1	0	17.8	16.5	20.6		17.5	20.2		18.5	17.0	
	1	20.4	17.9	25.4		18.9	29.2		19.9	21.1	
2	0	48.4	42.4	62.6	20.2*	45.2	64.7	19.5*	42.5	59.3	16.8*
	1	80.1	77.8	84.7	06.9**	77.5	92.8	15.3*	77.8	84.1	06.3*
	2	65.0	62.6	69.9	07.3***	62.1	80.7	18.6*	59.4	75.4	16.0*
3	0	61.1	58.7	67.4		60.3	65.4		59.6	67.7	
	1	85.2	83.5	88.8		83.5	95.0		84.2	87.8	
	2	93.5	93.2	94.5		92.6	100.0		92.2	98.4	
	3	79.4	78.5	81.5		77.7	94.4		77.5	86.5	
3+	0	77.6	79.2	73.9		80.0	63.6		78.3	75.0	
	1	94.8	93.5	99.0		94.4	98.0		94.5	96.8	
	2	96.5	95.8	98.8		96.5	97.0		96.3	98.1	
	3	97.7	97.4	98.7		97.7	98.1		97.6	98.6	
	3+	96.7	96.0	99.0		96.7	96.9		96.6	97.8	

* indicates p<.01, ** indicates p<.05 and *** indicates p<.10

Source: BDHS data 1999-2000.

Table 5.4: Son preference and desire for balance ratio of the selected background characteristics with two children.

Characteristics	Bangladesh	Types of place of residence		Religion		Educational level	
		Rural	Urban	Muslim	Non Muslim	Below secondary level	Secondary and higher level
% of respondents having two sons and not wanting another child	65.0	62.6	69.9	62.1	80.7	59.4	75.4
% of respondents having one son & one daughter and not wanting another child	80.1	77.8	84.7	77.5	92.8	77.8	84.1
% of respondents having two daughters and not wanting another child	48.4	42.4	62.6	45.2	64.7	42.5	59.3
Son preference ratio	1.34	1.48	1.12	1.37	1.25	1.40	1.27
Desire for balance ratio	1.23	1.24	1.21	1.25	1.13	1.31	1.12

Source: BDHS data 1999-2000.

Table 5.5: Effect of sex preference on demand for additional children

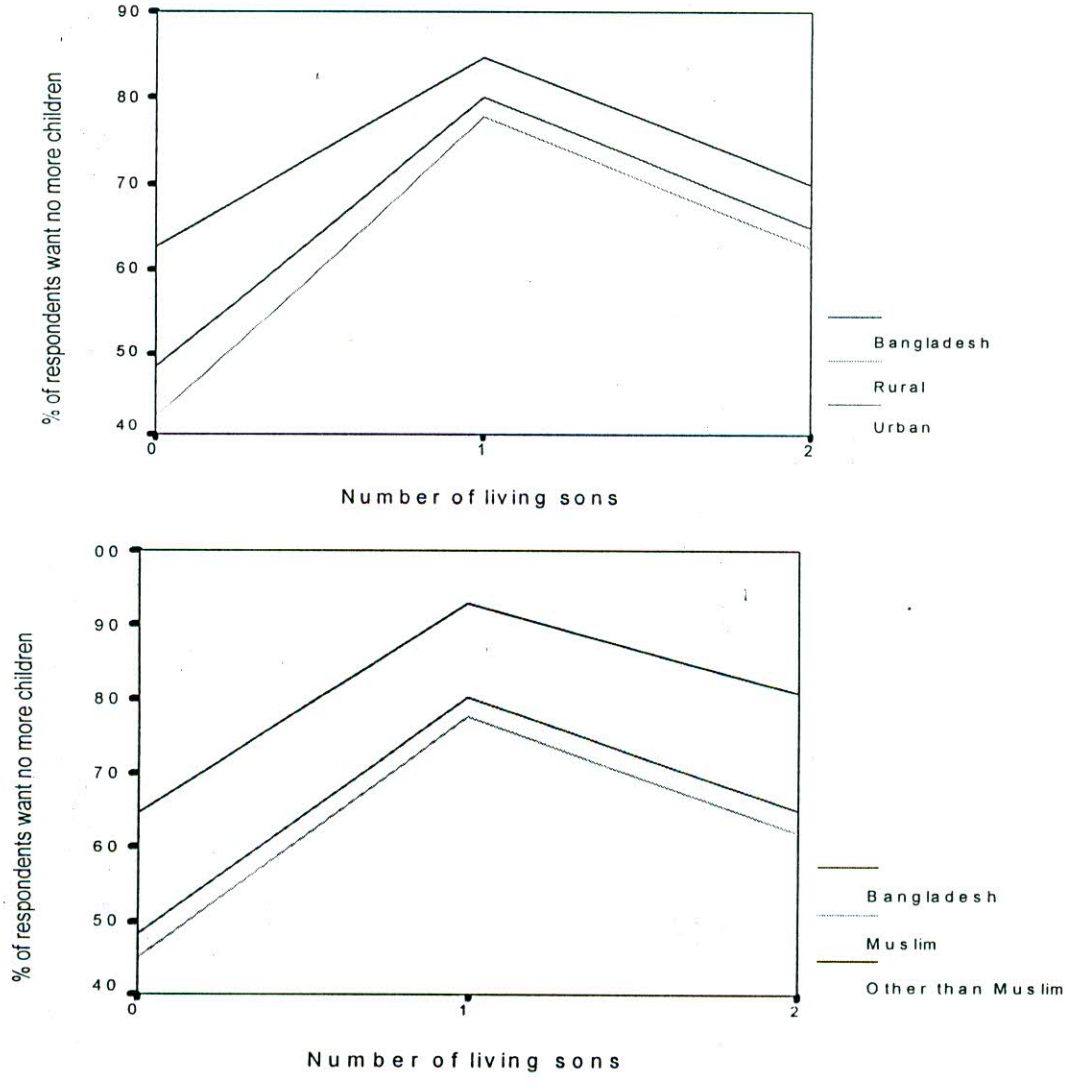
Characteristics		% of respondents having two children want no more children		Difference Col. 2- Col. 1	[1] Risk ratio Col. 2 / Col. 1
		Actual (Col. 1)	In absence of sex preference (Col. 2)		
Bangladesh		69.7	80.1	10.4*	1.15
Types of place residence	Rural	66.4	77.8	11.4*	1.17
	Urban	76.6	84.7	8.1*	1.11
Religion	Muslim	66.9	77.5	10.6*	1.16
	Non Muslim	84.0	92.8	8.8**	1.10
Educational level	Below secondary level	65.7	77.8	12.1*	1.18
	Secondary and higher level	76.9	84.1	7.2**	1.09

