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Food Security and the Inclusion of Family Planning within Social Safety Net Programs:  
A Present Value Costing Analysis in Two Landlocked Countries

By

Michelle Reid Hamel

A dissertation submitted in partial satisfaction of the

requirements for the degree of

Doctor of Philosophy

in

Demography

in the

Graduate Division

of the

University of California, Berkeley

Committee in Charge:

Ronald D. Lee, Chair  
Jennifer Johnson-Hanks  
Malcolm Potts

Summer 2015



## **Abstract**

### **Food Security and the Inclusion of Family Planning within Social Safety Net Programs: A Present Value Costing Analysis in Two Landlocked Countries**

by

Michelle Reid Hamel

Doctor of Philosophy in Demography

University of California, Berkeley

Professor Ronald D. Lee, Chair

This dissertation examines the effects of food insecurity which undermine both the health and the social and economic development potential of those affected by it. The majority of both the chronically undernourished and those who face acute food security crises, often on a recurring and increasingly predictable basis, are children. The intergenerational transmission of poverty and disadvantage mediated by food insecurity and malnutrition is substantial.

Cash transfer programs for the poor have expanded rapidly in the past decade and have become a powerful political tool to combat food insecurity. This project examines nascent safety net programs in two food insecure, landlocked countries with medium and high levels of population growth: Tajikistan and Niger. While not an obvious pairing, these countries furnish illustrative examples of food security challenges in Asia and Africa. Their growth rates encompass a range which may trigger policy attention in the presence of chronic food insecurity.

The project estimates the cumulative present discount value of public budgetary commitments to cash transfers under medium and low population growth trajectories within each country. It calculates the cost savings in each country associated with slower growth over 25 and 40 year periods. It then estimates the family planning program commodity investments required to reduce fertility to a level consistent with the low growth trajectory. A comprehensive literature review of family planning program efficacy and effect sizes informs these estimates.

The work demonstrates that the cost savings to national safety net programs associated with slower population growth could cover a substantial portion of contraceptive commodity needs in each country. In some scenarios, safety net program savings exceed forecast contraceptive costs. Surplus savings could be reinvested in the safety net programs to increase benefit levels, to expand coverage, or both. Illustrative expansion levels on both margins are discussed, along with discount rate sensitivity and other methodological assumptions. Finally, implied differences in dependency ratios and the size of each national labor force associated with divergent fertility trajectories are examined. Implications for domestic tax revenue streams are discussed.

There is great potential for national safety nets and comprehensive family planning programs to benefit from shared management, staffing, infrastructure, and data collection resources, thereby driving down costs that each might incur on its own. At this time of heightened international donor interest in both cash transfers and food security, the substantial complementary contributions of voluntary family planning programs should not be overlooked.

It is true that the tide of the battle against hunger has changed for the better during the past three years. But tides have a way of flowing and then ebbing again. We may be at high tide now, but ebb tide could soon set in if we become complacent and relax our efforts. For we are dealing with two opposing forces, the scientific power of food production and the biologic power of human reproduction. Man has made amazing progress recently in his potential mastery of these two contending powers. Science, invention, and technology have given him materials and methods for increasing his food supplies substantially and sometimes spectacularly, as I hope to prove tomorrow in my first address as a newly decorated and dedicated Nobel Laureate. Man also has acquired the means to reduce the rate of human reproduction effectively and humanely. He is using his powers for increasing the rate and amount of food production. But he is not yet using adequately his potential for decreasing the rate of human reproduction. The result is that the rate of population increase exceeds the rate of increase in food production in some areas.

There can be no permanent progress in the battle against hunger until the agencies that fight for increased food production and those that fight for population control unite in a common effort. Fighting alone, they may win temporary skirmishes, but united they can win a decisive and lasting victory to provide food and other amenities of a progressive civilization for the benefit of all mankind.

-Norman Borlaug  
Acceptance speech of the 1970 Nobel Peace Prize  
(excerpt)<sup>1</sup>

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<sup>1</sup> Norman Borlaug, "Acceptance Speech of the Nobel Peace Prize, 1970," *The Official Web Site of the Nobel Prize*, accessed August 12, 2014, [http://www.nobelprize.org/nobel\\_prizes/peace/laureates/1970/borlaug-acceptance.html](http://www.nobelprize.org/nobel_prizes/peace/laureates/1970/borlaug-acceptance.html).

Most of the developing world is now in crisis--one that is more serious than any ideological disagreement. Rapid population growth is putting relentless pressure on food supplies.

For six consecutive years world food consumption has exceeded production.

A precarious balance has been maintained through our surplus stocks. Seventy million tons of surplus grain have been used since 1961. But today the surpluses are gone.

We have rationalized our domestic agriculture to eliminate unneeded surpluses. During the past few months, we have acted to expand wheat and feed grain production. Half of our 60 million-acre cropland reserve will be returned to production.

But even the food-producing capability of U.S. farmers--unmatched in history--cannot suffice indefinitely in a world that must feed a million new human beings each week. [...]

The sound population programs, encouraged in this measure, freely and voluntarily undertaken, are vital to meeting the food crisis, and to the broader efforts of the developing nations to attain higher standards of living for their people.

