

Fertility Convergence*

Tiloka De-Silva^a Silvana Tenreyro^{a,b}

^aLondon School of Economics, CfM; ^bCEP, CEPR

July 2015

Abstract

A vast literature has sought to explain large cross-country differences in fertility rates. Income, mortality, urbanization, and female labour force participation, among other socioeconomic variables, have been suggested as explanatory factors for the differences. This paper points out that cross-country differences in fertility rates have fallen very rapidly over the past four decades, with most countries converging to a rate just above two children per woman. This absolute convergence took place despite the limited (or absent) absolute convergence in other economic variables. The rapid decline in fertility rates taking place in developing economies stands in sharp contrast with the slow decline experienced earlier by more mature economies. The preferred number of children has also fallen, suggesting a shift to a small-family norm. The convergence to replacement rates will lead to a stable world population, reducing environmental concerns over explosive population growth. In this paper we explore existing explanations and bring in an additional factor influencing fertility rates: the population programs started in the 1960s, which, we argue, have accelerated the global decline in fertility rates over the past four decades.

Key words: fertility rates, birth rate, convergence, macro-development, Malthusian growth, population.

*For helpful conversations we thank Charlie Bean, Robin Burgess, Francesco Caselli, Laura Castillo, Per Krusell, and Elizabeth Murry. The authors declare that they have no relevant or material financial interests that relate to the research described in this paper.

I Introduction

A vast literature in macro-development has tried to explain the determinants of fertility rates. Most studies build on the seminal framework of Becker (1960), Becker and Barro (1988), and Barro and Becker (1989), who illustrate how economic variables can influence fertility choice.¹

This paper brings attention to the rapid convergence in total fertility rates (TFR) experienced by most developing countries in the past few decades.² The world's average TFR declined from over 5 children per woman in 1960, to 2.5 in 2013. This trend is not driven by just a few countries: in 1960, half the countries in the world had a TFR above 5.8 children per woman. By 2013, the median TFR fell to just 2.2 children per woman, almost equal to the world's estimated replacement fertility rate of 2.25.

This rapid convergence has taken place in countries at widely different levels of development (measured as GDP per capita). Indeed, though there is a negative relationship between fertility and development across countries, suggestive of a substitution towards quality over quantity in the classic Barro-Becker framework, the fertility-development relationship has shifted downward and become flatter over time. The downward shift is considerable: today the typical woman has, on average, 2.5 fewer children than the typical woman living in a country at a similar level of development in 1960.

While fertility rates tend to be higher in rural than in urban areas, increased urbanization does not appear to be the main driver of the recent fertility decline: fertility rates in rural areas have also fallen sharply. Carrying out a straightforward decomposition of the overall fall in fertility into a within-region effect and a urbanization (or between-region) effect, we find that the within-effect accounts for over 85 percent of the decline in fertility, while urbanization accounts for the other 15 percent. Put differently, fertility has declined significantly both in rural and urban areas and only a small fraction (15 percent) of the decline in fertility can be accounted for by urbanization.

Another factor often cited as a determinant of fertility is female labour force participation. The cross-country correlation between fertility rates and female labour force participation, however, is very weak and the share of women in the labour force has not changed much in developing countries over the past few decades. In contrast, infant and child mortality rates are more positively correlated with fertility. The relationship is nonmonotonic: it is positive at low levels of mortality rates, becoming flatter thereafter—that is, fertility does not change with mortality once mortality exceeds a (fairly

¹Two recent examples in this literature are Manuelli and Seshadri (2009) and Doepke (2004).

²TFR is defined as the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with current age-specific fertility rates. Throughout the paper, we use fertility, fertility rate, and TFR interchangeably.

low) threshold. Mortality rates are argued to be a determinant of TFR: given a desired number of children, more births are needed to ensure that the right number of children survives to adulthood. Interestingly, though, surveys reveal that the number of desired children also fell significantly since the 1970s, suggesting that the higher fertility rate in earlier periods was not solely the result of a calculated overshooting needed to meet a desired target: there seems to have been a global shift towards a small-family norm. Lower mortality rates did play a role, we shall argue, in triggering a number of population policies aimed at reducing fertility.

It is instructive to contrast the fast convergence witnessed by developing countries in recent decades with the rather slow and secular decline in fertility rates experienced by more mature economies: the fertility decline began as early as the mid-1700's in some European countries and only reached replacement levels in the early twentieth century. While declines in mortality rates did not precede the fertility transition in every developed country, it has done so in almost every developing country. The increase in life expectancy, together with the high fertility rates in developing countries, is why population growth rates rose so fast in the postwar period. The fear of a population explosion lent impetus to what effectively became a global family planning program, which we believe was the most likely driver of the acceleration in the global fertility decline. The initiative, propelled in its beginnings by intellectual elites in the United States, Sweden, and some developing countries, most notably India, mobilized international private foundations as well as national governmental and nongovernmental organizations to advocate and enact policies aimed at reducing TFR.

By 1976, following the preparation of the World Population Plan of Action at the World Population Conference in Bucharest in 1974, 40 countries, accounting for 58 percent of the world's population and virtually all of the larger developing countries, had explicit policies to reduce fertility rates. Between 1976 and 2013, the number of countries with direct government support for family planning rose to 160.

We argue that while socioeconomic factors do play an important role in the worldwide fertility decline, the timing and speed of the decline over the past four decade suggests that the global family planning program played a significant role in accelerating the process. In line with this hypothesis, the data establish a strong positive association between per capita spending on family planning programs and the percent reduction in TFR. Collectively, the global family planning programs provided a policy template for fertility reduction, though there were significant differences in the actual implementation, as the policies had to be tailored to the specific context of highly diverse countries. There were two main

elements common to all programs:³ 1) promoting an increase in contraceptive supply and information (preferences and take up rates for different contraceptives varied significantly across countries and over time); and 2) creating public campaigns aimed at reversing pro-natalist attitudes and establishing a new small-family norm. Indeed, media campaigns appeared to have been critical in complementing contraceptive provision, as the initial phase of the program, focused mostly on contraception methods, did not appear to be sufficient to change fertility rates. During the 1970s, slogans proliferated in different media outlets (TV, radio, magazines), street posters, brochures, and billboards, all conveying a similar message regarding the benefits of small families.

While urban areas were easier to serve through the existing transport and communication infrastructure, most countries formed mobile teams to reach residents living in remote rural areas—indeed, some countries, like South Korea, focused their efforts particularly on rural areas. Not surprisingly, then, fertility rates fell also outside urban centers. Though religious groups were generally opposed to birth control policies, the family planning programs expanded in Buddhist, Christian, and Muslim countries alike. Remarkably, fertility reduction programs took place under both democratic and autocratic regimes, whether oriented to the political left or right (e.g. Chile under both Allende and Pinochet), and with or without strong government support (in some countries, like Brazil, family planning programs were initiated and almost exclusively run by nonprofit, nongovernmental organizations, while in others, like Singapore or India, the government was fully involved).

The absolute convergence to a global fertility rate close to replacement rates will lead to a constant population level, reducing environmental concerns over explosive population growth. To the extent that lower fertility rates are associated with higher levels of capital per capita (through lower capital dilution) and higher investment in human capital, particularly for women (Goldin and Katz 2002), the trends bode well for development and living standards in the poorest regions of the world.⁴

The rest of the paper is organized as follows. Section II studies the time-series and cross-sectional evidence on fertility rates since 1960. Section III revisits the evidence relating fertility to key covariates. Section IV discusses in detail the global population program and its effects on fertility reduction. Section V presents concluding remarks.

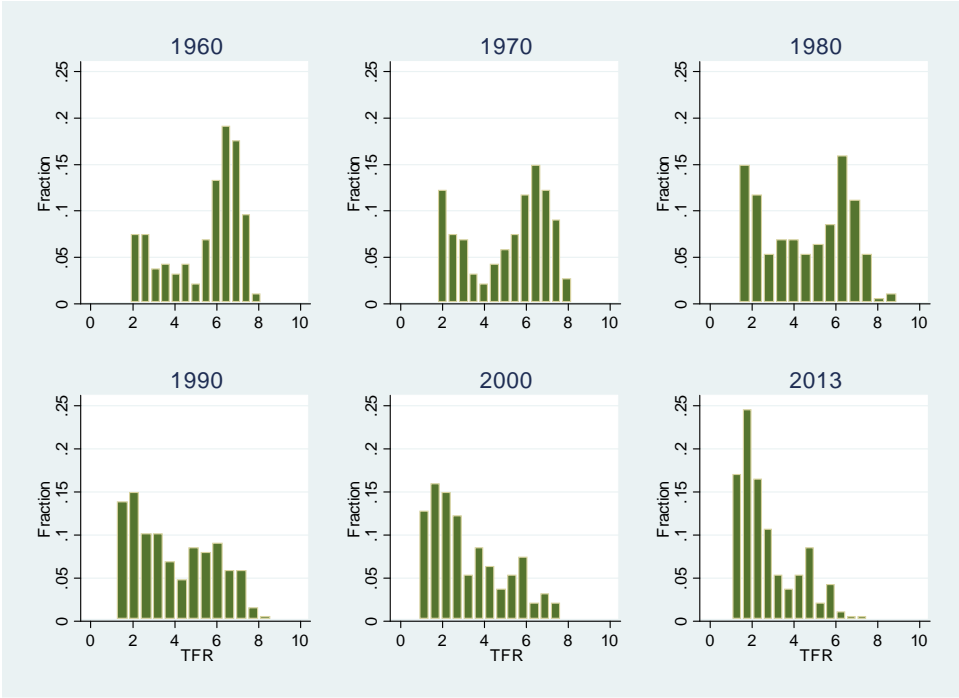
³Other measures put in place, although not uniformly in all countries, were increases in the legal age of marriage (e.g., Egypt and Tunisia), tax incentives (e.g., tax exceptions for families of up to three children in Korea), promotion of domestic contraceptive production, establishment of family planning clinics, post-partum follow-up programs, legalization of abortion, maternity leave and allocation of public apartments and school choice for families of up to two or three children (e.g., Singapore), etc. Different countries opted for different specific policies, adjusted to the domestic context.

⁴Insofar as the U.S. experience can be of guidance, the diffusion of contraception and the decline of fertility and postponement of childbearing could increase female empowerment in developing countries through higher levels of investment in human capital (Goldin and Katz 2002).

II Fertility across Time and Space

Since the 1960s, the world's TFR has steadily declined, more than halving over the five decades that we analyze. This decline has been experienced by most countries in the world and is not skewed by the experience of a few countries, particularly China's one-child policy. Using the World Bank's World Development Indicators (WDI), Figure 1 illustrates these developments by plotting the TFR histograms for the start of each decade; the bars show the fraction of countries for each TFR interval. (The figure shows 2013 rather than 2010 to report the latest information.) As the figure illustrates, there is a clear change in the shape of the distribution of fertility over time. In 1960, nearly half the countries in the world had a fertility rate between 6 and 8, with the median rate in the distribution equal to 5.8. In 2013, the largest mass of countries is concentrated around 2, with the median TFR equal to 2.2. The skewness changed from highly negative to highly positive over the period.

FIGURE 1
Fertility histograms over time



Notes: The figure shows fertility histograms at the beginning of each decade. (2013 is used rather than 2010 to report the latest information). The data comes from the World Bank's WDI database.

Key summary measures are reported in Table 1, showing the evolution of the world's TFR, together with the median and the range. As the Table shows, the median TFR has fallen dramatically, with the median woman now giving birth to 2.2 children, down from a 5.8 median in 1960.

TABLE 1

Fertility summary statistics

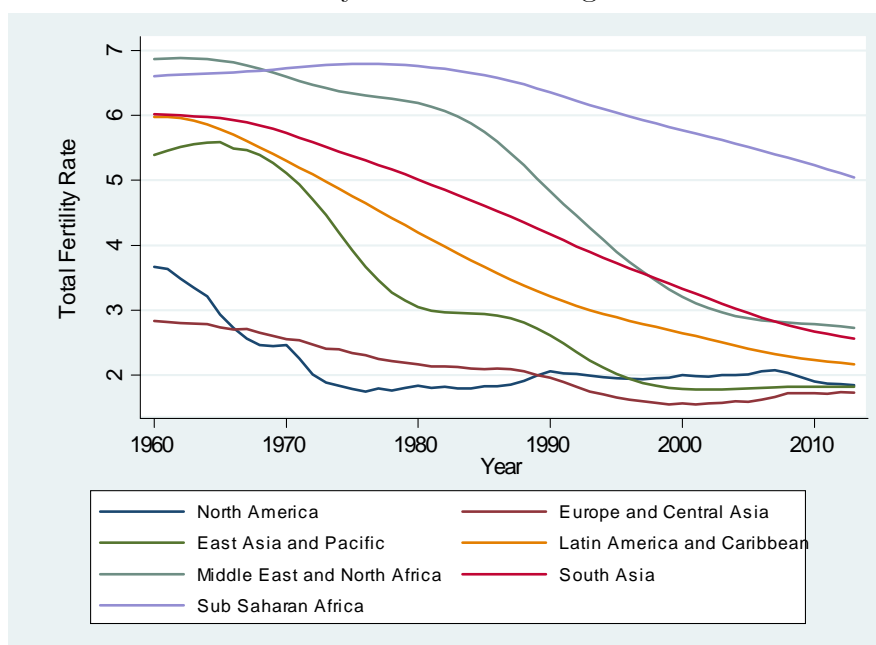
Year	Mean	Median	Min	Max
1960	5	5.8	1.9	8.2
1970	4.7	5.5	1.8	8.2
1980	3.7	3.4	1.4	9
1990	3.3	2.8	1.3	8.7
2000	2.6	2.4	0.9	7.7
2013	2.5	2.2	1.1	7.6

Notes: The table reports summary statistics of the total fertility rate at the start of each decade. The mean fertility rate is the "World" fertility rate available from the WDI, while the median, minimum and maximum are calculated using cross-country fertility rates for each year.

This decline in fertility rates has taken place across most regions in the world, as shown in Figure 2, which depicts the average TFR across broadly defined regions over time. As the figure illustrates, between 1960 and 2015, large declines in TFR took place in Latin America and the Caribbean, South Asia, and the Middle East and North Africa. Interestingly, while the global average continues to decline, fertility rates have been increasing slightly in North America, which reached its lowest TFR in the 1980s, and Europe and Central Asia, which bottomed up in the 1990s. This also suggests a slight convergence to 2 taking place in regions where the TFR was below 2.

FIGURE 2

Fertility trends across regions



Notes: This figure plots the trends in fertility trends by region, as defined by the World Bank, between 1960 and 2013. The data comes from the WDI database.