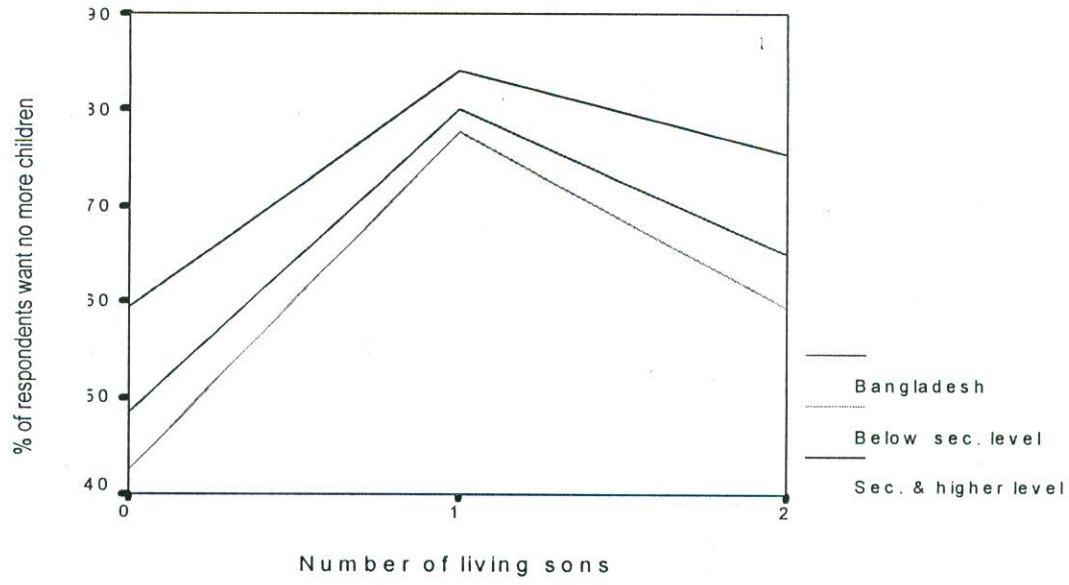
* indicates p<.001, ** indicates p<.025

Source: BDHS data 1999-2000.

[1] Risk ratio: The risk ratio takes on values between zero and infinity. One is the neutral value and means that there is no difference between the groups compared, close to zero or infinity means a large difference between the two groups on the variable concerned. A risk ratio larger than one means that group 1 has a larger proportion than group 2. If the opposite is true the risk ratio will be smaller than one.

Fig. 5.1: Comparison of % of respondents at parity 2, not wanting additional children by no. of living sons under selected background characteristics





5.6 Results and Discussion:

Within any parity, the combination of sons and daughters associated with a relatively higher percentage of respondents who did not want more children was interpreted to mean that the respondents had achieved their preferred sex composition of children i.e. there is no sex preference or absence of sex preference. If son preference were to affect the demand for additional children then, within any parity, those with one or more sons would be more likely not to want more children as compared to those who did not have any son. Conversely, if the desire for a balance sex composition was to affect fertility, within a given parity, respondent who had either all sons or all daughters would be more likely to want additional children as compared to those who had children of both sexes. Since the family planning program in Bangladesh still actively advocates a two-child family norm, an examination of sex preferences for children among couples who currently had two

children i.e. parity two was used to assess son preference and desire for balance ratios.

In the table 5.1, at parity two, there are 69.7 percent respondents (1435 respondents among 2059) not demanding any more children. In that parity, 66% respondents having two sons do not demand any more children corresponding to 50% respondents having two daughters. The difference between two proportions is statistically significant. About 80% respondents having balance sex composition of children do not demand any more children. Similarly, at parity three, 85.1% respondents (1264 respondents out of 1486 respondents) do not demand any more children. According to the birth order and its corresponding sex of children the percentages are shown in table 5.1. We investigated whether respondents demand behavior was sex-determined by analyzing the sex and birth order of children born to the 1435 and 1264 women at parity two and three respectively who do not demand any more children. From the table 5.1.1 the proportion of women who do not demand any more children whose last child was a boy was much higher than that of such women whose last child was a girl (54% vs. 46% at parity two and 52% vs. 48% at parity three). The contrast between women with all sons and those with all daughters 26% (366/1435) vs. 14% (206/1435) at parity two and 12% (149/1264) vs. 8% (102/1264) at parity three. At parity two, the difference is statistically significant. The results shown in table 5.1.1 is particularly striking. However, sizable proportions of women having families with one son and one daughter, showing that some couples prefer a balance composition of sex of children. The results obtained from table 5.1 and table 5.1.1 suggest that demand behavior is strongly driven by son preference as well as balance sex composition of children.

Table 5.2 presents a percentage distribution of female respondents corresponding to the selected background characteristics not wanting additional children by the number of living children. From the table, within each parity it is clear that the demand for additional children is higher among rural women than that of urban women. At parity two i.e. the women having two children, 33.6% rural women want additional children as compared to 23.4% in urban women and on the average 30.3%women want additional children in Bangladesh. The difference between proportions of rural and urban women about their demand for additional children is statistically significant. The higher demand among rural women as compared to urban women may due to the fact that rural women are comparatively more economically dependent on their male family members and they will be motivated to want a larger number of children, especially sons, who are perceived as an insurance against the risks of divorce, widowhood and old age. On the contrary, the life style is complicated to bear and rear the children in urban areas as compared to rural areas. So in spite of having son preference the couples of urban areas restrict their child bearing as soon as possible than the rural couples.

For the background characteristics religion, at parity two, 33.1% of the Muslim respondents demand for additional children as compared to 16% non-Muslim respondents. The difference is statistically significant. The higher demand for additional child among Muslim respondents as compared to non-Muslim women is due to the belief that family planning program to restrict childbearing is against the spiritual ideology. Such spiritual ideology is limited among the non-Muslim respondents.

For the background characteristics educational level, at parity two, 34.3% respondents having below secondary level education want additional children as compared to 23.1% respondents having secondary and higher level of education. With the help of t-test, introduced by SISA (Simple Interactive Statistical Analysis) dictates that the difference is statistically significant. This higher demand among the less educated women is because, they are not enough conscious about the family planning program and its positive impact on society. Also such less educated respondents are fully dependent on their male children with respect to future financial support, investment and shelter as compared to the more educated respondents.

