

**Effects of Fertility Decline on Family Well Being:
Opportunities for Evaluating Population Programs***

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Abstract

The paper considers the association between fertility and family outcomes. Voluntary population programs are supported to help people control their fertility and improve their lives, but just how strong is this link? Evaluations of family planning programs rarely isolate the contribution of policies to fertility reduction and thereby to the long run welfare of families. Many other developments are attributed a role in declining fertility. Do these two distinct sources of fertility variation have different welfare implications? To identify the effect of fertility, such as might be caused by exogenous factors including policies, empirical analysis has focused on the consequences of twins, the sex composition of initial births, and subsidies to local family planning, all of which may impact fertility independently of desired fertility and affect other family outcomes, such as the mother's market labor supply, and the health and schooling of her children. Instrumental variable estimates of the "cross-effect" of fertility on family welfare tend to be about half as large as the direct OLS estimates. Are quantity and quality of children really substitutes, and are the family benefits of exogenous fertility decline as large as the cross sectional associations would suggest?

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1. Introduction

Having children may generate benefits or costs for society, which may be either captured within the family or spill over and influence the welfare of other members of society. If these benefits minus costs borne by individuals outside of the family are substantial, society has a stake in private reproductive behavior. If the balance of benefits minus costs is negative, society may subsidize the adoption and use of birth control, for example; if the balance is positive, society may subsidize parent costs related to child health and schooling, for example. In the period of rapid population growth following the Second World War, the social spillover effects of high fertility were thought to be negative (Coale and Hoover, 1958; National Academy of Sciences, 1971). Subsequent assessments were less clear cut, and it was concluded that any social externalities of high fertility were not a dominant impediment to economic development (National Research Council, 1986; Johnson, 1999). With fertility today widely below the replacement level of two children per woman, the social benefits from pronatalist policies and immigration may be substantial in some countries, if the resulting younger populations mitigate fiscal problems associated with aging and generational equity (Lee, 2001; National Research Council, 2001). But in many low-income countries many people remain without access to modern birth control technologies, and providing women with these and other health services are an attractive policy opportunity which needs to be statistically evaluated.

Quantifying spillovers from fertility to social welfare has not been easy. Theoretical insights have not clarified which spillover mechanisms are important, or under what particular conditions they are likely to be substantial. Empirical evidence of the magnitude of social externalities of fertility depend on numerous, difficult to test, assumptions, many at the macro economic level, for which existing data cannot credibly discriminate among proposed models of behavior and social organization. This paper concentrates alternatively on the consequences of fertility for the private family, conceptualized as an inter-generational unit, and scrutinizes empirical evidence of a variety of mechanisms relating fertility to the health and well being of families. It should be noted explicitly that the scarcity of studies which satisfy my methodological requirements leads me to review all of the studies I could find estimating cross-effects of fertility on family outcomes, whether measured in a high- or low-income country. I would naturally prefer to focus on studies drawn from a low-income setting which might be closer to the context of those countries in Africa and poorer parts of Asia and Latin America where family planning and reproductive health programs are obviously lacking. Until proven otherwise, it will be assumed that behavioral responses to external factors share some similarities, but they will nonetheless heterogeneous across cultures and institutional settings, and different statistical designs will evaluate the effect of different treatments on different groups for which the welfare consequences of fertility change are undoubtedly different. Understanding the limitations of these studies may help in designing improved analytical methods and specifying additional data that would be most useful to improve future evaluations of family planning, reproductive health, and other health and welfare programs. The programs are hypothesized to empower women, and increase women's capacities and control over their own endowments, and possibly create additional benefits for women and their families and the wider society.

It may be useful to preview the conclusions of this literature survey before proceeding. I investigate fertility changes induced by events outside the control of the family as a basis for estimating how these exogenous fertility changes affect family welfare outcomes. I conclude that relatively little is credibly known about which factors help women and men achieve their reproductive goals, and how these factors play out in influencing their subsequent lives. I also draw a more controversial conclusion that the direct association between fertility declines and improvements in child welfare, as well as increases in women's market labor supply, *overstate* credible causal estimates of the cross-effects from exogenously-induced fertility declines to these fundamental social family outcomes. Moreover, I conjecture that society values these presumed cross-effects of fertility, and many observers interpret these cross-effects as causally contributing to general economic growth and alleviating poverty. In other words, improvements in the health and schooling of children, and increases in the productivity of women, who then become more involved in the market labor force, are important social justifications for promoting family planning in high- and low-income countries. These impacts of policy tend to be overstated because correlations across individuals and across countries are purported to be causal effects -- a common failure in the social sciences where social experiments are rare. The most plausible explanation for this overstatement of the cross-effects of fertility on family welfare is that unobserved variables are responsible for both outcomes, such as the preferences of parents or features of the development process which improve women's opportunities beyond childrearing (Cf, Moffitt, 2005). There are simply too few studies of reproductive health programs and their long run impacts to draw any tentative conclusions yet on how this new orientation of population programs have operated to improve development prospects and accelerate the reduction in poverty among women or inter-generationally among their children.

A decade after the Cairo Conference, what progress has been made in the systematic evaluation of the welfare consequences of population policies designed to improve women's health and augment their independence and empowerment? How much of gains are attributable to advances in (1) the improved nutritional status of girls and their access to preventive health care, especially in South and Central-West Asia and broad areas of Africa, or (2) to advances in the schooling of women relative to men by various general and gender targeted educational programs, or (3) to women's reproductive health programs, including family planning, assistance at birthing and pre- and post-natal care, voluntary counseling and testing of STDs, and anti-retroviral drug therapies for coping with HIV/AIDS. The funding for some of these health services has grown of late, but policy assessments of the form proposed in this paper are not likely to occur without explicit direction. As with programs designed to diffuse birth control and reduce fertility in the 1970s and 1980s, those delivering reproductive health services in the 21st century will probably not evaluate the impact of their programs in terms of measuring long run effects on women's productive capacities or the welfare of their families-- it is too difficult and time consuming when there is already a consensus that they are an appropriate priority. To advance these broader evaluation objectives, it will be necessary to first measure health status, which is more complex than measuring fertility, and then devise a way to link exogenous reproductive health program treatments to women's evolving health, their increased capacities in home production and in work in the market labor force, and their empowerment. These are major challenges facing the research and policy communities, and I should note at the outset well beyond the scope of this paper.

I will proceed as follows. Section 2 briefly discusses the aggregate implications of population growth and fertility for economic development and the empirical evidence available on these relationships. The consequences of fertility and health changes for individual and family well-being are described in section 3. Section 4 outlines the types of policies which may contribute to changes in fertility and mortality. Section 5 reviews empirical studies that have estimated from specific sources of variation in fertility the likely impact of voluntary population policies on the family. Section 6 draws some tentative generalizations from this survey of empirical studies and outlines research priorities.

2. Relationships between Population Growth, the Demographic Transition, and Development

Different types of behavior vary systematically by the age of an individual over the life cycle, and consequently the evolving age composition of national populations is expected to impact national averages for these behavioral outcomes, such as for example, the share of public and private expenditures on child health, expenditures on schooling, participation in the labor force, personal saving out of disposable income, and expenditures on elderly health care as a share of income (e.g. Modigliani and Brumberg, 1954). The link between the age composition of a population and national savings rates has been proposed as an explanation for the rise in Asian savings rates and economic growth rates from 1960 to 1990 (Higgins and Williamson, 1997; Bloom and Williamson, 1998), although the evidence for even this plausible connection is surprisingly fragile when studied with conventional econometric methods (Schultz, 2004b).¹

Although the association between changes in national savings rates and changes in age composition do not account for much of the recent increase in Asian growth, the repercussions of the demographic transition on the relative size of the labor force may be of greater importance, and also involve underlying micro behavioral relationships linked to fertility. In a country such as Singapore, for example, where the total fertility rate has declined from 6 to 2 children per woman from 1950 to 1990, the increase in the proportion of the population in the prime working ages between 20 to 59 increased from 1960 to 1990 from .44 to .62, or by 41 percent. If participation in the labor force in these ages did not change, the associated increase in the labor input per capita could add 29 percent to GDP per capita, assuming labor's share of national income remains constant at 70 percent.

In addition, the decline in fertility which caused most of the change in age composition is generally associated with a rise in women's participation in the market labor force, both because women work more when they are young if they marry later and start childbearing later, and because women enter the labor force more frequently in middle age after bearing fewer children than did earlier cohorts. Returning to Singapore, the proportion of women age 20 to 59 who are economically active increased from .22 to .40 from 1960 to 1990, according to ILO (1986) figures, which could contribute to an increase in efficiency units of male labor of roughly 27 percent $((.40-.22)/.22) * .5 * .67 = .27$, where women are assumed to receive two-thirds of men's

¹ I can find no tested explanation for why Latin America, which experienced declines in fertility which were of a similar magnitude and timing as those occurring in East Asia, did not appear to benefit from the same increases in savings rates and economic growth (Ahlberg, 2002).

wage. This growth in labor input per capita from women could then be associated with about a 19 percent growth in GDP per capita.

These two sources of growth suggest a 48 percent gain over 30 years, which is equivalent to an annual growth of nearly 1.5 percent. From 1990 to 2020, the changes in the age composition will be unfavorable to growth, and although female participation rates may continue to increase, male participation rates are expected to decrease with population aging, improved pensions and medical insurance. These illustrative calculations imply that perhaps a third of the 3-5 percent annual per capita growth rates sustained in East Asia in this period could be attributed to the increased efficiency units of labor per capita. But the rest appears to be explained by increases in the physical capital per worker, improvements in the human capital of the labor force, and growth in residual total factor productivity (Young, 1995). The behavioral relationships linking the decline in fertility to the rise in women's labor force participation and their increased investments in the human capital of their children appear more important than the aggregate savings rate or labor force contribution strictly associated with changes in the aggregate age composition. The remainder of this paper seeks ways to describe more precisely the family level linkages that could account for how welfare programs affect fertility and thereby impact other family outcomes, including female labor supply to the market economy, savings in physical capital, and investment in the human capital of children.

There are special challenges in analyzing aggregate country level data to clarify how policy interventions change the evolutionary course of the demographic transition and thereby impact on economic growth. I have explored whether centralized allocations of International Planned Parenthood Funds to national family planning programs could explain population policies, and per capita supplies of calories could account for child survival rates and thereby provide instrumental variable estimates to describe how family planning, child survival, and fertility are determined across countries and over time (Schultz 1994, 1997). In extending such approaches to explain economic growth, however, economists seem too willing to assume death rates, birth rates, and resulting age compositions are determined outside of the socioeconomic system or are exogenous to development (Bloom and Williamson, 1999; Barro and Sala-i-Martin, 1999). Sub-national aggregates for federal states may provide more convincing evidence on how distinctive policies at the state level change in commonly measured units and contribute to changing fertility, mortality, schooling, labor force participation rates for women, and savings. Synthetic cohort time series constructed from merging independent cross sectional household surveys can also retain regional strata at which level policies are observed to change, as are available in such countries as Thailand (SES), Taiwan (FIES), Indonesia (SUSENAS), Brazil (PNAD), and India (NSS). Panel surveys which follow all the members in the initial households over time and trace extensions and splits can then be merged with information on residential localities and regional variation in policies to analyze the issues discussed in this paper.² An

² Some analytical questions might be resolved by the construction of aggregations of the household data into different groups, which are assumed to share important but unobserved traits, such as birth cohorts, or cohorts born in a specific time and region that would embody the effects of common local welfare policies and geographic factors, such as climates which affect prevailing diseases and weather which perturbs agricultural incomes. These aggregations dictated by research design might sacrifice information on some individual characteristics, but

allied paper is being prepared to take stock of the more promising data sources for research along these lines.

3. Long Term Effects of Fertility for Individuals and Families : A Micro Perspective

In addition to connections between aggregate trends such as fertility, age composition, savings, and growth, there are many potential mechanisms at the family level which could link the declines in child mortality and fertility associated with the demographic transition to household resource reallocations associated with improvements in the welfare of women, children, and men. These linkages between production and consumption in the extended family occur over an extended period, during which children are a long term responsibility of parents and then become a customary form of old age insurance for parents. Thus, as outlined in Table 1, fertility can exert an influence over long term family choices and living arrangements.

