

Revisiting demographic transition: correlation and causation in the rate of development and fertility decline.

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Abstract

This study takes a retrospective look at the time course of total fertility rate (TFR) and the main factors purported to influence fertility rate, per capita wealth, female education and population-focused voluntary family planning programs. It was found that countries that implemented strong family planning programs achieved fertility reduction much faster and earlier than comparable countries that did not. Fertility decline typically preceded marked increases in wealth, but per capita wealth growth usually accelerated when fertility fell to between two and three births per woman. Thus the negative relationship between TFR and GDP per capita tends to be deeply concave for those countries that have achieved relatively low fertility. Higher fertility countries in the same region tend to follow a parallel course, but at a slower pace, and most with current fertility above three are yet to see sustained wealth increase. Girls' educational attainment was found to be neither a pre-requisite nor a sufficient measure to drive fertility decline. In the absence of significant income from oil or other resources, fertility reduction appears to be a necessary if not sufficient condition for sustained economic growth. Causation runs in both directions, with a virtuous cycle of prosperity and development of education and health services enhancing the reduction in family size, but interventions to promote prosperity are less cost-effective in priming this cycle than interventions for fertility reduction. The data do not support the claim that "development is the best contraception." On the contrary, they present a strong case that "contraception is the best development stimulus."

Introduction

The demographic transition, from high mortality and high fertility to low mortality and low fertility, is the hallmark societal change of the modern era. Globally, the achievement of mortality reduction has preceded that of fertility reduction, which remains far less uniform among countries. As long as fertility exceeds mortality, population grows, placing strain on natural resources and on economic capacity to provide for additional people. Yet, it is assumed that all nations will eventually complete the transition, and that high population growth rate is therefore only a transitory issue.

The belief that fertility decline and population stabilisation will occur as a natural consequence of socioeconomic modernisation has been referred to as demographic transition theory (Kirk, 1996). The theory contends that lower desired family size will follow from such factors as greater income, education, urbanisation and infant survival.

The negative correlation globally between per capita wealth and total fertility rate (TFR, the average number of children women have in their lifetime) has been used to claim that economic development drives the demographic transition, and thus "development is the best

contraceptive”. This adage was first attributed to India’s health minister Karan Singh at the UN’s third International Conference on Population and Development, in Bucharest in 1974. It has since been championed as a ‘convenient truth’ by development agencies and advocates who would rather not engage with the divisive issue of reproduction. The implication is that family planning programs are either unnecessary, ineffective or inappropriate.

Whether family planning programs are unnecessary, ineffective or inappropriate remains unsubstantiated in evidence. It is common to hear statements from aid agencies or development advocates such as “the evidence in most countries suggest it is mostly the move out of poverty that brings the growth rate down, not the other way around” (Costello, 2013) or “the single most tested, reliable method is the empowerment and education of women” (George, 2010, p168). References are never given, nor has this author succeeded in finding any empirical study which reached these conclusions.

This paper accepts the view, expressed in the Cairo Programme of Action, of “the crucial contribution that early stabilization of the world population would make towards the achievement of sustainable development” (UNFPA, 1995). It is argued that the soonest and lowest achievable peak in human population is most desirable, to minimise risks of food insecurity, dangerous climate change, energy constraints and critical loss of biodiversity and ecosystem functions. These hazards threaten to stabilise human population by increasing mortality. Thus it is not a greater population per se that should be avoided, but greater human suffering and mortality that results from population pressure. While technological and institutional improvements might be employed to accommodate more people from a limited resource base, the same improvements would be better employed to accommodate fewer people at a higher living standard. This places importance on the rate at which fertility is reduced in high fertility countries. Importantly, it also depends on the receptiveness of societies, rich and poor, to voluntary population stabilisation and its various repercussions such as an older demographic profile. Government pronatalism, as a misguided response to demographic ageing, is increasingly contributing to the extent to which global population growth has exceeded recent projections.