Table 5.3 clearly indicates a significant evidence of son preference both among rural and urban women. For instance, at parity two, both rural and urban women who did not have a son may want a son, while the desire for a daughter is fairly muted even among those who did not have a daughter. Further, the desire for a second daughter was virtually non-existent. This tendency is true in the other selected background characteristics. Son preference is observed among the respondents irrespective of their religious identity and level of education but it is comparatively lower among the non-Muslim and with moderately higher level of education. An examination of table 5.2 and 5.3 depicts that demand for additional children decreases with increasing number of survival children irrespective of residence, religion and level of education. Statistically significant difference in demand between rural &urban, Muslim & non-Muslim and levels of education are observed at parity two. It is evident from table 5.3 that at parity two and above, demand for additional children is directly proportional to the number of daughter. Alternately, the percentage of respondents not demanding additional

children increases with the number of surviving sons. The comparisons are done with the help of line diagram for selected background characteristics (figure5.1). The results indicated that among rural women with two children, those who had sons only were approximately 1.5 times as likely, as those who had daughters only to want no more children. In comparison, only 1.12 times among urban women wanted to terminate childbearing after two children if both children were sons as compared to those who had two daughters. Although, the desire for balance ratio was slightly higher for rural women than for urban women. The difference between the respondents under rural & urban, Muslims & non-Muslims and below secondary & secondary and higher level of education was not as pronounced as can be seen from table 5.4. The results of son preference ratios and desire for balance ratios are summarized in table 5.4

The overall impact of gender preferences for children on demand for additional children was quantified by the technique due to Arnold. The results from table 5.5 indicates that when gender preferences would be eliminated, the percentage of respondents who did not want more children would be increased approximately by 10% in Bangladesh (11.4% for rural women and 8.1% for urban women, 10.6% for Muslim women and 8.8% for other than Muslim women, 12.1% for below secondary educational level and 7.2% for secondary and higher level of education). Also evidence of sex preference for selected background characteristics is statistically significant. The significance test is performed with the help of 't'test. Here paired't' test was appropriate but for paired't' test, the data are not matched because the absence of sex preference is calculated hypothetically under some assumptions. In the last column of table 5.5 risk ratios are calculated for the

selected background characteristics as well as for Bangladesh. At parity two, the risk ratio about the demand for an additional child in Bangladesh is 1.15. It can be explained as, if sex preference for children is absent among the couples, 15% more respondents will be included with the respondents who do not want more children. Since sex preference is prevailing in our society, 15% respondents having two children are likely to take risk to achieve their preferred sex composition of living children. The risk ratio is higher among rural women than urban women. It is higher among Muslim respondents than non-Muslim respondents. Also risk ratio is higher among respondents with below secondary educational level as compared to secondary and higher level of education.

The results of present study clearly indicate that in Bangladesh son preference is still present and, as such, the fertility behavior of the respondents is influenced by a strong desire to acquire a minimum number of surviving sons in the family. Also it is argued by many population experts that further reduction of fertility is unlikely without considerable reduction in the desire of male children or sex preferences. Moreover, since women exhibit an evidence of desire for sons, remedial measures related to improving women's status in society, would be one way of hastening the erosion of prevailing social norms which supports and sustain son preference in Bangladesh. So policy makers thus need to find how to bring down son preference.

CHAPTER -SIX

Influence of sex preference on demand for a child and its consequences on contraceptive use in Bangladesh.

6.1 Introduction:

Since the Cairo International Conference on Population and Development in 1994, and the Beijing conference on women and the girl child in 1995, gender equality has been a priority area of demographic research. In the South Asian context, researchers have estimated that there are millions of women "missing" from the population, leading to an unusually high ratio of males to females. Sex preference is generally viewed as a socially determined bias. In a patriarchal society, couples prefer to raise a child who has the culturally accepted characteristics, status and economic potential associated with the male gender. This preference often influences behavior and may result in gender biases that negatively affect girls and women's welfare, health and survival. This preference may lead to discrimination. Sex preference influences not only discrimination and excess mortality but also demographic transition. Through the postponement of stopping behavior until the birth of a son, sex preference may exert its strongest effect on fertility during the intermediate stage of demographic transition, thereby, slowing fertility decline.

Reproductive intentions and behavior in many developing countries are strongly influenced by the sex of the offspring. Parental preferences for sons over daughters have been documented in several countries throughout the

world (Freedman and Coombs, 1974; Williamson, 1976; Cleland, Verrall and Vaessen, 1983). Especially son preference is commonly believed to be widespread in South Asia and in many developing countries, particularly where women are economically and socially dependent on men (Bairagi and Langsten, 1986; Arnold and Kuo, 1984; Cleland and others, 1983; Vlasoff, 1990). Empirical evidence from the analysis of the Demographic and Health Survey (DHS) data from 57 countries by Arnold shows that son preference remains particularly strong in South Asian countries and Bangladesh has the highest ratio of preference for sons over daughters. Sons are generally preferred over daughters owing to a complex economic and socio-cultural structure of the society. Sons are very highly prized because sons contribute more than daughters to family income, provide adequate support in old age to their parents, can perform funeral rituals and impose less of a financial burden and carry forward family name (Nag, 1991; Ali, 1989). On the other hand, the birth of a daughter is seen as bringing neither "benefit" nor "prestige" to the family. Daughters are often considered as an economic liability because of the dowry system as well as the high cost of weddings. Once married, daughters become physically and psychologically isolated from their parental home and are seldom seen as making significant contribution to their parental family (Chowdhury, 1994). Thus, when the net utility of having a son outweighs that of having a daughter, parents are likely to prefer sons to daughters and may be reluctant to stop childbearing until their desired number of sons has been achieved.

Preference for sons is especially salient in South Asia, East Asia, North Africa and some parts of Middle East. There is very little preference for sons in the developed countries or in Latin America where a preference for a

balanced number of sons and daughters is more common. In fact, several investigators have argued that preference for male children helps to sustain high fertility and is likely to act as a potential obstacle to rapid fertility decline. Rahman and Da Vanzo (1993) have argued that if couples desire to have one or more sons, then they might have larger families than would otherwise be the case, which could create a significant barrier to future fertility decline in many developing countries. Evidence suggest that couples in Bangladesh would definitely like to have one daughter but not more than that, an observation suggesting that son preference should not largely slow fertility decline (Chowdhury, 1994). Research shows that the women of Bangladesh want at least two sons, perhaps to ensure against the risk of loosing the only son to death, or to provide old-age security to their widowhood (Kabir and others, 1994). Although the common preference is for sons, there is evidence that parents may prefer to complete their families with a daughter (Mannan, 1988; Rahman and others, 1992). Das (1989) has claimed that the desire for at least one son and one daughter, and the tendency to continue child bearing until the desired minimum has been attained would increase the total fertility rate and crude birth rate in the population by 36 to 38 percent compared with what would happen if family size were limited to two surviving children regardless of their sex. Thus, when parents have a strong preference for a child of one sex, the sex composition of the children that they already have could influence their decision about whether or not to have another child.

