Chapter 7
The Impact of Voluntary Family Planning Programs on Contraceptive Use, Fertility, and Population

7.1 Introduction

When concern about the adverse impact of rapid population growth became widespread in the 1950 and 1960s, policy makers searched for interventions to slow growth. Family planning programs were an obvious choice, but there was significant doubt that these would work, because of the widely held belief that fertility would not decline until societies experienced significant, widespread social and economic change. Influential analysts argued that women in poor countries would not use contraception offered by programs because they wanted large families (Davis, 1967; Hauser, 1967). These doubts were allayed by findings from surveys which interviewed women about their reproductive preferences. Many women in Asia and Latin America (but not in SS Africa) wanted families of modest size (Lightbourne, 1987; Mauldin, 1965). Successful small experimental studies confirmed women's willingness to accept contraceptives, thus providing the scientific foundation for the family planning movement in subsequent decades (e.g., Fawcett, 1970; Foreit & Frejka, 1998; Freedman & Takeshita, 1969). From the late 1960s onward substantial funding from international sources became available to governments that were willing to start family planning programs (Donaldson, 1990; Piotrow, 1973). The availability of new methods (the pill, IUD, and new methods of sterilization) made the mass distribution of contraceptives more affordable and easier to implement. The family planning movement was particularly successful in Asia and North Africa (Robinson & Ross, 2007). In Latin America (and in the Philippines) opposition from the Catholic Church made governments reluctant to promote contraception, but large, well-funded NGOs (e.g., Profamilia in Columbia and BEMFAM in Brazil) took on the task of distributing family planning methods. In sub-Saharan Africa governments generally expressed little interest in family planning before the 1990s with notable exceptions of Botswana, Kenya, Ghana, and South Africa (May, 2017). In the 1990s the AIDS epidemic in large parts of the African continent put a damper on government investments in family planning. Everywhere the success of programs relied on

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strong support of government leaders. In the early 2000s several additional African countries implemented successful programs (e.g., Ethiopia, Malawi, Rwanda, and Zambia). Many other countries including Nigeria and the Democratic Republic of the Congo have made little progress in the development of strong programs.

7.2 The Role of Family Planning Programs in Removing Obstacles to the Use of Contraception

As noted in Chap. 3 the existence of large numbers of unplanned births and abortions in countries around the world is incontrovertible evidence that many women lack full control over their reproductive lives. Unplanned outcomes occur when sexually active women who want to avoid pregnancy either use no contraception or experience contraceptive failure. This is, in turn, largely the consequence of a wide range of social, health, and economic factors that pose barriers to women (and men) who wish to practice contraception (Bongaarts & Bruce, 1995; Bongaarts et al., 2012; Casterline et al., 1997; Casterline & Sinding, 2000; Casterline et al., 2001; Cleland, 2001; Cleland et al., 2006; El-Zanaty et al., 1999; Cleland forthcoming).

The main obstacles identified by researchers include:

Lack of knowledge. To use a modern method, women must be aware of its existence, and they must know how to use the method, and where to obtain supplies. Knowledge of at least one modern method was very limited in the 1950 and 1960s in the developing world, but by the early 1990s became widespread in Asia and Latin America and in a number of countries in SSA (Curtis et al., 1996).

Availability of family planning methods. A couple must have access to a contraceptive method to adopt it. For traditional methods such as abstinence and withdrawal no source is required (but partner cooperation is needed); and for permanent methods such as sterilization, one-time access suffices. But for widely used modern methods such as injectables, condoms and the pill, a dependable source within a reasonable distance is needed. The density of these access points varies widely among and within countries. Access is most difficult in rural communities in countries where family planning programs are absent or weak and is particularly problematic when traditional customs restrict women's mobility.

Costs. While physical proximity is important, services must be reasonably priced. The direct cost of commodities (e.g., pills, injection, condoms, IUDs), transportation, and provider fees for contraceptives and health care services can be substantial. As a result, poor women are often unable to afford modern methods without the subsidies provided by family planning programs.

Quality of services. To satisfy clients, services must be of adequate quality. This includes the provision of a choice of methods, a well-trained staff and the respectful treatment of clients. Most women prefer female providers.

Health concerns and side effects. Health concerns and fear of side effects are two of the most commonly expressed reasons for nonuse and for discontinuing the use of contraception. Choosing a method often involves weighing a variety of drawbacks to find the method that is least objectionable. The most serious health effects are cardiovascular complications of the pill; pelvic inflammatory disease, uterine perforation, and anemia for the IUD; and infections associated with sterilization and other methods. These complications are uncommon if users are well informed and service providers are well trained and have access to appropriate

equipment and drugs. Physiological effects (e.g., nausea, headache, weight gain, menstrual changes) associated with some contraceptive methods also influence women's choices.

Still other drawbacks play potentially significant roles in the decision to adopt a method. For example, manipulation of genitals or interruption of intercourse is required for the use of the condom, diaphragm, cap, sponge, and spermicides. Many women dislike the physical exams (often performed by male providers) required for IUD insertions and for fitting the diaphragm and caps. Others fear the surgical procedures associated with sterilization and implants. Loss of potency is a concern for some men who might otherwise consider a vasectomy. Many of these health concerns are based on or exaggerated by rumors and misinformation.

Objections from husbands or other family members. For many married women, objections to family planning from their husbands or partners is a sufficient reason not to practice contraception, despite their desire to do so. Other family members (e.g., parents or parents-in-law) or neighbors may also discourage the practice of contraception. Reasons for these objections may include the desire for more children than the women herself wants, costs of contraceptive supply and associated health care, concerns about side effects, and moral or religious beliefs. In traditional societies, family limitation and negotiation over sexual matters may not be considered respectable subjects.

Concerns about moral and social acceptability. In nearly every society the introduction of the idea of birth control and the methods used to achieve it meet resistance from political, church, and medical leaders. Family planning was viewed as usurping divine will, encouraging promiscuity leading to a breakdown of family life, and threating individual health and national vitality (Cleland, 2001). Such forms of resistance were common in Europe in the late nineteenth century, and resistance remains common in many contemporary developing countries. Sometimes the opposition is embodied in formal religious doctrine (e.g., the Roman Catholic ban on artificial methods and the Islamic opposition to sterilization). Up to the 1970s most African leaders had a mercantilist view of population: larger populations were better than smaller populations and rapid growth was better than slow growth. In Latin America the early enthusiasm for family planning revolved around limiting unsafe abortion rather than reducing fertility or population growth. It was not until about 1980 that the benefits of fertility decline, and smaller families became widely accepted by government leaders and the general population.

These obstacles to adoption of contraception are the main cause of unplanned pregnancies. Removing these barriers is, therefore, the goal of voluntary family planning programs. The primary task of family planning programs is to offer women and couples easy access to a wide range of affordable, reliable, and high-quality contraceptive methods and related services. To achieve this objective, many countries have built service delivery networks that may include hospitals, health and family planning centers, work-based clinics, mobile medical and paramedical units, community-based distribution, and commercial outlets. Contraceptives are usually provided at low cost or for free. The most effective programs have minimized access obstacles by training female outreach workers who visit women in their homes.

To be successful in helping women and couples avoid unintended pregnancies, family planning programs must go beyond simply providing physical access to contraceptive supplies and reduce or eliminate the other obstacles to contraceptive use noted above (Cleland et al., 2012; Cleland forthcoming). A number of approaches can address these barriers, including: (1) education campaigns through mass media, called IEC (information, education, and communication) or BCC (behavioral change communication); (2) training service providers to increase their knowledge and to

encourage improvements in the quality of services; (3) increasing women's empowerment and agency; (4) collaboration with community leaders; and (5) ensuring that others with significant influence on women's contraceptive behavior (e.g., husbands, partners, mothers-in-law) have accurate information about family planning and the costs and benefits of childbearing.

The final ingredient of a successful family planning program is strong support from government leaders at the local and national level. This support can be encouraged by providing regular briefings on program progress and on the social and economic benefits of contraceptive use and lower fertility. It is also crucial to collaborate with policymakers to remove or revise laws, regulations, official guidelines and other structural factors that are barriers to contraceptive adoption and distribution.

By providing access to high-quality contraceptive services, addressing barriers to use, and ensuring political support, family planning programs can maximize adoption of contraception among women who want to space or limit their births. Information and education campaigns about the benefits of smaller families also play an important role in increasing overall demand for contraception, as will be demonstrated below.