This study seeks to shed light on the relative contributions of family planning programs, increasing income and education for girls, for the pace of fertility decline in different countries. It draws mainly on macro-level data, collected by global agencies. Most evaluation of policies and programs has addressed immediate proximal impacts on communities and households (Robinson and Ross, 2007; Sinding, 2009; May, 2012). These evaluations have provided a great deal of evidence of the benefits of family planning interventions and of female education and economic empowerment, extending across a wide range of health and socio-economic indicators. However, this information is mostly qualitative, identifying the effects and the means by which they are mediated. It is hoped that a more distal view will highlight which contributing factors prevail, and thus add to understanding of effective policy.

Methods

Data were taken from the UN Population Division (2011a), World Bank (2012) and Population Reference Bureau (2012). The time course of change in Total Fertility Rate (TFR), and of GDP per capita, GNI per capita and girls’ primary school enrolment and completion were plotted for each nation for which data were available. Case studies were taken from each region to compare nations with differing strength and timing of family planning programs.

Total fertility rate data were available for five-year intervals from 1950. World Bank economic statistics were available for most countries in most years from 1960. Data on school enrolment and other social statistics were more sparse, beginning around 1970 for many nations and later for others. The “Adjusted net enrolment rate, primary, female (% of primary school age children)” (WB indicator code SE.PRM.TENR.FE) and “Primary completion rate, female (% of relevant age group)” (WB indicator code SE.PRM.CMPT.FE.ZS) were selected as having relatively good coverage of most countries since 1970. While secondary schooling may have a stronger influence on reproductive behaviour, insufficient data were available for indicators of secondary schooling. However, increasing access to primary schooling over time is likely to be paralleled by access to secondary schooling, if at a lower level. The World Bank data were averaged over five year intervals corresponding to the periodicity of the TFR data. No adjustments were made for missing values.

Results

Countries which implemented strong population-focused voluntary family planning programs showed an abrupt decline in their TFR following the introduction of the programs (Figure 1). The differential timing of these transitions strongly suggests that political will of national governments is a dominant factor in determining the timing, pace and extent of fertility decline. Over the first two decades following program initiation, rates of fertility decline were between 2 and 3 units per decade. These rates contrast with the slow decline, and recent stalling of decline, in less developed and least developed countries in aggregate.

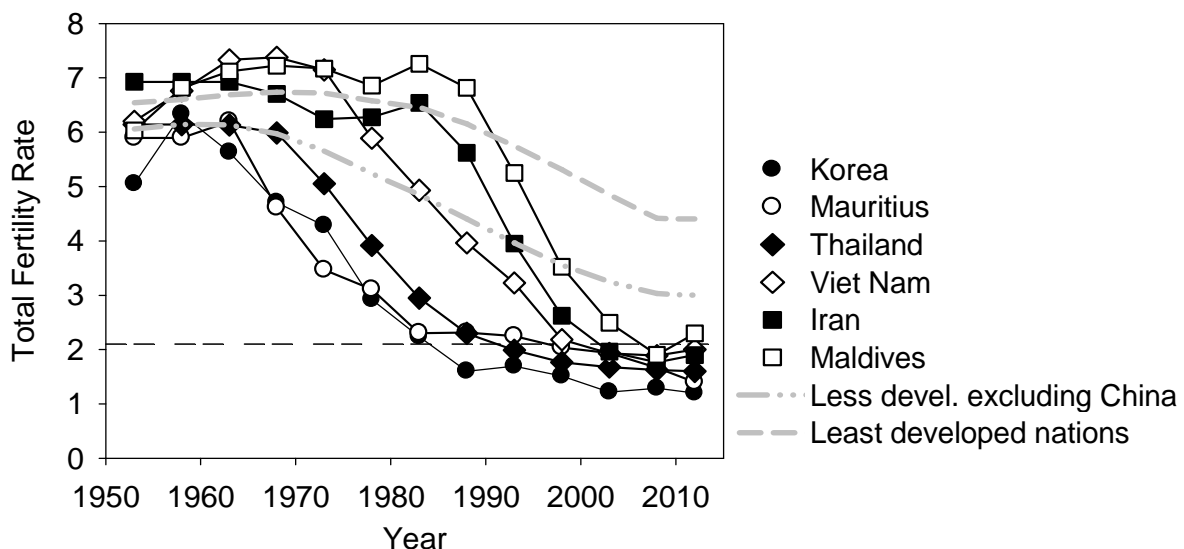


Figure 1. Time course of total fertility rate for selected countries which implemented population-focused voluntary family planning programs at differing times, showing rapid response of fertility after the initiation of the program.