Although strong preference for sons is often assumed to be a significant barrier to fertility reduction, no consistent association has been observed between the sex composition of the children and fertility regulation. The

associations are varied, for example, in cross-national settings among developing countries, Repetto (1972) concluded that fertility decisions are less influenced by sex preference and more by the costs and benefits involved with a child. Studies in India and Pakistan in the period 1960-1970 provide no clear evidence that son preference significantly affects fertility (De Tray, 1984; Mukherji, 1977). In Sri Lanka, De Silva (1993) argued that son preference has proven to be no substantial obstacle to achieving significant fertility decline. According to Arnold, the effect of sex preference would translate into a very small increase in the average number of children wanted. The author argued that the relatively small effect was due to the random biological process, which ensures that most couples would achieve their goal for a minimum desired number of sons and daughters early in their reproductive career by sheer biological chance. Therefore, at any given time there would be only a small proportion of couples who would motivate to have more children than they would have had without sex preferences. It is noteworthy, however, that the estimated effect was formed to be the highest in countries known to have strong son preference, i.e. India, Nepal and Korea. Evidence further indicates that despite strong preference for male children, several Asian countries like Taiwan, South Korea and China have experienced substantial fertility decline (Arnold and Liu, 1986; Chang, Freedman and Sun, 1981). However, analyzing data from a cohort study in Pakistan, Hussain and others (2000) showed that the sex of surviving children is strongly associated with subsequent fertility and contraceptive behavior. Also, recent Indian data have shown that the sex composition of children in the family affects subsequent fertility behavior (Arnold and others, 1998).

Analyzing national level survey data from Bangladesh for the years 1969-1979, Amin and Mariam (1987) concluded that son preference has a negative effect on contraceptive use regardless of socio-economic and demographic characteristics. However, the effect of son preference on fertility was not evident during the early 1990s; it was estimated that fertility would be reduced by 4-8 percent if there were no gender preference in the country (Chowdhury and Bairagi, 1990). When couples have had one or more sons they are more likely to accept contraception (Bairagi and Langsten, 1986; Amin and Mariam, 1987; Malhi and Singh, 1994; Malhi, 1995). Having sons not only motivates parents to accept contraception but also reinforces its continuation (Gadalla, McCarthy and Campbell, 1985; Rajaretnam and Despande, 1994) and is also related to the use of more effective birth control methods and acceptance of sterilization (Robey, 1985; Rahman, Akbar, Phillips and Becker, 1992). Moreover, couples with sons have longer birth intervals and fewer subsequent births (Bairagi and Langsten, 1986; Chowdhury and Bairagi, 1990).

6.2 Objective of the Study:

The success of the Bangladesh National Family Planning Program is reflected in the impressive increase in the use of modern contraceptive methods from 5% in 1975 to 43% in 2000, with total contraceptive use increasing from 7.7% to 53.8%, resulting in a substantial decline in fertility for the same period. The family planning effort of Bangladesh is widely recognized as one of the most successful programs in the world. Patriarchal social structure of Bangladesh still discourages women from practicing contraception until they have a son. In these circumstances, son preferences

may exert an influence not only on contraceptive use and fertility levels, but also on the progress of fertility decline.

Despite the relatively high and increasing level of contraceptive use, the data indicate that unplanned pregnancies are still common. Overall, one-third of births in Bangladesh can be considered as unplanned that is not demanded; 19 percent were mistimed (wanted later) and 14 percent were completely unwanted. The figure is not negligible and it should not be considered as an incidence. If all unwanted births were avoided, the fertility rate in Bangladesh would fall from 3.3 to replacement level of 2.2 children per women. In the present study, I think the respondents who were satisfied with their number and sex composition of living children, should remain under sterilization program. Since sterilization is an irreversible method a couple's decision to accept a permanent method of contraception precludes the birth of additional child. Unfortunately, sterilization program in Bangladesh is not popular because sterilization reflects some complicacy, one of which after sterilization, couples suffers the loss of one or more of their children. Secondly, the respondents are not interested to accept sterilization because the respondents having sterilization suffer with major surgical complicacies and problems associated with surgery may longer during several months even more than that. The problems may recurrently occur among the sterilized patients. It may also another reason to regret sterilization. Finally, there is some unknown fear among the couples about sterilization. Sterilization regret is about as common among urban women as among rural women. In this situation, couples practices temporary methods of contraception instead of sterilization. In my study, out of 8781 respondents, 5248 (59.8%) respondents do not demand any more children. Therefore,

they should practice contraception as long as the child bearing age but out of 5248 respondents only 3097 (59%) respondents practice temporary method of contraception and the rest 2151 (41%) are far from family planning program. Also for various reasons contraceptive discontinuation is present in Bangladesh. So there is some association between demand for a child and practice of contraception and it may be influenced by sex preference and affects contraceptive use in Bangladesh. Our aim is to identify the specific reasons for such a situation. For this reason I would like to test the hypothesis

H_0: There is no association between demand for a child and practice of contraception

Vs.

H_1: There is some association between the two attributes.

To test the hypothesis we construct the following 2×2 contingency table.

Table: 6.1

2×2 Contingency Table

Attributes		Contraception		Total
		Not practicing	Practicing	
Demand for a child	No	2151	3097	5248
	Yes	2047	1486	3533
Total		4198	4583	8781

Through χ^2 as well as Mantel-Haenszel test it is observed that there is significant association between demand for a child and practice of contraception and the direction of the association is negative. That is the

respondents having demand for a child are less likely to practice contraceptives. Since 59% respondents do not demand more children, they should terminate their childbearing but instead of sterilization they are practicing temporary method of contraception and 41% respondents do not practice contraceptives though they do not demand more children, their demand may be hidden. I think sex preference is one of the main reasons for this hidden demand. So in the present topic I would like to study the pattern of contraceptive use of respondents who did not demand any more children.

6.3 The toll of unwanted pregnancy:

Over the six years following the UN International Conference on Population and Development (ICPD,1996), unwanted pregnancies led to pressure on total fertility rate (TFR) as well as the deaths of nearly 700,000 women world-wide, accounting for about 21 percent of maternal mortality. According to estimates from a Global Health Council report (2002), at least 338 million unwanted pregnancies occurred during that period. Of these, about 251 million ended in abortion, resulting in 441,000 maternal deaths. An additional 88 million unwanted pregnancies were carried to term with 246,000 women dying from complications of pregnancy, labor and delivery. Rates of death were much lower in industrialized countries than in developing countries, where women are less likely to have ready access to skilled obstetric care and safe abortion services.

6.4 Data and Methodology:

The present study utilizes data from Bangladesh Demographic and Health Survey 1999-2000. It is the most recent and comprehensive of all the national level surveys conducted in Bangladesh. The Bangladesh

Demographic and Health Survey is a part of the worldwide Demographic and Health Surveys (DHS) program involving information on basic national indicators of social progress including fertility, contraceptive knowledge and use, fertility preference, childhood mortality, maternal and child health, nutritional status of mothers and children and awareness about some Sexually Transmitted Diseases (STD), AIDS etc. The survey was conducted during the period from November 1999 to March 2000. BDHS is a nationally representative survey that was implemented by Mitra and Associates and ORC Macro USA under the authority of the National Institute of Population Research and Training (NIPORT), Bangladesh. It is a nationally representative two-stage probability sample design and covered 10,544 ever married women aged 10-49 years from the selected households. The study is based on 8781 currently married women aged 10-49 who are able to bear children. The respondents under sterilization, widowed, divorced and declared infecund were not considered in the sample because they were not users of the contraception and there were no contribution about demand for a child in the population. In order to compare the impact of sex preference on contraceptive use the background characteristic place of residence, level of education, religion and employment status are considered. There are 3045 respondents from rural and 1538 from urban areas practicing contraception according to their permanent place of residence. 3909 respondents are Muslim 674 non-Muslim practicing contraception according to the characteristics religion. The corresponding number of respondents practicing contraception belongs to below secondary and secondary & higher level of education is 2969 and 1614 respectively according to the level of education. The number of respondents under working and non-

working group according to employment status, practicing contraception is 932 and 3651 respectively.