As shown in Table 2, fertility rates in East Asia and the Pacific fell from 5.4 to 1.81 over the period from 1960 to 2013 (a 66 percent reduction), while Latin America and the Caribbean went from an average TFR of 5.98 in 1960 to 2.16 in 2013 (a 64 percent decline). The Middle East and North Africa’s TFR fell from 6.87 to 2.83, the largest absolute decline in fertility from among all world regions, while South Asia’s TFR fell from 6.02 in 1960 to 2.56 in 2013. While absolute declines in fertility were not as large in North America or Europe and Central Asia, the percentage declines in both regions have been significant—nearly 50 percent in North America and close to 40 percent in Europe and Central Asia. Convergence in Sub-Saharan Africa has been slower, as this region recorded the lowest percentage decline in fertility over all 53 years. However, since the 1980s, TFR fell from 6.7 to 5, which represents a sizeable decline.⁵ Within this region, South Africa has already reached a TFR of 2.4, and Mauritius in 2013 reported the lowest African TFR, 1.4.

⁵The replacement fertility rate for Sub-Saharan Africa is also much higher than for the rest of the world: it is 2.52 as opposed to the world average of 2.25. (See Table A4 in the Appendix for replacement fertility rates by country.)

TABLE 2
Fertility decline from 1960-2013

Region	Absolute decline in TFR	Percentage decline in TFR
North America	1.8	49.8
Europe and Central Asia	1.1	39.0
East Asia and the Pacific	3.6	66.4
Latin America and Caribbean	3.8	63.8
Middle East and North Africa	4.2	60.3
South Asia	3.5	57.5
Sub-Saharan Africa	1.6	23.6

Notes: This table reports the absolute and percentage decline in TFR over the 1960–2013 period by region. Fertility declines are calculated using TFR data from the WDI database and the regions are as defined by the World Bank.

III Determinants of Fertility Rates

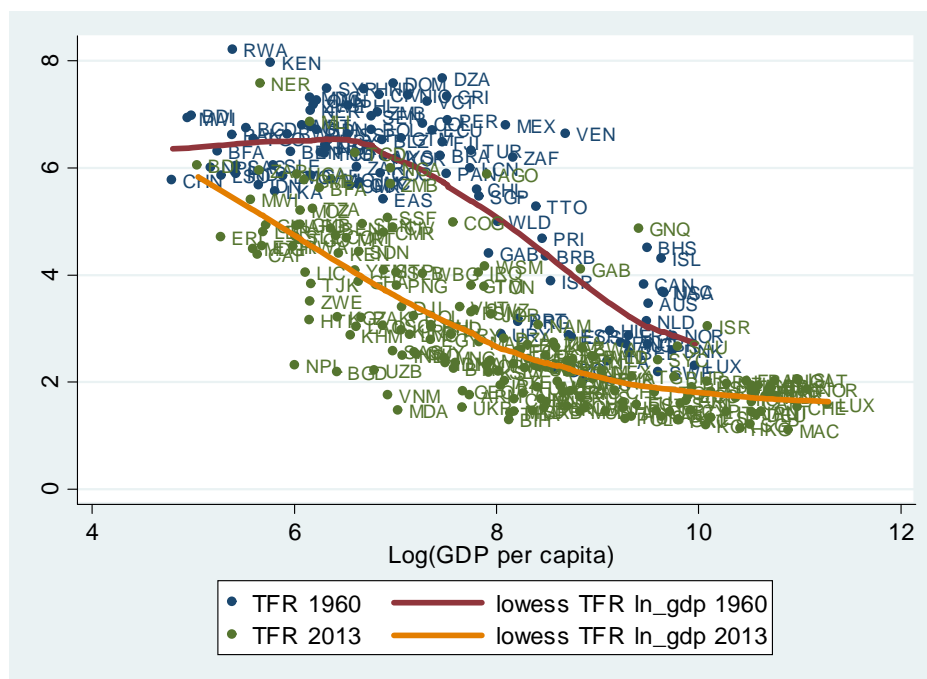
In this section, we study the covariation of fertility rates with the main variables emphasized in the literature. The data are taken from the World Bank’s WDI database unless otherwise noted.

A Fertility and Income

Several empirical studies have documented a negative relationship between fertility rates and income. While the relationship between fertility rates and income is indeed negative in the cross-section of countries, the main fact that this paper wishes to emphasize is that the relationship has shifted downward and become flatter over time. This development is illustrated in Figure 3, which shows the relationship between TFR and real GDP per capita both in 1960 and in 2013. The figure also shows a fitted polynomial line. The downward shift has been, on average, around 2.5 children per woman, meaning that today a woman has 2.5 children less than a woman living in a country at the same level of development had in 1960.

FIGURE 3

The Fertility-Income Relation in 1960 and 2013



Notes: The figure shows the scatter plots and lowess smoothed relationship between fertility and log of per capita GDP (in constant 2005 US\$) in 1960 and 2013. The data is from the WDI database.

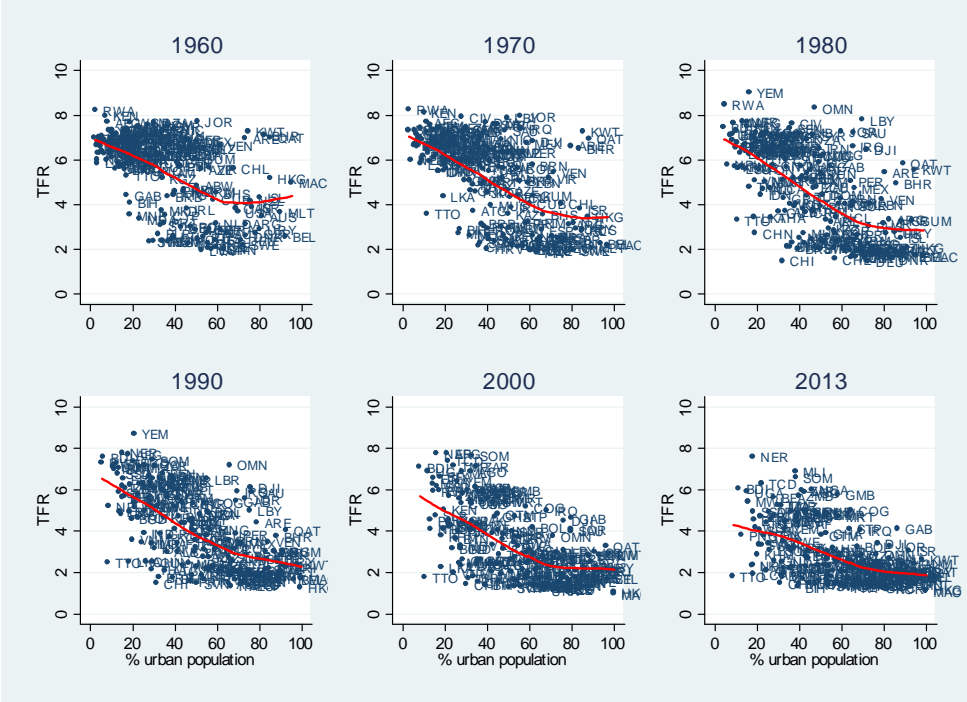
A significant amount of theoretical work has been devoted to generate a negative relationship between fertility rates and income. See for example Jones, Schoonbroodt, and Tertilt (2011), who study the theoretical conditions under which economic models can yield the negative relation observed in the data, and Manuelli and Sheshadri (2009), who seek to explain differences in fertility rates across countries with productivity and tax differences. But given the recent declines in fertility rates, the real challenge seems to be how to explain why countries with markedly different income levels are converging to very similar TFR. In Section IV we come back to this challenge and argue that the population programs started in the 1960s provide an explanation for the decline.

B Fertility and Urbanization

We now investigate whether increased urbanization can account for the decline in fertility rates. Rural areas have historically had much higher fertility rates than urban ones. Arguably, in rural areas, children can be a significant input in agricultural production. Moreover, despite the fact that parents can earn higher average wages in urban areas, it can cost more to raise children there, as the costs of

housing and (typically compulsory) education are higher.⁶ The negative relationship is illustrated in Figure 4, which plots the proportion of population living in urban areas against TFR for all countries (again, using data from the WDI).

FIGURE 4
Fertility and Urbanization



Notes: The figure shows the scatter plots and smoothed polynomial relationship between fertility and urbanization at the start of each decade. Urbanization is measured as the proportion of the population living in urban areas. Data comes from the WDI database.

Interestingly, though on average rural areas have higher TFR, the urbanization process alone cannot account for the sharp decline in fertility rates observed over the past five decades. Rather, it appears that fertility rates fell rapidly both in urban and rural areas. We are able to quantitatively explore this issue and assess the contribution of urbanization using TFR data from rural and urban areas obtained from the Demographic and Health Surveys (DHS). We decompose the fall in fertility rates into a within-region effect (corresponding to the decline in fertility within rural areas or urban areas) and a between-region effect (urbanization), corresponding to the decline in fertility rates due to the change in a country’s urban population share.

⁶This idea is presented in Becker (1960) as farmers having a comparative advantage in producing both children and food, though this advantage is smaller for higher “quality” of childrearing. Caldwell’s net wealth flow theory (1976) also supports the view that wealth flows from children to parents in primitive agricultural societies, whereas the direction of flows reverses as society modernises and costs of raising children go up.

In formulas, the overall fertility rate equals the weighted average of urban and rural fertility rates:

$$F_t = \lambda_{R,t}F_{R,t} + \lambda_{U,t}F_{U,t}$$

where $\lambda_{R,t}$ is the proportion of the country's population living in rural areas in period t , $\lambda_{U,t} = 1 - \lambda_{R,t}$, and $F_{R,t}$ and $F_{U,t}$ are the rural and urban fertility rates at time t , respectively.

With some algebra, the change in overall fertility between time 0 and time t can be exactly decomposed as:

$$\Delta F_t = F_t - F_0 = \underbrace{(\Delta\lambda_{R,t}\bar{F}_R - \Delta\lambda_{U,t}\bar{F}_U)}_{\text{Urbanization (between-effect)}} + \underbrace{(\bar{\lambda}_R\Delta F_{R,t} + \bar{\lambda}_U\Delta F_{U,t})}_{\text{Within-effect}}$$

where 0 and t correspond to the start and end of the period, respectively; and the terms denoted with a bar are the time averages:

$$\bar{x}_j = \frac{x_{j,t} + x_{j,0}}{2}, \quad j = R, U; \quad x = \lambda, F.$$

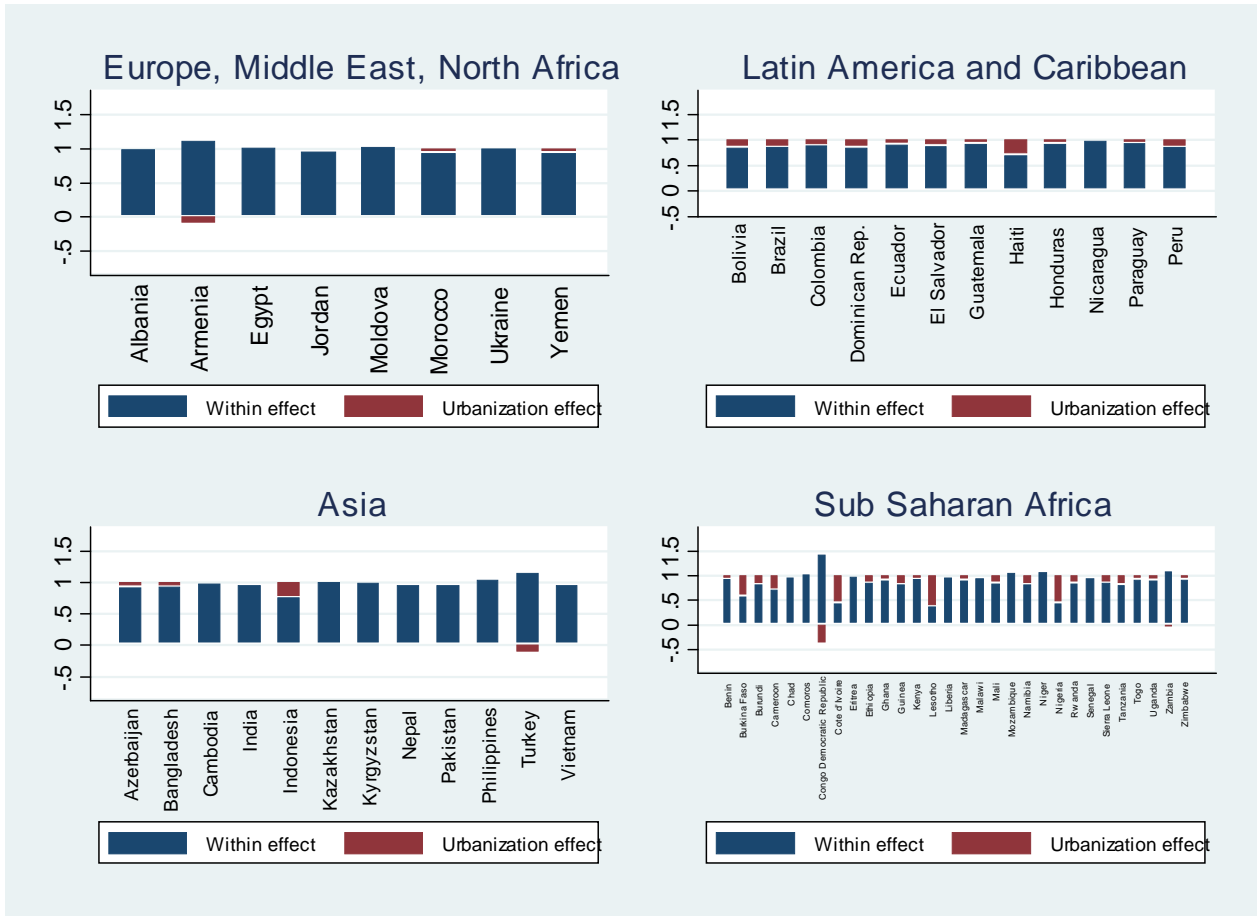
We perform this decomposition for 63 developing countries in which the DHS was carried out.⁷ Surprisingly, with an average contribution of about 15 percent, the results indicate that the urbanization process has not contributed very much to the overall fall in fertility rates (see Figure 5).

The contribution of urbanization does not vary significantly with a country's fertility or urbanization rates. This result suggests that while urbanization is indeed negatively correlated with fertility rates, there are other forces at work driving down fertility in both rural and urban areas around the world.

⁷It should be noted that since the DHS are carried out in different years and at different intervals in different countries, the period over which the changes are computed is not the same for every country. More details of the data are available in Table A3 in the Appendix.

FIGURE 5

Decomposition of the Decline in Fertility Rates



Notes: The figure plots the decomposition of the overall fall in fertility by the urbanization effect and the within-region effect. The data on urban and rural fertility is taken from the Demographic and Health Survey database and covers 63 developing countries over different time periods. The data on proportion of population living in urban areas for the corresponding years is taken from the World Development Indicators database.

(See Table A3 in the Appendix for more details.)