Figure 2 contrasts a country with strong family planning programs from each of four global regions with another country in the same region which did not explicitly or consistently promote family planning and smaller family norms. The latter generally showed a later and more gradual decline in TFR (Figure 2, left-hand charts).

In most countries, per capita GDP has risen fairly consistently over the half-century covered by the World Bank data. However, comparing family planning countries with non-family planning countries revealed a divergence, with family planning nations showing more rapid increase in wealth (Figure 2, middle charts). The timing of this divergence was always later than the fall in fertility, and hence cannot be considered a cause of the difference in fertility

rate. In fact, in most cases the acceleration of economic growth occurred after TFR had fallen to between two and three children per woman.

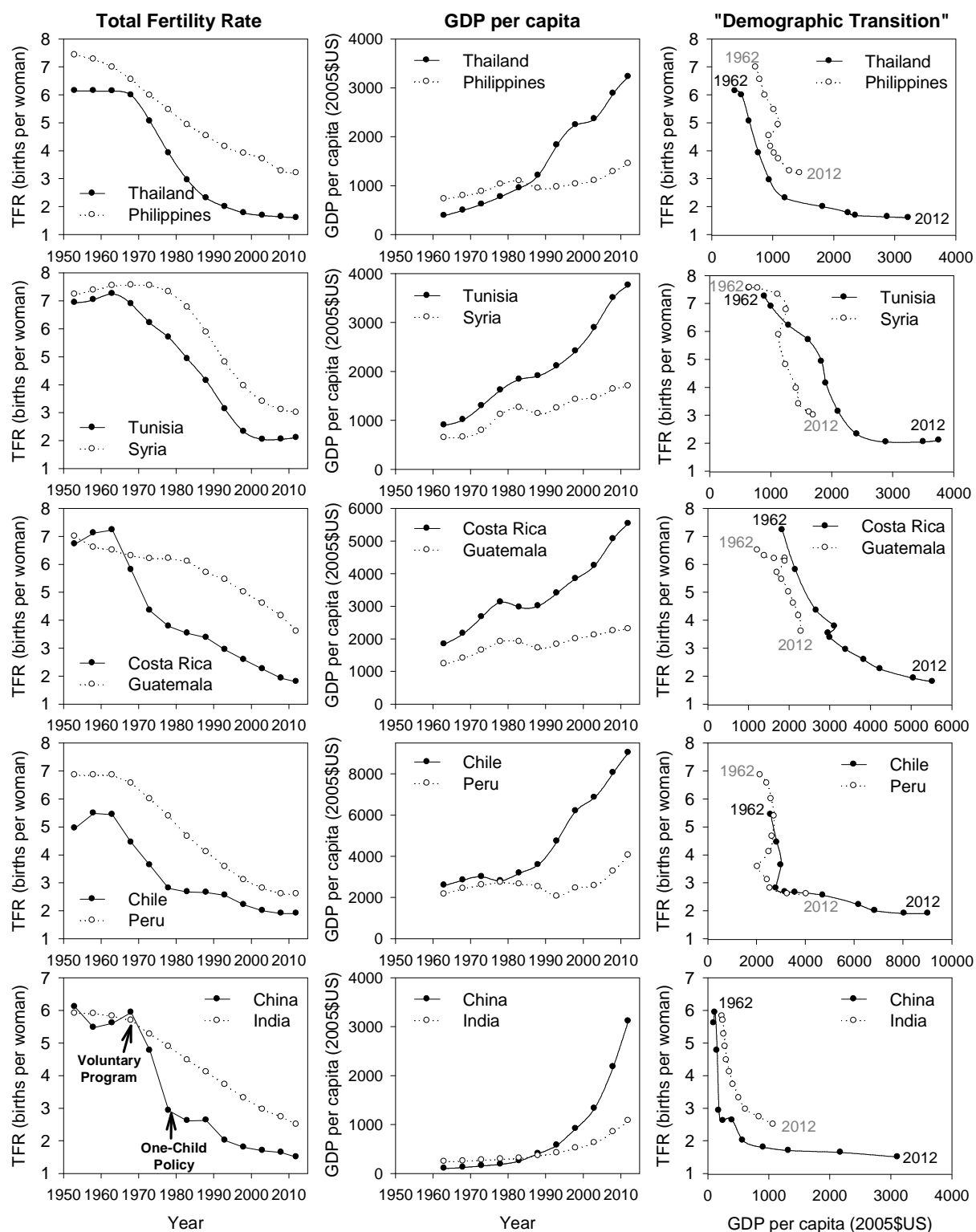


Figure 2. Fertility and wealth time courses for five nations which adopted family planning (solid lines) in contrast with comparable countries in the same region (dotted lines) which were weak or non-adopters of family planning. Left: the change in Total Fertility Rate (TFR, the average number of children born to each woman over her lifetime) over the period 1950 to 2008 (UN Population Estimates, 2010 Revision), middle: the average GDP per capita over 5-year intervals from 1960 to 2008 (adjusted to constant year 2000 US\$, ppp (purchase price parity), from World Bank World Development Indicators), and right: the relationship between TFR and GDP per capita.