In the present study I would like to estimate the effects of sex preference on contraceptive use and fertility. To measure the effect of sex preference on contraceptive use Arnold (1985) method was applied to this data to estimate the extent to which overall contraceptive practice rate would increase in the absence of sex preferences among the selected background characteristics. This technique assumes that in the complete absence of sex preferences, at any parity, all the couples would behave in a similar manner as those who are most satisfied with their existing sex composition of their living children i.e., at the maximum rate within that parity. More specifically, we calculate the rate of current use of contraceptive methods among women according to the number of sons at each parity and used the highest values at each parity regardless of sex composition, as estimates of the expected contraceptive prevalence in the absence of sex preference. Then the observed rate of contraceptive use is compared with the expected rate in order to quantify the overall impact of sex preferences on contraceptive practice. Greater the difference between these two rates, higher the impact of sex preferences on family planning practice.

In order to achieve the replacement level fertility, the mean ideal family size should never exceed 2.5. So the comments and conclusion are drawn on the basis of respondents under second parity.

Table 6.2: Percentage distributions of currently married women aged 10-49 not demanding any more children and practicing contraception by parity and sex of birth order of children.

Parity	Birth order			% of respondents who did not demand any more children and practicing contraception.	Number of respondents not demanding any more children and practicing contraception.	Difference between proportion of respondents having all sons and all daughter not demanding and practicing contraception	Total no. of respondents and overall % of respondents not demanding any more children and practicing contraception.
	1	2	3				
2	Male	Male	-	72.3	237	0.175*	1240 (75.9)
	Female	Male	-	84.5	273		
	Male	Female	-	85.0	305		
	Female	Female	-	54.8	126		
3	Male	Male	Male	84.5	93	0.223*	909 (89.5)
	Female	Male	Male	95.0	114		
	Male	Female	Male	94.0	109		
	Female	Female	Male	91.5	97		
	Male	Male	Female	97.6	122		
	Female	Male	Female	95.9	93		
	Male	Female	Female	89.7	130		
	Female	Female	Female	62.2	56		

Figures in parenthesis indicates percentage

* indicates significant at $p < 0.01$

Source: BDHS data 1999-2000.

Table 6.2.1: Percentage distribution of currently married women aged 10-49 not demanding any more children and practicing contraception by sex of the last child at 2nd and 3rd parity.

Parity	Sex of the last child.	% of respondents practicing contraception	Number of respondents.	Difference between proportion having last child male and female practicing contraception.	Total number of respondents not demanding any more children and practicing contraception.
2	Male	54.2	510	0.084**	941
	Female	45.8	431		
3	Male	50.7	413	0.014	814
	Female	49.3	401		

** indicates significant at $p < 0.025$

Source: BDHS data 1999-2000.

Table 6.3 :Percentages of female respondents corresponding to the selected background characteristics, not wanting additional children and practicing contraception by the number of living children.

No. of living children	Percentage of respondents not demanding additional children and practicing contraception												
	Bangladesh	Types of place of residence		Difference	Religion		Difference	Educational level		Difference	Employment status		Difference
		Rural	Urban		Muslim	Non-Muslim		Below secondary level	Secondary and higher level		Working	Not-working	
0	3.2	2.7	3.8		2.7	6.9		3.9	2.8		3.8	3.1	
1	13.4	10.7	17.9		11.6	22.9		13.1	13.8		21.0	11.6	
2	75.9	73.1	80.7	7.6*	73.3	87.6	14.3*	71.8	81.7	9.9*	80.9	74.4	6.5**
3	89.5	90.0	88.7		88.9	93.4		88.2	93.3		89.3	89.6	
3+	98.3	98.3	98.2		98.2	99.2		98.3	98.0		98.3	98.3	

* indicates significant at $p < 0.01$, ** indicates significant at $p < 0.025$

Source: BDHS data 1999-2000.

Table 6.4: Percentages of female respondents corresponding to the selected background characteristics, not wanting additional children and practicing contraception by the number of living children and living sons.

No. of living children	Percentage of respondents not demanding additional children and practicing contraception													
	No. of living sons	Bangladesh	Types of place of residence		Difference	Religion		Difference	Educational level		Difference	Employment status		Difference
			Rural	Urban		Muslim	Non-Muslim		Below secondary level	Secondary and higher level		Working	Not-working	
0	0	3.2	2.7	3.8		2.7	6.9		3.9	2.8		3.8	3.1	
1	0	9.4	6.7	13.7		8.3	15.6		9.3	9.5		8.8	9.5	
	1	16.9	14.1	21.4		14.5	28.1		16.3	17.4		30.7	13.5	
2	0	52.1	45.7	63.0	17.3**	48.0	70.0	22.0*	39.5	68.4	28.9*	50.0	52.6	2.6
	1	85.8	83.6	89.3	5.7***	83.9	93.8	9.9*	85.1	86.7	1.6	90.6	84.3	6.3***
	2	71.2	69.7	73.9	4.2	68.1	86.0	17.9*	65.7	80.2	14.5*	78.5	68.9	9.6****
3	0	64.6	62.3	68.6		64.1	66.7		64.5	65.0		65.2	64.4	
	1	91.8	91.1	93.2		91.0	96.2		90.3	95.2		92.1	91.7	
	2	95.6	96.0	94.7		95.0	100		94.9	97.8		97.3	95.2	
	3	83.7	87.1	76.5		82.0	93.3		81.7	90.9		73.7	85.9	
3+	0	82.2	88.5	73.7		82.9	75.0		80.0	90.0		90.9	79.4	
	1	98.7	98.8	98.4		98.5	100		98.9	98.0		100	98.3	
	2	98.7	98.1	100		98.5	100		99	97.2		100	98.4	
	3	99.4	99.2	100		99.4	100		99.4	100		98.5	99.6	
	3+	98.7	98.3	100		98.5	100		98.5	100		95.6	99.4	

* indicates significant at p < 0.01, ** at p < 0.025, *** at p < 0.05 and **** at p < 0.10

Source: BDHS data 1999-2000.

Table 6.5: Son preference and desire for balance ratio of the selected background characteristics with two children according to practice of contraception.