One hypothesis is that human capital formation is affected by changes in fertility and mortality. One of the Millennium Development Goals is to reduce maternal mortality in low-income countries where it occurs far more often than in middle- and high-income countries. Maternal mortality risks for a lifetime are undoubtedly diminished as fertility declines, other things being equal. And this reduction may be greater than the reduction in fertility itself, if the share of higher risk pregnancies is also reduced, such as those occurring to adolescents and older women at high parities. Health benefits enjoyed by women who have fewer children could also be substantial. Women's acute and chronic health problems may be affected by their childbearing. However, correlations between fertility and women's health, two outcomes which are determined at the household level, cannot be interpreted as causal, without much further study. I am not aware of such analyses

Adolescent and young women may be able to stay in school longer because they do not become pregnant, and programs which inform youth of contraceptive options and the likely consequences of their behavior should delay childbearing. Once they leave school, women who have fewer children accumulate more training and vocational experience outside of the home, which is associated with increased productivity in the market labor force and enhanced wages over their remaining lives. Regrettably, I have found no studies which assess how population programs lower fertility and thereby affect vocational experience and raise women's wages. Some instrumental variable (IV) studies reviewed later provide a basis for conjecturing the magnitude of such a mechanism from exogenous fertility change to women's accumulation of human capital and earnings capacity in later life. However, these IV studies are not yet a basis for generalization, because the scope for women to work in the labor force and outside of their family varies greatly across cultures and over time, and women who are relieved of the responsibility of bearing and rearing children can then engage in self-employment activities which add to family resources and increase the recognized opportunity value of women's time in other household chores. Women released from child care responsibilities may also increase their participation in self-help groups, including credit associations, and thus acquire productive assets

mitigate other analytical problems, such as bias due to specific types of measurement error and simultaneity of family and community choices, which can otherwise be misleading.

to enhance their business opportunities. Decision making in the community and participation in local government may evolve in different directions as women have the capacity to regulate the timing and number of their births.

Alaka Basu (2005) has hypothesized that sterilization of women may change their reproductive roles and as a consequence permit women at a much earlier age to be less culturally restricted in their mobility outside of the household in such countries as India. Women adopting sterilization at a relatively early age, such as 25 to 30, then realize a longer period of unencumbered activity in the household and community, which as their children go to school, allows women much greater freedom of movement and independent status than in earlier generations. Modern technologies of birth control may thus be a complex catalyst for long run social change of gender roles, but not one which has been empirically analyzed as an independent causal factor in transforming women opportunities.

A commonly hypothesized effect of fertility declines is to increase the average human capital of her children, noted in Table 1, IC. This may take the form of improved child nutrition, health, and schooling, and of family support which may increase the probability that a child will migrate from her or his birthplace, and leave the parental home and village. In most parts of the world, interregional migration of the child is positively related to the individual's prior schooling and health, and is associated with higher subsequent earnings opportunities (Schultz, 2001). Alternatively, diminished fertility in a community would diminish population growth and weaken Malthusian downward pressures on the local wage, reducing the incentive for children to migrate to other areas. Nonetheless, no studies were found which report decreased fertility of women induced by a population policy is associated with increased migration or intergenerational upward mobility of the women's children.

I would conjecture, as outlined in Table 1, that women who are helped by a family planning program to control their fertility would have both fewer children and receive larger transfers per child to support themselves in old age, although the strength of such a relationship with transfers back to the mother would presumably be mediated by family structures and the customary obligations of children to their elderly parents, as well as the provision by the state of pensions for the old and infirm. On the other hand, if the women who have had fewer children improve their earnings capacities and accumulate more physical assets through their savings, the mothers will be more likely to be self supporting and have weaker economic claims on the incomes of their offspring, even in an altruistic family. These linked inter-generational investments in child human capital leading to reciprocation in the form of child-to-parent transfers are rarely studied, and then generally under the assumption that fertility variation is initially exogenous, which is not satisfactory for our purposes (King, 1982).

Inter-household transfers are listed in Table 1, IV, but research on this topic has progressed slowly. Good information is rarely available on both the sending and receiving sides of the transfer, and without wealth or income or consumption data from all family units who might transfer resources it is hard to assess whether the transfer is motivated by altruism or strategic behavior to maximize individual lifetime consumption. One approach is to ask the sampled households about the economic status of the other household which sends or receives a transfer, but one expects the information elicited about the non-respondent household will be

subject to greater measurement error. Another approach is to interview purposefully both the households sending and receiving a transfer, and collect information to define the network of households to which one might turn for transfers. For example, to evaluate whether child fostering (a form of transfer) was beneficial or harmful for the welfare of children and families in Burkina, Akresh (2004) randomly sampled households, and identified the families to whom fostered children had been sent, or from which they had come. He then located and surveyed the households where these children had been fostered in. Only after this difficult logistical task was completed could he show statistically that the children who were fostered experienced an improvement in their schooling and health status after fostering, and the sibling left behind by the fostered child also benefitted from the fostering, but to a lesser degree, presumably due to the diminished drain on their origin household's resources due to fostering out of a child (Akresh, 2004).

There is finally the possibility that a reduction in a woman's fertility induced by providing her with improved opportunities for birth control contributes to a delay in the age of marriage of her children, most notably for daughters. As with migration, much of these cross effects could be explained by human capital investments in the form of the child's schooling. In Bangladesh a conditional transfer program made payments to a girl's bank account if she enrolled in secondary school and did not get married before the legal age of 18 (Arends-Kuenning, 2004). Although increasing women's schooling appears to be beneficial for her, a delay in her marriage age could involve private costs. Poor parents may find it costly for their daughter to delay her marriage beyond the age when she commands the best prospects in the marriage market. Field (2004) proposes that the optimal time for marriage may occur in rural Bangladesh immediately following menarche, after which the dowry the parents are required to pay increases, even if the daughter who is now older has completed more schooling. It is also unclear whether the wage returns a daughter might potentially earn due to attending more school are recovered by her parents, even if she takes a job before marriage (King, 1982; Quisumbing and Maluccio, 2003).

The second broad area of family resource allocation that is likely to be sensitive to fertility is the family's allocation of time, and specifically the woman's supply of labor to work outside of the family (Table 1, IIA). When they reduce their fertility, women tend to allocate more of their time to activities other than child care, and if the employment opportunities outside of the family are more attractive than those within the family, a program induced decline in fertility is likely to be associated with an increase in labor force participation and an increase in hours worked among those entering the market labor force. If the market employment opportunities for women were unattractive, she may allocate more time to home production and self employment activities. But as emphasized before, these correlations of fertility with different allocations of labor within the family are not a reliable measure of a causal effect, such as would follow from a decline in fertility achieved by an exogenous family planning program intervention, nor should it be assumed that women working in any specific set of activities will necessarily improve the welfare of these women.

The probability that children will work in the labor force and the number of hours they so work could also be impacted by a policy-induced decline in their mother's fertility (Table 1, IIB). One might hypothesize that mothers who have reduced their fertility are more likely to

send their children to school, and this may reduce the time available for the children to work. Yet, the connection between the increase in school enrollment induced by a random village allocation of the Mexican Progresa Program's conditional cash transfers for enrollment had a relatively small effect reducing the recorded level of child labor under age 17 (Schultz, 2004a). It should be noted, however, that child labor is not easily measured in a household survey in a low income country, because children generally work with their parents, without receiving formal payment, and are therefore not customarily viewed as "workers" despite their contribution to family income. There is also evidence that work and schooling do not exhaust the time of children, and children appear able to work without apparently reducing their schooling or subsequent earnings, although this is likely to depend on many other factors.

Models in which the labor supply of family members are explicitly coordinated recognize the interdependency of the time allocation of all family members, not only within the nuclear and intergenerational family but also the household, and the residential compounds of related households, e.g. the Bari in Bangladesh. In high income countries, the effect on the market labor supply of the husband of an increase in his wife's wage tends to be negative (uncompensated for the implicit income effect) but generally small and imprecisely estimated. In contrast, the effect on the wife's labor supply of an increase in her husband's wage tend to be negative and relatively large (Killingsworth, 1983; Schultz, 1981). The question in low income countries is how the entire family's labor supply responds to program-induced declines in fertility. Some evidence is later discussed on child labor and schooling responses in Bangladesh derived from a panel survey of the Matlab district (Sinha, 2003).

The life cycle model of savings assumes that children do not influence wealth accumulation, and the ratio of savings out of disposable income follows a regular profile with respect to age. Individuals accumulate sufficient wealth to smooth their consumption during their old age when their productivity declines (Modigliani and Brumberg, 1954). It is perhaps more plausible to assume parents are motivated to have children in part by the expectation that their children would support and care for them in old age (Samuelson, 1958). A policy induced reduction in fertility could motivate parents to substitute more of their resources into savings to replace the support they had previously expected from children. Although national accounts define savings as only the accumulation of nonhuman capital, parents may also increase their children's human capital as an alternative form of life cycle savings. Few studies even report the association between conventional savings and fertility of parents (Hammer, 1986), and I could not find a study estimating the savings effects of a policy-induced change in fertility. As with the Rosenzweig-Wolpin (1980b) model of fertility and female labor supply, parent preferences for childbearing as a means to smooth lifecycle consumption might be inversely related, across a heterogeneous population, to their relative preference for financial or human capital savings to achieve this objective.

It is widely hypothesized that parents in reducing their fertility may increase their transfers to each child in the form of gifts as well as human capital, motivated possibly by an increase in the returns for their support, schooling and child health investments (e.g. Becker, 1981; Quisumbing and Maluccio, 2003). If both physical savings, child human capital investments, and parent to child transfers are all substitutes for numbers of children, empirical

studies are needed to document the degree of substitutability, and how they vary across cultural and institutional settings (Quisumbing, et al. 2004).

The final consequence of fertility decline is on family living arrangements (Table 1, V). From the late 19th century onwards, economists have sought to understand the determinants of household expenditures by controlling for household demographic composition, or the number of household members in various age and sex categories (Deaton, 1997). When this approach is used to analyze the determinants of economic and demographic behavior, such as the family lifetime outcomes listed in Table 1, the assumption is implicitly made that household composition and living arrangements are independent of changes in fertility, and they are exogenous to human capital investments, time allocation, savings and transfers. However, these are restrictive working assumptions, and if they are violated the estimates of many behavioral and productive relationships centered on the family are likely to be biased. Households form and divide, and grow through births and in-migration, and decline through deaths and out-migration, partly in response to the key income, price and technology variables that are expected to account for household behavioral demands (Rosenzweig and Wolpin;1985 Foster, 1998; Maluccio, et al, 2003). Thus, household composition should be treated as endogenous to individual outcomes, and the long standing convention in studies of family welfare of conditioning on household composition should be avoided, or at least assessed as a potentially misleading model specification. If household composition adjusts to the opportunities created by a family planning program, which reduces the cost of birth control, then data on the extended family unit may need to be collected, and more suitable initial conditions specified to help explain the evolving composition of families (e.g. Akresh, 2004; Joshi, 2004).

4. Policy Interventions in Family Planning, Child and Reproductive Health?

Public policy interventions to promote the decline in mortality, morbidity, and fertility, are expected to extend private benefits to women and their families. Table 2 outlines five overlapping ways policy could contribute to declines in fertility, and because they operate by different mechanisms and influence different groups, they are likely to cause different “cross effects” on other forms of family behavior and outcomes as listed in Table 1.

First, public policies can subsidize the provision of sex education, information regarding best practice birth control methods, related supplies and medical services, reproductive health programs with testing and natal care. Subsidies could reduce the cost of contraceptives distributed by private providers, or support public delivery systems. The choice between private or public sector distribution should be determined to minimize social costs (psychic and monetary) and achieve an equitable distribution of the private benefits. If sex education and the introduction of modern means of birth control are achieved at lower costs per person through public schools and public family planning programs than can be accomplished through private markets, due perhaps to economies of scale, there is a clear efficiency argument for public involvement in the sector.

Subsidies may be a cost-effective method for promoting voluntary adoption of new birth control techniques. Once adoption and use of modern birth control is established, continuing the user subsidizes for family planning methods may be more prudently targeted according to the

income of the beneficiary and region of residence, among other criteria for screening. By targeting the subsidy to those groups whose fertility responds more for a given price subsidy, the program can maximize its effect on birth rates. An additional program objective could be to focus on lower-income rural households, or to reduce teen-age childbearing, or subsidize contraception where it is likely to reduce the prevalence of unsafe abortion. I would conjecture that when there are multiple competitive private market sources of birth control supplies, the urban middle and upper classes will not respond much in their demands to small changes in price; consequently, public contraceptive subsidies will have little effect on their birth rate. These subsidies become only a relatively small income transfer for this group. Private market dissemination of birth control may at this stage in the demographic transition serve adequately those who are better educated and informed about birth control and have relatively larger incomes. But without the assistance of a dissemination program supported initially by public subsidies, relying only on the private market to diffuse new birth control technologies could lead to increased economic inequalities during the demographic transition, as the benefits of improved birth control technologies are first realized by the better educated upper classes, leaving lower classes to cope with the burden of unwanted childbearing.