The relationship between TFR and GDP per capita is depicted in the right-hand charts of Figure 2. The curves are concave in most cases, as fertility declined before substantial economic development was achieved, but economic development accelerated below TFR of 3. If economic development were a major contributor to fertility decline, one would expect convex curves. Non-family planning countries typically followed a roughly parallel course, achieving little economic development while fertility remained high. Many of them are yet to reach the point at which per capita wealth accelerates.

As noted in Figure 2, China's fall in fertility largely predated the introduction of the one-child policy in 1979. China's communist government was initially pronatalist but food insecurity prompted a voluntary family planning program beginning in 1970, promoting later marriage and no more than two children. During the period of strong implementation of the one-child policy in the 1980s, the rate of fertility decline in China was much slower than over the previous decade. At least some of this change of pace would have been due to deferral of childbearing in the early years of China's voluntary family planning efforts, with deferred births eventually occurring in the 1980s. It is difficult to say whether the unpopular coercive measures actually increased desired family size, but the data do not provide any evidence that the coercive one-child program was either a necessary or a successful contributor to China's population stabilisation. The fertility rate achieved by China is similar to that achieved by other East- and South-East Asian nations through voluntary programs.

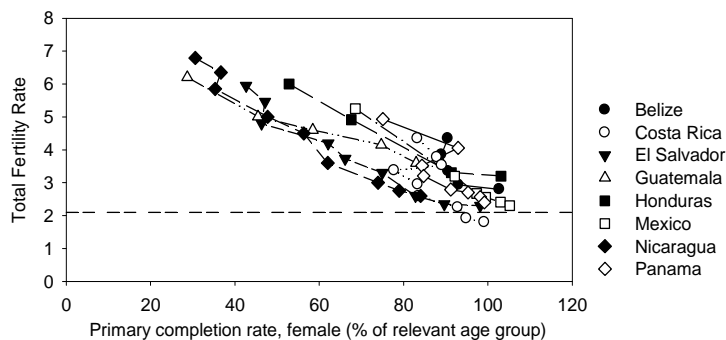
The relationships between girls' education indicators and TFR generally showed a negative correlation in most countries. However, a range of patterns is evident (Figure 3).

In Central America and South Asia, where efforts have been steady on both goals simultaneously, the curves are largely parallel although the pace at which individual nations have progressed along this common course varies.