-Lyndon B. Johnson  
upon signing the Food for Peace Act of 1966  
(excerpt)<sup>2</sup>

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<sup>2</sup> Lyndon B. Johnson, "Statement by the President Upon Signing the Food for Peace Act of 1966," *The American Presidency Project*, accessed August 12, 2014, <http://www.presidency.ucsb.edu/ws/?pid=28025>.

As the wealthiest nation on earth, I believe that the United States has a moral obligation to lead the fight against hunger and malnutrition.

- Barack Obama, October 9, 2012  
Feed the Future Progress Report<sup>3</sup>

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<sup>3</sup> *Feed the Future Progress Report: Boosting Harvests, Fighting Poverty*, October 2012.

*Remarks at the celebration of the 60<sup>th</sup> Anniversary of Food for Peace on July 10, 2014<sup>4</sup>:*

If we invested just a third [of] what the Pentagon receives in programs [...] that advance food security, healthcare, education, and job creation, especially for our young people, I believe we would be safer, and I believe we would be living in a much better world today. I think what you do is not only the right thing to do from a humanitarian perspective, I think what you do is where we should concentrate all of our efforts on national security. You know, if we are known around the world as the leader to end extreme poverty and hunger, and if we were more passionately leading that struggle, and that means Congress giving you what you need to do it, I gotta tell you, I think more people would like us. And I have this radical idea that if people like you they don't want to blow you up.

-Representative Jim McGovern,  
Member of the House of Representatives Agriculture  
Committee and the House Hunger Caucus

Radical ideas are always welcome.

-Nancy Lindborg,  
USAID Assistant Administrator for the Bureau for  
Democracy, Conflict, and Humanitarian Assistance

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<sup>4</sup> Jim McGovern and Nancy Lindborg, "TOPS Knowledge Sharing Meeting Keynote Address," *Food Security and Nutrition Network*, July 10, 2014, <http://fsnnetwork.org/topsfsn-network-knowledge-sharing-meeting-learn-adapt-apply>.



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## List of Abbreviations and Acronyms

CNFA	Citizens Network for Foreign Affairs
DAI	Development Alternatives, Inc.
DHS	Demographic and Health Survey
EAT	Enabling Agricultural Trade
FAO	Food and Agriculture Organization
FAST	The Farmer Advisory Services in Tajikistan Program
FFP	The Family Farming Program
FfP	Food for Peace
FP	Family Planning
FP2020	Contraceptive access goals associated with the 2012 London Summit on Family Planning
FTF(T)	Feed the Future(/ Tajikistan)
GHI	Global Hunger Index
GoN	Government of Niger
GoT	Government of Tajikistan
ICPD	International Conference on Population and Development, held in Cairo in 1994
ICT	Information Communication Technology
IEC	Information, Education, and Communications Campaigns, sometimes referred to as Behavioral Change and Communications (BCC)
IFFP	International Foundation for Family Planning
IFPRI	International Food Policy Research Institute
LARC	Long-Acting Reversible Contraceptive
LRFRP	Tajikistan Land Reform and Farm Restructuring Project
M&E	Monitoring and Evaluation
MCH(N)	Maternal and Child Health (and Nutrition)
MDG	Millennium Development Goal
MEAS	Modernizing Extension and Advisory Services
MSI	Marie Stopes International
PoU	Prevalence of Undernourishment
RH	Reproductive Health
SBCC	Social and Behavior Change Communication
SPRING	Strengthening Partnerships, Results, and Innovations in Nutrition Globally project
SUN	Scaling Up Nutrition
UNFPA	United Nations Population Fund
USAID	U.S. Agency for International Development
WFP	World Food Program
WPP	United Nations World Population Prospects
ZoI	Zone of Influence

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# Chapter 1: Food Security: An Overview

## I. Introduction

In a bit over a century, the human population of the world has more than quadrupled (Population Reference Bureau, 2013; United Nations, 1999). Today, there are over seven billion of us and one in eight suffers from chronic undernourishment according to the United Nations Food and Agriculture Organization<sup>1</sup> (FAO, IFAD, & WFP, 2013).

The importance of food security is both axiomatic, from a health, humanitarian, or rights-based<sup>2</sup> perspective, and instrumental, from a development or life-course perspective. Food insecurity and dietary inadequacy in utero and early childhood lead to permanent physical and cognitive deficits and have been shown to worsen educational, employment, and earnings outcomes later in life (Alderman, Hodinott, & Kinsey, 2006; Fink & Rockers, 2014; Grantham-McGregor et al., 2007; Sahn & Alderman, 1988; Schultz, 2010; Walker et al., 2007). In many countries, domestic and international development interventions focused on education and income generation are thus collectively undermined by a persistently high prevalence of food insecurity among children. When food insecure children become economically insecure adults, they are less able to provide for their own children, thereby exacerbating the intergenerational transmission of deprivation and vulnerability. Food insecurity is not only a symptom and a consequence of poverty, it is also among its chief causes.