Characteristics	Bangladesh	Types of place of residence		Religion		Educational level		Employment status	
		Rural	Urban	Muslim	Non Muslim	Below secondary level	Secondary and higher level	Working	Not-working
% of respondents having two sons not wanting another child and practicing contraception	71.2	69.7	73.9	68.1	86.0	65.7	80.2	78.5	68.9
% of respondents having one son & one daughter not wanting another child and practicing contraception	85.8	83.6	89.3	83.9	93.8	85.1	86.7	90.6	84.3
% of respondents having two daughters not wanting another child and practicing contraception	52.1	45.7	63.0	48.0	70.0	39.5	68.4	50.0	52.6
Son preference ratio (in terms of contraception)	1.37	1.53	1.17	1.42	1.23	1.66	1.17	1.57	1.31
Desire for balance ratio (in terms of contraception)	1.21	1.20	1.21	1.23	1.09	1.30	1.08	1.15	1.22

Source: BDHS data 1999-2000.

Table 6.6: Effect of sex preference on contraceptive use in Bangladesh.

Characteristics		% of respondents having two children want no more children and practicing contraception		Difference Col. 2- Col. 1	[1] Risk ratio Col. 2 / Col. 1
		Actual (Col. 1)	In absence of sex preference (Col. 2)		
Bangladesh		75.9	85.8	9.9*	1.13
Types of place residence	Rural	73.1	83.6	10.5*	1.14
	Urban	80.7	89.3	8.6*	1.11
Religion	Muslim	73.3	83.9	10.6*	1.14
	Other than Muslim	87.6	93.8	6.2**	1.07
Educational level	Below secondary level	71.8	85.1	13.3*	1.19
	Secondary and higher level	81.7	86.7	5.0**	1.06
Employment status	Working	80.9	90.6	9.7*	1.12
	Non-working	74.4	84.3	9.9*	1.13

* indicates significant at $p < 0.01$, ** indicates significant at $p < 0.025$

1. Risk ratio: The risk ratio takes on values between zero and infinity. One is the neutral value and means that there is no difference between the groups compared, close to zero or infinity means a large difference between the two groups on the variable concerned. A risk ratio larger than one means that group 1 has a larger proportion than group 2. If the opposite is true the risk ratio will be smaller than one.

2. 6.5 Results and Discussion:

One method of investigating the impact of sex preferences on fertility behavior is by examining data related to sex composition of living children of couples who do not demand any more children and are currently practicing contraception. If son preference is important then, within any parity, those with one or more sons would be more likely to be using some method of family planning as compared to those who have no son. Conversely, if the desire for a balanced sex composition affects fertility behavior then, within a given parity, couples who have had either all sons or daughters would be less likely to accept contraception particularly sterilization, as compared to those who have had children of both sexes.

In the data of Bangladesh Demographic and Health Survey 1999-2000, all currently married women age 10-49 were asked if they were currently using any contraceptive method, traditional or modern. In table 6.2, at parity two, 75.9% respondents (941 respondents out of 1240) practicing contraception who do not demand any more children. The results obtained from birth order and corresponding sex of children, the respondents practicing contraception having two daughters is much lower than that of having two sons (53% vs. 72%). The difference between the proportions is statistically significant. The practice rate of contraception is the maximum among respondents having balance sex composition of children. The similar trend is observed at parity three. Also the difference between the proportions of respondents practicing contraception having all sons and all daughters is statistically significant. We observed that respondents contraceptive practice behavior also sex-determined. By analyzing the birth order and its corresponding sex of

children from 941 and 814 respondents at parity two and three respectively are summarized in table 6.2.1 which represents the percentages of women having last child son and daughter not demanding any more children and practicing contraception. The proportion of women practicing contraception who do not demand any more children having last child son is higher than that of women having last child daughter (54% vs. 46%). The difference is statistically significant. But at parity three, contraceptive practice rate do not differ significantly among the respondents having all sons and all daughters (51% vs. 49%). Results obtained through contraceptive practice pattern from the table 6.2 and table 6.2.1 suggest that demand behavior is hidden and it is partially influenced by son preference as well as balance sex composition of living children though they expressed that they do not demand any more children.

Table 6.3 presents the percentage of currently married women who do not demand more children and currently using some method of family planning by the number of living children. Table 6.3 reveals that for the country as a whole the acceptance of contraception was found to increase as number of living children. The similar behavior was observed for all the selected background characteristics. It was observed that the acceptance of contraceptive method among urban women is higher than that of rural women. At lower parity, especially at parity two, the contraceptive practice rate is significantly higher among urban respondents. The practice rate of contraception is higher among the respondents having secondary and higher level as compared to lower level of education. At parity two, the difference is statistically significant. The rate is higher among the non-Muslim respondents as compared to Muslim respondents. The difference is

statistically significant for the second parity. The practice rate is higher among working women as compared to non-working women and the difference is statistically significant.

The analysis of data presented in table 6.4 indicates a common trend for all the selected background characteristics. With no exception, for all parities, women with no son were the least likely to practice contraception and the practice rate were highest among the women having balance sex composition of their living children. For example, at parity two the contraceptive practice rate was highest among the respondents having one son and one daughter. The contraceptive practice pattern is significantly higher among urban couples as compared to rural couples. The phenomenon is significantly higher among non-Muslim, more educated and working respondents as compared to their counterparts.

At parity two, the ratio of percentage of women with all sons and all daughters practicing contraception termed as son preference ratio in terms of contraception and the ratio of percentage of women with one son and one daughter and two sons practicing contraception termed as desire for balance ratio in terms of contraception (outlined by Chang et. al. 1981) are computed in table 6.5. According to this measure, son preference emerged particularly strong among rural women as compared to urban women. The preference is strong among Muslim, lower educated and working respondents. Though son preference is evident among the respondents under various selected background characteristics a desire to have a balanced sex composition of children or at least one daughter is also prevailing among the respondents of the country. The balance ratio is almost equal among rural and urban

women. It is higher among Muslim, lower educated and non-working respondents. From the study it seems that fertility behavior is largely determined by number of surviving sons and there is a desire to have a girl.

Table 6.6 present the estimates of couples who would have accepted contraception in the absence of sex preferences following the procedure outlined by Arnold (1985). Using this technique, at parity two, it is estimated that for the country as a whole, in the complete absence of any sex preference, the proportion of couples accepting contraception would increase from current 75.9 percent to 85.8 percent a modest increase of 9.9 percent (10.5 percent among rural respondents and 8.6 percent among urban respondents, 13.3 percent and 5.0 percent among below secondary and secondary & higher level of education respectively, 10.6 percent among Muslim and 6.2 percent among non-Muslim respondents, 9.9 percent among non-working and 9.7 percent among working respondents). The effect of sex preferences on contraceptive use rate is highest among less educated respondents and lowest among moderately higher educated respondents. The effects of sex preference on contraceptive use are statistically significant. The all significance test were performed with the help of t-test for equality of two proportion based on two independent samples (equivalent to Fisher's exact test for 2×2 contingency table). Since the proportion of respondents practicing contraception in the absence of sex preferences are estimated hypothetically under the assumption that in the complete absence of sex preferences, at any parity, all the couples would behave in a similar manner as those who are most satisfied with their existing sex composition i.e. at the maximum rate within that parity. Therefore in fact, two samples are not independent and in such a situation paired t-test was appropriate for

significance test. If sex preferences are completely eliminated, the samples become independent and under this assumption t-test is applied. In the last column of table 6.6 risk ratios for various selected characteristics as well as for Bangladesh are calculated. In this technique, at second parity, risk ratio of women practicing contraception who do not demand any more children in Bangladesh is 1.13. It can be explained as, if sex preferences for children is eliminated from the respondents, 13% more respondents who do not demand any more children would practice contraception. Due to sex preference couples are reluctant to practice contraception though they do not demand any more children. The risk ratio is higher in rural areas as compared to urban couples. The rate is higher among Muslim; lower level of education and non-working women as compared to non-Muslim, higher level of education and working women respectively.