C Fertility and Female Labour Force Participation

We now explore the relationship between fertility and female labour force participation, the latter is often viewed as a key covariate in fertility choice.⁸ The relationship is plotted in Figure 6, which shows the cross-country data in different decades, together with a fitted line. The data on female labour force

⁸A key premise underlying economic models of fertility since Becker (1960) is that childbearing is a time-consuming activity, an assumption that mediates the theoretical relation between fertility rates and income. Some models explicitly or implicitly assume that mothers have a comparative advantage in childbearing (e.g., Mincer 1963; Becker 1965). In these models, as the value of female time in the market increases, the opportunity cost of having children also increases; this tends to reduce the demand for children (substitution effect) and can indeed offset increases in the demand for children stemming from higher income (income effect).

participation (the proportion of women aged 15+ years who are participating in the labour force) com from estimates by the International Labour Organization (ILO), published in the World Development Indicators and are available from 1980 through to 2013. As the plots in Figure 6 show, the relationship is U-shaped rather than negative and seems to be flattening out over time.

This result should not be too surprising: in 2013 female labour force participation was highest in Sub-Saharan African countries (at an average rate above 63 percent), higher indeed than in North America, Europe, and Central Asia (regions for which participation rates were between 50 and 60 percent). In contrast, participation rates for women are vert low in South Asia (35 percent), the Middle East, and North Africa (just over 20 percent in 2013), regions with remarkably low TFR. For a given country over time (that is, controlling for country-fixed effects), the relationship appears to be negative, meaning that increases in labour force participation are associated with decreases in fertility rates, though the statistical association is very low (the R-square coefficients are below 5 percent.)

FIGURE 6
Fertility and Female Labour Force Participation



Notes: The figure shows the scatter plots and smoothed polynomial relationship between fertility rates and female labour force participation at the start of each decade (data is only available from 1980 onwards) for all countries. Female labour force participation is measured as the proportion of women aged 15+ years in the labour force. Data comes from the WDI database.

D Fertility, Mortality, and Replacement Rates

Infant and child mortality rates are often proposed as key determinants of fertility rates. The premise is that in countries with high mortality rates, the number of births needed to produce the desired number of children is higher, leading to a positive relation between TFR and infant and child mortality rates. This interpretation, based on an individual family's rational calculation, proves to be problematic when confronted with two additional pieces of evidence. The first is that TFR is also positively associated with the risk of maternal death (defined as the probability that a 15-year-old female will die eventually from a childbirth-related cause assuming that current levels of fertility and mortality—including maternal mortality—do not change in the future, taking into account competing causes of death). In a rational setting, a higher risk of maternal death should decrease rather than increase TFR. The strong positive correlation in the data between TFR and the risk of maternal death casts some doubt on the survival probability interpretation offered to explain the positive correlation between TFR and infant and child mortality rates.⁹ Rather, it would seem that health or broader economic factors that increase all types of mortality rates are positively correlated with TFR. The mortality rate for infants are plotted against TFR in Figure 7, while the mortality rates for children are plotted against TFR in Figure 8. Figure 9 plots the risk of maternal death against TFR.

In the next section, we argue that the decline in overall mortality rates was important in triggering the global population-control program, which originated from a concern about explosive population growth.

⁹There is also a positive correlation between TFR and the maternal mortality rate (defined as the number of maternal deaths per 100,000 live births) though the number of observations available is much smaller.

FIGURE 7

Total Fertility Rate and Infant Mortality Rate

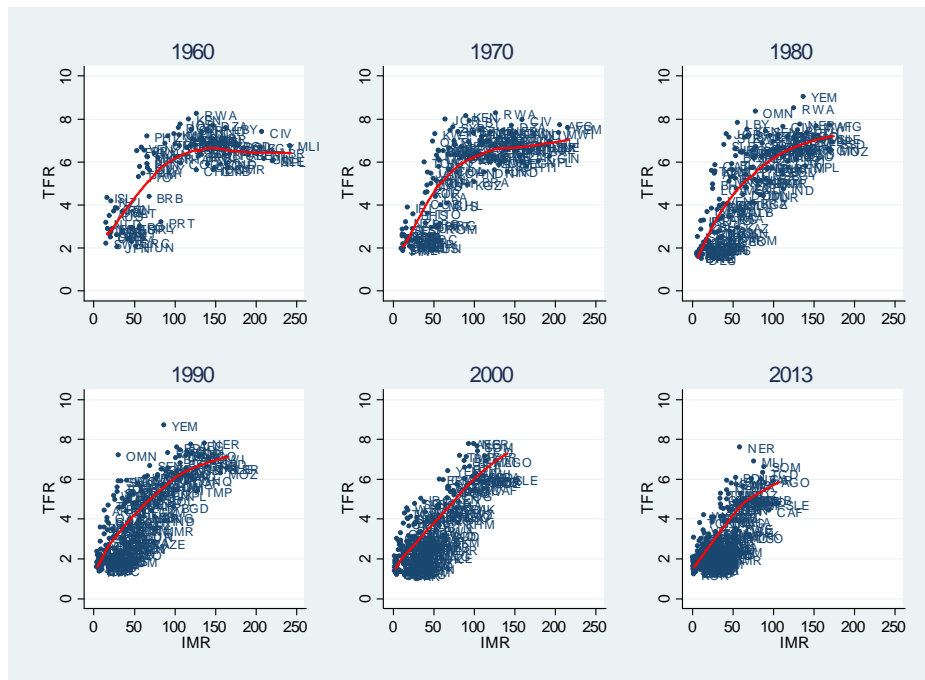


FIGURE 8

Total Fertility Rate and Child Mortality Rate

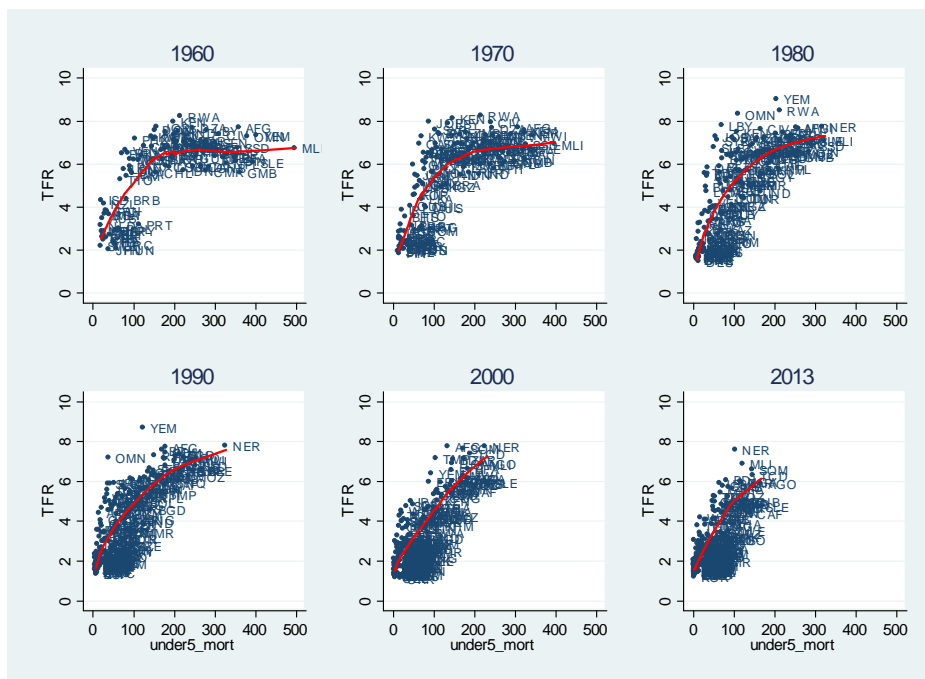
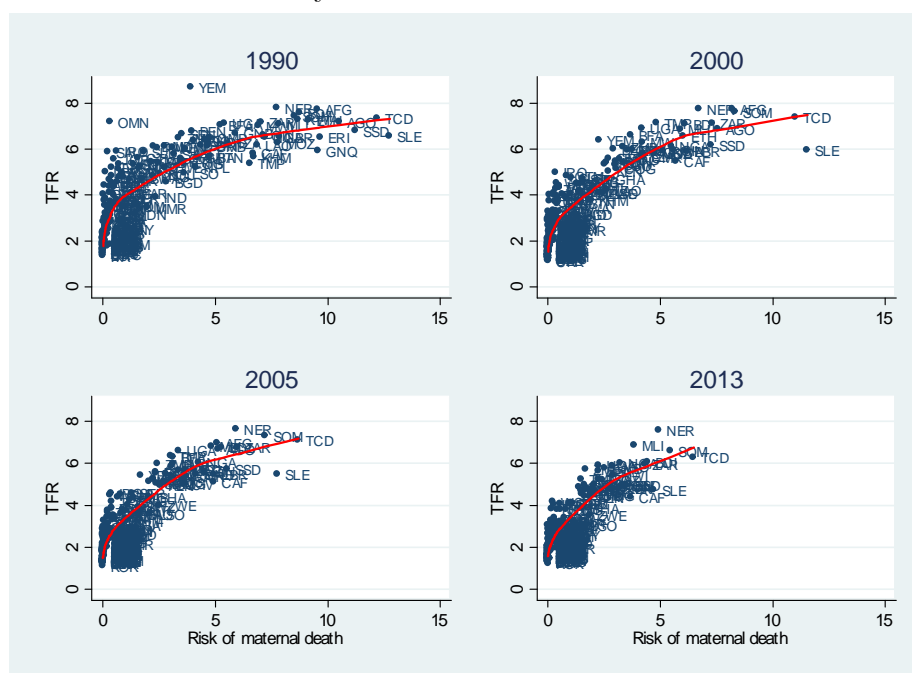


FIGURE 9

Total Fertility Rate and Risk of Maternal Death

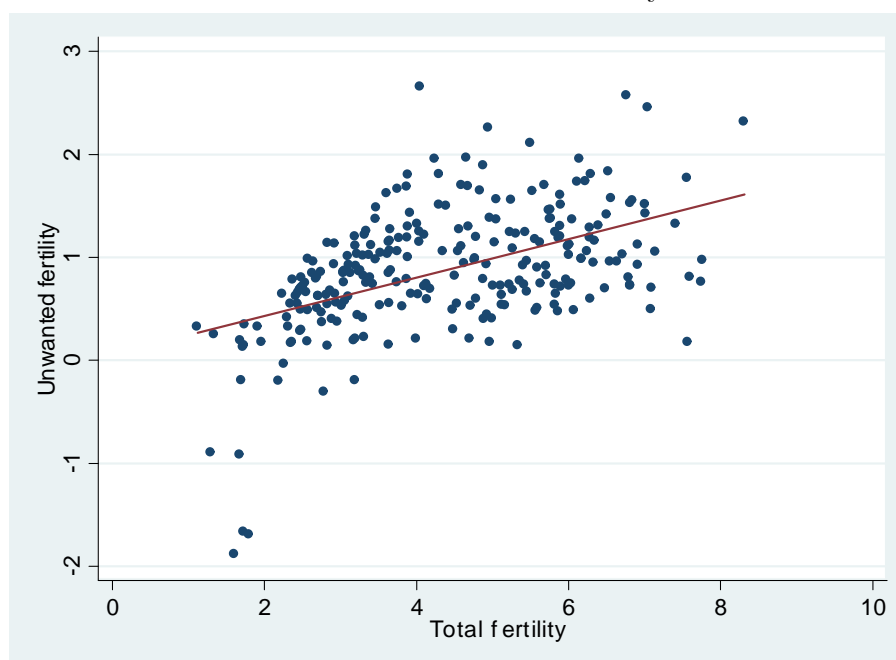


Notes: Figures 7, 8, and 9 show the scatter plots and smoothed polynomial relationship between TFR and infant mortality, child mortality and the risk of maternal death at the start of each decade (data for risk of maternal death is only available from 1990). Infant and child mortality are calculated as the number of infant (less than 1 year old) or child (less than 5 years-old) deaths per 1,000 lives births. The lifetime risk of maternal death is the probability that a 15-year-old female will eventually die from a maternal cause assuming that current levels of fertility and mortality (including maternal mortality) do not change in the future, taking into account competing causes of death.

The second piece of evidence suggesting that the reduction in fertility rates was not driven simply by a decline in mortality rates concerns the number of wanted children. The WDI reports on “wanted fertility”, meaning the average number of children reportedly desired by a woman in the survey. The data are available for different countries at different years. The number of wanted children has declined over time. Remarkably the “unwanted fertility”, that is, the difference between actual TFR and wanted fertility is almost invariably positive and positively correlated with actual TFR. This means that in countries with high fertility rates, people are not achieving their target: indeed, countries systematically err on the positive side, meaning that they always have more than the desired number of children. To some extent, this suggests that there is insufficient access to or use of contraception. Figure 10 illustrates this relationship.

FIGURE 10

Actual vs. Unwanted Fertility



Notes: The figure plots TFR against unwanted fertility. TFR and wanted fertility are from the WDI database and unwanted fertility is calculated as the difference between TFR and wanted fertility. The WDI publishes wanted fertility obtained from Demographic and Health Surveys from 90 developing countries.

Taken together, these two additional pieces of evidence suggest that the TFR is (or was) high, but not necessarily because of unconstrained rational decision making. In a rational setting it is hard to reconcile i) why increased risk of maternal death would increase fertility rates (unless of course, one was willing to argue that the infant mortality rate causes high fertility rates, but that maternal mortality rates are instead a consequence of high fertility rates); and ii) why people systematically have more than the desired number desired of children (e.g., the error is always one-sided). As already states, the latter suggests that there is insufficient access to or use of contraception.

In the next section, we discuss how the global effort to reduce fertility rates surged in response to the lower overall mortality rates and took as part of its mission the goal of decreasing “wanted fertility” by establishing a small family as a new ideal.

IV The Global Family Planning Movement and its Consequences

The following section provides a brief overview of the global family planning program, discussing the historical context as well as outlining some of its characteristics. We then examine more systematically the link between fertility policy adoption and declines in fertility.¹⁰

A Evolution of the Global Family Planning Program

After World War II, there was growing preoccupation with the unprecedented levels of population growth observed in most of the developing world due to the combined effect of declining mortality rates and high fertility rates. The problem was identified early on in several of the world's most populous nations such as India (the first country to introduce a national population policy) and Egypt, though a prevalent belief among most developing nations held that larger populations translated into having greater political power.¹¹ A growing concern about the population explosion in developing countries was particularly notable in the United States. A neo-Malthusian population-control movement developed, led by, among others, John D. Rockefeller III, whose main preoccupations were both the growing imbalance between population and resource growth, and the potential for political instability as most of the population growth was concentrated in the poorest countries of the world. In 1952, Rockefeller founded the Population Council, aimed at providing research and technical assistance for population programs across the world. The same year, India started the first national population program and, in parallel, the International Planned Parenthood Federation was established.¹² Private foundations including the Rockefeller and Ford Foundations, provided seed funding for research and planning programs, but it was in the mid-1960s when large-scale funding became available and the planning movement really took off. The first large-scale intervention was carried out by the Swedish government, which supported family planning efforts in Sri Lanka (then Ceylon), India, and Pakistan, starting in 1962 (Sinding 2007).¹³

¹⁰This and the following section draw heavily on Robinson and Ross (2007) who provide a compilation of case studies for 22 countries across the world on their family planning programs.