The second argument to expend public resources to facilitate the spread and voluntary use of birth control involves the consequences of improved birth control on the personal distribution of welfare *within families*, and specifically improvements in lifetime opportunities of women and their children. This linkage has not been studied in a satisfactory analytical framework, but could reinforce the priority for means-tested or targeted public-subsidized birth control programs. The major initial technological innovations in birth control occurred in the 1960s with the refinement of the intra uterine device (IUD-Ota ring) and the discovery of the oral steroid (pill), which separated the practice of birth control from the act of sexual intercourse, and gave women a more decisive and discrete role in the adoption and practice of birth control. Although it is not empirically well established, it is reasonable to presume that women are able to exercise greater control of their reproductive lives due to these new birth control technologies, and subsequent advances in birth control-- injections, implants, copper wrapped or drug coated IUDs, female condoms, and laproscopic sterilization procedures, and drugs for pregnancy termination – have further added to options for *women* to control their reproduction.

These changes in birth control technology reduce uncertainties regarding when women bear children, and allow them to plan more confidently for their own education and careers, and thus optimize their lifetime productive opportunities, working either in the home or in the labor force. Society should gain from this wider access to “best practice” methods of birth control, which allow women to invest more efficiently in their market-oriented human capital. Measured by cross-sectional wage structures estimated from representative household surveys, women with an additional year of schooling receive wages which are several percent higher, and these proportionate wage returns to schooling tend to be as high or higher for women than for men (Schultz, 1995). The diffusion and continued use of best practice birth control techniques should, therefore, motivate women to complete more schooling *relative* to men, other things being equal. This would increase the private wage returns to schooling for the average of men and women, and thereby contribute to faster overall economic growth, as measured in national

accounts.³ Consequently, these new birth control technologies probably redistribute control of resources within families, and according to some empirical studies guided by the bargaining models of the family should increase household expenditures on the nutrition, schooling, and health of children (Thomas, 1990, 1994; Haddad, et al. 1997; Schultz, 2001; Quisumbing and Maluccio, 2003).

Family planning and reproductive health programs are both types of public health programs (Table 2, II). Whether health programs should be publicly subsidized, and by how much and for whom, raise complex distributional issues to consider along with the program efficiency which can depend on scale. The health consequences of preventive and curative health care and behavior may not be widely understood, and the health gains from related behavior can be largely captured by private families or contribute to wider social benefits, as with the control of some communicable diseases. For which social externalities, distribution of private benefits and private responsiveness to subsidies, and private market alternatives can differ, with implications for policy priorities. Public subsidies for preventive health programs may be combined with private user charges for curative health care for chronic illnesses and degenerative diseases. Prenatal and antenatal care can improve the long term health of both mother and child, and childhood vaccinations are believed to be highly effective preventive health programs, because of their economies of scale and contribution to controlling communicable disease. Better early childhood nutrition and the prevention of inflammatory childhood diseases can increase childhood survival and are now connected to improvements the children realize as adults in reduced chronic illnesses and degenerative diseases of middle age and fewer functional limitations in old age (Barker, 2001; Finch and Crimmins, 2004; Fogel 2004). Introducing knowledge of and access to modern family planning methods, extending HIV/AIDS education, testing, and treatment programs are often justified as preventive health interventions, even when they involve in some cases the provision of more costly services, such as sterilization and anti-retroviral drug therapies.

A third form of public intervention involves conditional transfers to families if they engage in what are believed to be high-return investments in human capital. For example, Bangladesh introduced a secondary school scholarship program for girls, which placed the scholarship in a bank account for the girl when she finished school, contingent on her not marrying before age 18. In Mexico, transfers to poor mothers in rural marginalized areas were initiated in the PROGRESA program, if their children are enrolled in school and family members receive recommended vaccinations and preventive health care (Schultz, 2004a). These targeted public subsidies require methodical planning and careful monitoring to achieve their objectives. These conditional transfer programs offer a promising mechanism to alleviate poverty in the short run while encouraging longer run investments in the nutrition, health and schooling of poor children (Morely and Cody, 2003). Combined with effective targeting to the poor, conditional transfer programs may be more efficient in stimulating investment in human capital among the

³ Because national accounts neglect the value of many home produced commodities which are not sold in the market, such as most child care, increases in national income as measured will tend to overstate the growth in home and market production in a period when women shift their time from the home to the market labor force.

poor than conventional policies which increase without targeting public expenditures on services, by building infrastructure, increasing staff, or paying staff higher salaries.

Strengthening women's property rights to productive assets, inheritances, rights in divorce and in child custody are hypothesized to improve both the welfare of women and children. When women exercise more bargaining power in the family, they improve their own consumption and human capital capabilities, and this enhanced economic value of women's time is generally associated with lower fertility, and higher investments in their children's human capital (Schultz, 2001; Quisumbing and Maluccio, 2003). Where marketable title to land is not controlled explicitly by women, but vested in the hands of their husbands, it becomes more difficult for women to borrow credit to invest in their own self-employment enterprises.

The objective of many micro credit programs is to help women overcome some of these traditional disadvantages in the credit market. Group joint liability arrangements for borrowing, where members of the group socially enforce the repayment of the other borrowers in the group, to assure themselves the opportunity in the future to borrow from the revolving credit line. One prototype of this micro credit organization is the Grameen Bank of Bangladesh (Pitt and Khandker, 1998). The design of legal systems and the practice of customary arrangements at the time of marriage may affect bride prices and dowries, and may influence who actually controls the transfers at the time of marriage within the families, and have custody of the children of that union, if it dissolves (Grey, 1998; Quisumbing, et al. 2004; Joshi, 2004; Field, 2004). I could not find policy evaluation research assessing the effectiveness of these types of programs on fertility, health, or other family outcomes.

Population policies can either change the incentives and opportunities which lead people to voluntarily change their fertility, or it can set administrative limits on fertility, without compensating those who are then constrained from seeking their desired family size. Many of the welfare programs emphasized above which subsidize birth control, increased women's human capital, or strengthened their control of economic resources in the family, are designed to affect fertility by changing the balance of private costs and benefits of having more children.

Only China adopted a birth quota to reduce fertility and slow population growth in 1979, perhaps because the government had delayed starting a voluntary family planning program in the 1960s and 1970s when other East Asian countries did. The adjustment costs to this policy differs across people, though it is difficult to identify precisely who is "capped" and experiences a loss in welfare due to the quota. It is arguably the least educated, rural women who are most likely to be penalized by the quota, who tend to have the largest families in other similarly poor countries. Moreover, when exceptions to the quota are granted in China, the fines for an "out-of-plan" birth appear to be fixed in monetary terms at the community level, and appear therefore less of a disincentive to the rich than to the poor. Rationing theory implies that the "cross effect" of quota-induced reduction in fertility would increase the demand for other substitutes for children - possibly child schooling or physical savings - more substantially than would a decrease in fertility of the same magnitude caused by a social welfare program which induces a voluntary reduction in fertility (Tobin and Houthakker, 1954; Pollak, 1969). Here is a clear example of where different policies, which might lead to the same decline in fertility, will theoretically have a different effect on other family outcomes.

5. Empirical Studies of Fertility and the Consequences for Families

The extensive interdisciplinary literature reporting the direct associations between fertility and family outcomes (e.g. Becker, 1981; Blake; 1989; Hanushek, 1992; Lloyd, 1994; Desai, 1995) is not reviewed in this paper. Instead I concentrate on studies which estimate what is implicitly a causal model for fertility and another family choice outcome. In general these studies report both the direct (OLS or Probit) associations as well as an instrumental variable (IV) estimate consistent with their causal framework, thereby assessing the severity of the statistical bias due to neglecting the “omitted variable” or simultaneity problem that arises when fertility is correlated with the unexplained portion of the family outcome variable, or its error. If the statistical discrepancy between the OLS and IV estimates is empirically unimportant, the Hausman (1983) specification test of the null hypothesis that fertility is exogenous with respect to the relevant family outcome variable is accepted, and the OLS estimate is then preferred because it is likely to be more precise than the IV estimate and not overtly biased.. I would like to report here the severity of bias in estimating the long run impact of reproductive health programs for the woman’s productivity and family welfare, but I have not found any studies of these relationships, possibly because I do not know the field or how to locate these contributions, and am therefore restricted in this section on studies of fertility and its variation..

5.1 The Allocation of Women’s Time and their Fertility

Studies note differences in women’s labor supply depending on the woman’s marital status, number of children under age 18, and in particular the number of her pre-school-aged children (e.g. Mincer, 1962). These labor supply differences of women are employed in early investigations to infer how changes in marital status and fertility might have contributed to the increases in female market labor supply in the 20th century United States and elsewhere. Goldin (1990), for example, treats marriage and number of children as exogenous factors in her US study of the gender gap, and concludes the decline in fertility contributed to the increase in women’s labor force participation, which reduced the pay gap between women and men. The mechanism is intuitively clear that with fewer children, the productive value of a mother’s time at home in child care diminishes, allowing her to work outside of the family in activities which could not before be efficiently combined with her customary child care responsibilities (Heckman, 1974).

But if fertility and female labor supply are both decisions over which women may exercise some choice, and it is hard to imagine they are not coordinated to some degree, and that factors affecting both outcomes could be unobserved by the researcher, such as parent preferences. Rosenzweig and Wolpin (1980b) assumed that heterogeneity of women’s preferences for childbearing and for work in the labor market are distributed across the US population in a systematic pattern, probably inversely. This specific pattern of preference heterogeneity would lead to a larger negative association between fertility and female labor supply than would be expected if only an exogenous factor, such as a decline in the price of birth control, caused fertility to decline and thereby raised the amount of time women supply to the market labor force. To estimate this policy’s effect, the researcher could use information on the behavior of women who are differentially exposed to an exogenous policy treatment. Any

external policy-induced decline in fertility can then be evaluated, and the cross-effect of fertility on female labor supply can be assessed using IV estimation methods to deal with fertility as an endogenous variable.

Reallocating women's time from home work to market work does not necessarily entail any additional private gain or social advance. It may occur because a woman's household became more impoverished, or because the market wage rates available to the women increased. Push and pull factors may both be relevant to women's labor supply behavior, making the time allocation of women, and for that matter children, an interesting dependent variable, but not an indicator of improvements in the welfare of the private individual, their family, or of the broader society.

5.2 Family as Coordinator of Choices involving Reproduction, Production, and Consumption

One empirical strategy is to model a set of lifetime decisions of couples, including fertility, labor supply, human capital investments in children, and physical savings, as determined jointly and simultaneously. Cross effects from one family outcome to another are not likely to be zero, because all of the choices are constrained by total lifetime resources endowments, market prices, technology, and parent persistent preferences over various forms of consumption. Preferences and other determinants of family choices are not held constant, realistically, in most empirical analyses. Therefore, variation in the choice variables which are unexplained by observed constraints will tend to be correlated; in other words, the errors in the equations estimated for fertility and other family outcomes will not be uncorrelated. Research can then proceed to either estimate a reduced-form or a structural model of these family choices or behaviors.

A *reduced-form equation* can be approximated in which each family choice variable is expressed as a function of all observed environmentally fixed constraints on the family, thereby excluding from the list of explanatory variables those which are thought to involve an element of lifetime choice for the family. These reduced-form estimates may provide a basis for evaluating policy, if the policy is administered as a randomized social experiment, such that the differences in treatment are not correlated with unobserved determinants of family behavior. Even if the policies are exogenous to the family's conditions, the reduced form does not indicate the pathways by which the policy works to influence family outcomes.

Reduced form estimates, because they are not dependent on a potentially controversial choice of an "exclusion restriction" are estimated side by side for fertility and other observed family outcomes. Insight into the system of household behavior may be accumulated by estimating this series of reduced form equations, and some hypotheses are developed to account for how parents treat different outcomes, as *substitutes* for each other to satisfy similar objectives, or as *complements* which reinforce demands. Reduced form studies have examined data from India (Duraismy and Malathy, 1981; Rosenzweig and Wolpin, 1982), Colombia (Rosenzweig and Schultz, 1982), Bangladesh (Hussein, 1989), Cote d'Ivoire and Ghana (Benefo

and Schultz, 1996), for example.⁴ Some investigations analyze only the fertility outcome as a function of the local allocation of resources to the family planning program, controlling for what are assumed to be fixed household characteristics, as in Taiwan (Schultz, 1974), Thailand (Schultz, 1992) or Indonesia (Gertler and Molyneaux, 1994). However, the local variation in family planning program treatment may not be independent of the local population's preferences or unobserved characteristics, because governments may systematically allocate program resources to where they believe they are most needed, and people will tend to migrate, other things equal, to reside where local services appeal to their preferences (Rosenzweig and Wolpin, 1986, 1988).