7.3 Program Impact on Contraceptive Use

Well-designed family planning programs can help women implement their fertility preferences and reduce unintended births and abortions. A number of evaluations of these programs have found that they can have a significant impact on contraceptive use and fertility (Ahlburg & Diamond, 1996; Bongaarts, 1997, 2020; Bongaarts & Hardee, 2019; Miller & Babiarz, 2016; Tsui, 2001). However, other studies (in particular, Pritchett, 1994) conclude that family planning programs have a minimal impact on reproductive behavior. We will examine this controversy in more detail, beginning with a summary of the evidence that family planning programs have an impact on fertility.

Three different approaches have been used to obtain estimates of family planning programs' impact across a wide range of periods and contexts.

7.3.1 Controlled Experiments

Controlled experiments are the gold standard for evaluating interventions, but very few large-scale experiments have been conducted to assess family planning programs, in part because they are expensive and take a long time to complete. The largest and most influential of these experiments is the Family Planning and Health Services Project (FPHSP), started in the late 1970s in Matlab, a rural district in Bangladesh (Cleland et al., 1994; Phillips et al., 1982, 1988). At the time FPHSP started, Bangladesh was one of the poorest and most highly agricultural countries in the world, and there was widespread skepticism that family planning would be accepted

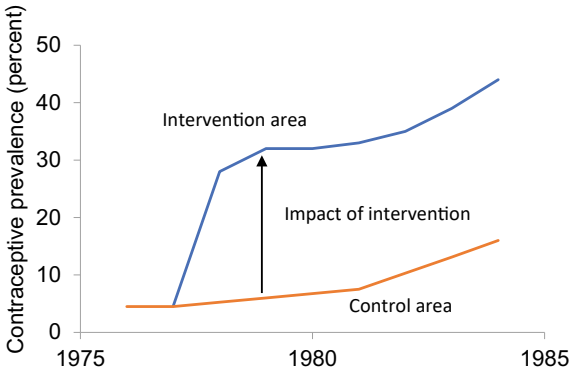

Fig. 7.1 Contraceptive use trends in family planning experiment in Matlab, Bangladesh (Phillips et al., 1988; Cleland et al., 1994)

in such a traditional society. The FPHSP divided the Matlab district (population of 173,000 in 1977) into experimental and control areas of approximately equal size. The control area received the same services as the rest of the country. In the1970s these services were very limited and did not significantly affect contraceptive use. In the experimental area comprehensive high-quality family planning services were provided, aimed at reducing the costs (monetary, social, psychological, and health) of adopting contraception. In the experimental area women were provided with free services and supplies of modern contraceptive methods; home visits by well-trained female family planning workers; regular follow-up to address health concerns; information campaigns; menstrual regulation services; and outreach to husbands, community leaders, and religious leaders to address potential social and familial objections from men.

The impact of the program was large and immediate (Cleland et al., 1994; Phillips et al., 1988). As shown in Fig. 7.1, within two years, modern contraceptive use increased from five to 33% among married women in the experimental area while little change occurred in the control area. The experiment left no doubt that a well-designed family planning program could be successful in a very poor, largely illiterate, agricultural society. Its success led the Bangladesh government to implement a nation-wide family planning program that employed many of the innovations from the Matlab, such as house-to-house visits by well-trained young female community health workers (Cleland et al., 1994).

7.3.2 Natural Experiments

Unlike controlled experiments, which are carefully designed and implemented to evaluate a particular intervention, 'natural experiments' take advantage of existing diversity and compare two populations with similar social, economic, cultural, and religious characteristics, but with differing approaches to family planning. Differences between such populations in contraceptive use and fertility demonstrate the

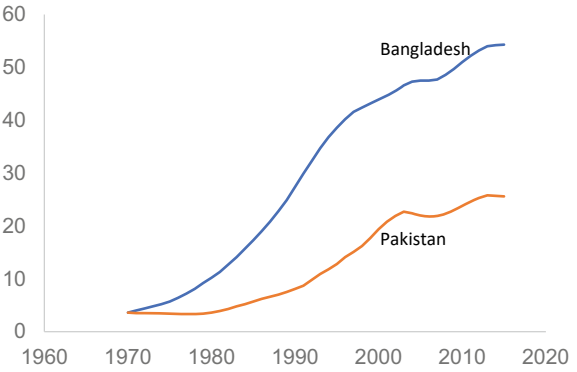

Fig. 7.2 Contraceptive prevalence (modern) in Bangladesh and Pakistan, 1970–2015 (United Nations, 2021)

potential effects of voluntary family planning (Bongaarts et al., 2012; Cleland, 1994; Lee et al., 1998).

One of the best-known examples of a natural experiment is the comparison of Bangladesh and Pakistan, which were one country from independence in 1947 until 1971. Both had similar cultures and levels of social and economic development. However, the countries differed remarkably in their commitment to voluntary family planning. Following the Matlab experiment, Bangladesh, starting around 1980, implemented one of the world's most comprehensive national family planning programs based on the Matlab model, while Pakistan's program lacked government funds and commitment and remained weak and relatively ineffective (Cleland & Lush, 1997).

Figure 7.2 plots the contraceptive prevalence rate among married women (mCPR) from 1970 to 2015 for the two countries. Both started at very low levels in 1970 and rose over time, but the increase in Bangladesh was substantially larger than in Pakistan. By 2015 the gap had reached almost 30% points (54.3% vs. 25.6%). The most recent Demographic and Health Survey conducted in 2017–2018 suggests that Pakistan's mCPR leveled off in the mid-2010s (NIPS-Pakistan & ICF, 2019).

Previous examinations of the Pakistan-Bangladesh difference in reproductive behavior have also attributed it largely to the much higher quality family planning program in Bangladesh (Cleland & Lush, 1997).

Other natural experiments lead to broadly similar conclusions (Bongaarts et al. forthcoming). Rwanda and Burundi are poor, densely populated countries in East Africa with comparable socio-economic profiles. Rwanda's family planning program is much stronger than Burundi's leading to mCPR gap in 2015 of 24.1% points (47.2% vs. 23.1%). Ethiopia and Nigeria are the two largest countries in SSA. The former has an effective family planning program while the latter does not. As a result, Ethiopia's mCPR (36.0%) exceeds Nigeria's (10.8%) by 25.3% points (United Nations Population Division, 2021).

The three natural experiments had comparable results with mCPR gaps in 2015 of 28.7% points for Bangladesh-Pakistan, 24.1% points for Rwanda-Burundi and 25.3% points for Ethiopia-Nigeria.

7.3.3 *Natural Experiments: Adjusted Results*

These comparisons of three country pairs should be regarded as approximations of the impact of strong versus weak family planning programs because the levels of development in the countries in each pair are not exactly the same. In the absence of family planning programs in both countries of each pair their levels of contraceptive use might still be different in 2015 because socio-economic conditions differ. To address this issue, we continue the analysis of natural experiments but control for the level of education when comparing the countries. As noted in Chap. 4, education is by far the most influential socio-economic determinant of fertility. Taking its potential confounding effect into account should lead to more accurate results from the natural experiments.

Figure 7.3 plots the mCPR of Bangladesh and Pakistan by level of education from 1970 to 2015. The figure looks like Fig. 7.2, which is not surprising because the values of all plotted points are the same. But there is a crucial difference between the two figures: In Fig. 7.2 each observation for each country is plotted in the corresponding year, which is measured along the horizontal axis. In Fig. 7.3 the horizontal axis measures the level of education in the corresponding year. For example, the last point (A) in the graph for Bangladesh is the 2015 level of mCPR (54.3%) which is plotted at 6.4 years of education. For Pakistan the mCPR in 2015 is estimates at 25.6 (point C) but in that year the level of education was 5.0 years, significantly below the level in Bangladesh. Pakistan's mCPR is lower than Bangladesh's not only because of its weaker program but also because of its lower level of education.