In the last decade, social safety nets have emerged as a key tool to combat hunger. In their most basic form, safety nets provide guaranteed cash or food transfers to vulnerable population segments based on clear eligibility criteria. The U.S. Agency for International Development (USAID) is increasingly allocating resources earmarked to buttress food security to such programs. This dissertation argues that social safety net programs aimed at improving food security in medium to high population growth countries would be more affordable, more sustainable, and possibly more effective (via per capita benefit increases) if they better accounted for population growth and provided direct or coordinated access to voluntary family planning services. Many additional economic and social benefits stemming from access to contraceptive services are discussed but not modeled empirically. The factors which currently stand in the way of broader global access to family planning services relate more to political sensitivities in Washington than to a dispassionate assessment of beneficiary communities' needs or the structural hurdles they face.

Food security is a concept both intuitively simple and empirically complex. The 1996 World Food Summit in Rome produced a widely cited definition: "Food security exists when all people,

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<sup>1</sup> The global estimated prevalence of undernourishment for the period 2011-2013 is 842 million people or 12% of global population.

<sup>2</sup> The U.N. General Assembly adopted the International Covenant on Economic, Social, and Cultural Rights in 1966. This resolution includes recognition of "the right of everyone to an adequate standard of living for himself and his family, including adequate food, clothing and housing, and to the continuous improvement of living conditions" (United Nations General Assembly, 1966, pt. 3).

at all times, have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs and food preferences for an active and healthy lifestyle” (FAO, 1996). It is broadly understood to encompass four pillars: availability, access, utilization, and stability (FAO, 2008). Availability captures the sufficiency of food at the national or community level to meet the caloric and nutritional needs of those reliant upon it. Access entails both economic and physical conditions which mediate the ability to procure available food. Utilization encompasses preparation and storage practices but also physiological characteristics which support or undermine the ability to absorb micronutrients. Finally, stability reflects the regularity and predictability of the latter three pillars over time and is particularly meaningful in environments characterized by recurrent seasonal deficits and/or shocks. Food security, then, can be conceptualized as a series of hierarchical conditionalities: each pillar becomes achievable only when those preceding it are mounted (C. B. Barrett, 2010).

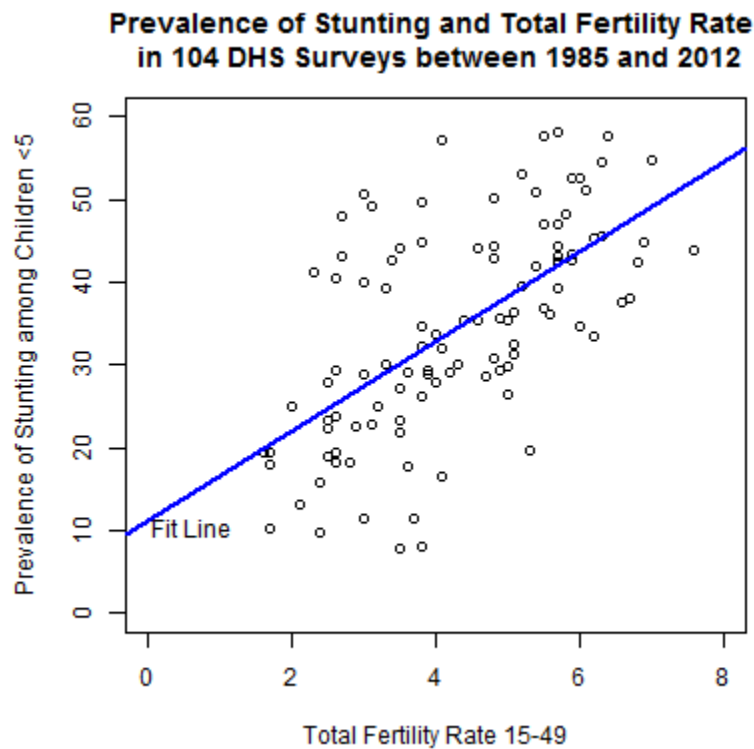
Food security is also necessarily concerned with the ratio of a food supply to the number of people who depend on it, whether the locus of inquiry is the country, the community, or the household. Indeed, none of the pillars above could be demonstrably established without answering the question, “for how many people?” In some of the most food insecure parts of the world, population growth is outstripping agricultural output or distributional gains. But weak domestic agricultural production doesn’t necessarily pose a threat to food security: the cases of Singapore, Iceland, and Cyprus are illuminating. At the same time, Amartya Sen (1983) has taught us that most famines occur in the presence of food; a robust harvest does not guarantee against starvation when unfairly distributed or financially inaccessible. Still, many poor countries must be largely self-reliant for their food supplies given that some of the very conditions germane to their depth of poverty also undermine their ability to trade on global markets (including being landlocked or grappling with poor infrastructure, inadequate governance, civil unrest, or a simple lack of funds, perhaps itself due to poor natural resource endowments which simultaneously limit agriculture). Without the wealth to meet their food needs through imports or the systems in place to leverage their own productive potential, rapidly growing populations constitute additional pressure when food security is tenuous.

The relationship between total fertility rate (TFR) and the prevalence of stunting among children under five,<sup>3</sup> employed here as a proxy for food insecurity, is presented in Figure 1.1. Stuntedness is defined as having an internationally standardized height for (month of) age z-score which falls two or more standard deviations below an age-appropriate mean (this and other food security indicators are discussed in detail at the end of this chapter).