Alternatively, fertility can be assumed to be an explanatory variable determining another family outcome, and this *structural equation* estimated conditional on an identification strategy. The conventional simultaneous equations approach to estimating such a structural relationship is to propose an "exclusion restriction" which specifies a variable that affects fertility but does not affect the other family outcome, except through its intermediate impact on fertility. For example, Schultz (1978) studied U.S. married women's labor supply in the 1967 Survey of Economic Opportunity, and assumed that women's residential location at age 16 influenced preferences for fertility (Duncan, 1965), but did not otherwise affect labor supply, controlling for the effect of current residential location and other personal factors.

Rosenzweig and Evenson (1977) estimate a system of equations across Indian 1961 Census districts to account for a relatively comprehensive set of family outcomes, including fertility, labor supply, and school enrollments for boys and girls. But to prescribe from economic theory even the sign of the partial effects of exogenous constraints such as the wages of children on schooling and child work decisions required additional structural assumptions regarding cross-substitution effects, etc.

5.3 Instrumental Variable Estimates of the "Cross Effects" of Fertility on Family Outcomes

The empirical literature on fertility and its consequences on the family is thin, probably because there is no consensus on what variables are valid exclusion restrictions, or in other words, variables which explain a significant part of the variation in fertility, but do not otherwise contribute to modifying other family outcomes of interest. To advance our knowledge of the

⁴ A study of the Colombian 1973 Census sample began by estimating reduced form equations for children ever born and child mortality rates of women by age cohorts separately for rural and urban residents, and found across 900 municipalities that more expenditures on family planning and more clinics per capita are associated negatively with fertility and child mortality, controlling for the woman's characteristics and the community climate and infrastructure (Rosenzweig and Schultz, 1982). Subsequent research reported to USAID exploited information on malaria prevalence to identify the cross effect of child mortality on fertility, by assuming that malaria affects only child mortality, whereas fertility is only affected by family planning expenditures. These conditional demand estimates of fertility on child mortality were small and never statistically significant, whereas the child mortality effects on fertility were large and significant in all six urban age groups of women.

magnitude of these “cross effects” from fertility to other family outcomes, it is important to realize that the magnitude of the cross effect may also depend on the source of change in fertility. A policy variable represents a specific “local area treatment effect” (LATE) on the fertility of certain groups in the population whose fertility is responsive, which may then spillover to influence other family outcomes (Imbens and Angrist, 1994; Heckman, 1997; Moffitt, 2005). With this interpretation of what instrumental variables (IV) estimates approximate, it is reasonable to select an instrument to predict fertility which simulates policies governments or non-profit organizations view as feasible. In this case, LATE estimates represent an estimate of the likely consequences of this realistic policy treatment.

But there are few large-scale long term studies to document how experimentally allocated treatments of a population to family planning or reproductive health, or a similar social welfare program, have impacted fertility and other family outcomes. Most research on the “cross effects” of fertility rely instead on two instrumental variables: (1) twins or multiple births, and (2) the sex outcomes of births. These instruments explain only a small share of the variation in fertility, but this share is arguably independent of the demands for children and thus uncorrelated with other family outcomes, except to the degree that they covary with fertility. Twins are more readily interpreted across cultures as an instrument, because they represent a “treatment” of a woman to an unanticipated “shock” or increase in her biological supply of births, yet they have the disadvantage of occurring infrequently, in the sense that they normally affect only about half a percent of pregnancies, and therefore a large sample is required to obtain precise estimates from this instrument of the cross effect of fertility.⁵ Twins are also different from singleton births, on average they are lighter and less healthy, and may require more substantial reallocations of family lifetime resources than mistimed births (Behrman and Rosenzweig, 2004).

Twins as an Exogenous Instrument for Fertility

Rosenzweig and Wolpin (1980b) analyzed twins as a rationing device which allocates fertility more or less randomly, as well as modifies the timing of births. They propose a two period model of fertility and labor supply to illustrate that the cross effect of a “twin on first birth” in the first period on the mother’s labor supply would be larger in the first period than in a second period, by which time more adjustment has taken place. They also postulate preference heterogeneity on the part of couples, by which they mean those with stronger than average preferences for numbers of children also tend to have stronger than average preferences for women not working in the market labor force. The preference heterogeneity implies that the

⁵ Rosenzweig and Wolpin (1980b; 2000) emphasize that parents have a goal in terms of the number and timing of births, and the effect of a birth on the mother’s labor supply will differ depending on the time labor supply is measured, e.g. the year after the birth and twenty years thereafter. A “twin on first birth” may provide parents with the time to adopt contraception and avoid having more births, even if they only wanted two. But the parents would still have to accommodate the unwanted timing of their first two births. A contraceptive failure leading to an unwanted or mistimed birth could have different implications, if it occurred before marriage or after, or if it occurred on the first or after the last intended birth. Models dedicated to explaining the timing of births have not been a clear improvement, in my view, over simpler static lifecycle models.

directly observed cross effect (estimated by ordinary least squares-OLS) of fertility on labor supply would be a larger (absolute value) negative effect than if the cross effect were estimated on the basis of an exogenous shock of a “twin on first birth”. They also argue the need to control for age at first birth in their model to deal with the timing of births within the biologically determined reproductive span of the couple. Conditioning their labor supply estimates on the age at first birth, an endogenous decision variable, complicates the interpretation of their estimates (Rosenzweig and Wolpin, 2000). They analyze the 1965 and 1973 U.S. National Fertility Surveys from which they obtain samples of about 4000 women who had a first birth before age 25 or after age 24. Their estimates based on 87 pairs of twins and conditioning on age at first birth are imprecise but generally consistent with their framework.

Bronars and Grogger (1994) consult the 1970 and 1980 U.S. Census public use microdata samples to obtain a much larger number of twins, which they define as a mother whose two oldest children in the household under age 18 are of the same age and born in the same quarter of the year. Angrist and Evans (1998) use to predict fertility either “twins-on-second-birth” or “sex outcome of the first two births”, or both, to estimate (by instrumental variables) how fertility exerts a “cross effect” on several dimensions of the mother’s labor supply. Both of these studies of women with two or more births find twins add to the woman’s fertility, and given the large sample sizes, twins significantly diminish the mother’s labor supply. Of more importance for this paper, the IV estimate based on twins on second birth as an instrument are somewhat less than half as large in absolute value as the OLS direct estimates, confirming that according to a Hausman-type specification test, fertility is not exogenous in the labor supply equation of the mother. The IV estimate is thus preferred as an unbiased measure of the cross-effect of fertility on the mother’s market labor supply, and it is half as large.

The second instrument Angrist and Evans (1998) propose to identify independent variation in fertility is the sex of the first two births, where the sex composition is hypothesized to be independent of preferences for numbers of children or unobserved variables likely to affect female labor supply. The power of the instrument to predict fertility depends on parents having a distinct reproductive response to different combinations of boys and girls. The paper reports that a US couple is about 15 percent more likely to continue to have a third birth (.46 versus .40 in the 1980 Census) if their first two births are either both boys or both girls. In other words, parents prefer to have at least one boy and one girl. When having a third birth is predicted on the basis of the sex outcome of the first two births, and this identifies the IV effect of fertility on the labor supply. The IV estimate of fertility’s effect reducing the mother’s labor supply is again much smaller in absolute magnitude than the OLS estimate.⁶

⁶ Angrist and Evans (1998) also reports evidence across age groups suggesting that the labor supply effect of the twin on second birth or same sex outcomes are larger (negatively) for younger women for whom the marginal birth may be a more recent event, consistent with the Rosenzweig-Wolpin (1980b) timing model. The OLS estimates of fertility’s effect on the mothers labor supply in 1980 are consistently larger in absolute value than the IV estimates across different dimensions of her work and its value: (1) working for pay (OLS from -.18 to IV -.12), (2) for hours per week (-6.7 to -4.6), (3) weeks per year (-9.0 to -5.7), and (4) in terms of total annual labor income of the mother (-\$3768. to -1961.). Their estimates from the 1990 Census are similar.

Jacobsen et al (1999) examine the 1970 and 1980 Censuses and use as their instrument for fertility the sex of the first two births and obtain negative IV estimates of the cross effect which are significantly smaller in absolute value than the OLS estimates. Following the same birth cohort of women statistically represented in 1970 Census and ten years older in the 1980 Census, they show that the labor supply IV effects of fertility on mother's labor supply diminished as the cohort ages, consistent with the birth timing model of Rosenzweig and Wolpin (1980b).

The sex of the first two births and whether the second birth is a twin are analyzed by Iacovou (2001) as instruments for predicting the probability of women continuing to have a third birth in the United Kingdom, and the resulting effect of this variation in fertility on the mother's labor supply. Estimates are for women with two or more births in the National Child Development Study (NCDS) which includes a cohort born in a week in 1958 and followed through 1991 (n=3188), and a British Household Panel Study (BHPS) from 1991-1992 (n=1374). According to the direct partial association (OLS), a third birth is significantly negatively associated with the woman participating in the labor force and her hours of work. But when the effect of the third birth on labor supply is estimated by IV methods, the cross effect on labor supply is no longer statistically different from zero in either sample and switched sign to positive. The inverse association between fertility and female labor supply in the UK is apparently not driven by these measures of exogenous births. Heterogeneity in preferences for children and women's work, as hypothesized by Rosenzweig and Wolpin (1980b), or other unobservables correlated with fertility and female labor supply in opposite directions, are possible explanations for these findings from the UK.

Because the naturally occurring frequency of multiple births is low, twins may not be an ideal instrument for fertility unless large samples are available and reporting of twins is very accurate. Therefore, as an alternative instrument for fertility (or conceptually fecundity) Xia Li (2004) analyses whether a woman on her first pregnancy experiences a miscarriage. Miscarriages are reported to occur in roughly 11 percent of first births reported in the 1995 US National Survey of Family Growth (n=7000 when 1998 survey is also included).⁷ Using a miscarriage on first pregnancy to identify exogenous variation in fertility, she finds the probability of miscarriage is negatively and significantly related to children ever born, suggesting the instrument proxies subfecundity or a discouragement effect of this event on the demand for childbearing.⁸ The associated IV estimate of the cross-effect of fertility on a mother's labor force participation and hours worked is negative, and about one half the absolute magnitude of the directly estimated (OLS) association. The magnitude of her OLS and IV point estimates of these cross effects of fertility on female labor supply are similar to those reported by Angrist and Evans (1998), when she restricts her sample to be relatively comparable to their sample from the 1990 Census.

⁷ Although miscarriages occur much more frequently than twins, the overall power of miscarriages as an IV for fertility is not much better than twins in these US surveys.

⁸ If all women are not equally aware of an early miscarriage, or fail to report this event, this instrument could be measured with error, and if reporting the event is related to the demand for children, it could undermine its validity for an exogenous instrument for fertility.

Sex Composition of Births as an Instrument for Fertility

The reproductive response of parent to their sex preferences for offspring may differ widely across cultures, and could also change with economic development, but there are relatively few studies in low income countries from which to generalize. Chun and Oh (2002) use the sex of the *first* child in Korea as an instrument for predicting fertility in the first stage regression before estimating women's labor force participation. They analyze the 1996 wave of the Korean National Survey of Family Income and Expenditures (n= 3997). Having a male on first birth is associated with a woman having .15 fewer children at the time of the survey; Korean parents appear to be more likely to stop bearing children after having a male birth than a female birth, and the effect of a second male birth is also to reduce further the likelihood of continuing to a third birth. When the labor force participation effect of fertility is estimated based on this significant instrument, an additional child is associated in the IV estimate with female labor force participation being reduced, -.28, whereas the OLS association between fertility and labor force participation is smaller in absolute magnitude, -.06. This is the only case I have found where the IV estimate of the cross effect of fertility on a family outcome is absolutely larger than the OLS estimate of the same parameter. This empirical regularity suggests that the local area treatment effect (LATE) of a male on first birth is to decrease the woman's labor force more than would the average association of fertility and labor force participation (Imbens and Angrist, 1994). Apparently in Korea those women whose fertility is most affected by their preference to have a male child are also less likely than the average to work in the labor force. In Korea parents who appear to have a stronger preference for their offspring to be male tend to also have a stronger preference for women to not work outside of the home or at least to dedicate more of the mother's time to the highly valued task of rearing a son.