To assess the family planning program impact without the confounding effect of education we must compare the two countries when they were at the same level of education. In this case we compare the two countries at an education level of 5 years of schooling, which gives a mCPR of 26 for Pakistan in 2015 and 49 for Bangladesh in 2007 (points C and B in Fig. 7.3). The education-adjusted gap between the two

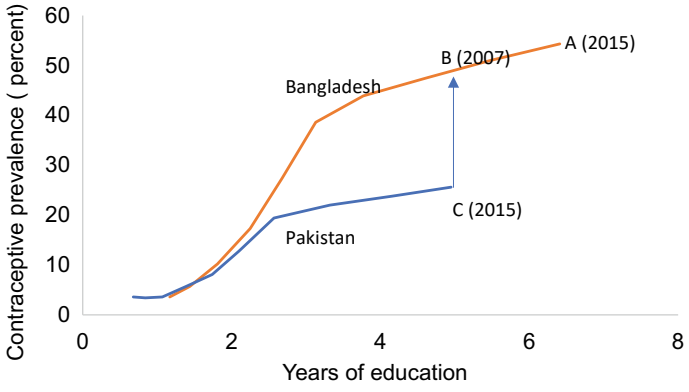

Fig. 7.3 Contraceptive prevalence by education, Bangladesh and Pakistan, 1970–2015 (United Nations, 2021; Wittgenstein Center, 2021)

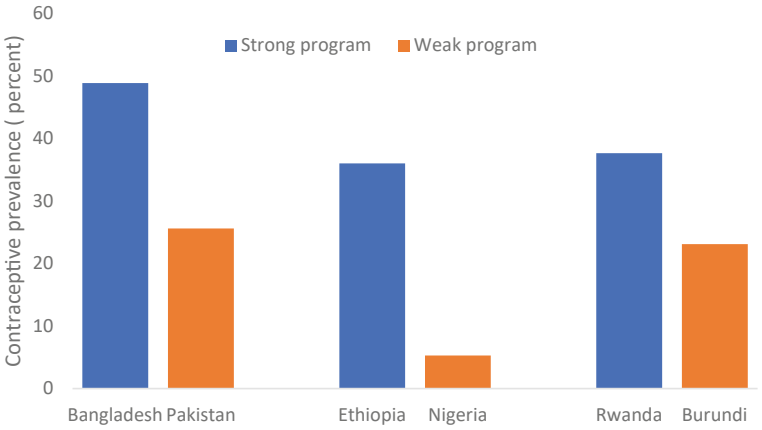

Fig. 7.4 Education adjusted mCPR in 2015 for three pairs of countries with strong/weak family planning programs (Authors' calculations from United Nations, 2021)

countries therefore is 23% points (49–26) rather than the unadjusted gap of 29% points obtained from Fig. 7.2.

Figure 7.4 presents education adjusted results for the natural experiments in three pairs of countries Bangladesh-Pakistan, Ethiopia-Nigeria, Rwanda-Burundi. The results for the adjusted mCPR gap between the country with the strongest and weakest program countries are, respectively 23, 31 and 15% points for married women.

These findings from natural experiments are informative but do not provide accurate estimates of the full family planning program impact. Instead, these comparisons provide an estimate of the *difference* between the weaker and stronger programs and do not give an estimate of the *total* program impact of the strong program country, because the weaker programs have some effect that cannot be ignored. To address this issue, we turn to regression analysis.

7.3.4 Regressions: Program Impact on Contraceptive Use, Demand, and Satisfaction

In the absence of experimental evidence for most countries, researchers have relied on regression analysis to estimate the effects of family planning programs on the level and pattern of fertility. As noted earlier, the extensive literature on the determinants of fertility identifies two general factors as the main determinants of fertility declines in the developing world over the past half century: socio-economic development, in particular education, and family planning programs. Regression analyses have been used to estimate the separate impact of development versus family programs on contraceptive use and fertility change (Ahlburg & Diamond, 1996; Bongaarts, 1998, 2020; Bongaarts & Hardee, 2019; Miller & Babiarz, 2016; Pritchett, 1994; Tsui,

2001). In these regressions, contraceptive use or fertility are the dependent variables and the independent variables consist of one or more socio-economic indicators, plus an indicator of family planning program effort.

A key issue in these regressions is measurement of the strength of a program in a country, which is not straightforward. The oldest indicator is the Family Planning Program Effort (FPE) score, which has been used since the early 1970s to gauge the strength of national programs (Kuang & Brodsky, 2016; Ross & Smith, 2011). To obtain this score, knowledgeable observers in each country answer questions about a variety of program characteristics and policy actions. Their responses are combined to yield an overall FPE score. Over the past three decades, the FPE score for countries has been measured in eight cycles ending in 2014.

The FPE scores suffers from some shortcomings. Differences among countries and across cycles can occur simply because the experts often must make subjective assessments and the experts change over time. In addition, the questions included in the index have been refined and changed over time. As a result, differences between FPE scores of countries and trends for individual countries should be interpreted with caution.

More recently, Bongaarts and Hardee (2017) have proposed an alternative program indicator called *Public-sector family planning program impact score* to measure the quality and scope of a government sponsored family planning program. We will refer to this variable as the 'program score' (PS). It equals the product of two other variables: (1) the proportion of demand that is satisfied by modern methods; and (2) the proportion of modern methods that is provided by the public sector. PS therefore equals the proportion of all demand that is satisfied with modern methods from the public sector. This score, which can be consistently measured over time in countries with Demographic and Health Surveys (DHS), does not rely on subjective assessments. It ranges from zero in the absence of a government program to a theoretical value of 100 for the strongest public programs where all demand for contraception is met by the public sector. A country can have low demand and a low mCPR but a high PS if the mCPR is close to the demand and all contraception is provided by the public sector. Conversely, a country can have high demand and a high mCPR but a low PS if the public sector is small and contraceptives are mostly provided through the private sector.

To provide a first look at the relationship between education, program score, and contraceptive use, we plot in Fig. 7.5 the prevalence of modern contraception (mCPR) by the mean years of schooling among women aged 20–39. The figure contains 22 markers, one for each of 22 largest countries in SSA, representing observations at the most recent DHS (ca. 2013). The size of the round marker is proportional to the program score of the country which ranges from 5 in Congo DR to 62 in Zimbabwe.

If female education were the only determinant of the mCPR, the observations for all countries would fall on a single upward sloping line. This is clearly not the case, indicating an impact of family planning programs and other factors. In general, the higher the level of women's educational attainment and the higher the program score, the higher the mCPR. A key finding is that at any level of women's educational attainment, the mCPR varies widely. For example, in the countries with

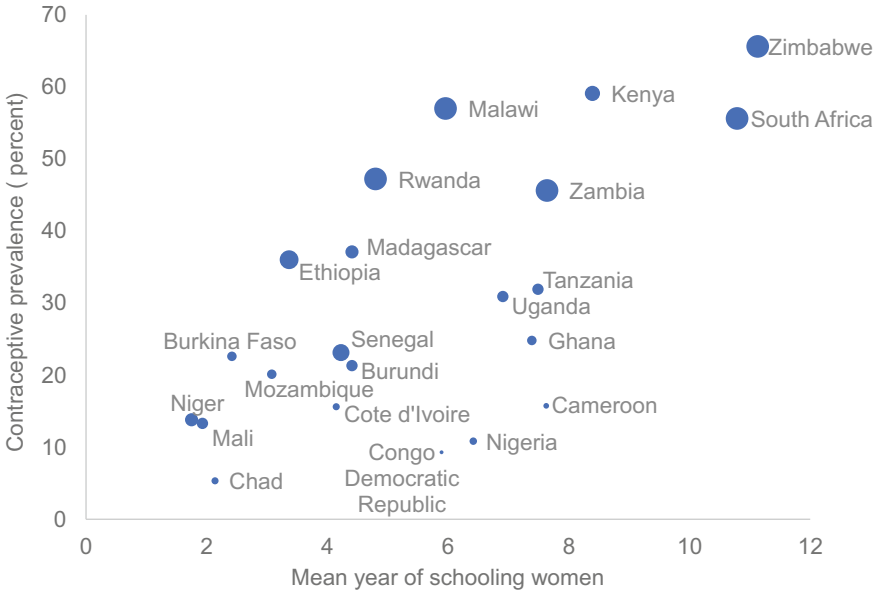

Fig. 7.5 Contraceptive prevalence by mean years of schooling and program score (circle), 22 sub-Saharan Countries 2015 (United Nations Population Division, 2021; Wittgenstein Center, 2021)

average schooling levels around six years, the mCPR ranges from 9% in Congo DR to 57% in Malawi. As will be shown below, the differences among countries with similar levels of women's educational attainment are to a large extent the result of program differences. The findings in Fig. 7.5 suggest that education and program score both have a substantial effect on mCPR, but quantifying these effects requires formal regression analysis.