¹¹This sentiment was observed in countries including Turkey, Indonesia, and Egypt in the 1950s and 1960s.

¹²An early birth-control movement led by feminist Margaret Sanger in the United States (who set up the first birth-control clinic in the USA in 1916) and Elise Ottesen-Jensen in Sweden was another force leading to the efforts for fertility reduction. This movement initially had a different focus: its goal was to promote individual control over fertility rather than an explicit population policy to avert explosive global population growth.

¹³Over time, several international organizations, like USAID and the World Bank, joined in providing funds and support for family planning programs around the world.

By the 1960s, there was a strong consensus in development policy circles that curbing population growth was a high priority. Funding agencies began to be actively involved in providing financial and technical assistance for population programs in developing countries. The invention of the modern intrauterine device (IUD) and the oral contraceptive pill around the same time allowed for the possibility of easy-to-use and effective contraceptive methods becoming widely available for public use.

These early family planning efforts showed rapid success in East Asian countries, with Hong Kong, South Korea, Singapore, and Thailand leading the rankings. Program implementation and success would take longer in other developing countries partly due to the difficulty of overcoming cultural inhibitions and religious opposition towards birth control, as well as operational problems including inadequate transport infrastructure and insufficient funding. However, the World Population Conference in 1974 appeared to be a turning point for the global family planning movement. In 1976, 93 governments were providing direct support for family planning (some governments provided support for family planning for other than demographic reasons), while explicit policies to limit fertility were introduced in 40 countries (data on number of countries by policy comes from the UN World Population Policy database).¹⁴ Between 1976 and 2013, 114 countries adopted policies to reduce fertility rates. The number of countries with policies to reduce fertility rates in a given year increased over the decades, with some countries eventually needing to reverse course in order to keep their population stable. This is clearly illustrated by the fact that at present, the number of countries wishing to maintain their level of fertility, or even raise it, is increasing, as birth rates have fallen below the replacement fertility rates. Together with this trend, the number of countries with state support for family planning has also continued to rise steadily (see Tables 3 and 4).¹⁵

¹⁴For instance, in Latin America, the adverse effects of illegal abortions was the key rationale for establishing family planning programmes.

¹⁵Note that while Table 3 refers to the number of countries by type of support for family planning by the government, it does not necessarily include the countries with private sector involvement in the provision of family planning services.

TABLE 3

Number of Countries by Fertility Policy Goals

Year	Lower Fertility	Maintain Fertility	No Intervention	Raise Fertility	Total
1976	40	19	78	13	150
1986	54	16	75	19	164
1996	82	19	65	27	193
2005	78	31	47	38	194
2013	84	33	26	54	197

Notes: The table shows the number of countries by fertility policy implemented. The data is obtained from the U.N. World Population Policies database and begins in 1976. Countries are categorized according to whether they had a policy to lower, maintain or raise fertility or if they had no intervention to change fertility.

TABLE 4

Number of Countries by Government Support for Family Planning

Year	Direct support	Indirect support	No support	Limit	Not permitted	Total
1976	95	17	28	10	0	150
1986	117	22	18	7	0	164
1996	143	18	26	2	0	193
2005	143	35	15	1	0	194
2013	160	20	16	0	1	197

Notes: The table shows the number of countries by the type of support extended by the state for family planning services. The data is obtained from the U.N. World Population Policies database and begins from 1976. Countries are categorized by whether their governments directly supported, indirectly supported or did not support family planning as well as if the government limited family planning services or did not permit family planning in the country.

In 1976, the countries that had policies to reduce fertility covered nearly one-third of East Asian countries, a quarter of Latin American and Caribbean countries and nearly two-thirds of South Asian countries. By contrast, only a fifth of countries in North Africa, the Middle East, and Sub-Saharan Africa had a fertility reduction policy in 1976. By 2000, 88 countries had implemented a fertility reduction policy at some point (by this time, some of them had reached their fertility reduction targets and changed to policies of maintaining fertility rates) including half of the countries in East Asia and Latin America, and more than two-thirds of the countries in Sub-Saharan Africa and South Asia. These countries represent 70 percent of the world's population.

B Features of Family Planning Programs

The early phases of planning programs in most developing countries typically addressed the technological side of the population problem by attempting to provide a range of contraception methods (oral contraceptives, IUD, condoms, sterilization, and abortion) and information on their use. Increases in the supply of contraceptives soon proved insufficient to lower fertility rates, particularly in poorer or more traditional societies. This failure led to concerted efforts to change public attitudes and beliefs and establish a new small-family norm through active mass-media campaigns. We discuss these two faces in turn.

The implementation of the family planning programs varied vastly across countries. Differences included the price at which contraception was offered (public versus commercial provision, subsidies to production or sales, and so on.), the delivery system through which services were provided, the outlets for the mass-media campaigns, and the supplementary policies that accompanied the core measures (Freedman and Berelson 1976).

Most countries began their family planning programs with a clinic-based approach that took advantage of the existing health infrastructure to provide modern contraceptive methods. This approach was supplemented by the deployment of trained field workers who would make house calls, particularly in rural areas. Many countries also implemented postpartum programs in hospitals, to advise women on the use of contraception, often after giving birth or undergoing an induced abortion. However, this approach had limited success in regions where a large proportion of women gave birth outside of the formal health care system.¹⁶ In some nations such as Iran and Malaysia, family-planning programs were linked to maternal and child health services at an early stage, which allowed for better integrating

¹⁶In fact, this was the case in countries like India and Iran.

the program into the country's health system.¹⁷

Many of the programs established in the 1950s and 1960s just focused on enhancing service provision, but it became apparent that this approach was insufficient, particularly in countries where populations were very conservative or mostly uneducated and poor. For instance, countries with a predominantly Catholic or Muslim population had difficulty gaining wide acceptance for their programs, so planners had to work on achieving a balance between these cultural factors and their policy targets. Indonesia offers a good example of a program that worked around this issue. Early on, the program published a pamphlet titled “Views of Religions on Family Planning” that documented the general acceptance of family planning by four of Indonesia's five official religions—Islam, Hinduism, and Protestant and Catholic Christianity—to illustrate that family planning did not go against religious beliefs. To overcome fears that husbands would resist male doctors or health professionals working with their wives, the family planning program in Bangladesh relied heavily on female health workers to visit women in their homes to educate them about and supply them with contraceptive methods. This modality ensured a greater diffusion of contraceptive knowledge and methods in rural Bangladesh.

Mass communication was commonly used to educate the population on family planning, and most important, to change public views by establishing a small-family norm. Most countries used television, radio, and print media to publicize and promote their programs. In India, the family planning program's slogan, “Have only two or three children, that's enough,” was widely publicized on billboards and even on the sides of buildings. Other slogans in India were “A small family is a happy family” and “Big family: problems all the way; small family: happiness all the way” (Khanna 2009). Bangladesh publicized the slogans “Boy or girl, two children are enough” and “One child is ideal, two children are enough” (Begum 1983). South Korea ran the slogan “Stop at two, regardless of sex” (Kim and Ross 2007). Hong Kong chose “Two is enough” (Fan 2007), and so on. China took population planning to the extreme in 1979, when it imposed a coercive one-child policy. But the Chinese TFR actually started falling significantly before the one-child policy was implemented. Indeed, the sharp decline started after 1973, with mass-media messages such as “Later, longer, fewer” (Tien 1980) and “One is not too few, two, just right, and three, too many” (Chang, Lee, McKibben, Poston and Walther, 2005). In Singapore, bumper stickers, coasters, calendars and key chains reinforcing the family planning message were distributed free of charge; in Bangladesh, a television drama to highlight the value of family planning outreach work was aired (Piotrow and Kincaid, 2000). The Indonesian program is

¹⁷Towards the 1990s, with the rebranding of family planning as sexual and reproductive wellbeing, more countries followed this approach.

particularly noteworthy in its collaboration between the government and community groups in getting the messages of the program across. In Latin America, the Population Media Centre (PMC), a non profit organization, collaborates with a social marketing organization in Brazil to ensure the inclusion of social and health themes in soap operas airing on TV Globo, the most popular television network in Brazil. (TV Globo's programming is estimated to currently reach 98 percent of Brazil's population, and 65 percent of all of Spanish-speaking Latin America.) PMC studied how programs like "Paginas da Vida" (Pages of Life) influenced Brazilians: about two-thirds of women interviewed said "Paginas da Vida" had helped them take steps to prevent unwanted pregnancy. Brazil's telenovelas have been popular across Latin America since the 1980s; they tend to depict the lives of characters from invariably small families, who were also very rich and glamorous.¹⁸

Stronger inducements such as monetary or in-kind incentives and disincentives were also used in some countries as means of encouraging families to practice birth control. In Tunisia, for example, government family allowances were limited to the first four children; in Singapore, income tax relief was restricted to the first three children as was maternity leave, the allocation of public apartments, and preferred school places. Incentives for female or male sterilization was a common feature of family planning programs in India, Bangladesh, and Sri Lanka and resulted in a large number of sterilizations taking place during the 1970s. In Bangladesh, field health workers were paid for accompanying an individual to a sterilization procedure, while in Sri Lanka and India both the sterilization provider and patient were given compensation. In Kerala, India, individuals undergoing sterilization were given a payment equal to a week's worth of food for their entire family and entered into a raffle to win about a month's of income of a typical person. This type of incentivized compensation scheme, combined with increased regional sterilization targets, led to a drastic increase in sterilization procedures.¹⁹

In addition to increased provision of information on and access to family planning methods, attempts were also made to delay marriage and childbearing or to increase birth spacing as a means of controlling fertility. For example, the legal age of marriage was increased to 18 years for women and 21 years for men in India, and to 17 years for women and 20 years for men in Tunisia. China raised the legal age for marriage in urban areas—to 25 years for women and 28 years for men—and rural areas—23 years for women and 25 years for men. China also imposed a minimum gap of three to

¹⁸The main force behind the anti-natalist movement in Brazil was BEMFAM, an affiliate of the International Planned Parenthood Federation. The military regime of the 70s, and the Church hierarchy were opposed to birth control, though the local Clergy and multiple non governmental organizations advised and informed in favour of contraceptive use. Telenovelas were arguably a good counterbalance to the religious and military opposition. In other Latin American countries, such as Colombia and Chile, family planning had strong support from the government.

¹⁹Critics alleged that many acceptors were coerced by officials who stood to gain from higher numbers, both in monetary and political terms.

four years between births and restricted the number of children to three per couple until it decided to accelerate the decline even more aggressively by implementing the draconian one-child policy in the 1980s.

More recently, likely as a result of the sizable decline in birth rates, fertility control has been put on the back burner. In fact, the current HIV/AIDS epidemics have somewhat overshadowed fertility control, particularly in African countries, while family planning did not even warrant being a sub-goal in the Millennium Development Goals agreed to in 2000. Many countries are also now below replacement-level fertility rates and more are attempting to raise fertility rates to avoid the consequences of large aging populations. Nonetheless, it appears that family planning programs have been incorporated into the broader framework of sexual and reproductive health services and become firmly entrenched in health care systems around the world.

A natural question of course is whether the type of less coercive intervention carried out by most countries can be effective in helping to rapidly change norms and in overcoming other socioeconomic influences that affect fertility rates. Recent experimental (or quasi-experimental) studies suggest that this may indeed be the case. La Ferrara, Chong, and Duryea (2012) find that Brazilian regions covered by a television network showing soap operas that portray small families experienced a bigger reduction in fertility rates. Bandiera, Buehren, Burgess, Goldstein, Gulesci, Rasul, and Sulaiman (2014) find that in Uganda, adolescent girls who received information on sex, reproduction, and marriage reported wanting a smaller number of children. Evidence of family planning programs in the United States appears to be more mixed, though recently Bailey (2013) has shown that a U.S. family planning program significantly reduced fertility. In the next section we explore the question using cross-country data on spending and implementation effort of the program and their relationship with fertility reduction.

C Fertility Policies and the Decline in Fertility Rates

It is challenging to assess the quantitative effect of the fertility programs on the basis of cross-country data, as clearly there are a number of omitted variables that could blur the estimation of a causal effect. The task is particularly difficult since different countries opted for a wide and varied range of policies, with the specific choice of measures partly dictated by their feasibility in each country's institutional and cultural setting.

The following section includes a descriptive analysis of the relationships between fertility rates, population policy, funds for family planning, and family planning program efforts across countries. Fertility rates are obtained as before from the World Bank's WDI. Data on the existence of a fertility

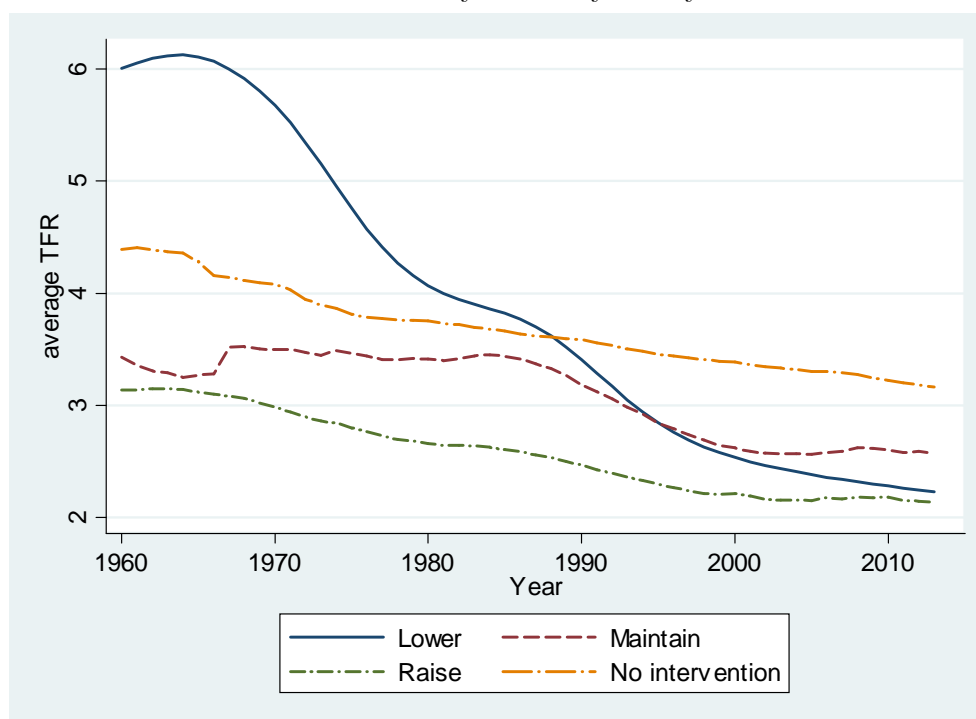
policy and government support for family planning come from the U.N. World Population Policies Database. Data on funds for family planning are taken from Nortman and Hofstatter (1978), Nortman (1982), and Ross, Mauldin and Miller (1993) which, taken together, cover funding for family planning by source for 58 countries over various years starting in 1972 and going up to 1992. Finally, family planning program effort is measured using the Family Planning Program Effort Index published in Ross and Stover (2001); this indicator, based on work by Lapham and Mauldin (1984), measures the strength of a given country's program on four dimensions (policies, services, evaluation, and method access). The score has a potential range of 0–300 points, based on 1–10 points for each of 30 items, and has been calculated for 1972, 1982, 1989, 1994, and 1999.