Technological developments may undermine the validity of these two instruments for measuring exogenous variation in fertility. Techniques to test for the sex of the fetus early in a pregnancy (e.g. by means of ultrasound, amniocentesis, or chorionic villus sampling) allow parents who have a sufficiently strong preference for the gender of their child to abort a fetus, if it is of the unwanted sex. If this occurs, the sex composition of children may become correlated with the couples' preferences for women to work (and other family choice outcomes), and cease to be a valid instrument for estimating the cross-effect of fertility. The increasing number of male to female births at each successively higher parity in countries such as Korea, China, and portions of India may reflect a strong preference for male offspring.⁹ Since about 1980 in high income countries, twins are also a questionable instrument for fertility, because drugs administered to assist parents to conceive a child also increase the probability of having a multiple births. Because parents of multiple births are increasingly likely to have used fertility

⁹ By 1989 the ratio of male to female births in Korea increased from a normal value of 1.06 for first births, to 2.17 for fourth-order births (Schultz, 1997, Table 4). Models of fertility estimated from Chinese data for women with at least one birth also reveal the strength of traditional male preference, in which the share of male births reduces the likelihood a Chinese woman will have an additional birth at all estimated parities (Schultz and Zeng, 1995). However, it has been observed that the sex ratio of births may be affected by the prevalence of Hepatitis B Virus, which may offer an alternative biological mechanism for part of the regional pattern of sex ratios at birth (Oster, 2005).

enhancing drugs, twinning will be correlated with subfecundity, on the one hand, and also with relatively strong preferences on the part of parents for additional children. It can no longer be confidently assumed that twins and multiple births are uncorrelated with the preferences of parents for childbearing or for women working in the market labor force.

5.4 Testing the Quantity-Quality Hypothesis : Fertility and Child Human Capital

Another consequence of fertility within the family could arise if the number of siblings affects the productivity, consumption, and welfare of a child. It has been hypothesized that parents who have more children commit less of their time and resources to each of their children (e.g. Becker, 1960; Becker and Lewis, 1974; Zajonc, 1976 ; Blake, 1989).¹⁰ This inverse relationship between what is called the “quantity of children” and the “quality of children” suggests that parents who are encouraged to have fewer children may also invest more in the human capital per child, and thereby improve the health, education, and lifetime consumption opportunities of their children. This view of the tradeoff for parents between having more offspring and allocating more resources to each child, given their resources, is also a central idea in sociobiology and psychology (Zajonc, 1968; Wilson, 1975; Becker, 1981). As with female labor supply, parents undoubtedly have heterogeneous preferences for the quality of children, and these qualitative preferences could change the shadow price of an additional child. Because society often intervenes to provide social services to improve childhood nutrition, public health, and schooling, the magnitude of this quantity-quality tradeoff could be a factor motivating society to assist couples to avoid unwanted children, or to subsidize birth control¹¹.

Cross tabulations of census, administrative, and survey data on a respondent’s number of siblings and their schooling or their success in the labor market appear to be consistent with the quantity-quality hypothesis (Becker, 1960; Blake, 1989). But this empirical regularity is not sufficient to argue the relationship is causal, and even this correlation is not evident in some rural low-income populations where education levels are low. For example, Maharani (2004) documents in the Indonesian Family Life Survey collected in 1993 and 1997 that a woman’s completed fertility and the schooling of her children are not inversely related in rural areas, and

¹⁰ Becker (1960: p. 217) conjectured: “Because (child) quality seems like a relatively close substitute for quantity, families with excess children would spend less on each child than other families with equal income and tastes. Accordingly, an increase in contraceptive knowledge would raise the quality of children as well as reduce their quantity.”

¹¹ In those states which first legalized abortion in the United States, the frequency of crime two decades later appears to have diminished significantly. A study has explored many aspects of these data and argues that the increased access to abortion, as a means for avoiding unwanted children among the poor, led to a reduction in youth from disadvantaged backgrounds in those states, which was the cause for the decline in crime (Donohue and Levitt, 2001). One interpretation of their instrumental variable estimates of the determinants of crime is that policy which reduces unwanted childbearing (i.e. legal access to abortion) helps not only poor women and their children, but also relieves society of the external social costs of crime. Indicators of child welfare and living conditions are also shown to improve for children whose parent had access to legal abortion (Gruber, et al. 1999).

indeed there is a positive relationship among women age 40-49, which becomes insignificant only among younger rural women. Among women residing in urban areas, there is no simple pattern among older women, and the “modern” tradeoff is significantly different from zero only for the women age 20-29.¹² Montgomery et al (1995) analyze Living Standard Measurement Surveys from Cote d’Ivoire and Ghana collected in the late 1980’s and find little direct association that schooling of children is lower for women who have higher fertility. But even when the conventional inverse empirical regularity between these family choice variables is present, it does not imply that an exogenous increase in fertility would necessarily depress the school attainment of a woman’s children, or vice versa. To test the quantity-quality hypothesis the researcher requires a setting where the variation in quantity (e.g. completed fertility or number of siblings) is caused by an exogenous variable which is arguably a valid instrument for fertility and uncorrelated with desired, demanded, or preferred fertility.

Based on the Additional Rural Income Survey of 1969-71 from India, Rosenzweig and Wolpin (1980a) use the frequency of twins per completed pregnancy as an instrument for a woman’s completed fertility. This approximately random instrument is then shown to be significantly associated with lower levels of completed schooling of the woman’s children, based on 25 twins in 1633 families, and associated with lower expenditures on consumer durables, which are used to represent non-child household commodities. If one assumes that twin rate is independent of other determinants of schooling, income etc., fertility is increased by about .8 births by a twin, and this exogenous shock to fertility induces the family to substitute away from schooling per child. In a rationed consumer demand framework where the allocation of twins is an exogenous shock to fertility, the negative cross-effect of fertility on schooling per child is evidence that parents treat their number of children and the human capital per child as substitutes, consistent with the quantity-quality hypothesis.

Another way to distinguish exogenous variation in fertility is to recover a measure of biological heterogeneity in a couple’s fecundity by assuming more structure for the reproductive process and antagonizing the important choice of contraceptive practice. In other words, contraceptive practice and conception rate of a couple are used to infer the couple’s latent reproductive endowment or biological fecundity. Desired family size and accumulating knowledge by the couple of their reproductive endowment is expected to influence whether in each period they use a contraceptive, and how effective a method they choose. The technical effectiveness of various contraceptives to reduce fertility is first estimated in the form of a two-stage fertility production function, in which local prices and household characteristics affect the couple’s demand for contraception. Then this estimated model and the actual contraceptive practice are used to recover the residual variation in a couple’s latent rate of conception (Rosenzweig and Schultz, 1985). The couple’s unexplained variation in fertility is then

¹² I would conjecture that at the low levels of schooling attained by the children of older rural Indonesian women, schooling was not a major cost of childbearing, and wealthier rural parents sought more children and provided them with more schooling because land allowed them to employ more child labor. In the urban sector where today the average child receives some secondary schooling, and children are a less important source of family income, the modern trade-off is clearly evident in the cross section. However, this does not mean that family planning programs have increased the schooling of children. But the hypothesis warrants study.

attributed to the couple's fecundity. With the Malaysian Family Life Survey from 1971 to 1976, this measure of fecundity is analogous to twins, but a continuous variable approximating a couple's reproductive "endowment", given their contraceptive behavior. This fecundity variable is associated with more children ever born, use of more effective contraception (n=816), lower birth weight for her children, and less schooling per child, controlling for her education, age, and husband's earnings (Rosenzweig and Schultz, 1987). All of these IV estimates of the effects of exogenous fertility on child quality outcomes are smaller in absolute value than if they are estimated as the direct partial association between fertility and the indicator of child quality.¹³

Fertility and child health outcomes are analyzed as joint choices in the Kenyan Welfare Monitoring Surveys of 1994 and 1997 (n=4921, 3206), in which the rate of twinning per completed pregnancy is employed as an instrument for children ever born among women over age 35, controlling for age, region, etc. The negative partial correlation (OLS) between fertility and child health is significant, but this association becomes smaller and less statistically significant when the mother's fertility's effect on child health is estimated using the rate of twinning as the instrumental variable (Schultz and Mwabu, 2003).¹⁴

¹³ Studies also distinguish when a respondent indicates she has had more births than desired, or if a recent birth (when it was conceived) was mistimed, or not wanted ever. Montgomery and Lloyd (1999) estimated from four Demographic Health Surveys whether the schooling of a woman's children is partially associated with her reporting mistimed births in the last five years, or had more births than desired. If it is assumed that the occurrence of mistimed and unwanted births is uncorrelated with the couple's preferences for childbearing or determinants of desired fertility, these mistimed and unwanted births would be valid instruments for exogenous fertility. Instead the authors estimate a joint probit model to explain excess fertility and a discrete measure for the schooling of her children. Their model specification test is that the errors in the two equations are independent, which is rejected in the case of Egypt and the Philippines, and one case of Kenya (Appendix C). Conditional on the joint independence of the errors in the fertility and schooling equations, they report that unintended or undesired fertility is associated with less schooling of children in Dominican Republic and the Philippines, but is not significantly related to schooling in Kenya or Egypt. Because undesired fertility is defined relative to desired fertility, the two variables would seem to be related by definition, causing them to be correlated if only due to occasional reporting errors in desired fertility. They might have adopted the instrumental variable estimation approach, and assumed the unwanted or mistimed births were valid instruments to predict fertility, and then condition child schooling on this instrumented form of fertility. Comparing this IV estimate of the unwanted fertility cross-effect with the OLS estimate of the cross-effect would allow them to calculate a Hausman (1983) specification test of whether fertility appeared to be exogenous in their schooling equation. Rosenzweig and Schultz (1987) find that their residual estimate of fecundity of couples in Malaysia is significantly correlated with the couple's reporting their last birth unwanted or mistimed. The problem with this methodological approach is that the respondent's classification of a birth as mistimed or unwanted is subjective and is arguably endogenous itself, invalidating it as an exogenous instrument for fertility.

¹⁴ The health of children under age five is summarized by height-for-age and sex, and weight-for-height by age and sex, expressed as standardized Z scores, which is defined as the child's deviation from the median child of the same age and sex as observed in a well nourished (US)

Other studies estimating the effect of exogenous variation in fertility on child quality have used the sex composition of births, but it should be emphasized that these instruments have explanatory power to predict fertility among parents who have a preference between having boys and girls, and thus these sex composition instrumental estimates of the cross effect of fertility on child quality are not likely to approximate the effect of other policy instruments such as a subsidy for contraception in a family planning or a reproductive health program. These estimates of the quantity-quality tradeoff are therefore culture specific and not likely to be comparable to estimates based on other fertility instruments. They do, however, provide insight into the importance of estimating the effect of fertility as if it were an endogenous family choice variable rather than exogenous with respect to family investment in child quality, which is regrettably the common practice in the social sciences (Zajonc, 1976; Becker, 1981; Blake, 1989).

Lee (2004) analyzes the determinants of fertility and child educational investments in Korea. He examines the Korean Household Panel Study from 1993 to 1998 ($n=5180$), and finds that if a woman's first child is a girl, the woman is more likely to have a second birth, and the time to the second birth is also shorter, according to a hazard model. The same is true for continuing to a third birth, if the first and/or second births is a girl. Relying on whether the first birth is a girl as an instrument for completed fertility, Lee finds the direct (OLS) estimate of the elasticity of educational investment per child with respect to fertility is -0.5 , whereas the instrumental variable estimate of this elasticity is -0.3 . The random variation in sex of the first child as an instrument for the mother's fertility yields smaller absolute effects of fertility on investments in children's education than when the analysis is based on the direct partial correlations. Much of the substitution observed across women between their fertility and the education of their children is thus eliminated when the analysis focuses on variation in fertility which is exogenous to parent demands, and induced by random variation in the sex of their first birth.

Jensen (2005) hypothesizes that son preference combined with a sex-differentiated birth stopping rule would lead girls to have more siblings than boys, and this could explain why girls are in larger families and get less education in a country such as India. In a 2001 Survey of Aging in Rural areas of five Indian states ($n= 2693$ households) Jensen reports that girls have $.47$ more siblings if the first child in their family is a girl and $.76$ more siblings if the first two births are girls (Table 5). Dividing his sample into those couples who indicate a son preference and a desire to educate sons more than daughters (51%), the OLS estimated effect of an additional sibling is -1.2 years of schooling, whereas the estimated effect of siblings instrumented by the sex of the first two births is $-.69$. The quantity-quality tradeoff is still present, but diminished by about half when it is based on a random treatment of the couple to the sex outcomes of their first two birth.

population, expressed in units of standard deviations for each age and sex group. The findings are robust to constructing the Z scores around Kenyan median anthropometric growth curves for children rather than those derived from US population figures.

In another study of India, Sarin (2004) reported that in the NFHS of 1998 a woman whose first two births are boys is expected to have a smaller completed family size, with beneficial consequences for her children's health. But these IV estimates of the cross-effects of fertility on child health are substantially smaller than those implied by the OLS estimates of the same relationship. The role of sex of offspring as an instrument for fertility or other family behaviors requires that the researcher interpret cultural and economic repercussions of the sex composition (Deolalikar and Rose, 1998; Rose, 2000). Hypothesizing how decisions are made in the family can explain further regularities and potentially lead to the derivation of additional testable implications. But stratifying the sample according to stated preferences of the respondent, as reported by Jensen (2005), may introduce other types of endogenous sample selection bias.