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<sup>3</sup> Although stunting is a commonly employed food insecurity metric, there is limited consensus on the best approach to measuring this phenomenon. Alternative indicators are discussed later in this introduction.

Figure 1.1:<sup>4</sup>



There is an obvious correlation between average fertility rates and stunting prevalence at the national level, particularly as fertility increases: only one of 36 country-year observations with a TFR over five exhibits a stunting prevalence of less than 30 percent (ICF International, 2012). Still, any causal relationships are not straightforward. It has been argued elsewhere, by Malthus and others, that rapid population growth puts untenable pressure on limited food production and distribution systems (as well as on economic development more broadly) (Brown, 2012; Weisman, 2014). The ensuing scarcity of food results in undernourishment coupled with higher mortality rates in the short term and a host of deleterious outcomes in the longer term for those who survive. The argument suggests a long-run homeostasis of population size, in balance with environmental limitations.

Alternatively, it is plausible that food insecure societies derive utility from larger family sizes and the labor and insurance functions they provide (Cain, 1977; Caldwell, 1976; Filmer & Pritchett, 2002), or that greater population density itself accelerates technological progress in service of raising sustainable population levels (Boserup, 1965). Under such a rationale, homeostatic population reversions are rejected as inconsistent with long-run, growth-dependent welfare.

Observing that “[d]istinctively human behaviors would alter in many respects the mechanisms and appearance of homeostasis but do not rule out its existence” (Lee, 1987, p. 444), Lee finds

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<sup>4</sup> Source: (2012)

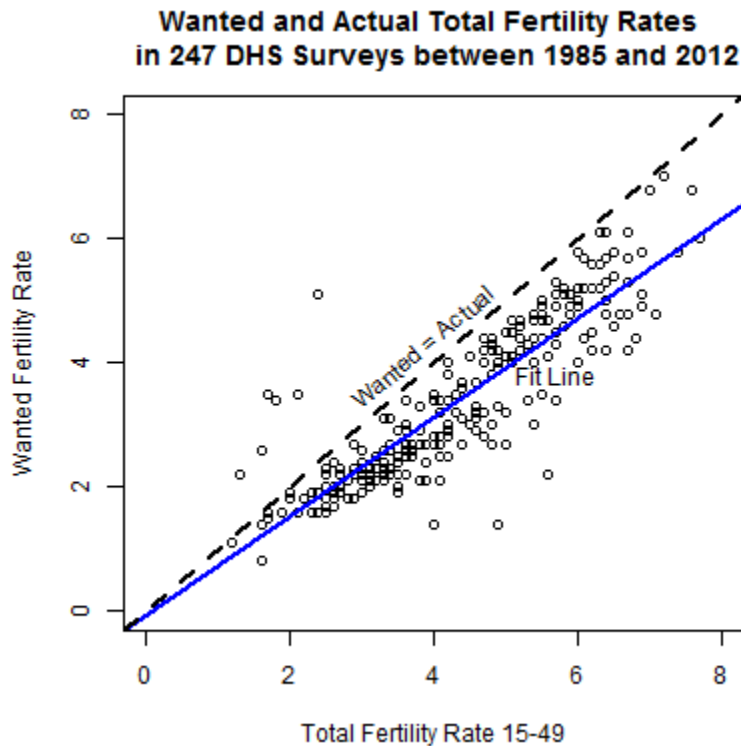


empirical evidence of homeostasis throughout human history which does not necessarily contradict Boserup's interpretation. He explains:

There is a weak but persistent tug from density effects. It is essential to realize, however, that as long as there is any trace at all of density dependence, no matter how weak, this tug, by its systematic persistence, comes to dominate human population dynamics over the long run, if not the short. Its relative unimportance over shorter intervals makes it tempting to dismiss, but doing so would make nonsense of longer run population change. [...] Unlike animals, **the human population has tended toward equilibria that have been tending upward at an accelerating rate. The acceleration might reflect long-run positive feedback between density and technological progress, as Boserup has suggested. [...] In the long run, if population growth continues, natural resources must eventually reemerge as an unavoidable constraint on human numbers.** (Lee, 1987, pp. 452, 458, 459, emphasis added)

Even if and where larger family sizes represent economically rational household decision-making, fertility is not so precisely regulated. Figure 1.2 depicts the relationship between actual and desired fertility in 247 DHS Surveys.

Figure 1.2:<sup>5</sup>



This data clarifies that while desired and actual fertility are strongly linked, on average, most women in DHS-visited developing countries have more children than they wish to. The Guttmacher Institute estimates that 222 million women globally have an unmet need for modern

<sup>5</sup> Source: ICF International (2012)

contraception,<sup>6</sup> and that their numbers living in the poorest countries are increasing (Guttmacher Institute, 2009; Singh & Darroch, 2012). As noted above, most country-year observations with higher fertility levels are also confronted with serious food security challenges.

This introductory chapter proceeds with a section profiling U.S. Government investments in global food security. Section 3 then describes the growing prevalence of social safety nets as a means to combat chronic hunger and the nascent “resilience” agenda among the donor community. Section 4 discusses empirical approaches to gauging food security in order to diagnose priority countries, to benchmark levels of deprivation, and to illuminate both measurement challenges and the lack of consensus around key indicators.