Our regression analysis of mCPR trends in SSA is an updated and expanded version of one carried out by Bongaarts and Hardee (2019). The regressions focus on sub-Saharan Africa because most countries in this continent are still in their fertility transitions and many governments have made only limited investments in family planning programs. The debate about the impact of family planning programs is clearly especially relevant in this continent. In addition, the program score was designed for use in SSA, and can be biased in other continents where the private sector has become the dominant provider of services, often with the assistance of governments.

Three regression models are presented below, with mCPR, the demand for contraception, and the satisfaction of demand as the three dependent variables. Each regression has two explanatory variables: (1) education as measured by the average years of schooling among women aged 20–39 ('education'); and (2) program score, PS. In Chap. 4 education was found to be the dominant socio-economic determinant of fertility especially in SSA. (Adding other socio-economic indicators yielded no new significant coefficients.) The regressions rely on data from 33 countries in SSA with

Table 7.1 Results of fixed effects regression models of contraceptive prevalence on socio-economic variables on in 33 sub-Saharan Africa countries with two or more DHS surveys after 1990

Model 1: mCPR		
	Coefficient	p
Education	2.29	0.000
Program score	0.64	0.000
Constant	−5.50	0.01
R^2	0.91	
Model 2: Demand for contraception		
Education	1.65	0.01
Program score	0.30	0.000
Constant	36.5	0.000
R^2	0.63	
Model 3: Satisfaction of demand		
Education	3.77	0.01
Program score	0.91	0.000
Constant	−3.55	0.000
R^2	0.93	

at least two Demographic and Health Surveys after 1990 and with a population size above one million. Data from all available DHSs in each country are included (ICF International, 2021) for a total 133 surveys. By using countries as their own controls, fixed effects models account for time-stable differences among countries, which may otherwise introduce bias into parameter estimation.

Model 1 in Table 7.1 presents the results for the regression of the determinants of mCPR. The coefficients for women's education and PS are highly significant, thus confirming their impact on contraceptive prevalence. A year of education raises mCPR by 2.29% and a point increase in the PS raises the mCPR by 0.64%.

Figure 7.6 plots the country specific estimates of the total program impact at the time of the most recent DHS survey. Each estimate is obtained by multiplying the PS regression coefficient of 0.64 by the observed value of the PS in each country. The biggest program impacts, exceeding 30%, were found in South Africa, Zimbabwe, Zambia, Rwanda, Malawi, Namibia, and Ethiopia. In contrast, the program impact was less than 5% in Cote d'Ivoir, Congo and the Democratic Republic of the Congo.

Models 2 and 3 in Table 7.1 present results from the fixed effects regressions for demand and for the satisfaction of demand. The effects of education and the program score are statistically significant in both models. For example, in Model 3 the coefficient for the program effect on percent of demand satisfied equals 0.91. This means that a 50% change in PS on average leads to an increase of 45% in the percent of demand satisfied. The family planning program score also affects demand for contraception, but with a smaller coefficient of 0.30. In other words, PS affects contraceptive prevalence by raising both demand and the level of satisfaction, with the latter being three times more important than the former.

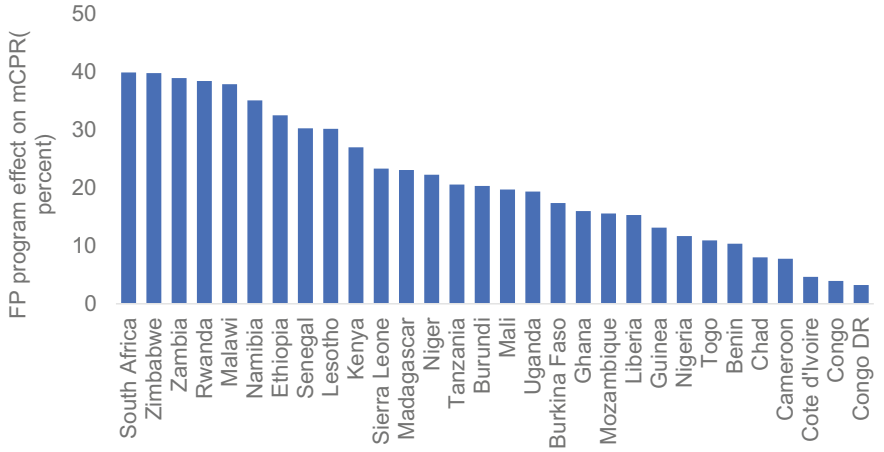

Fig. 7.6 Impact of family planning program on modern contraceptive prevalence

The three different approaches to estimating the mCPR impact of the highest-quality family planning programs yield the following results: (1) 28% for the controlled experiment in Matlab; (2) 15–31% for differences between stronger and weaker programs in 'natural experiment' comparisons of countries; and (3) 30–40% for the absolute effects of the strongest programs in SSA in regression analyses. These findings are broadly consistent with one another. However, the first and second approaches underestimate the absolute program effect and just estimate the difference between weak and strong programs, thus ignoring any program effect in the weaker program countries or control area. The regression approach does not have this bias and can therefore be expected to yield somewhat higher program impact estimates on the mCPR.

7.4 Program Impact on Fertility

The three different approaches to estimating the program impact on contraceptive prevalence can also provide estimates of the program impact on fertility.

7.4.1 Controlled Experiments

As shown in the preceding section, contraceptive use in the experimental area of Matlab rose sharply while little change occurred in the control area. One would therefore expect a more rapid fertility decline in the experimental than in the control area. This was exactly what was observed: a difference of 25% (around 1.5 births

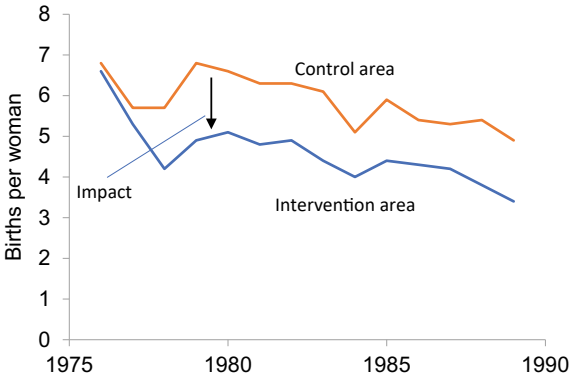

Fig. 7.7 Fertility impact of family planning experiment in Matlab, Bangladesh (ICDDR, 1994, 2001; Phillips et al., 1982)

per woman) was maintained through the 1980s until the services in the control area and in the rest of the country were also improved (see Fig. 7.7).

A similar but more complex quasi-experimental study was conducted in the Navrongo district of Northern Ghana in the 1990s, where over a third of women wanted to space or limit additional births but few were using contraception. Though direct estimates of changes in contraceptive use from the Navrongo project are not available, an evaluation found that the project led to improved knowledge and use of modern contraception and to a decline in the TFR of one birth per woman in the initial three years of the project, a 15% decline in fertility relative to comparison areas (Debpuur et al., 2002).

7.4.2 Natural Experiments

As expected, the differences in mCPR trends between Bangladesh and Pakistan since 1970 have led to differences in fertility transitions. In 1970 the TFR was close to 7 births per women in both countries, a level that had probably not changed significantly for many decades. In the 1980s the TFRs began to diverge (see Fig. 7.8) and by 2015 the gap between the two countries reached 1.6 births per woman (3.7 vs. 2.1).

Natural experiments in other countries yield broadly similar results. Ethiopia and Nigeria, and Rwanda and Burundi are pairs of countries with comparable socio-economic profiles. The TFRs declined to substantially lower levels in countries with stronger programs (Ethiopia and Rwanda) than in corresponding weaker program countries (Nigeria and Burundi). The 2015 difference between the TFRs of the stronger and weaker program countries ranged from 1.0 birth per woman for Ethiopia-Nigeria pair to 1.5 births per woman for the Rwanda-Burundi pair.

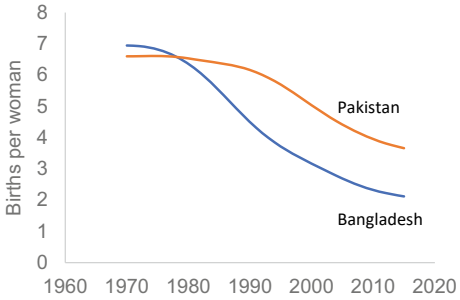

Fig. 7.8 Total fertility rate 1970–2015 Bangladesh and Pakistan (United Nations, 2019)

7.4.3 Natural Experiments: Adjusted Results

The TFR results from these natural experiments are confounded by differences in socio-economic development between the countries in each pair. To address this issue, we introduce a control for the level of education in all countries. As discussed in Chap. 4 education of females is the most important determinant of fertility decline.