Qian (2004) examines the consequences of China's relaxation of its one-child policy to allow a one-boy-two-child policy after about 1975. She analyzes a sample of 28,771 households from the 2000 Census, drawn from 21 rural counties in four provinces for which she relies on the 1998 China Health Nutrition Survey to document the timing of local changes in the birth quota policy. First-born girls born in 1977-81 are shown to have 0.2 more siblings than first-born girls born earlier in 1973-76 under the one child policy. Qian attributes this significant change to the local government's policy change, and relates this increment in siblings to an *increased* probability of .04 in first-born girls being enrolled in school in 2000 (compared to a sample average of .44 in Tables 1 and 5). However, the direct ordinary least squares estimate of the partial association of sibling number on girls enrollment is $-.017$, and significantly different from zero as typically observed in the descriptive literature on child quality(schooling)-quantity(sibling number). If this change in sibling number is uncorrelated with unobserved factors determining the parent's demand for male and female children and their schooling, the estimated cross-effect of relaxing the birth quota is estimated to increase significantly the schooling of girls, but not of boys. Thus, child quality and quantity do not appear to be substitutes in this study, but rather appear to be complements. It is also shown that the male to female sex ratio of first births declines with the relaxation of the birth quota by .06 (from a mean of about 1.12 in Table 4), which is consistent with the relaxation of the quota policy contributing to diminished selective abortion on the basis of sex screening of fetuses. I interpret these findings to suggest that the welfare gains to the Chinese family from the option of an additional birth increases the demand for the schooling of the first-born girl and this positive (income?) effect dominates the cross-substitution effect from quantity to quality, if it is negative. It seems likely that the quantity and quality tradeoff requires a more elaborate framework to deal with the distinction between boys and girls in such settings, and may also need to be modified to approximate the effects on family behavior when population policies operate through birth quotas rather than as voluntary family planning with subsidized contraception, health, or child schooling services.

Using Norwegian administrative data for all persons, Black, et al (2004) rely on the occurrence of twins on a second or subsequent birth as an instrument to predict the completed schooling of a woman's children (currently age 25 or more) born before the arrival of the twins. The twin-induced variation in the mother's fertility is not a statistically significant determinant of the children's schooling, based on the IV estimate, with or without controls for birth order. The conventional OLS relationship, however, is strongly negative (Black, et al. 2004: Table 6).

Their evidence is consistent with heterogeneity in women's preferences for going to school and for reduced childbearing (or another unobservable variables such as ability) which contributes to the inverse direct OLS relationship.¹⁵ The capacity of Norwegian mothers to compensate for the effect on the "quality" of earlier children of having a later twin may be greater in a high income country such as Norway with its egalitarian welfare and schooling systems than of a mother in a low income country. In other words, the magnitude of the OLS bias implied by estimating the effect of fertility on child quality by instrumental variables may not be precisely replicated in a low-income country.

5.5 Estimating Program Effects on Fertility and on Other Family Outcomes

It is reasonable to assume that if the private costs of birth control are reduced by a population program, fertility is likely to decline.¹⁶ Table 1 outlines other family outcomes which might be potentially affected over the lifetime of the beneficiary by a program-induced decline in fertility. As stressed in this paper, many of these potentially important mechanisms have not been empirically studied, but could be analyzed by using social experiments or by using well-designed instrumental variables to identify exogenous variation in fertility which is not correlated with demand factors or parent preferences for fertility and other outcomes.

Many forms of social welfare policy, including family planning and reproductive health programs, which an individual does not control could be a valid instrument potentially affecting fertility, and these programs would then be an exogenous treatment from the couple's point of view. Family planning policies which may reduce the cost of avoiding a birth for persons who have local access to the program may lead to the assumption that treatment to the program is independent of the couple's reproductive preferences or the conditions which lead different couples to want few or many births. The random occurrence of twins and the reduction in the private cost of birth control due to a family planning program therefore influence fertility in opposite directions, but otherwise can be thought of as having a similar type of exogenous effects on fertility.

But the welfare consequences for different individuals of a supply shock to fertility or a family planning programs intervention will differ according to each couple's reproductive goals, their current number of surviving children, age, and fecundity (Schultz, 1992). The private cost of a twin on first birth will be smaller for a couple who want many children, than for the couple who wants only one. The private benefit of a policy-induced decline in the price of birth control is smaller for the couple who wants many more children, than for the couple who want no more children, other things being equal. The policy treatment provided by the independent family planning program and the twin on first birth yield instrumental variable (IV) estimates which identify a local area treatment effect (LATE). However, there are relatively few studies which

¹⁵ Contrast this with the finding of how a child's cognitive ability is related to the the education and cognitive ability of its biological and adoptive parents (Scarr, 1978)

¹⁶ The reduced price of birth control would raise the cost of children which is assumed to dominate any incomes effect which might increase the demand for children, if children are a "normal" economic good, whose demand increases with more income and no change in prices.

report estimates of fertility variation induced by a population program. There are two I know of which also examine how the program impacts long run outcomes for the family.

A key issue for social policy is will a subsidy for family planning not only reduce fertility, but also improve child quality and family welfare? Studies evaluating the success of family planning programs often stop with an evaluation of how contraceptive knowledge, attitudes and practices change following a program intervention. And even when the intervention treatment is designed as a sophisticated randomized experiment, the short run focus on adoption of modern means of birth controls methods distributed by the program overlooks the longer run repercussion (Cf. Taiwan, Taichung City Experiment in 1963, documented by Freedman and Takashita, 1969). Few studies follow up the program intervention to evaluate how the treatment is associated with fertility outcomes over time. Program evaluations should assess how *completed* fertility is impacted by the program, as well as the timing of births. Although it may be important that the program provides better control over the timing of births, one expects program evaluation of the adoption of modern contraceptives to overstate the change in *the practice of effective* birth control, simply because many couples would have used more traditional birth control methods to deal with unwanted conceptions in the absence of the program. Traditional means of birth control, such as prolonged breast-feeding, postpartum delay of intercourse, and even induced abortion, may diminish in the aftermath of a modern family planning program, suggesting the uptake rate of modern contraceptives will tend to overstate the program's impact on fertility, as well as overlook other welfare gains (Schultz, 1992). Changes in fertility in the first few years after a program starts would likely overstate the longer run consequences on lifetime fertility, because initially the program achieves a better timing of births which may delay the onset of childbearing and cause a transitory dip in period-specific birth rates.

Miller (2004) estimates the relationship between the timing of a Colombian woman's exposure to a local family planning program and her fertility, and the relationship between this exposure and a variety of indicators of her welfare and that of her children. Miller interprets these associations as reduced-form estimates of the consequences of the family planning programs. This reduced form approach has the attraction that it captures the effects of family planning that may influence a variety of family outcomes, some of which may operate through fertility decline, while other program effects may empower women and foster changes in social organization that could also matter for these family outcomes. Earlier exposure to family planning is shown to be positively related to the woman's years of education, work in the formal sector, and negatively associated with current cohabitation in 1993, but is insignificantly related to the share of her children who are dead. The data do not match the woman to her own children in the household, and those children who are enumerated in the mother's household could also be an unrepresentative sample, because the age of leaving home is likely to be negatively related to poverty. But based on statistical adjustments for the community characteristics, Miller reports evidence that "statistical mothers" with longer exposure to local family planning programs are associated with children who are more likely to be attending school, have completed more years of education, are less likely to work in the formal sector, and are less likely to have already had a child of their own. In sum, the study concludes that exposure of a woman to family planning from age 15 to 44 is associated with a reduction in cumulative fertility of 10-12 percent in urban areas, improvements in her education of 0.3 years attainment, and increase in her formal

employment, as well as causing an intergenerational increase in her children's schooling of 0.1 years, and a delay in her child's first birth (Tables 5, 9, 10). The educational gains of children associated with their mother's exposure to family planning appear to be greater for boys than for girls. There is also evidence that the inequality in municipality education (i.e. standard deviation) is lower in 1993 for those who have had more local exposure to family planning. Miller interprets this pattern as consistent with family planning access and mother's education being substitutes in their effect on the costs of avoiding unwanted births, a pattern directly estimated in the 1973 census of Colombia (Rosenzweig and Schultz, 1982).

A limitation of the study is that the Colombian family planning program started in the late 1960s in the major metropolitan areas, and then expanded in the 1970s and 1980s to serve smaller towns and rural municipalities, suggesting that those communities first served by the family planning program are unrepresentative of Colombia. Women in these metropolitan areas who were first served by the family planning program probably already had stronger demands for birth control than the average woman of that age within urban or rural areas in the 1993 census sample. The variable representing exposure to family planning for women of different cohorts within a region may therefore also capture the effect of other changing characteristics of these neighborhoods that may influence desired fertility and may also be associated with poverty reduction. If these characteristics are not adequately controlled for by including, as Miller does, dummies for municipality and linear municipality trends, the estimates of the family planning program effect will tend to be biased. Miller tests his identifying assumption of exogenous program placement by comparing changes in fertility between women of different ages in the five years before a family planning program started in a region, and finds no relation to fertility or to the other welfare indicators (Table 7). The analysis also focuses on women in urban or rural areas, but may need to explicitly deal with sample selection bias due to intersectoral migration, and excluding migrants and rural residents does not address fully this problem. Interregional migration is frequent in Colombia, especially from rural to urban areas, and already by 1973 migration is related to women's fertility, child mortality, and children's education, conditional on the woman age, education, and region (Schultz, 1988b). Nonetheless, Miller's (2004) study illustrates how historical data can be used to evaluate the longer term welfare consequences of family planning, and for that matter the approach could be extended to evaluate reproductive health programs that are introduced in a staggered regional fashion within a single country, even when the program's implementation does not follow an experimental design (Cf. Colombia by Rosenzweig and Schultz, 1982; Indonesia by Gertler and Molyneaux, 1994; and Taiwan and Thailand, Schultz, 1974, 1980, 1992).

There have been few social experiments designed to document the efficacy of family planning programs on lifetime fertility and on the long-run welfare of family members, including children. One example I know of occurred in the Demographic Surveillance System (DSS) in rural Matlab, Bangladesh, where there was implemented in October 1977 an intensive outreach family planning and health services project, which visited all reproductive aged women approximately every two weeks and reduced the private time and psychic costs of obtaining birth control, especially injectables, in half of the surveyed villages (70 out of 149 in DSS). In 1996 4363 households were surveyed in Matlab in the program treatment and control communities (MHSS), allowing Sinha (2003) to estimate the direct and "cross-effects" of the family planning outreach intervention that may have generally improved the welfare of women, children and men

in the treatment villages. She found this social experiment (n= 4124) was significantly associated with women reporting 14 percent fewer children ever born in 1996, less than the 25 percent decline which Phillips et al (1982) found in the first two years (1978-79) of program operation. As anticipated above, the program had a larger effect on fertility in the short run, probably due to longer spacing of early births which were partially offset in the long run in terms of completed fertility (Phillips, et al. 1988; Koenig, et al. 1992).¹⁷

In the 1980s and 1990s Bangladesh achieved a large increase in school enrollment rates. The program treatment villages, however, did not show a higher level of school enrollment or completed schooling achievement among the children compared with the matched children in the control communities. Residence in the villages exposed to the program treatment is a significant instrument for predicting fertility, but the IV estimate of fertility's cross-effect on schooling among either girls or boys separately is insignificant and small in magnitude, failing to confirm Becker's (1960, 1981) hypothesis of parent substitution of quality for quantity.¹⁸

Sinha also analyzes whether the program-induced decline in fertility contributed to a reduction in child labor supply, and finds no effect for girls and a statistically significant small effect of the family planning program *increasing* labor supply by boys. Reduced-form estimates of the program treatment effect directly on school enrollment, attainment, and child labor also confirm the same lack of effects of the program on child schooling, and a small effect increasing male child labor, precluding that the program exerted its influence on family outcomes through pathways other than fertility.¹⁹ Thus, this one long-term evaluation of a family planning and

¹⁷ In Taiwan, analyzing the partial association of family planning program activity per woman across 361 districts, the apparent effect of the program on age-specific birth rates was larger in the first few years of the program than after five years, when the program's effect on fertility could no longer be precisely estimated from the cross sectional variation. Including regional fixed effects and estimating first differences did not change the results appreciably. It is also noted that the reductions in births related to an increased application of program staff per woman of reproductive age implies nonlinear effect, with diminishing returns to scale of effort (Schultz, 1974). A similar pattern of diminishing returns to scale is observed in Thailand's public family planning program as of 1970 (Schultz, 1992).