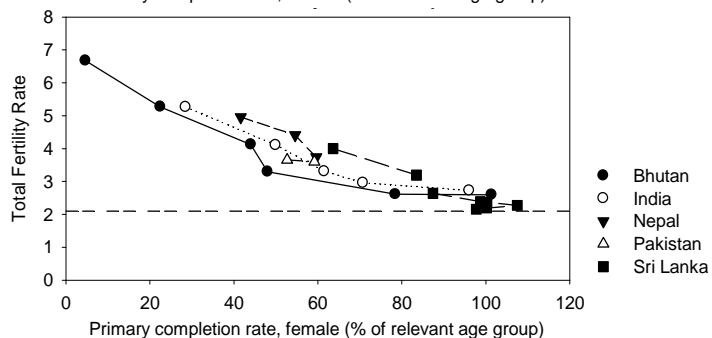
In South East Asia a wider range of patterns exists. The Philippines and Malaysia have had high female participation in schooling throughout the period of the data, but have shown only a slow decline from high fertility rates. In contrast, Thailand achieved considerable fertility reduction at low levels of girls' schooling, including that which predated the schooling data presented. The same may be said of Indonesia (Sukamdi, 2011) although the World Bank data set does not include educational data from its earlier period of fertility decline. Laos and Cambodia have seen rapid increase in girls' education accompanied by fertility decline initially, but recently as family planning has fallen in development priority their fertility decline has stalled despite continued progress on education.

North Africa also provides contrasts between nations. Morocco reduced fertility with little improvement in girls' education, while both improved in parallel in Tunisia and fertility followed education improvement in Algeria. Egypt, with inconsistent government support for family planning, has shown slow decline in TFR despite attaining high rates of school completion by girls. Libya's rapid improvement in girls' educational attainment in the 1970s was not followed by fertility decline until the late 1980s (during which period no data on educational attainment are recorded).

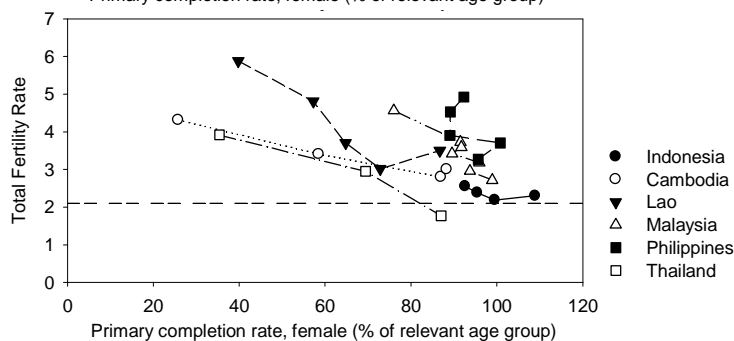
A: Central America



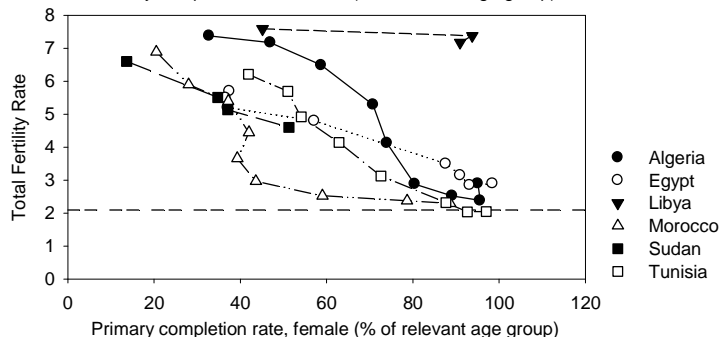
B: South Asia



C: South-East Asia



D: North Africa



E: West Africa

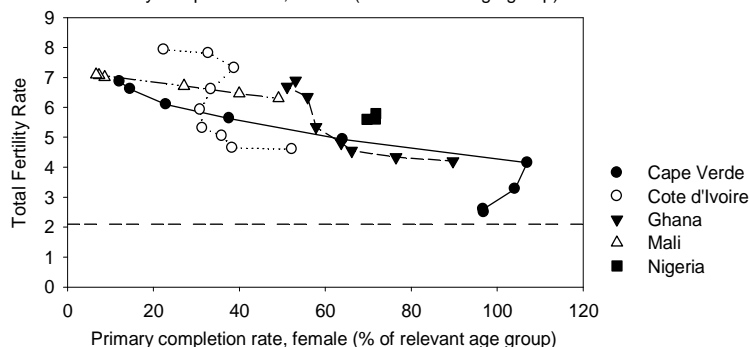


Figure 3. Relationship between total fertility rate and girls' education attainment (primary school completion) for selected nations from global regions. Female primary completion rate are World Bank indicator SE.PRM.CMPT.FE.ZS, data are average of those available for five-year periods between 1970 to 2010, and 2012. Total fertility rate 1970 to 2010 are from UN Population Division (2011) and for 2012 from Population Reference Bureau (2012).