## II. U.S. Government Investments in Global Food Security

Despite the contributing role of population pressure to global food insecurity, discourse of population size, structure, or growth is notably absent from the communities of policy and practice which concern themselves with feeding the world.

Two of the five functional bureaus of the United States Agency for International Development (USAID) have mandates to improve food security. The Office of Food for Peace<sup>7</sup> oversees both development and emergency programming “to reduce hunger and malnutrition and ensure that all people at all times have access to sufficient food for a healthy and productive life,”<sup>8</sup> a mission that echoes the 1996 Rome Declaration.

Food for Peace traces its history to 1954, although the shape of its programming has evolved substantially in the intervening decades (this evolution is discussed in Chapter 2). Outside of acute crises, in which food provisioning (cash or in kind transfers) is critical, technical interventions seek to support the development and sustainability of conditions which undergird long-term food security by targeting the root causes of hunger. The Office of Food for Peace clarifies that “[t]hese programs aim to reduce chronic malnutrition among children under five and pregnant or lactating women, increase and diversify household income and strengthen and diversify agricultural production and productivity to build **resilience** and reduce the need for food assistance” (“Office of Food for Peace,” 2014).

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<sup>6</sup> “Women of reproductive age (15–49) are considered to be in need of contraception if they are using contraceptives—modern or traditional—or are using no method but are married or are unmarried and sexually active (i.e., had had sex in the three months prior to being surveyed), are fecund and do not want a child soon (in the next two years) or at all; identify their current pregnancy as unintended; or are experiencing postpartum amenorrhea after an unintended pregnancy. Women in need who are not currently using a modern contraceptive method—that is, women who use no method or a traditional method—are considered to have an unmet need for modern methods. Women who use traditional methods are included as having unmet need for modern contraception because the methods they are using are more likely to fail than modern methods. Modern methods include male and female sterilization, IUDs, implants, injectables, pills, male condoms and other supply methods, such as spermicides and female condoms. Traditional methods mainly include withdrawal and periodic abstinence” (Singh & Darroch, 2012, p. 4).

<sup>7</sup> situated within the Bureau for Democracy, Conflict, and Humanitarian Assistance

<sup>8</sup> Office of Food for Peace web page. <http://www.usaid.gov/who-we-are/organization/bureaus/bureau-democracy-conflict-and-humanitarian-assistance/office-food> Accessed 8/11/2014.

In Fiscal Year 2013 alone, Food for Peace allocations across emergency and development (non-emergency) programs exceeded \$1.9 billion in 46 countries (USAID, 2014). In the last five fiscal years,<sup>9</sup> Food for Peace has registered 1,218 transactions (disbursements) totaling over \$3.3 billion with USASpending.gov (United States Government, 2014). Nearly two-thirds of that obligation was to emergency programs.<sup>10</sup> Unfortunately, these emergencies are often not unforeseen. In the past 15 years, Food for Peace has allocated nearly \$4.5 billion to acute emergencies. Seven countries received over \$50 million in emergency funds over that period: Sudan (over \$1.3 billion), Ethiopia, Zambia, Pakistan, Zimbabwe, Somalia, and Afghanistan. Table 1 shows the number of emergency program transactions per country for the whole period as well as the number of years, out of a maximum of 15, in which a given country received support.

**Table 1.1: Top Recipient Countries of Food for Peace Emergency Funds from FY 2000 to FY2014 (either >\$50M in receipts or ≥5 years of emergency funding)**

Country	Total 15 Year Emergency Program Obligation from FFP	Total Transactions	Total Years (out of 15) in which the country received emergency support
Sudan	\$1,312,163,033	91	12
Ethiopia	\$552,175,534	98	9
Zambia	\$273,024,656	11	2
Pakistan	\$192,673,745	17	2
Zimbabwe	\$103,698,949	26	3
Somalia	\$77,597,198	39	8
Afghanistan	\$59,177,365	9	5
Haiti	\$48,893,933	35	10
Kenya	\$47,780,801	16	6
Guatemala	\$15,535,501	24	8
Yemen	\$8,809,869	11	6
Sierra Leone	\$1,667,900	12	6
Indonesia	\$342,273	8	5

The frequency with which a handful of countries confront food security emergencies highlights the need to consider just how predictable these emergencies actually are. Several areas of the world are particularly vulnerable to regular, recurrent shocks. Such regions are simultaneously afflicted by limited agricultural productive capacity (some are disproportionately affected by climate change), poor governance, and civil unrest. It is impossible to parse the relative contributions of each of these, and other factors, to food scarcity outcomes, but it is also irresponsible to dismiss the contribution of population pressure. The combined total population of these 13 countries grew by more than 34 percent over that 15 year period.

Of the \$1.2 billion allocated to Food for Peace development programs between 2010 and 2014, substantial shares went to some of these same countries. The largest sums went to Ethiopia (\$186 million), Haiti (\$62 million), the DRC (\$57 million), Liberia (\$43 million), Uganda (\$34

<sup>9</sup> The U.S. Government Fiscal Year runs from October 1 through Sept. 30. Data are drawn from FY2010 through FY 2014 and were downloaded on 9/9/14. Records from FY2014 may therefore be incomplete.