¹⁸ Foster and Roy (1997) report a positive education effect for some of the children in families in the villages offered the intensive family planning and health program treatment.

¹⁹ A potential weakness of this study of the long term effects of a randomized family planning initiative is that individuals could have migrated out of the Matlab district in response to the treatment, making the 1996 sample of non-migrants unrepresentative and potentially a biased basis for evaluation. Perhaps the women who benefitted from the family planning program and avoided unwanted births were then more successful in migrating out of Matlab and in their new locations invested more in the schooling of their children than those staying behind in the treatment areas. This form of attrition bias in panel surveys warrants more study (Fitzgerald, et al. 1998). If the respondents to the 1996 Survey could be matched to those who resided in the treatment and control villages immediately after 1977 intervention, in an earlier Census, it might be possible to estimate the likelihood of leaving the original sample region, and then assess whether attrition differed between the treatment or control areas.

health project documents a major decline in fertility, but does not find the anticipated increase in children's schooling or decrease in child labor, or the cross-effects of the fertility decline which are commonly seen as an important social externality justifying family planning and health programs in the least developed countries. Half a century of experience with implementing family planning programs throughout the world has produced relatively few salient experimental evaluation studies which document the long-term consequences of family planning programs on family welfare. It is also surprising how few evaluations there are of even the direct effects of family planning programs on *completed* fertility, where the local allocation of the program treatment has been experimentally designed or statistically analyzed to yield credible evidence of program impact.

Other economic and demographic conditions that are hypothesized to have contributed to the transition decline in fertility include (1) improved child health and survival and diminished child malnutrition which are associated with increased supplies of food calories per capita and of course widely improved public health programs for children and mothers; (2) increased educational attainment of females relative to males; and (3) improved employment opportunities for women, especially those arising outside of the family, which empower women and are less readily combined with a mother's performance of child care (Schultz, 1994, 1997, 2002). In the remainder of the paper, I discuss research which has sought to establish how public policies have affected child health and parent education, and thereby reduced fertility and affected the welfare of woman and families.

5.6 Health as a Factor Changing Fertility and Family Well Being

Improvement in health and declines in mortality benefit families and is often assumed to motivate parents to reduce their fertility (Schultz, 1981). The many-fold increase in world population since the onset of the Industrial Revolution is a result of the decline in age-specific mortality rates, and has led to a doubling of life expectation at birth. Toward the end of the 19th Century this improvement in health became associated with larger proportionate declines in age-specific mortality for infants and young children than for adults. After the Second World War improved in drugs and public health methods diffused to most parts of the low-income world, with the consequence that infant and child mortality fell abruptly (Preston, 1980). If the reproductive goals of parents are framed in terms of having a specific number of *surviving* children to work with their parents and care for their parents in old age, the improved prospects of child survival could explain some of the subsequent decline in birth rates.²⁰

²⁰ Studies of household surveys have generally documented the positive association between a woman's child mortality rate and her fertility rate (e.g. Schultz, 1969, 1974, 1981). But this empirical regularity should be interpreted with caution as evidence of a replacement response of parents to the experience of child loss, because other factors are probably contributing to both the decline in child mortality and fertility. Lacking a valid exogenous basis for identifying this cross-effect of child mortality on fertility, only reduced form equations can be estimated for both fertility and child mortality rates. Where there exists a clear empirical basis for identifying cross-effects, they may be tentatively estimated, and they suggest substantial positive responses of fertility to child survival in low income countries (Rosenzweig and Schultz, 1982; Schultz, 1994, 1997; Benfer and Schultz, 1996).

Clinical panel studies (Barker, 1997) and historical samples (Fogel, 2004) link improvements in nutrition and health of the mother before birth and reduced exposure of the child to early infectious diseases to improved adult health status, reduced chronic health problems after age 50, and increased years of disability-free life in old age (Kannisto, et al. 1994; Finch and Crimmins, 2004). Conditions that achieved the reduction in child mortality and improvements in early child nutrition may have physically and cognitively facilitated children's school achievement and enhanced their productivity as adult workers (Schultz, 2001). As in the case of evaluating family planning, however, researchers have rarely relied on "natural experiments" from which they could identify the contribution to this advance in health of specific policy interventions. These are important connections to evaluate more precisely, because public health and nutrition interventions compete today for limited public resources in low income countries. Setting priorities without knowing the consequences of providing particular interventions for particular groups will undoubtedly waste resources and slow economic and social development.

The impact of fertility on family members requires careful empirical assessment. This paper has surveyed the evidence I could find on exogenous sources of fertility to assess the likely impact of exogenous population policy on long run family outcomes. Although I have only outlined the conditions under which these estimates are satisfactory, more formal models characterize how estimates differ.²¹ Because the behavioral and biological mechanisms involved cut across disciplines, research in demography, sociology, public health, and clinical sciences are all relevant. Much additional research is undoubtedly relevant and omitted here due to my lack of familiarity with these allied fields. Different forms of survey and experimental data, including qualitative research, have much to offer. One factor common to most efforts to understand fertility and health outcomes is education, as a determinant of the productive value of time and a learned capacity to innovate and use efficiently new techniques and possibly facilitate the schooling achievements of their children. Parent education is also being reappraised as more than an exogenous endowment of a child's family, and viewed as an endogenous choice variable capturing the influence of unobserved variables operating on marriage match quality, and genetically determined ability, transmitted genetically as well as economically to the child (e.g. Scarr, 1978; Plug, 2004).

5.7 Educational Attainment of Women as a Factor Changing Fertility and Family Well Being

The effects of female and male education on fertility and child health are critical for understanding the demographic transition, just as they are for explaining changes in health and birth control practices (Schultz, 1994, 1997). Instrumental variable methods may be useful in exploring whether the associations between parents education and health and fertility are causal, or biased by unobserved heterogeneity, such as due to preferences or innate abilities that affect many facets of family behavior. Research on this topic is currently concentrated in high-income

²¹ See Rosenzweig and Wolpin (2000) and especially their last section which discusses estimates of the effect of fertility on mother's labor supply.

countries, although it may ultimately prove more important in low-income settings. The central question is whether policy-induced changes in the education of women may exert less of an effect on fertility and on family health outcomes than implied by direct correlation estimates which assume the education of men and women is exogenous to family outcomes. The consequences of schooling on labor productivity has been analyzed for fifty years by many social scientists who are skeptical that the correlation between schooling and wages is causal. The choice to go to school is a family and individual decision, possibly affected by unobserved abilities, educational opportunities, and policies which could benefit different sub-populations.

Currie and Moretti (2003) report for the United States that if a junior college opens in the county of birth of a woman, this local educational opportunity is positively associated with her probability of attending college. This association occurs for women who were of the age to enter college, and is not significant for earlier birth cohorts of women, suggesting the relationship is not due to other persistent characteristics of regions. Using these junior college openings as their instrument for educational attainment of a sequence of birth cohorts of women, they estimate this instrumental variable effect of the woman's education on health outcomes related to her first birth. On the whole, the schooling induced by the local college opportunities (i.e. IV estimate) has a beneficial effect raising her first child's birth's weight, increasing the likelihood of prenatal care, and decreasing her smoking during the pregnancy. In other words, the expansion of local college educational opportunities increases women's enrollment which appears to cause these women on average to have improved health outcomes for themselves and their children.²² The OLS estimates of these educational effects are not notably diminished (in absolute value) by instrumenting for the women's education by the colleges openings. Thus, in this US case, adding local educational facilities that impacts women's schooling improves the health of the next generation of children. But the data do not lend themselves to an analysis of the joint contributions of the schooling of the mother and the father to child health outcomes.

The educational attainment of Indonesian men and women as observed in 1995 are related to a 1974 primary school-building program (INPRES) in the individual's birthplace (Duflo, 2001). Empirical checks confirm that program outlays are not associated with educational attainment of persons who were already too old in 1974 to benefit from the new schools (i.e. over age 12) and thus not a persistent regional advantage in educational opportunities. The magnitude of the effect of school building on schooling attainment is larger for those who were in 1974 younger (i.e. from age 12 down to age 2). The school-building-induced gain in education is associated two decades later in 1995 with wages of the potential beneficiaries born in those regions being higher. These wage returns to education are similar to those estimated by direct OLS estimation of the conventional wage function which treats education as exogenous. Thus, local area beneficiaries of the school building program appear to have enjoyed the same wage returns to schooling as reported by the entire population. This study does not confirm a systematic ability (omitted variable) bias due to estimating the effect of education on wage productivity as if schooling were simply exogenous.

²² Moretti indicates that in an early draft of the paper they also reported that the instrumented education of the woman was associated with a delay in her first birth (greater age), suggesting the effect of the local junior college treatment was to reduce fertility as well as improve the health status of first child.

Breierova and Duflo (2004) extend the analysis of the Indonesian school building program to assess its impact on fertility and child mortality of parents who are consequently better educated by the program. They account first for the average of wife and husband schooling and then for the schooling difference between wife and husband using as instruments the school building program in birthplace and the Indonesian difference in age of husbands and wives, which is substantial. These predicted average and gender differences in education are then employed to account for the women's fertility and child mortality as of 1995. First the direct partial associations (OLS) of a woman's schooling and her husband's schooling reveals the common pattern that women who are better educated have lower child mortality and lower fertility, and their husband's schooling is negatively associated with child mortality but positively associated with fertility.²³ Women who were six in 1974 and thus able to benefit fully from the new schools are only 27 in 1995, and may not have completed their childbearing. The authors report estimates which suggest the probability of having a child by age 15 is significantly reduced by the gender difference in education, whether estimated by OLS or IV methods. But the number of children ever born by age 25 is not associated with the IV gender difference in education, possibly because the better educated women will have fewer children than their less educated peers after 1995. Although the paper is not now able to assess how the program's effects on gender differences in schooling affected completed fertility, the empirical strategy may be more informative based on data from a later survey merged to the respondents birthplace.

The reasons for employing IV estimates for parent education is to understand how educational policies impact both males and females education levels and thereby affect how these changes in the levels and gender differences in education operate through the marriage market to affect families over their life cycle. It has been hypothesized that women who are better educated may be sought by men in the marriage market and thus women's schooling reflects men's preferences for lower fertility and higher child quality. The association of female schooling and fertility and child quality could, therefore, embody a combination of influences: women's enhanced productivity in the labor market, their greater effectiveness in rearing healthy and productive children, and men's high valuation of both traits in their wives (Behrman et al, 1994, 1997). The outcome of the marriage market and bargaining process cannot in general be forecasted, but part of the direct association of female education with lower fertility and higher child quality could be due to the preferences of husbands for these final outcomes. Men would then be willing to exchange their economic endowments for a wife with the capacities to rear higher quality children -- the bargaining model of the family provides a setting where he can exchange his resources for such a productive wife. The instrumental variable approach might eventually be applied to other countries where regional educational expansions have been implemented at a staggered local level. But the power of these program instrument to explain

²³ The tables 6 and 7 in the paper by Breierova and Duflo (2004) indicate the dependent variable representing child mortality is not the death rate but the number of child deaths the woman has reported. If indeed the measure is as reported, then the regressions are not easily interpreted or related to other studies, for they are predicting a product of the child death rate and the woman's birth rate. For other studies of fertility and an interpretation of differences in wage effects of men and women on fertility and child mortality see Schultz (1974, 1981, 1997) .

the *gender difference* in schooling may depend importantly on the age difference of wives and husbands being substantial.

The compulsory length of education in Norway was increased during the 1960s, but the timing of the reforms was left to be determined by the municipal school districts. These legislative changes in compulsory school laws are associated with individuals completing more years of schooling, if they came from the districts where the reform occurred before they completed the relevant level of schooling (Black, et al, 2003). Administrative data on all Norwegian women aged 16-74 are merged with the educational attainment records of their children who were in 2000 between the ages of 25 and 35. When the educational attainment of the woman's children is regressed (OLS) on the woman years of schooling, the coefficient is .237. But when the mother's education is instrumented by the local timing of the legislative reforms in her birthplace, the coefficient on her policy-induced schooling falls to .076 and is not statistically different from zero (n=143,579: Table 3). A similar result is obtained for father's education, although the sample is about a third smaller and probably therefore less representative. I interpret their findings to imply schooling induced by this compulsory education legislation affects primarily individuals in the population who have lower than average preferences for both obtaining more schooling for themselves and for their children. Thus, in this case, the IV estimates imply that policy induced changes in compulsory education of mothers are less likely to improve the schooling or "quality" of offspring, compared with the direct OLS association between mother's and child's schooling. The study does not instrument for the gender difference in schooling of the parents, probably because it is a weak instrument and the age gap between husbands and wives in Norway is smaller than in Indonesia.