Sub-Saharan Africa's data "cloud" (not shown) is almost horizontal, with considerable progress in girls' education in most nations accompanied by little decline in fertility. Figure 3 E shows selected countries, demonstrating the impact of different policy settings. The early success of family planning programs in Ghana and Cote d'Ivoire were achieved without high access to education, but have not been sustained. Neither Nigeria's relatively high access to education nor Mali's rapidly improving access have translated into fertility decline. Cape Verde has achieved both high education of girls and low fertility, and is the only nation to have graduated out of Least Developed Country status in recent years (May, 2012, p 241).

It may be concluded from these data that education of girls is not necessary for achieving fertility reduction, as some nations have achieved it while education access was low. It is also apparent that education access is not sufficient to cause fertility reduction, since some nations have maintained high fertility in spite of high participation of girls in education.

Several countries in most regions have seen TFR level off or rebound, above replacement rate fertility, despite further improvements in educational attainment of girls. This appears to be due to a number of factors, including reduced international support for family planning, a change in emphasis of family planning toward achieving desired family size but not influencing it, and increased concern by national governments about demographic ageing (UNPD, 2011b).

It should be noted that population stabilisation depends on a decline in absolute growth rate (annual increment of people), not only relative growth rate. Bangladesh added as many people in 2010, with a TFR of 2.3, as it did in 1970 with a TFR of 6.9. Although Bangladesh's annual increment came down considerably from its peak in 1989, it has begun to increase again in recent years since fertility decline slowed. Indonesia and Algeria, both rebounding from near-replacement fertility and still experiencing strong demographic momentum, are adding more people per annum than in 1970 and are close to exceeding their highest ever increment.

According to the Population Reference Bureau's 2012 World Population Data Sheet, neither least developed countries nor less developed countries excluding China have seen a decline in fertility since the UN Population Division's estimate for 2005-2010. The UN's medium projection depends on a fertility decline of around one unit per decade in these countries.

Discussion

The position that family planning is ineffective or inappropriate is held by people from a range of ideological perspectives, and thus its defences are inconsistent. Some do not believe that overpopulation is possible – that even if the planet is finite, man's ingenious ability to derive sustenance from it is not (Simon, 1981). Others refuse to consider the possibility of limits to human population, in the belief that all such discussions are driven by misanthropic, racist people whose ideas should not be given oxygen. Perhaps faith in divine providence better describes their position than a conscious belief in infinite resources. Some do acknowledge the ultimate potential for overpopulation, but are assured that population growth will end naturally without intervention well before limits are reached. They generally refer to the UN's medium projection as proof, without acknowledging the UN Population Division's own insistence that the projection assumes a rapid fall in fertility and that "this middle scenario could require additional substantial efforts to *make it possible*" (Wilmoth, 2013; original emphasis).

Others are genuine in their conviction that efforts to reduce poverty will suffice. This position may be motivated by a belief that family planning is intrusive on the reproductive rights of individuals. Given the prevalence of coercive pregnancy and the well-documented unmet need for fertility control among married women in developing countries, a far stronger case can be made that the neglect of family planning is the greater threat to reproductive rights. This is indeed the position taken in the Cairo Programme of Action, and in the Millennium Development Goals, yet support for family planning has shrunk under the tenure of these agenda.

The efficacy of voluntary family planning programs in reducing fertility has been widely reviewed and affirmed (Robinson and Ross, 2007). Many factors including socioeconomic status and education levels contribute to the pace of uptake, but these factors in the absence of family planning programs and political support for birth reduction are not sufficient to ensure uptake. The analysis presented in this paper reinforces this conclusion.