The adjustment procedure used for the mCPR can also be applied to obtain an estimate of the education adjusted gap for the TFR. Figure 7.9 plots the TFR of Bangladesh and Pakistan by level of education from 1970 to 2015. In 2015 the TFRs of the two countries differed by 1.6 births per woman. But at the education level of five years of schooling, the gap is just 1.1 births per woman. The education adjustment clearly reduces the gap.

This, however, is not the whole story because there is another bias. As is clear from Fig. 7.9, Bangladesh started off in 1970 at a higher fertility level than Pakistan. To assess the impact of relative impact of the programs we must take this different starting point into account. We do this by comparing the *declines* in fertility of the two countries between the first and last points where a comparison is possible (i.e., at education levels of 1.4 and 5.0 years, respectively). At the education level of 1.4 Bangladesh's fertility is higher than Pakistan's by 0.4 births per woman and at the education level of 5 the gap is 1.1. The decline is 4.4 births per woman in Bangladesh and 2.8 in Pakistan. The difference in declines is therefore 1.6 births

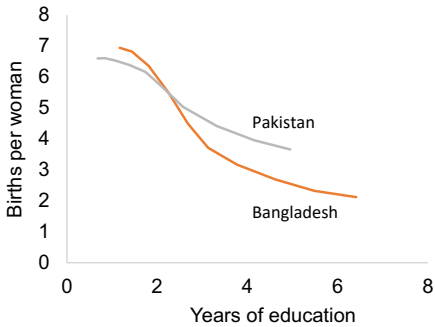

Fig. 7.9 Total fertility rate by level of education, 1970–2015, Bangladesh and Pakistan (Authors' calculations; United Nations, 2019)

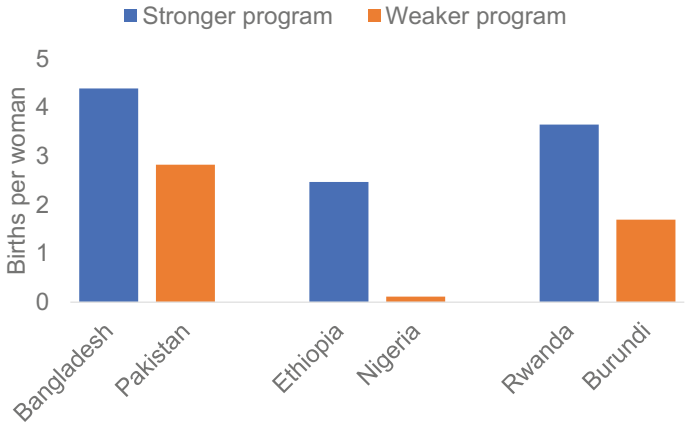

Fig. 7.10 Education adjusted declines in TFR: stronger versus weaker program countries (Authors' calculations; United Nations, 2019)

per woman. This gap might be the result of the difference in the strengths of family planning programs in Bangladesh and Pakistan (in the early 2000s the PS score of the two countries equaled 39 and 19 respectively). Differences in other socio-economic conditions that grew over time also had an impact but the adjustment for level of education minimizes their role.

Figure 7.10 presents education adjusted declines for the natural experiments in three pairs of countries: Bangladesh-Pakistan, Ethiopia-Nigeria, Rwanda-Burundi. The adjusted TFR gaps in declines are 1.6, 2.4 and 2.0 births per woman, respectively, which might be attributable to differences in the strength of family planning programs.

7.4.4 Regressions: Program Impact on Fertility

The regression analyses of fertility declines rely on the same methodology as the regression analyses of the mCPR presented above. The determinants of fertility and its wanted and unwanted components in SSA will be assessed by relying on fixed effect regressions using country-level data from all DHS surveys in 33 countries with at least two such surveys. Table 7.2 presents the results of four models:

Model 1: The determinants of the TFR

The two independent variables included in Model 1 are women's education and the family planning program score. The coefficients for both variables are highly significant. On average, an increase of one year in school reduces the TFR by 0.185 births per woman and one point increase in the family planning score reduces the TFR by 0.025 births per woman.

Table 7.2 Results of fixed effects regression models of total fertility rate on education and program effort in 33 countries in sub-Saharan Africa

Model 1: TFR		
	Coefficient	p
Education	−0.185	0.000
Program score	−0.025	0.000
Constant	6.80	0.000
R^2	0.51	
Model 2: Wanted TFR		
Education	−0.215	0.000
Program score	0.016	0.001
Constant	5.7	0.000
R^2	0.55	
Model 3: Unwanted TFR		
Education	0.03	0.504
Program score	−0.01	0.011
Constant	1.05	0.000
R^2	0.02	
Model 4: Unwanted TFR (2)		
Education	−0.067	0.099
Program score	−0.016	0.000
Wanted TFR	−0.452	0.000
Constant	−3.64	0.000
R^2	0.39	

Model 2: the determinants of wanted TFR

The coefficients for education and program score are both highly significant and negative as expected on theoretical grounds. On average, one year of education reduces wanted fertility by 0.215 births per woman and one point in the PS score reduces the wanted TFR (WTFR) by 0.016 births per woman.

Model 3: the determinants of unwanted TFR

Model 3 repeats Models 1 and 2 except that the dependent variable is unwanted fertility (UWTFR). The results show a significant effect of program score but not for education. The latter finding is surprising because educated women generally have more knowledge about and access to contraception and have higher opportunity costs associated with an unwanted birth. The explanation for this unexpected finding lies in the process discussed in Chap. 3. Model 3 produces biased effects because it ignores the potential confounding effect of declining wanted fertility on unwanted fertility. As wanted fertility declines the potential number of unwanted births rises. Improvements in education and family planning programs have an uphill battle to overcome this rising level of potential unwanted fertility. The result of these competing factors is

a non-significant effect for education and a relatively small but significant effect for family planning.

Model 4: the determinants of unwanted TFR with control for wanted TF

To reveal the unbiased effect of education and family planning score it is necessary to control for the confounding effect of declining wanted fertility. This is the objective of model 4 which is the same as model 3 except that wanted fertility is added as a third explanatory variable. As expected, model 4 results show a highly significant inverse effect of WTFR. In addition, the effects of education and family planning program are larger than in model 3 and are statistically significant (at the 10% level for education). The coefficient for the effect of program score on unwanted fertility (−0.016) is the same as for the effect on wanted fertility.

To provide further insight into these regression results we calculate the absolute effects of women's schooling and the family planning program on the TFR in each country. This effect can be estimated by multiplying the regression coefficients in model 1 by the observed values of the two explanatory variables. Figure 7.11 plots the resulting fertility effects in countries with a population over 5 million at the time of the most recent DHS survey. The average education effect (1.04 births per woman) exceeds the average program effect (0.84 births per woman). There is considerable variation among countries. For example, the education effect exceeds 1.5 birth per woman in Kenya, South Africa and Zimbabwe, but is less than 0.5 in Mozambique, Burkina Faso, Mali, Niger, and Chad. The countries with the highest program effects (around 1.5 births per woman) are Malawi, Rwanda, South Africa, Zimbabwe, and Zambia.[1]

The three different approaches to estimating the fertility impact of family planning programs yields comparable results: a reduction of 1.5 births per woman over a reproductive lifetime in the Matlab experiment, 1.6 to 2.4 births per woman in countries involved in the natural experiments, and around 1.5 in the countries in SSA with the highest family planning program scores.

7.5 Program Impact on Population Trends

By addressing the reproductive needs of couples, family planning programs raise contraceptive prevalence. This in turn reduces fertility and population growth, changes the age structure, and increases the demographic dividend.

To illustrate, we compare fertility and population trends in Pakistan and Bangladesh. In 1975–1980, the two countries had nearly the same high fertility near 7 births per woman, but, as seen above, trends diverged in subsequent decades, with more rapid declines in Bangladesh than in Pakistan. By 2015, Bangladesh's

[1] These regression results are slightly different from those presented in Bongaarts (2020). The main reason for this difference is that Bongaarts (2020) uses the standard DHS calculation for wanted fertility while the present study relies on a different approach proposed by Bongaarts (1990).