Comparing the trends in mean TFR by the fertility policy observed in 1976 paints a striking picture (see Figure 11).²⁰ While fertility has fallen in all regions (even in the group of predominantly European countries that wanted to increase fertility!), the countries that had identified the need to reduce fertility in 1976 recorded by far the highest average fertility rates before 1976 but the second-lowest average fertility rates by 2013. The countries where there was no intervention had the second-highest average fertility rates in 1976 and became the highest fertility group by 2013.

²⁰The data on fertility policy begins from 1976 but there were several countries that had already adopted fertility reduction policies beforehand.

FIGURE 11

Evolution of Fertility Rates by Policy in 1976



Notes: The figure illustrates the evolution of weighted average TFR, with countries grouped by the fertility policy observed in 1976. The policy could be to lower, maintain, or raise fertility; there also could be no intervention.

We use funding data for family planning and family planning program effort as measures of the inputs into programs around the world. Table 5 reports the amount of funds (in real terms) available for family planning by source over the 1970s and 1980s for each country. Latin American countries appear to have the largest amount of per capita funds, exceeding US\$ 2 per capita (in 2005 U.S. dollars) of total funding in Costa Rica, El Salvador, and Puerto Rico. (The per capita figures in Table 5 are expressed in terms of 2005 U.S. dollar cents). The region also has the highest proportion of nonstate funding for family planning, more than double the state-funding in some countries. By contrast, in Asia, the funding is predominantly state-led. As a percentage of GDP, total funds for family planning averaged at around 0.05 percent in the 1970s and 0.07 percent in the 1980s, but was as high as 0.47 percent in Bangladesh and 0.46 in Korea in the 1980s.

TABLE 5

Funds for family planning by country

Country	Total per capita		Government per capita		Nongoven per capita		Total funds as a	
	funds (in U.S. cents)		funds (in U.S. cents)		funds (in U.S. cents)		% of GDP	
	1970s	1980s	1970s	1980s	1970s	1980s	1970s	1980s
Asia								
Afghanistan	n.a	2.56	n.a	0.00	n.a	2.56	n.a	n.a
Bangladesh	41.02	186.56	16.39	36.24	24.63	150.32	0.07	0.47
Hong Kong, China	54.65	66.00	26.74	48.42	27.91	17.57	0.01	0.00
India	68.42	99.55	64.10	89.67	4.32	9.88	0.08	0.16
Indonesia	74.75	101.37	39.52	71.38	35.23	29.99	0.09	0.11
Korea, Rep.	108.63	147.06	85.32	132.12	23.32	14.94	0.04	0.46
Malaysia	165.63	105.86	102.10	95.60	63.53	10.26	0.04	0.03
Mongolia	n.a	6.60	n.a	n.a	n.a	6.60	n.a	0.00
Nepal	28.06	35.94	15.67	27.93	12.40	8.02	0.07	0.12
Pakistan	76.01	41.58	32.21	18.07	43.79	23.51	0.13	0.07
Philippines	145.58	62.43	79.85	37.85	65.73	24.58	0.11	0.05
Singapore	134.12	97.74	132.62	97.38	1.50	0.36	0.01	0.01
Sri Lanka	16.11	16.68	n.a	11.76	n.a	4.92	0.02	0.02
Taiwan	50.88	89.44	46.52	89.35	4.36	0.10	n.a	n.a
Thailand	44.54	42.87	11.33	26.70	33.21	16.17	0.03	0.03
Vietnam	n.a	n.a	n.a	5.81	n.a	n.a	n.a	n.a
Latin America and Caribbean								
Bolivia	13.20	n.a	0.96	n.a	12.25	n.a	0.01	n.a
Brazil	n.a	8.70	2.28	0.00	n.a	8.70	n.a	n.a
Colombia	59.18	47.40	n.a	23.70	n.a	23.70	0.02	0.02
Costa Rica	184.92	203.73	52.57	132.81	132.35	70.92	0.05	0.06
Dominican Rep.	91.42	n.a	43.28	n.a	48.15	n.a	0.04	n.a
El Salvador	300.66	324.76	237.06	235.47	63.60	89.29	0.15	0.22
Honduras	n.a	125.80	n.a	0.00	n.a	125.80	n.a	0.08
Nicaragua	n.a	n.a	n.a	204.57	n.a	n.a	n.a	n.a
Panama	n.a	59.59	n.a	14.29	n.a	45.30	n.a	0.01

TABLE 5 (contd.)

Country	Total per capita		Government per capita		Nongovern per capita		Total funds as a	
	funds (in U.S. cents)		funds (in U.S. cents)		funds (in U.S. cents)		% of GDP	
	1970s	1980s	1970s	1980s	1970s	1980s	1970s	1980s
Puerto Rico	897.43	n.a	390.17	n.a	507.26	n.a	0.09	n.a
Trinidad and Tobago	n.a	n.a	n.a	26.51	n.a	n.a	n.a	n.a
Venezuela	n.a	n.a	123.35	1.50	n.a	n.a	n.a	n.a
North Africa and Middle East								
Egypt	16.33	n.a	1.81	11.96	14.51	n.a	0.01	n.a
Iran	248.01	n.a	243.34	0.07	4.67	n.a	0.05	n.a
Iraq	n.a	3.26	n.a	2.25	n.a	1.02	n.a	0.00
Jordan	n.a	61.82	n.a	21.45	n.a	40.37	n.a	0.02
Morocco	n.a	55.53	n.a	45.49	n.a	10.05	n.a	0.03
Tunisia	124.05	130.23	36.10	73.57	87.96	56.66	0.05	0.06
Turkey	23.03	23.58	21.81	20.51	1.22	3.06	0.01	0.01
Sub-Saharan Africa								
Botswana	n.a	15.40	n.a	7.48	n.a	7.93	n.a	0.01
Burkina Faso	n.a	23.93	n.a	6.70	n.a	17.23	n.a	0.05
Central African Rep.	n.a	35.21	n.a	16.93	n.a	18.28	n.a	0.05
Congo, Rep.	n.a	n.a	n.a	0.37	n.a	n.a	n.a	n.a
Ethiopia	n.a	6.66	n.a	n.a	n.a	n.a	n.a	0.02
Ghana	49.70	n.a	40.64	n.a	9.06	n.a	0.04	n.a
Guinea	n.a	15.24	n.a	0.71	n.a	14.53	n.a	0.02
Kenya	n.a	43.36	n.a	12.25	n.a	31.11	n.a	0.07
Liberia	n.a	48.34	n.a	n.a	n.a	n.a	n.a	0.08
Madagascar	n.a	3.78	n.a	1.46	n.a	2.32	n.a	0.01
Mauritania	n.a	29.51	n.a	0.76	n.a	28.75	n.a	0.04
Mauritius	356.05	385.87	180.29	244.30	175.76	141.58	0.11	0.12
Nigeria	n.a	9.39	n.a	n.a	n.a	n.a	n.a	0.02
Rwanda	n.a	55.90	n.a	29.90	n.a	25.99	n.a	0.10
Somalia	n.a	2.00	n.a	n.a	n.a	n.a	n.a	0.01
Tanzania	7.52	n.a	0.35	n.a	7.17	n.a	n.a	n.a

TABLE 5 (contd.)

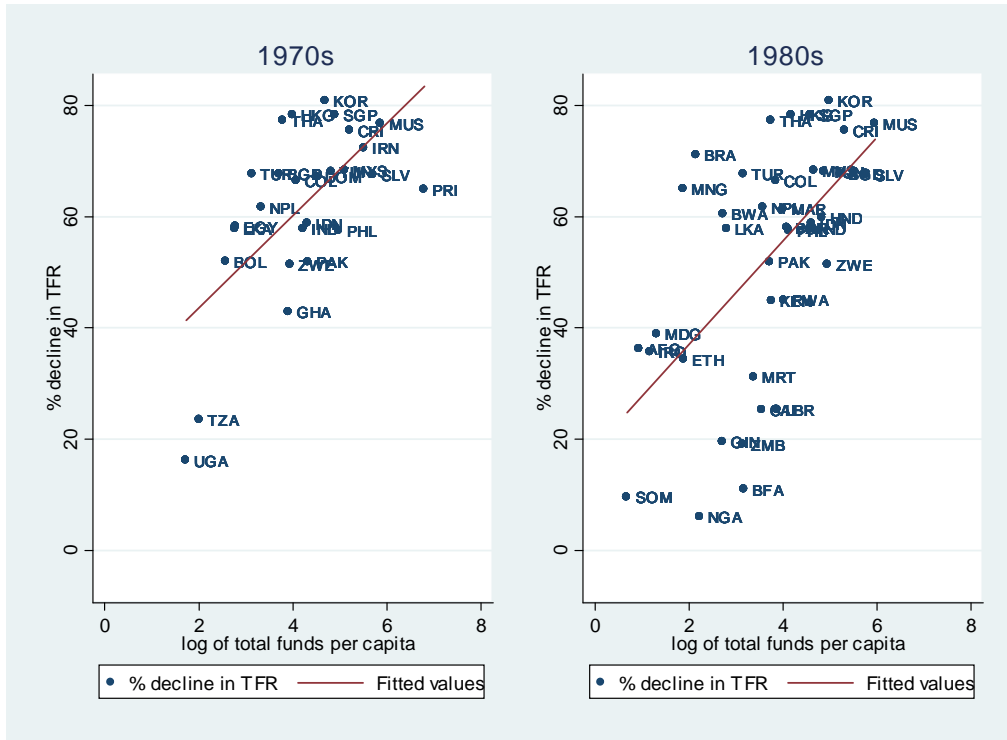
Country	Total per capita		Government per capita		Nongovern per capita		Total funds as a	
	funds (in U.S. cents)		funds (in U.S. cents)		funds (in U.S. cents)		% of GDP	
	1970s	1980s	1970s	1980s	1970s	1980s	1970s	1980s
Uganda	5.63	n.a	n.a	n.a	n.a	n.a	0.01	n.a
Zambia	n.a	23.26	n.a	3.53	n.a	19.73	n.a	0.03
Zimbabwe	51.70	142.60	45.47	100.50	6.23	42.10	0.02	0.10

Notes: The table reports the total funds for family planning per capita and per capita funds for family planning by source: government or nongovernment for the 1970s and 1980s. (We compute averages for the two decades as different countries have data for different years.) Averages for the 1970s and 1980s are computed in constant 2005 U.S.\$cents for comparability. The final two columns report the total funds for family planning as a percentage of GDP (both in nominal terms) averaged for the 1970s and 1980s. Data on funding for family planning are taken from Nortman and Hofstatter (1978), Nortman (1982), and Ross, Mauldin, and Miller (1993), while data on the price index (for conversion to real terms) and nominal GDP are from the World Development Indicators.

We next examine the relationship between (logged) total funds for family planning per capita (in constant 2005 US dollars) and the percentage reduction in total fertility rate over the 1960–2013 period (see Figure 12). Despite the small number of observations available (27 for the 1970s and 40 for the 1980s), there is a clear positive relationship, indicating that the countries with more funding for family planning experienced greater reductions in fertility rates. Regressions of the percentage decline in fertility on the total funding for family planning per capita for the two periods show highly significant positive coefficients with R-square values over 30 percent (see Table 6). Quantitatively, the results indicate that a 1 percent increase in funding per capita in the 1970s is associated with an 8.3 percent reduction in the total fertility rate.

FIGURE 12

Percentage reduction in fertility and funds for family planning



Notes: The figure shows the scatter plot and linear fit of the percentage decline in TFR from 1960 to 2013 and the log of total per capita funds (in constant 2005 US cents) for family planning for the 1970s and 1980s. Total funds are converted to 2005 US\$ before averaging for each decade. Data on TFR and consumer price index for the USA (used to convert the funds to real terms) are from the WDI and the data on funds for family planning are from Nortman and Hofstatter (1978), Nortman (1982) and Ross, Mauldin and Miller (1993).

TABLE 6

Decline in Fertility Rates and Funding for Family Planning Programs

Regressor	% change in TFR (1960–2013)			
	1973	1989	1970s	1980s
Log of total funds for family planning (per capita)	7.35*	8.88**		
	(2.85)	(1.82)		
Log of average funds for family planning (per capita)			8.29**	9.35**
			(2.66)	(1.73)
Constant	32.82*	21.23*	27.03*	18.28*
	(12.53)	(8.66)	(12.09)	(7.98)
R ²	0.36	0.31	0.41	0.34
Observations	24	27	27	40

Notes: The table reports the results of regressions of the percentage change in TFR from 1960 to 2013 on the logged value of total per capita funds for family planning for different years. The first two columns use the log of total per capita funds for family planning as the regressor for regressions in 1973 and 1989 (the two years with the highest number of observations). The third column uses the log of the average total per capita funds for the 1970s as regressor, while the fourth column uses the log of the 1980s average of total per capita funds. All funds are measured in constant 2005 US cents. The values in parentheses are robust standard errors. Data on TFR and the consumer price index for the United States (used to convert funds to real terms) is from the WDI and the data on funds for family planning are from Nortman and Hofstatter (1978), Nortman (1982) and Ross, Mauldin, and Miller (1993).

* Significant at 5% level ** Significant at 1% level

An alternative measure of program inputs is the family planning program effort index published by Ross and Stover (2001). The regional averages of family planning program effort indicate that East Asia and South Asia have, in general, had the strongest family planning programs over time (see Table 7). Latin America, North Africa, and the Middle East seem to have caught up on program effort over the three decades but the greatest improvement appears to have been in Sub-Saharan Africa in 1989-1999. (It is worth emphasizing that Sub-Saharan African countries were the latest to adopt family planning programs.)

TABLE 7

Program Effort Score by Region

Region	1972	1982	1989	1994	1999
Europe and Central Asia	20.0	27.0	46.0	42.2	53.0
East Asia and the Pacific	39.4	46.1	52.5	55.7	58.5
Latin America and the Caribbean	30.2	39.0	50.6	50.3	50.0
North Africa and the Middle East	11.4	17.9	40.5	41.8	58.3
South Asia	24.3	46.3	55.6	56.8	64.4
Sub Saharan Africa	5.0	15.5	36.7	43.9	51.1
Total	19.3	28.5	44.3	47.8	53.6
Number of countries	89	94	92	95	88

Notes: The table reports the average family planning program effort score for each region.