Effects of population growth on economic development

Family planning access is widely regarded as essential for women to achieve their reproductive rights and social autonomy, but these goals are not given high priority in development agenda. The overriding concern is for macro-economic development. Here a perception has evolved that population growth is beneficial, and that ‘stagnation’ or even ‘depopulation’ are serious threats to prosperity. The number of national governments who consider their population growth to be too low has risen, despite many of them experiencing strong population growth (UNPD 2011b). Even demographers with intimate understanding of the threats of population growth in developing countries are swayed by the weight of opinion that ‘stagnation’ should be avoided (May, 2012), although the weight of evidence is lacking. This bodes ill for the prospect of early stabilisation of the global population. The inevitable result is upward revision of future population projections until resource limits erode life expectancy.

This is a worrying development, since the benefit or otherwise of population growth in the short term does not diminish the risk of catastrophic impacts in the longer term. Already the escalation of conflict in many regions, and in Egypt in particular, is linked to population pressure (Lagi et al. 2011; Friedman, 2013; Ahmed, 2013).

It is doubly worrying when there is overwhelming evidence that population growth hampers economic development, in advanced as well as developing countries.

In understanding the economic impacts of population growth, it is necessary to separate those of population level in relation to the natural resource base, demographic age structure and population growth rate. Advocates for a positive or neutral impact of population growth generally omit analysis of the costs of growth rate. Those who have considered growth rate impacts find them to be strongly negative.

Coale and Hoover (1958) identified the effect of growth rate on saving and investment rate (supply of capital). In contrast, Sauvy (1961) emphasised the impact on demand for capital, specifically the need to divert available capital to the task of providing for additional people, just to stand still in terms of standards of living and employment availability, diminishing the investment available for per capita improvement. He termed this capacity expansion burden “demographic investment”. Robinson (1974) developed this analysis of the opportunity cost of capacity expansion, illustrating the case of Bangladesh. He estimated that “the cost of standing still with present population growth [3% p.a.] represents just about 75 per cent of all

the investment". While planned levels of investment might increase per capita income by 30 per cent over the following 20 years, if a European level of population growth applied (0.45% p.a. at that time) incomes would be increased by a factor of 2.5 (150%).

The ability of a society to maintain such levels of investment might best be assessed by expressing it as a proportion of national income. Estimates given in the literature for each one per cent population growth include 4 per cent for maintenance of housing and public infrastructure plus 3 to 4 per cent for the creation of employment (Sinha and Zacharia, 1984 p 217; Robinson, 1974). Thurow (1986) estimated 12.5% of GDP per one per cent population growth. This range concurs with estimates of actual expenditure per one per cent population growth of approximately 7 per cent of Gross National Income (GNI) in the United Kingdom (O'Sullivan, 2013) and 10 per cent of GNI in Australia (O'Sullivan 2012). This burden is additional to the burden of high youth dependency ratios in high fertility countries. Hence the economic stimulus from alleviating it (which we will term the "infrastructure dividend") is additional to, and likely to be greater than, that from the "demographic dividend" of reducing age dependency. Even in countries facing reversal of the demographic dividend due to ageing, the cost of "demographic investment" far exceeds the extent to which population growth may diminish the costs associated with demographic ageing (O'Sullivan, 2012).

The analysis presented in this paper supports the claim that population growth constrains economic development. Although the economic circumstances of individual nations differs greatly, the double benefit of infrastructure dividend and demographic dividend is evident in the acceleration of per capita wealth experienced by so many nations as TFR approaches two.

Thurow's (1986) essay argued that the focus on carrying capacity and the potential for overpopulation is unnecessary, if the cost of growth rate itself is sufficient reason to end population growth. Two and a half decades later, with an additional two billion people, planetary limits are becoming a real and present danger. Yet it appears that nations have never been less interested in population stabilisation.

The relationship between girls' education and fertility decline

Education for girls is widely cited as effective in reducing fertility rate. Within any society, those women who completed schooling tend to start families later and have fewer children than those who had limited schooling. However, the extent to which greater education causes the choice of lower fertility is less well established. Higher than average access to education implies higher than average economic situation and a relatively enlightened attitude of the parents towards education and career prospects for their daughters, and these factors themselves may influence marriage age and desired family size.