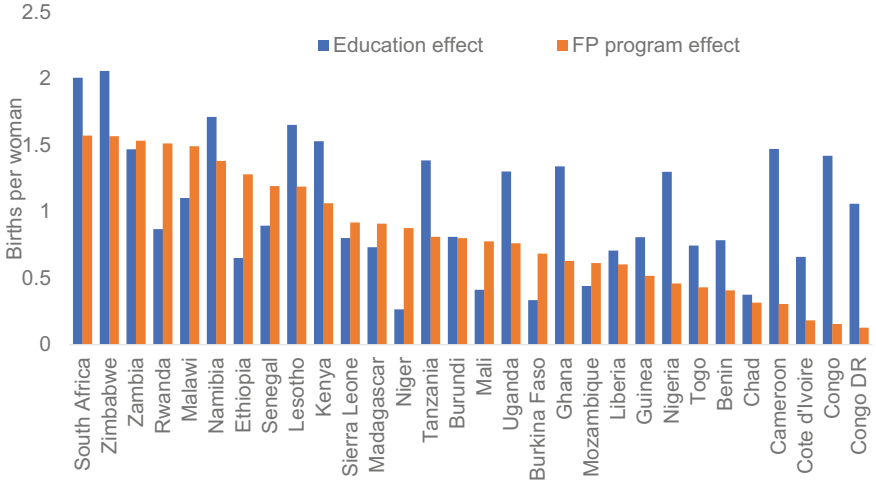

Fig. 7.11 Education and family planning program effects on TFR decline

fertility declined to 2.1 births per woman, while in Pakistan fertility stood at 3.7, a difference of 1.6 births per woman.

The different fertility trajectories resulted in increasingly large differences in population size over time (see Fig. 7.12). In 1980, the two populations were virtually the same size (about 80 million), but by 2100, Pakistan's population is projected to be more than double the size of Bangladesh's (403 vs. 151 million) (United Nations, 2019). This suggests that the Bangladesh family planning program led to a large reduction in the country's potential 2100 population.[2] Fertility and population trends are also affected by levels of socio-economic development, but this is unlikely to be the main explanation for the different population trajectories. Development levels, as measured by years of education, were similar in the 1970s in Bangladesh and Pakistan, which were and still are largely poor agricultural majority-Muslim countries. But over time education differences have appeared with education levels in 2015 reaching 6.4 years in Bangladesh and 5.0 years in Pakistan. This would be expected because one of the benefits of more rapid fertility decline is greater investments in education. It might therefore be argued that at least some of the education advantage of Bangladesh is due to earlier investments in its family planning program and the resulting demographic dividend (see Chap. 6).

The different fertility trajectories of Pakistan and Bangladesh also affect trends in the age structure and the demographic dividend. Figure 7.13 plots the proportion of working age people for the two countries from 1970 to 2015. After 1980 (the onset

[2] The difference in population projections is partly due to more rapid future life expectancy improvements in Bangladesh than in Pakistan. The UN's constant mortality projections yield populations sizes of 344 million for Pakistan and 120 million for Bangladesh. This finding indicates that differences in fertility trends are the dominant cause of differences in population projections to 2100.

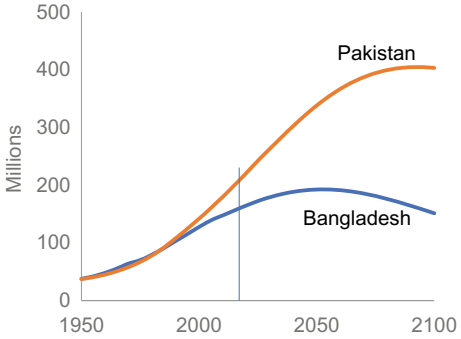

Fig. 7.12 Population Projections Bangladesh and Pakistan (United Nations, 2019)

of fertility decline in Bangladesh), the working age proportion of the population grew substantially faster in Bangladesh than in Pakistan. The economy also grew faster in Bangladesh than in Pakistan after 1990 (World Bank, 2021). There are, of course, other factors that contributed to the more rapid growth in Bangladesh, but the demographic tailwind was no doubt a key factor.

As noted earlier, the potential for a demographic dividend in SSA lies mostly in the future. To assess the potential demographic impact of a substantial investment in family planning programs in Africa, we compare the high and low variants of the UN population projections for SS Africa (United Nations Population Division, 2019). The difference between these two variants is the fertility level assumed in the future: the high variant exceeds the low variant by one birth per woman. Such a one-birth decline is achievable with the implementation of a high-quality family planning program (in fact Sect. 7.4 suggests the effect could be around 1.5 births per woman).

According to the medium variant, the population of SSA will quadruple in size from one billion in 2015 to 3.8 billion in 2100 (see Fig. 7.14). This projection assumes a steady decline in fertility and includes the impact of the AIDS epidemic. The high variant (with fertility a half birth higher than in the medium variant) projects 5.2 billion people in 2100. This trajectory could well become reality if no significant further investments are made in family planning, because past fertility declines have

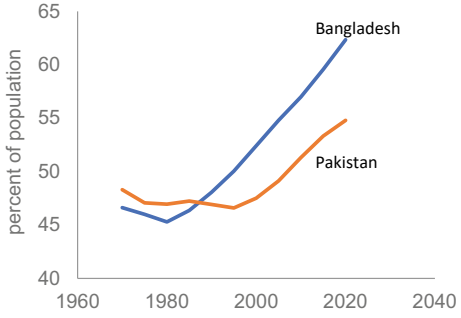

Fig. 7.13 Percent of population aged 18–64, Bangladesh and Pakistan (United Nations, 2019)

been much slower in SSA than in Asia and Latin America. The UN low variant projection (with fertility a half birth below the medium variant) estimates a population of 2.7 billion in 2100. This low variant could well be achieved with substantial new investments in family planning to meet a rising demand for contraception as desired family size declines. In that case, the population of SSA in 2100 would be nearly 2.5 billion lower than projected in the UN high variant and 1.1 billion below the medium variant. Clearly, a small reduction in fertility (1 birth per woman) has a large impact on future population growth (2.5 billion).

The alternative UN population projections also differ in their associated age distributions. Figure 7.15 plots the proportion of working age people for each projection variant in SSA. As expected, the high variant (with the highest fertility) has a much lower pace of increase in this proportion than the low variant. The peak of the dividend period occurs in the next few decades with the dividend about twice as large in the low than in the high variant.

The main conclusion from this exercise is that small differences in fertility trends can cause large differences in future demographic trends. Family planning programs can bring about fertility declines of about 1.5 births per woman; thus, they can potentially have a large impact on population size and age structure in future decades.

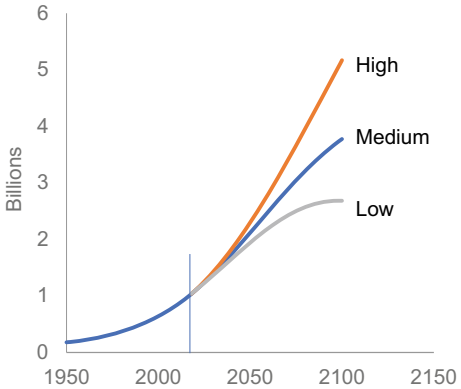

Fig. 7.14 Population projection variants, Sub-Saharan Africa (United Nations, 2019)

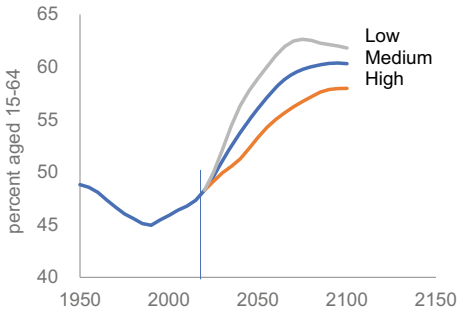

Fig. 7.15 Percent of population aged 18–64, Sub-Saharan Africa (United Nations, 2019)

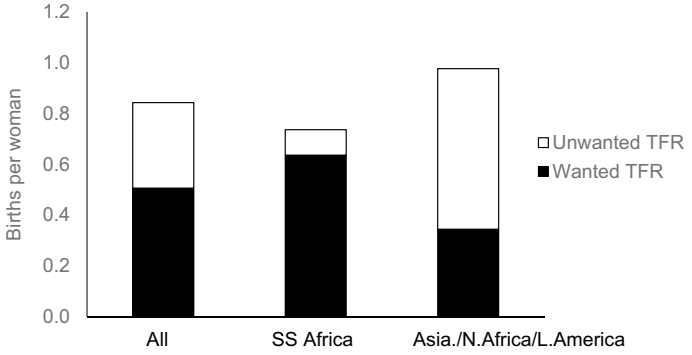

Fig. 7.16 Average decline in TFR, and its wanted and unwanted components between first and last DHS surveys after 1990 (Bongaarts, 2021)

7.6 Critics of Family Planning Programs

As discussed in Chap. 5, the literature on the fertility impact of family planning programs has been contentious. The most detailed and influential of these critiques was published in 1993 by Lant Pritchett. In contrast to earlier critiques (Davis, 1967; Demeny, 1979; Hauser, 1967) Pritchett undertook extensive analyses of reproductive statistics that had been gathered in World Fertility Survey and DHS up to about 1990.