<sup>10</sup> \$2,134,972,052 of reported FY10 through FY14 allocations was directed to emergency programs while \$1,179,397,720 was channeled to development programs.

million), and Zimbabwe (\$31 million) (United States Government, 2014).<sup>11</sup> This may be interpreted as a positive sign that USAID is attempting to fundamentally shift conditions which lead to recurrent vulnerability before crises hit. Its “resilience” agenda is discussed in the following section.

Interventions have included improved agricultural practices among smallholder farmers; community-led natural resource management and disaster risk mitigation (including food- and cash-for-work programs); access to formal and informal financial services including credit, savings, and insurance; off-farm income diversification; local and regional market integration and value chains; and an increased focus on both the supply of and demand for quality healthcare services. The distribution of individual mother and child or whole household rations (generally during the lean season) has also been a central program component.

While maternal and reproductive health interventions have long been part of a core package of Food for Peace development interventions, access to family planning information and/or services is not universal despite substantial unmet demand. The Guttmacher Institute estimates that an annual investment of \$8.1 billion would fully meet the existing need for modern contraceptive methods for all women in the developing world (2012 investment levels stood at \$4 billion) (Singh & Darroch, 2012).

The UN World Food Programme (WFP) has absorbed the lion’s share of Food for Peace funding in recent years. Over \$2 billion of the \$3.3 billion spent in the last five fiscal years went to the WFP, which provides no maternal or reproductive health services. Among non-UN entities, faith-based organizations dominate the field of program implementing partners. Catholic Relief Services (CRS) received the second highest level of FFP funding over the same period: over \$366 million across both development and emergency projects (United States Government, 2014). The combined five-year allocation to faith-based CRS, World Vision, the Adventist Development and Relief Agency, the Children’s Hunger Fund, Echocuba, Feed the Children, Food for the Hungry, Food for the Poor, Samaritan’s Purse, World Concern, World Help, the Board of Global Ministries of the United Methodist Church, Church World Services, the Church of Bible Understanding, Cross International, the Evangelistic International Ministry, and Medical Missionaries was just shy of \$500 million, or over 40 percent of all funds not channeled through the United Nations (United States Government, 2014). None of these organizations implement family planning programs on principle. The Bread for the World Institute’s comprehensive 2013 Hunger Report also makes no mention of population growth: indeed this report’s lengthy index lacks the terms “population,” “family planning,” “contraceptives,” or “birth control” although “abstinence,” “choose life,” and “faith communities” are included. This faith-based organization, and the report in particular, is sponsored in part by the Congressional Hunger Center and the FAO. Its leadership was represented on a panel to launch IFPRI’s 2013 Global Food Policy Report alongside the acting head of the second USAID arm that supports food security: Feed the Future.

This second mechanism is a more recent Presidential Initiative. At the 2009 G-8 Summit in L’Aquila, Italy, President Obama announced the Feed the Future initiative, a new and distinct

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<sup>11</sup> South Sudan, Sierra Leone, Bangladesh, and Malawi all received at least \$20M over the period and Guatemala, Burkina Faso, Mali, Madagascar, Niger, and Zambia received over \$10M (United States Government, 2014).

food security funding channel with a more precisely targeted focus on increased agricultural productivity and improved market conditions in 19 countries.<sup>12</sup> By mid-2012, the U.S. had met and exceeded its three-year commitment of \$3.5 billion to Feed the Future<sup>13</sup> and successfully leveraged an additional \$18.5 billion from G-8 members and other donors (AFSI, 2012).

The July 2009 Summit produced the *L'Aquila Joint Statement on Global Food Security* (AFSI, 2009) which was ultimately endorsed by 192 countries and a host of multilateral organizations<sup>14</sup> by the United Nations World Food Summit that November<sup>15</sup> (USAID, 2012c). In contrast to Food for Peace, the *Joint Statement* and Feed the Future place a greater emphasis on large scale agricultural growth through private sector engagement, rural infrastructure investments (including transportation, processing, storage, and irrigation), value chain facilitation, trade stimulation, and policy reform to make markets more accessible.<sup>16</sup> While the *Joint Statement* claims to take a “comprehensive approach to food security,” its elaboration upon that approach focuses almost exclusively on augmenting food supply<sup>17</sup> rather than addressing demand levels or consumption practices.<sup>18</sup> That is, it focuses on food availability, but not on access, utilization, or stability, and certainly not on stabilizing demand levels.