Wheeler and Hammer (2010) estimated that a dollar spent on family planning would avoid more births than a dollar spent on girls' education, in 70% of the countries studied. However, they emphasised the synergy between the two interventions, with secondary enrolment rates in particular anticipated to reduce the unit cost of family planning (expenditure per avoided birth). Hence they modelled the optimal allocation of funds allocating greater funding of education, where existing education access is low.

Potts and Marsh (2010) concluded "education reduces family size because more educated women are better able to surmount the many barriers separating them from the information and technologies they need to manage their childbearing. When these barriers are removed, then differences in fertility between illiterate and educated women largely disappear."

The data presented in this paper relate TFR to educational attainment actually achieved, rather than the funding of programs to achieve it. Here it is clear that causation flows in both directions. Anecdotal evidence associates family planning programs with greater retention of girls in secondary school. This is particularly true for those programs aimed at reducing child marriage and early pregnancy and those aimed at adolescent reproductive health education. Less directly, smaller families result in more educational investment in each child and less pressure for girls to remain at home to care for younger siblings (UN News and Media Division, 2011). Lower population growth rates greatly alleviate the challenge of providing sufficient schools and teachers for quality education (Campbell et al., 2007). In most developing countries, the ratio of girls to boys in secondary school is higher than the percentage of girls enrolled in school (World Bank, 2013), suggesting that girls' attendance is limited more by lack of school capacity or proximity than by social attitudes. A smaller youth bulge increases the prospects of school graduates finding employment, an important incentive for students and their families.

However, even among educated women, cultural conditioning and pressure to achieve large families may persist. Changing such cultural norms may require a combination of interventions, from public education of both men and women, to addressing the legal and institutional barriers to women achieving economic autonomy through employment, land tenure or access to financial services. Such measures are commendable in their own right, but also have a legitimate role in population policy. The success of family planning programs in reducing desired family size in many countries provides evidence that, while cultural context may be a complex issue, it is not intractable.

Conclusions

It was observed that countries that implemented strong family planning programs achieved fertility reduction much faster and earlier than comparable countries that did not. Fertility decline typically preceded marked increases in wealth, but per capita wealth growth accelerated when fertility fell to between two and three births per woman. Consequently the negative relationship between TFR and GDP per capita tends to be concave for those countries that have achieved relatively low fertility. This indicates that population growth is an economic burden, and its alleviation stimulates development. Higher fertility countries in the same region tend to follow a parallel course, but at a slower pace, and many with current fertility above three are yet to see sustained wealth increase.

In the absence of significant income from oil or other resources, sustained growth in per capita wealth appears to be dependent on fertility reduction to a substantial extent. Education of girls may enhance fertility reduction, but is not a substitute for family planning programs. Causation evidently runs in both directions, with a virtuous cycle of reduced birth rate and population growth enhancing prosperity and access to education and health services, in turn enhancing the reduction in family size. However, interventions to promote prosperity or for education of women are less cost-effective in priming this cycle than interventions for fertility reduction.

These observations are consistent with the many accounts of reduced fertility contributing to economic betterment of families and communities (Sinding, 2009). It is widely argued that fertility control is vital to allow women to complete schooling and to sustain employment outside the home. The demographic dividend of reducing age dependency is also widely recognised. Less recognised is the greater dividend of alleviating the need to expand infrastructure capacity (O'Sullivan, 2012). Unlike the demographic dividend, the

infrastructure dividend does not reverse as populations age. It far outweighs costs associated with demographic ageing.

Despite these well-substantiated arguments, it has become unfashionable to identify family size or population growth rate as impediments to economic development. Family planning programs are no longer central to national development plans, but have been framed as merely one among many competing health agenda.

It is concluded that fertility reduction through programs specifically aimed at reducing unwanted pregnancies and promoting smaller families have been powerful drivers of the rate of demographic transition and economic development. “Development as the best contraceptive” is not substantiated. This belief may indeed hinder economic development and limit its extent by ensuring a higher peak population than may have otherwise been realised. A far stronger case can be made that “Contraception as the best economic stimulus.”

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