The regional averages are calculated using data from Ross and Stover (2001).

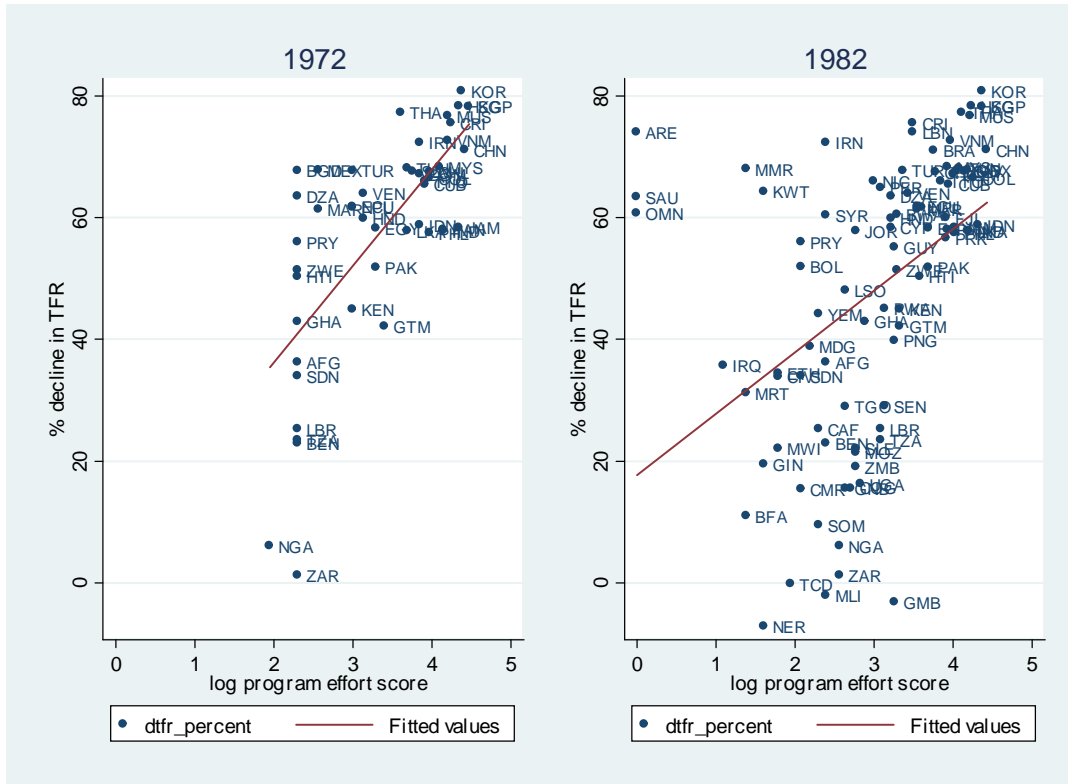
We next examine the relationship between the observed percentage reduction in fertility over the 1960–2013 period and the program effort score. Figure 13 indicates that there is a clear positive relationship, with larger fertility declines in countries with higher program effort, consistent with the results of the preceding section, where we found a strong positive correlation between funding for family planning and reduction in fertility. The relationship between the program effort score and the decline in fertility rates is strongest in 1972: the R-square coefficient of the regression of the percentage decline in TFR on the program effort score is 0.48 for 1972.²¹

In all, there appears to be a strong association between either the amount of funding or program effort and the decline in fertility rates. Most Sub-Saharan African countries were the latest to adopt family planning programs and their efforts only caught up recently to the rest of the world. Perhaps not surprisingly in light of the strong correlations, the countries in Sub-Saharan Africa are the ones where fertility rates still remain above the world's average.

²¹We report the results using program effort scores for 1972 and 1982. Program effort scores in 1989, 1994, and 1999 also have significantly positive relationships with the percentage reduction in TFR but the R-square coefficients are lower than in 1972.

FIGURE 13

Fertility Decline and Program Effort



Notes: The figure shows the scatter plot and linear fit for percentage decline in TFR (from 1960–2013) and program effort score for the years 1972 and 1982. Data on fertility decline is from the WDI database while program effort scores are from Ross and Stover (2001).

V Conclusion

This paper has argued that the meteoric convergence in fertility rates in the past four decades cannot be accounted for by convergence in other economic variables. The timing and speed of the decline coincides with the growth of a neo-Malthusian global population-control movement that designed and advocated a number of policy measures aimed at lowering fertility rates across the world. The precise measures chosen by different countries varied in nature, scope, and intensity, depending on the individual country’s socioeconomic context. Common to all programs was an enhanced provision of (different) contraceptive methods and a mass-media campaign to establish a new small-family norm.

The global convergence in fertility rates to near replacement fertility rates will eventually ensure a constant world population,²² reducing Malthusian and environmental concerns regarding the imbalance of resources and population growth. To the extent that lower fertility rates are associated with higher

²²Higher life expectancy implies that it will take another few decades to reach a constant population level.

investment in human capital, the trends bode well for development and living standards in the world's poorest regions. The coordinated efforts taken by most countries to contain population growth are an instructive example on how to reach a cooperative solution to a global economic problem.

Data Sources

DHS Program (2015). The DHS Program STATcompiler. ICF International. <http://www.statcompiler.com> (accessed June 18 2015).

Nortman, Dorothy L. and Ellen Hofstatter (1978). *Population and Family Planning Programs*. The Population Council. pp 38-41.

Nortman, Dorothy L. (1982). *Population and Family Planning Programs: A compendium of data through 1981*. The Population Council. pp 61-63.

Ross, John and John Stover (2001). The family planning program effort index: 1999 cycle: Dataset. *International Family Planning Perspectives*. <https://www.guttmacher.org/pubs/journals/2711901.pdf> (accessed July 20, 2015).

Ross, John A., Mauldin, W. Parker and Vincent C. Miller (1993). *Family Planning and Population: A compendium of international statistics*. The Population Council. pp 123-131.

United Nations Population Division (2015). World Population Policies Database: 2013 revision. United Nations. http://esa.un.org/PopPolicy/wpp_datasets.aspx (accessed July 20, 2015).

United Nations Population Division (2013). World Population Prospects: The 2012 revision. DVD edition. United Nations. <http://esa.un.org/wpp/Excel-Data/population.htm> (accessed July 22, 2015)

The World Bank (2015). World Development Indicators. The World Bank. <http://data.worldbank.org/data-catalog/world-development-indicators> (accessed July 20, 2015).

References

Ansley, J. C. (1969). The decline of fertility in europe from the french revolution to world war II. In S. Behrman & L. Corsa (Eds.), *Fertility and Family Planning: A World View* chapter 1, (pp. 3–24). The University of Michigan Press.

- Attane, I. (2002). China's family planning policy: An overview of its past and future. *Studies in Family Planning*, 33(1), pp. 103–113.
- Bailey, M. J. (2013). Fifty years of family planning: New evidence on the long-run effects of increasing access to contraception. *Brookings Papers on Economic Activity*, 46(1), 341–409.
- Bandiera, O. et al. (2014). Women's empowerment in action: Evidence from a randomised control trial in africa. (Working Paper).
- Barro, R. J. & Becker, G. S. (1989). Fertility choice in a model of economic growth. *Econometrica*, 57(2), pp. 481–501.
- Becker, G. S. (1960). An economic analysis of fertility. In U.-N. B. C. for Economic Research (Ed.), *Demographic and Economic Change in Developed Countries* chapter 7, (pp. 209–40). Columbia University Press.
- Becker, G. S. (1965). A theory of the allocation of time. *The Economic Journal*, 75(299), pp. 493–517.
- Becker, G. S. & Barro, R. J. (1988). A reformulation of the economic theory of fertility. *The Quarterly Journal of Economics*, 103(1), pp. 1–25.
- Begum, H. (1993). Family planning and social position of women. *Bioethics*, 7(2-3), 218–223.
- Bongaarts, J. (1997). The role of family planning programmes in contemporary fertility transitions. In G. W. Jones & others (Eds.), *The Continuing Demographic Transition* chapter 18, (pp. 422–43). Clarendon Press.
- Brown, G. F. (2007). Tunisia: The debut of family planning. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 4, (pp. 59–70). World Bank.
- Caldwell, J. C. (1976). Toward a restatement of demographic transition theory. *Population and Development Review*, 2(3/4), pp. 321–366.
- Chang, C.-F. et al. (2005). *Fertility, Family Planning and Population Policy in China*. Routledge.
- Doepke, M. (2004). Accounting for fertility decline during the transition to growth. *Journal of Economic Growth*, 9(3), pp. 347–383.

- Espenshade, T.J.; Guzman, J. & Westoff, C. (2003). The surprising global variation in replacement fertility. *Population Research and Policy Review*, 22, pp. 575–583.
- Fan, S. (2007). Hong kong: Evolution of the family planning program. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 12, (pp. 193–200). World Bank.
- Freedman, R. (1997). Do family planning programs affect fertility preferences? a literature review. *Studies in Family Planning*, 28(1), pp. 1–13.
- Freedman, R. & Berelson, B. (1976). The record of family planning programs. *Studies in Family Planning*, 7(1), pp. 1–40.
- Goldin, C. & Katz, L. F. (2002). The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of Political Economy*, 110(4), 730–770.
- Harkavy, O. & Roy, K. (2007). Emergence of the indian national family planning program. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 18, (pp. 301–324). World Bank.
- Hull, T. H. (2007). Formative years of family planning in indonesia. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 15, (pp. 235–256). World Bank.
- Jain, A. K. & Ross, J. A. (2012). Fertility differences among developing countries: Are they still related to family planning program efforts and social settings? *International Perspectives on Sexual and Reproductive Health*, 38(1), pp. 15–22.
- Jones, Larry E.; Schoonbroodt, A. & Tertilt, M. (2011). Fertility theories: Can they explain the negative fertility-income relationship? In J. B. Shoven (Ed.), *Demography and the Economy* chapter 2, (pp. 43–100). University of Chicago Press.
- Khanna, S. (2009). Population growth and "missing" girls. In *Fetal/Fatal Knowledge: New Reproductive Technologies and Family-Building Strategies in India (CSCSI)* chapter 4, (pp. 57–74). Cengage Learning.
- Kim, T. & Ross, J. A. (2007). The korean breakthrough. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 11, (pp. 177–192). World Bank.

- King, T. (2007). Family planning and the world bank in jamaica. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 10, (pp. 155–174). World Bank.
- La Ferrara, Eliana; Chong, A. & Duryea, S. (2012). Soap operas and fertility: Evidence from brazil. *American Economic Journal: Applied Economics*, 4(4), 1–31.
- Lapham, R. & Mauldin, W. (1984). Family planning program effort and birthrate decline in developing countries. *International Family Planning Perspectives*, 10(4), 109–118.
- Manuelli, R. E. & Seshadri, A. (2009). Explaining international fertility differences. *The Quarterly Journal of Economics*, 124(2), pp. 771–807.
- Mauldin, W. P., Berelson, B., & Sykes, Z. (1978). Conditions of fertility decline in developing countries, 1965-75. *Studies in Family Planning*, 9(5), pp. 89–147.
- Mincer, J. (1963). Opportunity costs and income effects. In C. Christ & others (Eds.), *Measurement in Economics* chapter 3, (pp. 67–82). Stanford University Press.
- Moore, R. (2007). Family planning in iran, 1960-79. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 3. World Bank.
- Nortman, D. L. (1982). *Population and family planning programs: A compendium of data through 1981*. The Population Council, 11th edition.
- Nortman, D. L. & Hofstatter, E. (1978). *Population and family planning programs*. The Population Council, 9th edition.
- Piotrow, P. T. & Kincaid, D. L. (2001). Strategic communications for international health programs. In R. E. Rice & C. K. Atkin (Eds.), *Public Communication Campaigns* chapter 14. Sage Publications, 3rd edition.
- Robinson, W. C. & El-Zanaty, F. H. (2007). The evolution of population policies and programs in the arab republic of egypt. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 2. World Bank.
- Robinson, W. C. & Ross, J. A., Eds. (2007). *The Global Family Planning Revolution: Three decades of population policies and programs*. World Bank.

- Ross, J. & Stover, J. (2001). The family planning program effort index: 1999 cycle. *International Family Planning Perspectives*, 27(3), 119–129.
- Ross, John A.; Maudlin, W. P. & Miller, V. C. (1993). *Family Planning and Population: A compendium of international statistics*. The Population Council.
- Schuler, Sidney Ruth; Hashemi, S. M. & Jenkins, A. H. (1995). Bangladesh's family planning success story: A gender perspective. *International Family Planning Perspectives*, 21(4), 132–166.
- Sinding, S. W. (2007). Overview and perspectives. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 1. World Bank.
- Teng, Y. M. (2007). Singapore: Population policies and program. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 13. World Bank.
- Tey, N. P. (2007). The family planning program in peninsular malaysia. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 16. World Bank.
- Tien, H. (1980). Wan, xi, shao: How china meets its population problem. *International Family Planning Perspectives*, 6(2), 65–73.
- Wright, N. H. (2007). Early family planning efforts in sri lanka. In W. C. Robinson & J. A. Ross (Eds.), *The Global Family Planning Revolution: Three Decade of Population Policies and Programs* chapter 20. World Bank.

Appendix

TABLE A1

Total fertility rate by country

Country	1960	1970	1980	1990	2000	2010	2013
Afghanistan	7.67	7.67	7.67	7.69	7.73	5.66	4.90
Albania	6.19	5.05	3.68	2.97	2.38	1.74	1.77
Algeria	7.65	7.64	6.89	4.76	2.51	2.82	2.80
Andorra						1.22	
Angola	7.32	7.30	7.20	7.17	6.84	6.22	5.86
Antigua and Barbuda	4.43	3.68	2.12	2.06	2.32	2.13	2.09
Argentina	3.11	3.07	3.33	2.99	2.48	2.22	2.18
Armenia	4.55	3.21	2.39	2.54	1.69	1.74	1.74
Aruba	4.82	2.91	2.39	2.25	1.87	1.70	1.67
Australia	3.45	2.86	1.89	1.90	1.76	1.93	1.92
Austria	2.69	2.29	1.65	1.46	1.36	1.44	1.44
Azerbaijan	5.57	4.61	3.29	2.74	2.00	1.92	2.00
Bahamas	4.50	3.53	2.99	2.64	2.07	1.90	1.89
Bahrain	7.09	6.50	4.92	3.74	2.77	2.14	2.08
Bangladesh	6.73	6.95	6.36	4.55	3.12	2.28	2.18
Barbados	4.33	3.11	2.00	1.74	1.77	1.84	1.85
Belarus	2.67	2.31	2.03	1.91	1.31	1.44	1.62
Belgium	2.54	2.25	1.68	1.62	1.67	1.86	1.79
Belize	6.50	6.30	5.85	4.51	3.59	2.80	2.68
Benin	6.28	6.75	7.03	6.74	5.98	5.10	4.85
Bermuda					1.74	1.76	1.63
Bhutan	6.67	6.67	6.55	5.64	3.61	2.38	2.23
Bolivia	6.70	6.58	5.52	4.91	4.14	3.36	3.22
Bosnia and Herzegovina	4.05	2.88	2.09	1.71	1.38	1.24	1.28
Botswana	6.62	6.64	6.22	4.70	3.41	2.76	2.62
Brazil	6.21	5.02	4.07	2.81	2.36	1.84	1.80

TABLE A1 (contd.)