To assess the separate roles of socio-economic development and family planning programs Pritchett examined the available empirical evidence on levels of wanted and unwanted fertility in a large number of developing countries. His main findings were that there is a strong—about one to one—correlation between wanted fertility (WTFR) and the TFR, but no significant correlation between unwanted fertility (UWTFR) and TFR. He drew several conclusions:

> a) *"Excess" or "unwanted" fertility plays a minor role in explaining fertility* (Pritchett, 1994: 34)

This claim has been found problematic in several subsequent studies (Bongaarts, 1994, 1997, 2011, 2020; Casterline, 2009; Lam, 2011). The central flaw in Pritchett's analysis was its reliance on cross-sectional data because in the early 1990s relatively few countries had repeated fertility surveys. As the number of surveys has grown in the 1990s and 2000s an increasing number of countries have at least two surveys, thus allowing the estimation of actual changes over time in fertility indicators.

Figure 7.16 presents an updated decomposition of the change in the TFR into wanted and unwanted components.[3] The trends are derived by comparing fertility estimates from the earliest and latest available DHS surveys (on average from 1996 to 2014) in 54 countries from Bongaarts (2021).

Key findings:

[3] Wanted and unwanted fertility is estimated with a procedure proposed by Bongaarts (1990).

- The average decline in the TFR (0.84) for all countries substantially exceeds the decline in the wanted TFR (0.51). This finding is contrary to Pritchett expectation of approximately equal changes in the wanted TFR and total TFR. The same is true for the regional estimates.
- The average unwanted TFR for all countries declined by 0.34 (from 1.0 to 0.66), while Pritchett predicted constant unwanted fertility. The decline in the unwanted TFR accounts for 40% of the decline in the TFR in all countries. This is consistent with the findings of Casterline (2010), Lam (2011) and Günther and Harttgen (2016).
- Substantial differences exist between regions: the contribution of decline in the wanted TFR is much larger in Asia/N.Africa/L.America (65%) than in SS Africa (14%).

These findings demonstrate that the declines in unwanted fertility over time play an important role in reducing overall fertility.

b) *If improved family planning programs were driving fertility declines, they should be accompanied by a reduction in excess fertility. This is not the case* (Pritchett, 1994: 34).

This statement ignores the rise in the exposure to the risk of unwanted pregnancies that occurs as desired family size declines. As discussed in the previous section, in the absence of contraception, a decline in desired family size would be accompanied by a roughly equivalent rise in unwanted/excess births because women have three decades of potential reproductive years when they are usually sexually active and biologically capable of getting pregnant. In reality, such huge increases in unwanted fertility are not observed because women practice contraception, but unwanted births nevertheless occur because of the obstacles to contraceptive use and because of contraceptive failure. Family planning programs reduce but do not eliminate these obstacles. As a result, a substantial impact of family planning programs is consistent with a non-declining level of unwanted fertility in the early phases of the fertility transition.

c) In his discussion of the Matlab experiment Pritchett admits its large impact on contraceptive use and fertility, but then claims: "*The fertility changes were large not because fertility was particularly responsive to program intervention but because the effort was massive and expensive. This program expense makes it unlikely that this degree of effort will be replicated at a national scale in Bangladesh, or in any low-income country.*" (Pritchett, 1994: 36)

This statement is incorrect as demonstrated by the experience of Bangladesh and several other poor African countries such as Ethiopia, Malawi and Rwanda. Once the success of the Matlab project became known around 1980, the government of Bangladesh implemented a nationwide program based on the lessons from this experiment. As shown in Fig. 7.2 the country's modern contraceptive use rose rapidly and reached 27% in 1990 and 54% in 2015, well ahead of the mCPR in Pakistan. Another demonstration of the impact of the introduction of a nationwide family planning program is found in Iran. As documented in Chap. 2 Iran had the most rapid fertility decline in the developing world with the TFR declining from above 6 in 1986 to below 2.5 in 1997. Socio-economic indicators improved during this period, but not

at an extraordinary rate. The most plausible main explanation for Iran's rapid fertility decline is the introduction of a family planning program around 1990 (Roudi-Fahimi, 2002).

> d) *fertility desires are largely determined by socio-economic forces other than family planning and .. fertility desires determine fertility* (Pritchett, 1994: 19). *In the conclusion: "we have focused ..on the importance of desired fertility in explaining fertility variations and on the relatively small independent role of contraceptive access (or family planning programs more generally).* (Prichett, 1994: 41)

These statements reveal two common but erroneous assumptions made by Pritchett and other critics. First is the suggestion that family planning programs are only about access to contraceptive supplies. Earlier in this chapter we discussed the many other obstacles that face potential users of contraception and the key role family planning programs play in addressing these obstacles. Access is of course part of the reason for unplanned pregnancy, but family planning programs have much broader objectives. The second problem with the above statement is that Pritchett assumes that family planning programs have no effect on wanted fertility. As argued above, fertility preferences are affected by media campaigns implemented by programs and by statements from government officials. The evidence presented in the regression analyses summarized in Tables 7.1 and 7.2 document the important role of family planning programs as a determinant of demand for contraception and on wanted fertility (see also Bongaarts, 2011).

In short, Pritchett's influential analysis is seriously flawed. He correctly concluded that fertility preferences are a key driver of fertility declines. But his claims that unwanted fertility is nearly constant and that family planning programs have trivial effects are incorrect.

7.7 Conclusion

This chapter examined the long-standing debate about the extent to which family planning programs influence contraceptive behavior and fertility. Three sources of evidence were examined: (1) controlled experiments; (2) natural experiments; and (3) statistical analyses. The three sources provided broadly comparable estimates of the impact of a family planning program i.e., a rise of 25–35% in contraceptive prevalence and a decline of 1.5 births per woman in the TFR. The regression analysis was also used to examine the effects of family planning programs on contraceptive demand and its satisfaction, and on wanted and unwanted fertility. As expected, family planning programs increase the satisfaction of the demand for contraception and reduce unwanted fertility. Contrary to common assumptions made in economic theories of fertility, family planning programs also have a substantial impact on the demand for contraception and on wanted fertility. These findings help explain why family planning programs have been effective in several countries in SSA where desired family size has historically been high relative to other regions in the developing world.

References

Ahlburg, D., & Diamond, I. (1996). Evaluating the impact of family planning programs. In D. A. Ahlburg, A. C. Kelley & K. O. Mason (Eds.), *The impact of population growth on well-being in developing countries* (pp. 299–336). Springer.

Bongaarts, J. (1990). The measurement of wanted fertility. *Population and Development Review, 16*, 487–506.

Bongaarts, J. (1994). The impact of population policies: Comment [on Pritchett]. *Population and Development Review, 20*(3), 616–620.

Bongaarts, J. (1997). The role of family planning programmes in contemporary fertility transitions. In G. Jones, J. Caldwell, R. Douglas, & R. D'Souza (Eds.), *The continuing demographic transition* (pp. 422–444). Oxford University Press.

Bongaarts, J. (2011). Can family planning programs affect high desired family size in sub-Saharan Africa? *International Perspectives on Sexual and Reproductive Health, 37*(4), 209–216.

Bongaarts, J. (2020). Trends in fertility and fertility preferences in sub-Saharan Africa: The roles of education and family planning programs. *Genus, 76*, 32.

Bongaarts, J. (2021). The effects of family planning programs on wanted and unwanted fertility in sub-Saharan Africa. In *Paper presented at the session on population policies and the demographic transition at the 2021 IUSSP international population conference.*

Bongaarts, J., & Bruce, J. (1995). The causes of unmet need for contraception and the social content of services. *Studies in Family Planning, 26*(2), 57–75.