In sum, it seems that women's demand for a child remain hidden and reflects it on practice of contraception and it is clearly linked to the number of living sons among her surviving children. In a society experiencing fertility transition, sex preference is going to emerge as a major constraint for the family planning program. In the light of these findings it appears that further increase in the contraceptive prevalence rates in the country may become increasingly more difficult unless there is a decline in the hidden demand for male children. Thus, it is important the Government of Bangladesh, instead of propagating the two-child family norm across the board, emphasize those policies that actively enhance women's status through education as well as involving them in the workforce in the country and change attitudes towards girl children.

CHAPTER -SEVEN
Concluding Remarks and Policy Implications

The key issue emerging from the 1999-2000 Bangladesh Demographic and Health Survey is that the impressive 50 percent fertility decline that characterized the 1980s has stalled at a little above three children per woman. Three successive DHS surveys, covering the period from 1991 to the present, have shown virtually identical total fertility rates (TFR) of 3.4 in 1993-1994, 3.3 in 1996-1997 and 3.3 in 1999-2000.

The government of Bangladesh has a target of achieving replacement level fertility by the year 2005, so an important question is whether the fertility decline is likely to remain stalled at this plateau or whether it is likely to resume in the near future. Due to various reasons it is impossible to achieve the target within the time period. However, it is estimated that 'every five years delay' in achieving replacement level fertility results in a three percent larger final population size, equivalent to an additional 8 million or so and it is the consequences of such stalled fertility rate. The follow on questions include what are consequences if the decline remains stalled and what can be done to overcome this situation. Are there any approaches that have not yet been utilized to minimize the negative impact of fertility persisting at a level above replacement?

The potential consequences must be viewed in the context of the likely projections. The World Bank has projected the population of Bangladesh is out to a stationary state. Assuming Bangladesh attains replacement level

fertility in 2010, the World Bank projects that the population will stop growing at 263 million in the mid-twenty-second century. This equates to a doubling of the year 2000 population and has major implications for resources, particularly in urban areas, where most of this population increase will have to be absorbed. The World Bank projections indicated that the mid-twenty-first century, the population will reach 217.8 million. This is virtually identical to the United Nations Population Division medium-variant projection of 218.2 million for the same year. Also, the United Nations Population Division medium-variant projection assumes Bangladesh will attain replacement level fertility by the year 2015. These projections do not go beyond 2050.

It is assumed that when a population attains replacement-level fertility, it stops growing. It should be clear from the projections described above that this is not the case in Bangladesh. The reason is that Bangladesh has a very young population, with 24 million females under age 15 years, compared with 21 million in the early reproductive age range of 15-30 years. Even at replacement levels of fertility, these young women and their offspring will, as they age, produce more than 3 million births per year for many decades.

Future population growth will be determined by three components: i) unwanted fertility, ii) high desired family size and iii) population momentum. The contribution of population momentum to the future growth of the Bangladesh population completely dominates the other two components such that four-fifth of the 85 million to be added by middle of this century will be due to momentum. Only 15 percent of that growth will

be due to unwanted fertility, and 3 to 4 percent will be due to high desired family size (Streatfield, 1998).

In 1999-2000 the contraceptive prevalence rate exceeded half of all married women (54%) for the first time. This level of contraceptive prevalence is approximately consistent with the TFR of 3.3, compared with international experience (actually a contraceptive prevalence rate of 53.8 percent equals to a TFR of 3.48 using the formula CPR=97.7-12.6×TFR, Ross et. al., 1999 or 3.53 using an earlier, 1993 Ross et. al., formula TFR=7.2931-0.07×CPR). The rapid rise in family planning use since 1983 has primarily been due to the adoption of modern temporary methods. Sterilization has registered a decline during the 1990s (to 7 percent for female sterilization and less than 1 percent for male sterilization). This shift away from permanent methods to reversible methods has implications for commodity costs, supply logistics, and methods effectiveness. The reluctance of users to adopt clinical method appears to be associated with a general caution about any clinical or surgical procedures.

Since the 1960s, the developing world as a whole has moved 77 percent toward achieving replacement-level fertility, although some of the least developed countries still have a long way to go. The most immediate determinants of further decline are contraceptive practice, abortion use, breast feeding, reduced demand for children and marriage patterns. Regarding contraceptive practice, a greater variety of methods is needed in Bangladesh, ideally with at least one long-term method and one short-term method being provided to at least half of the population. Furthermore, a

better understanding of the reasons for reluctance of clients to use any clinical methods is needed.

From the findings of chapter-three, it is evident that the demand for children decreases as increase of age of the women and it is remarkable among the women under age 30. In order to minimize such demand for children the family planning program efforts should be strengthened among the ever-married women under age 30. An important challenge is to reduce the differentials of demand for children among administrative divisions. As for example, Chittagong and Sylhet division have higher demand for children as any other division in Bangladesh. It is observed (Khuda, et. al. 2000) that the impact of such higher demand is the lowest contraceptive prevalence among the women in Chittagong and Sylhet division. In order to overcome such differentials about demand for children improved family planning services as well as adult education should be strengthened in Chittagong and Sylhet division.

Results obtained from chapter-three also suggested that differentials of demand for children among religious groups are remarkable. The demand for children is significantly lower among Christianity and Hinduism than Muslim and Buddhism. Therefore, the positive impact of family planning program and importance of small family norm should be included in the curriculum of religious education especially in the secondary level and motivational activities can be targeted to reduce these differentials.

It is observed from chapter-three that education especially secondary or higher level is important for reducing fertility, infant and child mortality, improving the human capital of the population. Also education along with

improved family planning services can help women avoid unintended pregnancies and the abortions that sometimes follow them. Therefore, social, economic, or other changes drastically affect the value or cost of children and reduce fertility rates within education groups. Improvement in family planning programs may hasten the transition to replacement level as well. So, policy makers should be stressed on such sectoral improvements.