From these three disparate studies dealing with the possible endogeneity of parent education, I would not venture to draw any empirical conclusions. It is appropriate to treat the school attainment of women (and men) as choice variables, which are affected by unobserved variables that affect fertility, child mortality, and other family lifetime outcomes, such as ability. Employing IV estimation techniques to identify the effects of men's and women's program-induced education on fertility and investments in child quality may lead to more reliable and more realistic estimates of the consequences of educational policies as they are likely to affect the demographic transition in low income countries.

6. Tentative Conclusions and Issues for Research

Fertility may be an important determinant of the welfare of women, children, and men. Policies that help to reduce fertility are expected to improve the well being of the population, but unassailable empirical evidence of these connections from fertility to family well being, induced by a specific policy intervention such as family planning or public health, are not evident in my reading of this literature. Mere associations do not provide satisfactory answers to questions of this type (Moffitt, 2005).

To assemble more compelling evidence on the connections between fertility and family outcomes, researchers must understand better the specific mechanisms determining fertility, and how these mechanisms play out over a lifetime in order to control more suitably for other factors which could affect both fertility and the family outcomes, and to specify valid instruments for

exogenous sources of fertility, child mortality, and reproductive health variation. It is also common to assume that a policy intervention operates on a family outcome only through its effect on fertility. Frequently this working assumption that a policy operates exclusively through one channel is not credible. Policy evaluation of the payoff to social welfare programs, such as family planning, that are thought to change complex forms of lifetime behavior with many ramifications for other family arrangements, are difficult for at least three interrelated reasons.

First, social welfare programs tend to be national in scope, and they may respond in politically subtle ways to evolving private demands by the population for the program's services, as well as the public's priorities. Therefore, program treatments vary across the population in a manner which is not random, and thus complicate what would otherwise be a more straightforward statistical evaluation of the effect of an experimental program's treatment across program administrative regions (Rosenzweig and Wolpin, 1986,1988).

Second, different groups in society may respond differently to the same social welfare program treatment, which implies the spillover effects on family outcomes, if any, of a certain program-induced change in fertility, is expected to benefit "locally" different groups in society, according to their reproductive response to the program (Imbens and Angrist, 1994). The local area treatment effect (LATE) interpretation of the instrumental variable (IV) empirical strategy used to identify the causal effect of a policy on completed fertility, and then used to infer the cross effect of fertility on family outcomes is complicated by these forms of program and population heterogeneity (Heckman, 1997; Moffitt, 2005).

Third, the responsiveness of individual well-being to a policy-induced change in fertility of a specified magnitude will depend on the types of family "activities" which are available to substitute for having fewer children, and how the parents whose fertility is affected view these alternatives. More specifically, do parents with fewer (unwanted) children because of a social welfare program decide that (1) the mother who has been responsible for child care will now reallocate more of her lifetime to work outside of the family, (2) do the parents encourage their children to obtain more schooling or get better nutrition and health care, and (3) do parents save more of their income in the form of physical capital because this accumulated wealth substitutes for children as a means for their support in old age, when parent productivity and health status declines?

Based on the empirical studies I have reviewed in this paper, I would offer the following tentative answers to these questions:

(1) Only about half of the direct association between fertility and a mother's market labor supply or for that matter the woman's labor market earnings, is due to the causal effect of fertility as it varies due to observable exogenous variables, such as twins, sex of offspring, or possibly even local area family planning programs. Although maximizing women's productive opportunities is clearly a social goal, it is more ambiguous and context dependent whether society should intervene and expend its resources to encourage women to reallocate more of their time to participate in the market labor force. Women may be privately and socially more productive in the home than the market under some conditions. A clearer objective for population policies should be to increase the productivity of women and the wages they face in

the labor market, which is part of the reorientation in population policies called for in the Cairo Population Conference.

(2) The trade off between the quantity of children a woman bears and the quality of those children is viewed by many as a universal empirical regularity, but may be only observed as a correlation in high income societies and in some middle income countries, and then significantly only in urban areas. A plausible reason for this inverse relationship between fertility and average child human capital is unobserved heterogeneity in people's preferences and constraints. Therefore, fertility-reducing social welfare programs in middle and low income countries may not necessarily stimulate greater investments in the average level of human capital of children. A priority for research in this area should be documenting the empirical regularity underlying the quantity-quality tradeoff, using a variety of methods and types of data, which rely on credible sources of exogenous variation in fertility.

(3) the hypothesis that policy-induced fertility declines have contributed to increases in family savings rates is intuitively plausible, as is the life cycle savings hypothesis. However, I find no empirical evidence at the family level testing the hypothesis that fertility and savings are substitutes or even related (the exception is Hammer, 1986). Yet this mechanism might provide a causal explanation for savings rates to increase as fertility rates decline in parts of Asia (Schultz, 2004b).

There are few studies which establish beyond a reasonable doubt how population policy interventions in low-income country have affected lifetime fertility, and fewer still which trace through the long-term consequences of this policy-induced change in fertility on other forms of lifetime behavior which society views as important. Why are the resulting changes in economic and social opportunities for women and their children not documented? This represents a gap in basic knowledge needed to set policy priorities today in much of the world where the demographic transition is still underway. The lack of population policy evaluation studies is partly explained by the complexity of the behavioral and biological processes being analyzed. Also the retrospective or panel data required to implement long-term program evaluations of family planning, reproductive health, and public health interventions are not widely available in low-income countries and will require major sustained investments. But this lack of data and investment in social experiments also reflects the past priorities of development agencies who should have borne the cost of replicating evaluations studies of the policies they have vigorously endorsed. Despite these potential explanations for the gap in research evaluating the consequences of population programs, fifty years of world-wide engagement to extend the best birth control technologies to the world's population should have been linked to building a firmer foundation of knowledge needed evaluate policy alternatives.

The issues surrounding evaluation of population policy are not satisfactorily understood, perhaps because an early consensus emerged that family planning programs combined with new innovative birth control technologies were clearly a cost effective response to the problem of high levels of fertility. Such a consensus may have undermined the search for stronger empirical bases for setting policy priorities and defining trade-offs. I have illustrated how investigations of fertility and female labor supply made progress in identifying empirically the consequences of fertility variation due to exogenous "quasi natural experiments". The sex of initial offspring and

the occurrence of twins have functioned as illustrative means to instrument for exogenous variation in fertility in high-income countries. As an empirical regularity, most of the studies reviewed find that exogenous sources of fertility variation exert an absolutely smaller effect on the mother's market labor supply and on the health and schooling of her children than is widely reported from cross sectional (correlation) studies. Social or natural experiments of this form are far from perfect substitutes for well-run policy experiments. But they may suggest the likely magnitude of the long term consequences of population programs on female labor supply and investments in the human capital of children, two important sources of modern economic growth (Young, 1995).

The challenge remains to extend these statistical approaches to assess specific mechanism by which social welfare policy is likely to affect fertility and family outcomes. Family outcomes should also be broadened to include not only the health and schooling of a woman's children, but also their migration and adult earnings capacities, as well as the consequences for the woman's one educational attainment, marriage prospects, inter-generational transfers from parents to children, and back from children to parents, and savings held in the form of various marketable wealth including homes, consumer durables, land, business capital, financial assets, and jewelry. These outcomes within the family, moreover, will have a strong bearing on the way in which individuals form families and households, and how households share resources with extended families and across kinship systems. This defines an extensive research agenda, one which can be expected to advance more rapidly, if more researchers share consistent conceptual and statistical frameworks, and they are encouraged to invest in the collection and public dissemination of multipurpose household survey data, which are specifically designed to better answer the questions of population policy evaluation in a heterogeneous developing world.

Table 1: Fertility Declines may impact Various Family Behaviors and Outcomes

- I. Human Capital Formation
 - A. Mother's health improves with less childbearing, especially at young and old ages
 - B. Mother's market wage rises as her training through experience in the labor market increases
 - C. Child's health improvements may eventually be documented along many dimensions
 - (i) Infant survival and survival until age five increases
 - (ii) Weight at birth may increase
 - (iii) Height for age and sex increases
 - (iv) Weight for height by age and sex increases
 - (v) Age of menarche decreases
 - (vi) Survival to retirement (about 65) increases
 - (vii) Inputs to produce health increase, such as expenditures on preventive health
 - D. Child's schooling increases along many dimensions a survey can assess
 - (i) Age of entry into school system
 - (ii) Repetition of school years because of failure to matriculate
 - (iii) Current enrollment, given age and sex
 - (iv) Graduated from specific levels of the school system
 - (v) Final year of schooling completed as an Adult
 - (vi) Inputs to produce schooling increase, such as expenditures, student time on homework, or parent home time facilitating schooling
 - E. Child's migration from parent residential community
 - (i) To find better employment
 - (ii) To marry and reside with spouse's family
 - F. Delay age at marriage for child
- II Family Labor Supply or Time Allocation
 - A. Mother's market labor supply outside of the family increases
 - B. Children's labor supply may decrease if their Schooling increases
 - C. Father's labor supply not likely to respond in short run and may ultimately decrease
- III Saving rate of parents increases to accumulate physical wealth for production and retirement. Because savings is measured only at the household level, it is difficult to attribute savings to age groups because intergenerational units exist at both ends of the life cycle.
- IV. Transfers of cash, goods, and time to and from Household Members
 - A. From parents to their children
 - B. From children to their parents
 - C. Among other relatives in extended family or clan
 - D. From the state to support the vulnerable old and young
- V. Household Living Arrangements
 - A. Household formation
 - (i) Marriage or cohabitation or visiting relationships
 - (ii) Partition as sons and daughters of household head leave to establish own household or join the family of their spouse
 - (iii) Migration to improve economic opportunities
 - B. Household partition because of death or ill health of head
 - C. Female heads household
 - (i) Because to widowhood
 - (ii) Because of divorce or permanent separation
 - (iii) Because of temporary migration of husband who remains de facto head

Table 2 : Mechanisms by which Population Policy may Influence Family Behavior and Fertility

- I. Subsidize Home Productive Inputs or Activities
 - A. Subsidize the diffusion of knowledge or best practice reproductive technological opportunities, through sex education in schools, family planning in health clinics and outreach programs, STD clinics, HIV voluntary testing and counseling
 - B. Subsidize the cost of adoption of new technology, i.e. new methods of family planning
 - C. Subsidize the continuing use of family planning by lowering user costs
 - D. Provide lower cost and lower risk options for male and female sterilization
 - E. Increase access to safer and lower cost abortion

- II. Provide Local Public Health Care for Preventive and Curative Purposes
 - A. Prenatal care and tetanus vaccination of mother
 - B. Assistance with child birth
 - C. Monitoring early child growth and provide oral dehydration therapy
 - D. Childhood vaccinations
 - E. Protocols to identify health crises and securing appropriate treatment

- III. Cash Transfers to Families Conditional on their Investments in Child Human Capital
 - E. Food and nutritional supplements targeted to the poor and malnourished
 - F. School enrollment of girls and boys at critical transitions in school system
 - G. Discourage early marriage among girls
 - H. Discourage child labor in unhealthy and dangerous unskilled occupations

- IV. Strengthen the Property Rights and Bargaining Empowerment of Women
 - A. Define and enforce property rights of women in productive assets and wealth
 - B. Establish and enforce rights to inheritance of women
 - C. Codify settlement patterns for women in divorce and regarding child custody
 - D. Facilitate information and legal protection for migrants to change residences
 - E. Discourage dowries or secure mechanisms whereby they become the property of the woman, in the event that the marriage ends or husband dies
 - F. Discourage polygyny

- V. Involuntary Rationing of Births as in China's One-Child Policy
 - A. No compensating subsidy payment made to encourage fertility compliance
 - B. Without different rationed family sizes, all costs of compliance are born by those who initially wanted many children, e.g. poorly educated, rural women
 - C. Welfare loss of these rationed women is also associated with stronger incentives for them to shift their consumption toward the best available child substitutes, for which the cross-price effects are positive and large

- VI. Social Institutions Intermediate between the Family and Government that Modify Fertility and Family Behavior
 - A. Social organizations and networks which transmit knowledge and modify attitudes toward birth control and risk management
 - B. "Ideational" change mediating the practice of contraception supported or resisted by social stratification
 - C. Social capital which changes capacity for behavioral change and production, in addition to family endowments, markets, and government institutions
 - D. Kinship supports networks which distribute the costs and benefits of children beyond the family
 - E. Role of political leadership in promoting change in social norms associated with birth control and women's empowerment

- VII. Qualitative Research which may help clarify how individual behavior responds to cultures and contexts, and community characteristic

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