Bongaarts, J., Cleland, J., Townsend, J., Bertrand, J., Das Gupta, M. (2012). F*amily planning programs for the 21st century: Rationale and design*. Population Council.

Bongaarts, J., & Hardee, K. (2017). The role of public-sector family planning programs in meeting the demand for contraception in sub-Saharan Africa. *International Perspectives on Sexual and Reproductive Health, 43*(2), 41–50.

Bongaarts, J., & Hardee, K. (2019). Trends in contraceptive prevalence in sub-Saharan Africa: The roles of family planning programs and education. *African Journal of Reproductive Health, 23*(3), 96–105.

Casterline, J. (2009). Demographic transition and unwanted fertility: A fresh assessment. *Pakistan Development Review, 48*(4), 387–421.

Casterline, J., Perez, A., & Biddlecom, A. (1997). Factors underlying unmet need for family planning in the Philippines. *Studies in Family Planning, 28*(3), 173–191.

Casterline, J., & Sinding, S. (2000). Unmet need for family planning in developing countries and implications for population policy. *Population and Development Review, 26*(4), 691–723.

Casterline, J., Sathar, Z., & Ul Haque, M. (2001). Obstacles to contraceptive use in Pakistan: A study in Punjab. *Studies in Family Planning, 32*(2), 95–110.

Cleland, J. (1994). Different pathways to demographic transition. In F. Graham-Smith (Ed.), *Population: The complex reality: A report of the Population Summit of the World's Scientific Academies* (pp. 229–247). Royal Society.

Cleland, J. (2001). Potatoes and pills: An overview of innovation-diffusion contributions to explanations of fertility decline. In J. B. Casterline (Ed.), *Diffusion processes and fertility transition: Selected perspectives* (pp. 39–65). National Academy Press.

Cleland, J. (forthcoming).. The contraceptive revolution In: J. May (Ed.), *International Handbook of Population Policies*. Springer.

Cleland, J., & Lush, L. (1997). Population and policies in Bangladesh, Pakistan. *Forum for Applied Research and Public Policy, 12*, 46–50.

Cleland, J., Bernstein, S., Ezeh, A., Faundes, A., Glasier, A., & Innis, J. (2006). Family planning: The unfinished agenda. *The Lancet, 368*(9549), 1810–1827.

Cleland, J., Phillips, J., Amin, S., & Kamal, G. (1994). The determinants of reproductive change in Bangladesh: Success in a challenging environment. Washington, DC: World Bank Group.

Curtis, S., & Neitzel, K. (1996). *Contraceptive knowledge, use, and sources.* DHS Comparative Studies No. 19: Macro International.

Davis, K. (1967). Population policy: Will current programs succeed? *Science, 158*, 730–739.
Demeny, P. (1979). On the end of the population explosion. *Population and Development Review, 5*(1), 141–162.
Debpuur, C., Phillips, J., Jackson, E., Nazzar, A., Ngom, P., & Binka, F. (2002). The impact of the Navrongo project on contraceptive knowledge and use, reproductive preferences, and fertility. *Studies in Family Planning, 33*(2), 141–164.
Donaldson, P. (1990). *Nature against us: The United States and the world population crisis, 1965–1980.* University of North Carolina Press.
El-Zanaty, F., Way, A., Kishor, S., & Casterline, J. (1999). *Egypt in-depth study on the reasons for nonuse of family planning*. National Population Council.
Fawcett, J. (1970). *Psychology and population.* The Population Council.
Feyisetan, B., & Casterline, J. (2000). Fertility preferences and contraceptive change in developing countries. *International Family Planning Perspectives, 26*(3), 100–109.
Foreit, J., & Frejka, T. (Eds.). (1998). *Family planning operations research: A book of readings.* Population Council.
Freedman, R., & Takeshita, J. (1969). *Family planning in Taiwan: An experiment in social change.* Princeton University Press.
Günther, I., & Harttgen, K. (2016). Desired fertility and number across time and space. *Demography, 53*, 55–83.
Hauser, P. (1967). Family planning and population: A book review article. *Demography, 4*(1), 397–414.
Hernandez, D. (1982). The impact of family planning programs on fertility in developing countries: A critical evaluation. *Journal of Social Research, 10*, 32–66.
ICDDR, B. (1994). Health and Demographic Surveillance System—Matlab, Volume 21, Registration of Health and Demographic Events 1992, Scientific Report No. 73, Health and Demographic Surveillance Unit, Public Health Sciences Division, International Centre for Diarrhoeal Disease Research, Dhaka, Bangladesh.
ICDDR, B. (2001). Health and Demographic Surveillance System—Matlab, Volume 32, Registration of Health and Demographic Events 1999, Scientific Report No. 88, Health and Demographic Surveillance Unit, Public Health Sciences Division, International Centre for Diarrhoeal Disease Research, Dhaka, Bangladesh.
ICF. (2021). The DHS Program STATcompiler. http://www.statcompiler.com. Retrieved September 29, 2021.
Kuang, B., & Brodsky, I. (2016). Global trends in family planning programs, 1999–2014. *International Perspectives on Sexual and Reproductive Health, 42*(1), 33–44.
Lam, D. (2011). How the world survived the population bomb: Lessons from 50 years of extraordinary demographic history. *Demography, 48*, 1231–1262.
Lee, K., Lush, L., Walt, G., & Cleland, J. (1998). Family planning policies and programmes in eight low-income countries: A comparative policy analysis. *Social Science in Medicine, 47*(7), 949–959.
Lightbourne, R. (1987). Reproductive preferences and behaviour. In J. Cleland & C. Scott (Eds.), *The world fertility survey: An assessment* (pp. 838–861). Oxford University Press.
Mauldin, W. (1965). Fertility studies: Knowledge, attitude, and practice. *Studies in Family Planning, 1*(7), 1–10.
Mauldin, W., & Ross, J. (1991). Family planning programs: Efforts and results, 1982–1989. *Studies in Family Planning, 22*(6), 350–367.
May, J. (2017). The politics of family planning policies and programs in sub-Saharan Africa. In: J. Casterline & J. Bongaarts (Eds.), *Fertility transition in sub-Saharan Africa, Population and Development Review 43*(Suppl.), 308–329.
Miller, G., & Babiarz, K. (2016). Family planning program effects: Evidence from microdata. *Population and Development Review, 42*(1), 7–26.
National Institute of Population Studies (NIPS) Pakistan and ICF. (2019). Pakistan demographic and health survey 2017–2018.

Phillips, J., Simmons, R., Koenig, M., & Chakraborty, J. (1988). The determinants of reproductive change in a traditional society: Evidence from Matlab Bangladesh. *Studies in Family Planning, 19*(6), 313–334.

Phillips, J., Stinson, W., Bhatia, S., Rahman, M., & Chakraborty, J. (1982). The demographic impact of the family planning-health services project in Matlab Bangladesh. *Studies in Family Planning, 13*(5), 131–140.

Piotrow, P. (1973). *World population crisis: The United States response*. Praeger.

Pritchett, L. (1994). Desired fertility and the impact of population policies. *Population and Development Review, 20*(1), 1–55.

Robinson, W., & Ross, J. A. (Eds.). (2007). *The global family planning revolution: Three decades of population policies and programs*. World Bank.

Ross, J., & Smith, E. (2011). Trends in national family planning programs, 1999, 2004 and 2009. *International Perspectives on Sexual and Reproductive Health, 37*(3), 125–133.

Roudi-Fahimi, F. (2002). *Iran's family planning program: Responding to a nation's needs*. Population Reference Bureau.

Tsui, A. (2001). Population policies, family planning programs, and fertility: The record. In: R. Bulatao, J. Casterline (eds.), Global fertility transition. *Population and Development Review 27*(Supplement), 184–204.

United Nations Population Division. (2019). World population prospects 2019, Online Edition. Rev.1. Department of Economic and Social Affairs, United Nations.

United Nations Population Division. (2021). Estimates and projections of family planning indicators 2021. United Nations.

Wittgenstein Centre for Demography and Global Human Capital. (2021). Wittgenstein Centre Data Explorer Version 1.2. http://www.wittgensteincentre.org/dataexplorer. Reterived May 3, 2021.

World Bank. (2021). World development indicators. World Bank Group. https://data.worldbank.org/indicator.