Feed the Future lacks targets which seek to align agricultural productivity growth with current and future demand. It never asks, “for how many people?” although many of the 19 Feed the Future priority countries have moderately to rapidly growing populations. According to the UN Population Division, Feed the Future countries alone will be confronted with nearly 300 million additional mouths to feed over the next 20 years, an aggregate population increase of 48% between 2014 and 2034<sup>19</sup> (United Nations, Department of Economic and Social Affairs, Population Division, 2013). Three of the 19 countries, Mali, Uganda, and Zambia, are projected to grow by over 80% in the next two decades. This implies an average annual growth rate of 1.98 percent for all 19 countries and 3.1 percent for the fastest growing three.<sup>20</sup> The 2009 FAO High-Level Expert Forum projected that crop and cereal yields will grow by .8 to .9 percent per annum in developing countries, on average, over the coming decades while overall food production will need to double by 2050 in order to meet increased demand and the richer consumption

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<sup>12</sup> Bangladesh, Cambodia, Ethiopia, Ghana, Guatemala, Haiti, Honduras, Kenya, Liberia, Malawi, Mali, Mozambique, Nepal, Rwanda, Senegal, Tajikistan, Tanzania, Uganda, and Zambia. Nicaragua was formerly a Feed the Future country but it was dropped after two years when the government failed to produce an adequate country implementation plan (USAID, 2012c).

<sup>13</sup> The U.S. had allocated a total of \$3.786 billion by the Camp David G-8 Summit in 2012 (G8, 2012)

<sup>14</sup> including the FAO, IFAD, ILO, WFP, The World Bank, and WTO

<sup>15</sup> This revised and expanded document became known as the Rome Principles for Sustainable Global Food Security.

<sup>16</sup> See the AFSI Joint Statement on Global Food Security (2009) for a more detailed articulation of the international consensus on investment priorities.

<sup>17</sup> The one exception in a long list of production-focused investments to promote food security is “expansion of employment and decent work opportunities” which is presumably included to buttress purchasing power (AFSI, 2009, p. 2).

<sup>18</sup> The L'Aquila Joint Statement makes reference to

<sup>19</sup> This figure is derived from the medium fertility variant of population forecast estimates. The total population of Feed the Future countries stands at 608 million in 2014 and is forecast to reach over 900 million by 2034, an increase of 32 percent (United Nations, Department of Economic and Social Affairs, Population Division, 2013).

<sup>20</sup> See Appendix A for details.

preferences associated with higher incomes (FAO, 2009). That doubling requirement refers to the average developing country, not the fastest growers.

While Feed the Future doesn't articulate agricultural output targets, it *has* committed to a target of reducing the prevalence of both poverty and of stunting in the sub-national regions of concentrated activity, or "zones of influence," by 20 percent over five years (USAID, 2012c). The first Progress Report notes that "[w]hat we ultimately care about is reducing hunger, largely through increased agriculture-driven economic growth for smallholder farmers and **resilience** programs for populations at risk of food crises" (USAID, 2012c, p. 11). The precise mechanisms by which it seeks to meet that target are unclear.

### III. The Growth of Social Safety Nets and the "Resilience" Agenda

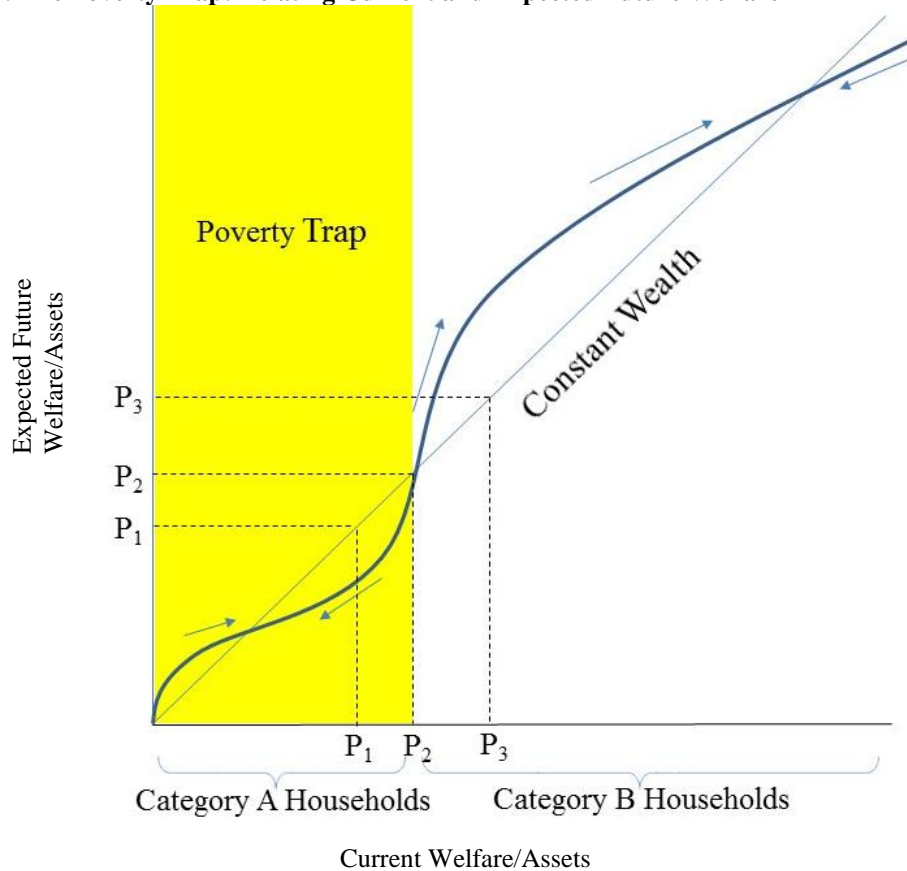
In recent years, USAID funds earmarked to achieve food security objectives have increasingly been funneled towards social safety net programs. Safety nets are a subset of social protection entitlement programs which provide subsistence food or cash transfers to vulnerable, often food insecure population segments. Food for Peace has recently supported safety net programs in Ethiopia and Haiti and the degree to which it should channel resources towards such programs in the future was a topic of discussion and debate at a July 2014 conference with its implementing partners.<sup>21</sup> While Feed the Future does not support safety net programs directly, it acknowledges their importance for the least well off who lack a critical level, or threshold, of resources to benefit from improved market conditions.