It is evident from the analysis introduced in the same chapter that the demand for children is higher among currently non-pregnant women as compared to currently pregnant women. But due to complicacy parity differentials are not computed. Also it is observed that after second and higher parity most of the pregnancy is unwanted. The usual approach to minimizing unwanted fertility is to provide effective family planning services with some back up (e. g., menstrual regulation) in case of contraceptive failure. Instead of this, making a wide range of birth spacing practices and contraceptive methods including, where authorized, emergency contraception-available to all women of reproductive age may be an effective strategy for preventing unwanted pregnancies and unsafe abortion, and for helping women to achieve their reproductive desires. Facilities must ensure that treatment is not contingent upon women's acceptance of a contraceptive method.

From the analysis noted in chapter-three, the demand for children is significantly higher among women having less than two children. So, in order to reduce such demand the field worker involved in family planning programs should explain the positive impact of single child and discourage them for further one. The government of Bangladesh has already declared

many opportunities for the family of single child. We also observed that demand for children is higher among non-working or housewives as compared to working women. In order to reduce the differentials female empowerment as well as women's socio-economic status should be enhanced through proper education and involve them in various income generating activities.

From the analysis, we notice that the desired family size is significantly affecting the demand for children. That is the desired higher family size is responsible for higher demand for children. The approach to reducing high desired family size includes, but can not be limited to, providing motivation, information, etc., to low parity couples. Largely though, it requires social changes that minimize gender preference for sons. This requires economic changes that ensure non-familial security for elderly parents and usually alternative roles for women so that child bearing is not the only option for them. It also requires levels of child health where by parents can be reasonably certain that their children will survive to adulthood.

From the study given in chapter-three, the mass media especially television plays a vital role to reduce demand for children. Therefore, in order to limit the demand for children it should ensure that the women have easy access to mass media especially television in rural as well as urban areas. The positive impact of small family norm should be broadcasted in television. It is also observed in the same chapter that the NGO sector is currently playing an important role on family planning programs, especially, in rural areas. It is found that the demand for children is lower among women associated with the activities of NGOs. Therefore, in order to reduce the demand for children

the integrated family planning programs should be introduced among public sector as well as private sectors like promising NGOs.

Due to population momentum the female age at marriage is also significant for higher fertility in Bangladesh. It can be predicted that women married at a young age will have more children and that long exposure to family life results in more children. The options for minimizing the impact of population momentum are generally focused on increasing average age at childbearing. This involves strategies to increase age at marriage and to delay births, especially first birth.

The majority of countries, including Bangladesh, still rely primarily on a single method, although this goes against most recommendations. Greater efforts must be made in Bangladesh to achieve more of a balance of methods, increasing especially the long-term, cost-effective methods through improved clinical service standards. Instead of such improvement, the removal of the social, psychic and economic costs of contraception through improvement in the quality and coverage of family planning services would further accelerate the current reproductive changes that are taking place in Bangladesh, thus hastening its fertility transition, even in the face of pervasive poverty and economic stagnation.

In Bangladesh, it is clear that desired family size is still substantially lower than current fertility. The pattern of actual fertility exceeding wanted fertility. The policies for closing the gap are much the same as for addressing unmet need. They revolve around a wide range of effective and affordable contraceptives readily available to the public, together with comprehensive family planning information.

If this unmet need could be met, as directed in the 1994 International Conference on Population and Development (ICPD), then achievement of replacement fertility is feasible. Interestingly, analysis of trends in unmet need, together with contraceptive prevalence, shows that combined they tend to range from 65 percent to 75 percent in most surveys. This is the level required for replacement fertility in most societies. However, intensions do not always match actions. Only 71 percent of women currently not using family planning state that they plan to use it in the future, although some may not need (or may believe they do not need) protection against pregnancy. The policies regarding meeting unmet need are basically the same as for the family planning program as a whole, apart from more emphasize on identifying specific subgroups that may need particular approaches.

The positive relationship between infant mortality and fertility is consistent with the replacement hypothesis; with greater uncertainty about the survival of children in rural households, parents tend to increase the number of births, and this behavior is very strong as the parents' goal is to have a greater number of surviving children. Therefore, in order to achieve the replacement level fertility, the women who believe three-child family norm should motivate and explain them the importance and utility of small family norm and simultaneously infant and child mortality should be reduced.

In the analysis mentioned in chapter-five, it is clearly indicates that in Bangladesh, sex preference is still present especially son preference. Son preference is higher among rural women as compared to urban women. It is also significantly higher among Muslim and having lower level of education

as compared to their counterparts. Therefore, the demand for children among respondents is influenced by a strong desire to acquire a minimum number of surviving sons in the family. So, the further reduction of demand for children is unlikely without considerable reduction in the desire of male children or sex preferences. The policy makers should pay their attention about remedial measures related to improving women's status in the society.

It is observed from the findings that sex preference, especially son preference, plays a vital role on contraceptive practice among women and it reflects a significant barrier in reducing further fertility decline in Bangladesh. So, the most important policy implication from the findings is that further fertility would decline if sex preference be eliminated from the society. Since the sex preference is regulated by socio-economic and cultural factors, its effect should not be neglected in a least developed and conservative society like Bangladesh where women are considered to be of low status in terms of education and other social standards. Short-term and temporary method of population control activities may be ineffective in reducing the effect of sex preference on fertility. Therefore, an integral effort is essential to decrease gender inequality as well as to increase the status of women, which potentially could help to enhance further fertility decline in Bangladesh.

From the findings in chapter-six, it is observed that about 25 percent respondents do not demand any more children but not practicing any contraceptive methods. It may be the impact of unmet need for contraception. However, the government of Bangladesh as well as researchers should specify such couples and identify the reasons for not

practicing contraception. Family planning program efforts should be strengthened among such couples to avoid unwanted pregnancies and to accelerate the rate of fertility decline to be able to achieve replacement level.

Also it is observed in same chapter that women's demand for children remain latent and reflects it on practice of contraceptive and it is clearly linked to the number of living sons among her surviving children. Thus it is important that the government of Bangladesh, instead of propagating the two-child family norms across the board, emphasize those policies that actively enhance women status through education and involving them in the workforce in the country and change attitudes towards girl children. The government of Bangladesh is already taken an extended program in this area with the female secondary stipend assistance program, as are some NGOs like the Bangladesh Rural Advancement Committee (BRAC) with minimum targets for female primary school enrolment. These approaches have great potential and should be expanded. The textile sector has generated substantial formal-sector employment opportunities for young women and there must be many other avenues to expand such employment. This approach must be pursued, not only for the financial well-being of the individuals but also for the future welfare of the nation.

Finally, the further acceleration in contraceptive prevalence and fertility decline will require major efforts and be directed at improving women's status, more access to the media and improving program efforts in the low-performing divisions. Therefore, the government of Bangladesh should be aimed at operationalizing the delivery of the wider reproductive health service package in rural and urban areas of the country. In addition, the

government should also attach greater priority to development in the social sector, including enhancement of women's status, especially through increased female education and employment opportunities and improved access to the media. Such investment, in addition to their direct benefits, would further accelerate the process of fertility decline in the country.

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