Country	1960	1970	1980	1990	2000	2010	2013
Brunei Darussalam	6.49	5.75	4.25	3.53	2.40	2.05	1.99
Bulgaria	2.31	2.17	2.05	1.82	1.26	1.57	1.50
Burkina Faso	6.29	6.62	7.13	7.01	6.59	5.87	5.61
Burundi	6.95	7.31	7.45	7.54	7.06	6.30	6.03
Cabo Verde	6.89	6.94	6.38	5.31	3.70	2.43	2.29
Cambodia	6.97	6.48	5.69	5.62	3.75	2.97	2.86
Cameroon	5.65	6.21	6.61	6.43	5.62	5.02	4.78
Canada	3.81	2.26	1.74	1.83	1.49	1.63	1.61
Central African Rep.	5.84	5.95	5.95	5.78	5.45	4.63	4.37
Chad	6.25	6.53	6.96	7.31	7.35	6.60	6.26
Channel Islands	2.42	2.12	1.45	1.46	1.40	1.44	1.46
Chile	5.58	4.02	2.68	2.62	2.09	1.86	1.82
China	5.76	5.47	2.71	2.51	1.51	1.65	1.67
Colombia	6.81	5.60	3.99	3.10	2.64	2.38	2.29
Comoros	6.79	7.06	7.13	5.57	5.32	4.92	4.71
Congo, Dem. Rep.	6.00	6.21	6.59	7.13	7.09	6.25	5.93
Congo, Rep.	5.88	6.26	6.18	5.35	5.13	5.07	4.97
Costa Rica	7.31	5.01	3.62	3.18	2.41	1.85	1.80
Cote d'Ivoire	7.35	7.91	7.60	6.36	5.38	4.91	4.87
Croatia	2.33	2.01	2.00	1.63	1.39	1.55	1.51
Cuba	4.18	4.03	1.89	1.75	1.63	1.47	1.45
Curacao						2.20	
Cyprus	3.50	2.61	2.35	2.41	1.71	1.48	1.46
Czech Rep.	2.09	1.92	2.08	1.90	1.15	1.51	1.45
Denmark	2.57	1.95	1.55	1.67	1.77	1.87	1.73
Djibouti	6.46	6.80	6.44	6.09	4.47	3.60	3.39
Dominican Rep.	7.56	6.18	4.42	3.47	2.89	2.58	2.48
Ecuador	6.69	6.13	4.74	3.77	3.07	2.66	2.56
Egypt	6.63	5.94	5.37	4.35	3.31	2.88	2.77
El Salvador	6.73	6.20	5.14	3.95	2.93	2.26	2.18
Equatorial Guinea	5.51	5.68	5.73	5.90	5.77	5.14	4.85

TABLE A1 (contd.)

Country	1960	1970	1980	1990	2000	2010	2013
Eritrea	6.90	6.65	6.63	6.49	5.94	4.97	4.70
Estonia	1.98	2.17	2.02	2.05	1.36	1.72	1.56
Ethiopia	6.88	6.98	7.32	7.25	6.53	4.90	4.52
Fiji	6.46	4.54	3.91	3.40	3.09	2.67	2.59
Finland	2.72	1.83	1.63	1.78	1.73	1.87	1.80
France	2.85	2.55	1.85	1.77	1.89	2.03	2.01
French Polynesia	5.66	5.06	3.99	3.40	2.46	2.11	2.06
Gabon	4.38	5.08	5.68	5.42	4.60	4.21	4.09
Gambia	5.57	6.09	6.34	6.11	5.92	5.80	5.75
Georgia	2.96	2.60	2.32	2.18	1.61	1.82	1.82
Germany	2.37	2.03	1.44	1.45	1.38	1.39	1.38
Ghana	6.75	6.95	6.54	5.62	4.67	4.05	3.86
Greece	2.23	2.40	2.23	1.40	1.27	1.51	1.29
Greenland				2.44	2.31	2.20	2.05
Grenada	6.74	4.60	4.25	3.84	2.58	2.24	2.17
Guam	6.05	4.37	3.25	3.01	2.82	2.47	2.41
Guatemala	6.53	6.24	6.18	5.58	4.80	3.97	3.78
Guinea	6.10	6.20	6.53	6.58	5.94	5.17	4.92
Guinea-Bissau	5.83	6.07	6.32	6.65	5.85	5.12	4.93
Guyana	5.67	5.07	3.65	2.47	2.59	2.68	2.55
Haiti	6.32	5.76	6.06	5.43	4.30	3.35	3.15
Honduras	7.46	7.27	6.31	5.14	4.00	3.15	3.00
Hong Kong, China	5.16	3.42	2.05	1.27	1.04	1.13	1.12
Hungary	2.02	1.98	1.91	1.87	1.32	1.25	1.34
Iceland	4.29	2.81	2.48	2.30	2.08	2.20	2.04
India	5.87	5.49	4.68	3.88	3.15	2.56	2.48
Indonesia	5.67	5.47	4.43	3.12	2.48	2.43	2.34
Iran	6.93	6.44	6.48	4.82	2.19	1.90	1.92
Iraq	6.25	7.36	6.57	5.88	4.97	4.21	4.03
Ireland	3.78	3.85	3.21	2.11	1.89	2.05	2.01
Israel	3.87	3.78	3.24	2.82	2.95	3.03	3.03

TABLE A1 (contd.)

Country	1960	1970	1980	1990	2000	2010	2013
Italy	2.37	2.38	1.64	1.33	1.26	1.46	1.43
Jamaica	5.42	5.48	3.73	2.95	2.60	2.33	2.26
Japan	2.00	2.14	1.75	1.54	1.36	1.39	1.43
Jordan	7.69	7.93	7.26	5.54	4.05	3.46	3.24
Kazakhstan	4.56	3.54	2.90	2.72	1.80	2.60	2.64
Kenya	7.95	8.08	7.46	6.04	5.01	4.62	4.38
Kiribati	6.95	6.05	5.07	4.63	3.88	3.05	2.95
Korea, Dem. Rep.	4.58	4.33	2.68	2.29	1.99	2.00	1.99
Korea, Rep.	6.16	4.53	2.82	1.57	1.47	1.23	1.19
Kosovo				3.90	2.95	2.29	2.16
Kuwait	7.25	7.24	5.52	2.36	2.87	2.67	2.60
Kyrgyzstan	5.17	4.89	4.04	3.69	2.40	3.06	3.20
Laos	5.96	5.97	6.28	6.15	4.19	3.29	3.02
Latvia	1.94	1.96	1.86	2.02	1.25	1.36	1.44
Lebanon	5.74	4.95	4.00	3.00	2.23	1.51	1.50
Lesotho	5.84	5.81	5.59	4.92	4.09	3.21	3.04
Liberia	6.41	6.70	6.97	6.50	5.88	5.02	4.79
Libya	7.54	7.87	7.77	4.97	3.05	2.53	2.36
Liechtenstein					1.57	1.40	1.51
Lithuania	2.56	2.40	1.99	2.03	1.39	1.50	1.60
Luxembourg	2.29	1.97	1.50	1.60	1.76	1.63	1.57
Macao SAR, China	4.95	2.17	1.67	1.69	0.94	1.00	1.08
Macedonia, FYR	3.72	2.98	2.57	2.24	1.68	1.45	1.43
Madagascar	7.30	7.33	6.51	6.26	5.55	4.65	4.47
Malawi	6.91	7.30	7.62	7.00	6.25	5.64	5.39
Malaysia	6.19	4.87	3.79	3.52	2.83	2.00	1.96
Maldives	7.02	7.23	7.07	6.10	3.27	2.34	2.26
Mali	6.70	6.90	7.05	7.06	6.84	6.84	6.85
Malta	3.62	2.03	1.99	2.04	1.70	1.36	1.43
Mauritania	6.78	6.78	6.43	5.98	5.38	4.84	4.67
Mauritius	6.17	3.95	2.67	2.32	1.99	1.57	1.44

TABLE A1 (contd.)

Country	1960	1970	1980	1990	2000	2010	2013
Mexico	6.78	6.72	4.71	3.38	2.66	2.28	2.19
Micronesia, Fed. Sts.	6.93	6.94	6.22	4.96	4.30	3.46	3.29
Moldova	3.33	2.58	2.48	2.41	1.57	1.48	1.46
Mongolia	6.95	7.57	6.21	4.05	2.14	2.44	2.44
Montenegro	3.52	2.69	2.27	1.87	1.82	1.70	1.67
Morocco	7.07	6.69	5.68	4.06	2.70	2.58	2.74
Mozambique	6.60	6.59	6.49	6.24	5.78	5.41	5.19
Myanmar	6.05	5.96	5.00	3.42	2.43	2.00	1.94
Namibia	6.15	6.46	6.45	5.23	4.03	3.23	3.05
Nepal	5.99	5.97	5.76	5.17	4.07	2.62	2.30
Netherlands	3.12	2.57	1.60	1.62	1.72	1.79	1.72
New Caledonia	6.28	4.30	3.42	3.19	2.59	2.17	2.28
New Zealand	4.13	3.16	2.03	2.18	1.98	2.15	1.95
Nicaragua	7.34	6.89	6.13	4.75	3.25	2.63	2.50
Niger	7.05	7.42	7.71	7.76	7.73	7.58	7.56
Nigeria	6.35	6.47	6.78	6.49	6.10	6.02	5.98
Norway	2.85	2.50	1.72	1.93	1.85	1.95	1.85
Oman	7.25	7.31	8.30	7.16	3.72	2.90	2.85
Pakistan	6.60	6.60	6.54	6.02	4.47	3.43	3.19
Palau				2.76	1.54		
Panama	5.87	5.17	3.88	3.08	2.82	2.55	2.47
Papua New Guinea	6.28	6.16	5.69	4.80	4.51	3.95	3.78
Paraguay	6.50	5.74	5.22	4.54	3.68	2.97	2.86
Peru	6.88	6.31	5.01	3.83	2.93	2.51	2.42
Philippines	7.15	6.26	5.18	4.32	3.81	3.15	3.04
Poland	2.98	2.20	2.28	2.06	1.37	1.38	1.30
Portugal	3.16	3.01	2.25	1.56	1.55	1.39	1.28
Puerto Rico	4.66	3.15	2.61	2.22	2.05	1.66	1.64
Qatar	6.97	6.92	5.81	4.02	3.24	2.09	2.02
Romania	2.34	2.89	2.43	1.83	1.31	1.54	1.53
Russia	2.52	1.99	1.89	1.89	1.21	1.57	1.70

TABLE A1 (contd.)

Country	1960	1970	1980	1990	2000	2010	2013
Rwanda	8.19	8.23	8.45	7.27	5.90	4.84	4.51
Samoa	7.65	7.19	6.20	5.12	4.50	4.34	4.15
Sao Tome and Principe	6.24	6.47	6.41	5.40	4.69	4.29	4.08
Saudi Arabia	7.22	7.28	7.21	5.84	3.99	2.83	2.64
Senegal	6.95	7.34	7.38	6.63	5.56	5.05	4.93
Serbia					1.48	1.40	1.45
Seychelles					2.08	2.10	2.40
Sierra Leone	6.03	6.70	7.06	6.53	5.92	4.94	4.71
Singapore	5.45	3.09	1.74	1.87		1.15	1.19
Slovak Republic	3.04	2.41	2.32	2.09	1.30	1.43	1.34
Slovenia	2.32	2.27	2.04	1.46	1.26	1.57	1.58
Solomon Islands	6.39	6.91	6.75	5.85	4.72	4.24	4.03
Somalia	7.25	7.18	7.01	7.40	7.61	6.87	6.56
South Africa	6.17	5.59	4.79	3.66	2.87	2.47	2.39
South Sudan	6.72	6.88	6.85	6.77	6.13	5.19	4.92
Spain	2.86	2.84	2.20	1.36	1.23	1.37	1.32
Sri Lanka	5.54	4.34	3.41	2.48	2.24	2.34	2.34
St. Lucia	6.97	6.10	4.70	3.40	2.31	1.98	1.91
St. Martin (French part)				2.12	1.83	1.82	1.81
St. Vincent & Grenadines	7.22	6.01	3.99	2.96	2.38	2.07	2.00
State of Palestine				6.53	5.40	4.22	4.01
Sudan	6.69	6.89	6.80	6.15	5.44	4.64	4.42
Suriname	6.61	5.65	3.92	2.73	2.74	2.35	2.27
Swaziland	6.72	6.88	6.66	5.74	4.21	3.56	3.33
Sweden	2.17	1.92	1.68	2.13	1.54	1.98	1.91
Switzerland	2.44	2.10	1.55	1.58	1.50	1.52	1.52
Syria	7.47	7.57	7.09	5.31	3.96	3.08	2.96
Tajikistan	6.24	6.88	5.66	5.18	3.95	3.78	3.82
Tanzania	6.81	6.77	6.65	6.21	5.69	5.43	5.21
Thailand	6.15	5.60	3.39	2.11	1.68	1.44	1.40
Timor-Leste	6.37	5.92	4.77	5.34	7.11	5.60	5.20

TABLE A1 (contd.)

Country	1960	1970	1980	1990	2000	2010	2013
Togo	6.52	7.08	7.21	6.33	5.29	4.79	4.64
Tonga	7.36	5.94	5.55	4.64	4.25	3.91	3.77
Trinidad and Tobago	5.26	3.55	3.28	2.45	1.75	1.80	1.80
Tunisia	7.04	6.44	5.35	3.38	2.08	2.13	2.25
Turkey	6.30	5.56	4.36	3.08	2.45	2.10	2.04
Turkmenistan	6.42	6.30	5.01	4.35	2.84	2.41	2.33
Uganda	7.00	7.12	7.10	7.09	6.87	6.16	5.87
Ukraine	2.24	2.09	1.95	1.84	1.11	1.45	1.51
United Arab Emirates	6.93	6.61	5.42	4.39	2.64	1.87	1.80
United Kingdom	2.69	2.44	1.90	1.83	1.64	1.92	1.92
United States	3.65	2.48	1.84	2.08	2.06	1.93	1.87
Uruguay	2.88	2.90	2.72	2.52	2.24	2.08	2.05
Uzbekistan	6.71	6.49	5.13	4.07	2.58	2.34	2.20
Vanuatu	7.20	6.27	5.58	4.93	4.37	3.50	3.38
Venezuela	6.62	5.40	4.20	3.45	2.82	2.47	2.39
Vietnam	6.35	6.47	5.05	3.56	1.98	1.82	1.74
Virgin Islands (U.S.)	5.62	5.17	3.14	2.95	2.06	1.81	1.77
Yemen, Rep.	7.29	7.54	8.99	8.67	6.36	4.50	4.08
Zambia	7.02	7.44	7.18	6.47	6.07	5.81	5.69
Zimbabwe	7.16	7.42	7.10	5.18	4.07	3.72	3.49

Notes: The table reports the total fertility rate for each country at the start of each decade and in 2013 (the most recent data). Data is from the World Development Indicators database.

TABLE A2

Summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max	Source
Total fertility rate	10484	4.13	2.04	0.84	9.22	WDI
GDP per capita	8232	9231.08	15335.40	50.04	158802.50	WDI
Total population	11455	23.5 mn	98 mn	4279.00	1.36 bn	WDI
% of urban population	11388	49.40	25.57	2.08	100.00	WDI
Infant mortality rate	9139	55.92	47.68	1.60	269.50	WDI
Child mortality rate	9206	84.66	82.58	2.00	497.90	WDI
Risk of maternal death	1098	1.30	2.18	0.00	13.09	WDI
Wanted fertility	257	3.51	1.40	0.80	7.40	DHS
Female LFPR	6280	50.03	17.28	8.50	90.80	WDI
Total family planning funds (pc)	378	95.70	138.00	0.19	1180.34	(Complied from multiple sources)*
Govt family planning funds (pc)	367	62.57	84.33	0.00	545.56	
Family planning programme effort score	458	38.72	23.66	0.00	92.00	Ross and Stover (2001)

Notes: The table reports summary statistics for total fertility rate, GDP per capita (in constant 2005 US\$), total population, proportion of urban population (%), infant and child mortality rates (per 1000 live births), risk of maternal death, wanted fertility, female labour force participation rate (% of women aged 15+ participating in the labour force), total and government funds for family planning per capita (in constant 2005 US cents) and family planning programme effort score.

WDI refers to World Development Indicators database and DHS to Demographic and Health Surveys.

* Total and government funds for family planning per capita (in 2005 US cents) are obtained from Nortman and Hofstatter (1978), Nortman (1982) and Ross, Mauldin and Miller (1993).

mn: millions, bn: billions

TABLE A3

Fertility Rate Decomposition

Country	Fertility decline	Between-effect	Within-effect	First year	Last year
Albania	1.05	1.55%	98.45%	2002	2008
Armenia	0.04	-11.09%	111.09%	2000	2010
Azerbaijan	0.06	7.97%	92.03%	2001	2006
Bangladesh	0.99	6.75%	93.25%	1993	2011
Benin	1.10	6.85%	93.15%	1996	2011
Bolivia	1.66	15.56%	84.44%	1989	2008
Brazil	0.91	14.56%	85.44%	1986	1996
Burkina Faso	0.67	43.07%	56.93%	1993	2010
Burundi	0.48	19.16%	80.84%	1987	2010
Cambodia	0.69	2.03%	97.97%	2000	2010
Cameroon	0.71	29.33%	70.67%	1991	2011
Chad	0.05	4.07%	95.93%	1996	2004
Colombia	1.11	11.59%	88.41%	1986	2010
Comoros	0.23	-1.27%	101.27%	1996	2012
Congo Dem. Rep.	-0.13	-41.38%	141.38%	2007	2013
Cote d'Ivoire	0.38	57.77%	42.23%	1994	2011
Dominican Rep.	1.43	15.20%	84.80%	1986	2013
Ecuador	1.17	10.51%	89.49%	1987	2004
Egypt	1.74	-0.49%	100.49%	1988	2008
El Salvador	2.05	12.54%	87.46%	1985	2008
Eritrea	1.23	3.07%	96.93%	1995	2002
Ethiopia	0.57	15.44%	84.56%	2000	2011
Gabon	0.04	361.30%	-261.30%	2000	2012
Ghana	2.39	10.49%	89.51%	1988	2008
Guatemala	1.87	8.42%	91.58%	1987	2008
Guinea	0.49	18.97%	81.03%	1999	2012
Haiti	1.66	30.37%	69.63%	1994	2012
Honduras	2.11	8.00%	92.00%	1996	2011
India	0.70	4.39%	95.61%	1992	2005

TABLE A3 (contd.)

Country	Fertility decline	Between-effect	Within-effect	First year	Last year
Indonesia	0.58	24.33%	75.67%	1987	2012
Jordan	2.07	5.15%	94.85%	1990	2012
Kazakhstan	0.46	0.02%	99.98%	1995	1999
Kenya	2.00	7.75%	92.25%	1989	2008
Kyrgyzstan	-0.32	1.56%	98.44%	1997	2012
Lesotho	0.08	62.90%	37.10%	2004	2009
Liberia	1.63	4.13%	95.87%	1986	2013
Madagascar	1.49	10.45%	89.55%	1992	2008
Malawi	0.96	6.09%	93.91%	1992	2010
Mali	1.22	16.51%	83.49%	1987	2012
Moldova	0.22	-2.15%	102.15%	1997	2005
Morocco	2.19	6.83%	93.17%	1987	2003
Mozambique	-0.84	-4.38%	104.38%	1997	2011
Namibia	1.75	19.12%	80.88%	1992	2013
Nepal	1.99	4.52%	95.48%	1996	2011
Nicaragua	1.09	3.00%	97.00%	1998	2006
Niger	-0.66	-5.96%	105.96%	1992	2012
Nigeria	0.41	56.66%	43.34%	1990	2013
Pakistan	1.09	5.03%	94.97%	1990	2012
Paraguay	2.35	6.57%	93.43%	1990	2008
Peru	1.58	14.41%	85.59%	1986	2012
Philippines	1.07	-3.87%	103.87%	1993	2013
Rwanda	1.72	16.41%	83.59%	1992	2010
Senegal	1.34	6.12%	93.88%	1986	2010
Sierra Leone	0.21	15.80%	84.20%	2008	2013
Tanzania	0.89	19.59%	80.41%	1991	2010
Togo	1.33	8.81%	91.19%	1988	1998
Turkey	-0.12	-14.29%	114.29%	1993	1998
Uganda	1.05	10.59%	89.41%	1988	2011
Ukraine	0.41	0.13%	99.87%	1999	2007

TABLE A3 (contd.)

Country	Fertility decline	Between-effect	Within-effect	First year	Last year
Vietnam	0.42	4.22%	95.78%	1997	2002
Yemen	1.14	6.59%	93.41%	1991	1997
Zambia	0.30	-8.02%	108.02%	1992	2007
Zimbabwe	1.30	8.92%	91.08%	1988	2010

Notes: The table reports the overall decline in fertility, the percentage due to the between-region effect (urbanization effect) and within-effect of the change, and the years over which the overall change is calculated. Data on urban and rural fertility rates are obtained from the Demographic and Health Surveys, while the proportion of urban population is taken from the World Development Indicators database.

TABLE A4

Replacement Fertility Rates 2010

Country	RFR	TFR	Country	RFR	TFR
World	2.25	2.49	Italy	2.08	1.41
			Kazakhstan	2.16	2.59
North America			Kyrgyzstan	2.16	3.06
Canada	2.08	1.63	Latvia	2.09	1.17
United States	2.08	1.93	Lithuania	2.08	1.55
Europe and Central Asia			Luxembourg	2.06	1.63
Albania	2.12	1.74	Macedonia, FYR	2.08	1.45
Armenia	2.20	1.74	Moldova	2.11	1.48
Austria	2.07	1.44	Montenegro	2.10	1.70
Azerbaijan	2.27	1.92	Netherlands	2.07	1.79
Belarus	2.09	1.44	Norway	2.07	1.95
Belgium	2.07	1.84	Poland	2.08	1.38
Bosnia and Herzegovina	2.10	1.24	Portugal	2.08	1.36
Bulgaria	2.10	1.49	Romania	2.10	1.33
Channel Islands	2.09	1.44	Russia	2.11	1.54
Croatia	2.08	1.46	Serbia	2.09	1.40
Cyprus	2.08	1.48	Slovak Republic	2.07	1.40
Czech Rep.	2.07	1.49	Slovenia	2.07	1.57
Denmark	2.07	1.87	Spain	2.08	1.38
Estonia	2.09	1.63	Sweden	2.07	1.98
Finland	2.06	1.87	Switzerland	2.07	1.52
France	2.07	2.03	Tajikistan	2.24	3.78
Georgia	2.17	1.82	Turkey	2.12	2.10
Germany	2.07	1.39	Turkmenistan	2.21	2.41
Greece	2.08	1.51	Ukraine	2.11	1.45
Hungary	2.08	1.25	United Kingdom	2.07	1.98
Iceland	2.07	2.20	Uzbekistan	2.19	2.50
Ireland	2.09	2.07			

TABLE A4 (contd.)

Country	RFR	TFR	Country	RFR	TFR
East Asia and Pacific			Tonga	2.12	3.91
Australia	2.07	1.87	Vanuatu	2.15	3.50
Brunei	2.08	2.05	Vietnam	2.17	1.82
Cambodia	2.23	2.97	Latin America and Caribbean		
China	2.22	1.65	Antigua and Barbuda	2.07	2.13
Fiji	2.13	2.67	Argentina	2.08	2.22
French Polynesia	2.08	2.11	Aruba	2.10	1.70
Guam	2.09	2.47	Bahamas	2.11	1.90
Hong Kong, China	2.08	1.13	Barbados	2.08	1.84
Indonesia	2.14	2.43	Belize	2.12	2.80
Japan	2.07	1.39	Bolivia	2.24	3.36
Kiribati	2.18	3.05	Brazil	2.12	1.84
Korea, Dem. Rep.	2.15	2.00	Chile	2.07	1.86
Korea, Rep.	2.08	1.23	Colombia	2.12	2.38
Laos	2.20	3.29	Costa Rica	2.08	1.85
Macao, China	2.07	1.00	Cuba	2.08	1.47
Malaysia	2.08	2.00	Curacao	2.09	2.20
Micronesia, Fed. Sts.	2.21	3.46	Dominican Rep.	2.14	2.58
Mongolia	2.11	2.44	Ecuador	2.12	2.66
Myanmar	2.23	2.00	El Salvador	2.13	2.26
New Caledonia	2.09	2.19	Grenada	2.10	2.24
New Zealand	2.08	2.16	Guatemala	2.16	3.97
Papua New Guinea	2.30	3.95	Guyana	2.20	2.68
Philippines	2.14	3.15	Haiti	2.33	3.35
Samoa	2.15	4.34	Honduras	2.16	3.15
Singapore	2.09	1.15	Jamaica	2.14	2.33
Solomon Islands	2.23	4.24	Mexico	2.10	2.28
Thailand	2.12	1.44	Nicaragua	2.12	2.63
Timor-Leste	2.21	5.58	Panama	2.11	2.55

TABLE A4 (contd.)

Country	RFR	TFR	Country	RFR	TFR
Paraguay	2.16	2.97	Tunisia	2.10	2.13
Peru	2.13	2.51	United Arab Emirates	2.07	1.87
Puerto Rico	2.08	1.66	Yemen, Rep.	2.32	4.50
St. Lucia	2.09	1.98	South Asia		
St. Vincent & Grenadines	2.09	2.07	Afghanistan	2.40	5.66
Suriname	2.16	2.35	Bangladesh	2.19	2.28
Trinidad and Tobago	2.13	1.80	Bhutan	2.22	2.38
Uruguay	2.09	2.08	India	2.32	2.56
Venezuela	2.11	2.47	Maldives	2.10	2.34
Virgin Islands (U.S.)	2.10	1.80	Nepal	2.22	2.62
Middle East and North Africa			Pakistan	2.31	3.43
Algeria	2.15	2.82	Sri Lanka	2.09	2.34
Bahrain	2.07	2.14	Sub Saharan Africa		
Djibouti	2.36	3.60	Angola	2.69	6.22
Egypt	2.12	2.88	Benin	2.44	5.10
Iran	2.12	1.90	Botswana	2.37	2.76
Iraq	2.16	4.21	Burkina Faso	2.58	5.87
Israel	2.07	3.03	Burundi	2.58	6.30
Jordan	2.12	3.46	Cameroon	2.51	5.02
Kuwait	2.08	2.67	Cape Verde	2.08	2.43
Lebanon	2.08	1.51	Central African Rep.	2.70	4.63
Libya	2.11	2.53	Chad	2.71	6.60
Malta	2.08	1.38	Comoros	2.38	4.92
Morocco	2.16	2.58	Congo, Dem. Rep.	2.78	6.25
Oman	2.08	2.90	Congo, Rep.	2.42	5.07
Qatar	2.07	2.09	Cote d'Ivoire	2.70	4.91
Saudi Arabia	2.07	2.83	Equatorial Guinea	2.65	5.14
Syria	2.11	3.08	Eritrea	2.25	4.97

TABLE A4 (contd.)

Country	RFR	TFR	Country	RFR	TFR
Ethiopia	2.31	4.90	Nigeria	2.71	6.02
Gabon	2.31	4.21	Rwanda	2.29	4.84
Gambia	2.43	5.80	Sao Tome & Principe	2.24	4.29
Ghana	2.39	4.05	Senegal	2.31	5.05
Guinea	2.54	5.17	Seychelles	2.09	2.10
Guinea-Bissau	2.60	5.12	Sierra Leone	3.00	4.94
Kenya	2.34	4.62	Somalia	2.56	6.87
Lesotho	2.50	3.21	South Africa	2.31	2.47
Liberia	2.41	5.02	South Sudan	2.56	5.19
Madagascar	2.26	4.65	Sudan	2.36	4.64
Malawi	2.50	5.64	Swaziland	2.59	3.56
Mali	2.68	6.84	Tanzania	2.35	5.43
Mauritania	2.39	4.84	Togo	2.48	4.79
Mauritius	2.08	1.47	Uganda	2.41	6.16
Mozambique	2.64	5.41	Zambia	2.45	5.81
Namibia	2.18	3.23	Zimbabwe	2.32	3.72
Niger	2.53	7.58			

The table reports replacement fertility rates (RFR) and total fertility rates (TFR) for all countries for 2010. TFR data is from the WDI. Replacement fertility is calculated using the approximation given in Espenshade, Guzman and Westoff (2003): Replacement fertility rate = $\frac{(1+sex\ ratio\ at\ birth)}{(Probability\ of\ survival\ to\ mean\ childbearing\ age)}$

Sex ratio at birth and probability of survival to age 25 for women are obtained from the UN World Population Prospects (2013).