The theory of change undergirding a safety net strategy can be conceptualized with a classic multiple equilibria poverty trap formulation, as depicted in Figure 1.3 (Christopher B. Barrett & Conostas, 2013).

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<sup>21</sup> The TOPS Knowledge Sharing Meeting convened in Washington, DC on July 10<sup>th</sup> and 11<sup>th</sup>, 2014.

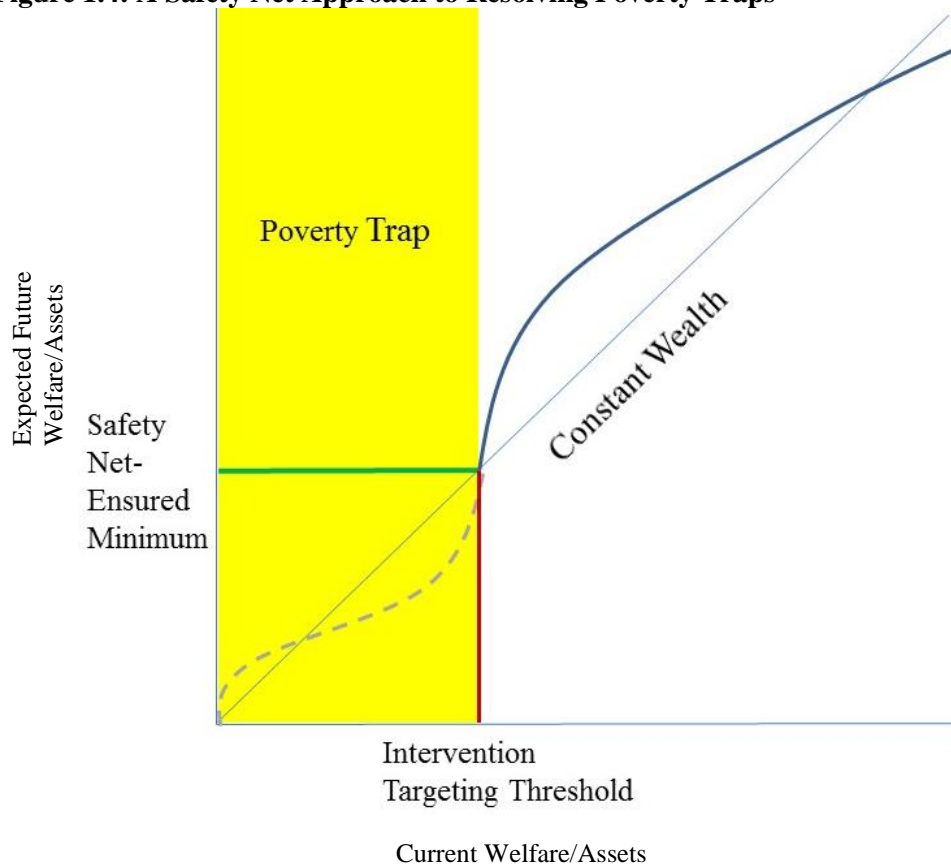
**Figure 1.3: The Poverty Trap: Relating Current and Expected Future Welfare**



In this model, there is a threshold value of current wealth or assets below which households lack the ability to build future welfare or even maintain current levels. Here, “Category A Households” fall within this poverty trap. While there is a stable equilibrium within the poverty trap zone, it represents a status of extreme destitution and vulnerability. “Category B Households,” conversely, find themselves on a wealth-building trajectory, at least to a certain point of stable welfare. Lybbert and McPeak (2012) find evidence of such a threshold among livestock holders in Kenya.  $P_1$ ,  $P_2$ , and  $P_3$  represent different possible poverty lines. Depending on where that line is drawn, it may be the case that Category A households above the poverty line find themselves regularly falling back below it ( $P_1$ ), that the poverty line itself represents the inflection point between wealth accumulation and wealth loss ( $P_2$ ), or that some households outside of the poverty trap zone still find themselves below the poverty line but on a path to reach it over time without intervention ( $P_3$ ).

Social safety nets are designed to furnish a minimum level of welfare through conditional or unconditional direct transfers to enable Category A households to escape the poverty trap. Interventions include cash transfers, public works, in-kind transfers (including school feeding programs), and fee waivers or price subsidies for essential services ((Grosh, 2008)). Figure 1.4 depicts the introduction of a safety net. Note that, depending on where the poverty line is drawn, eligibility for the safety net program may fall above or below it, provided that the appropriate threshold level for targeting is known (which is seldom, if ever, the case).

**Figure 1.4: A Safety Net Approach to Resolving Poverty Traps**

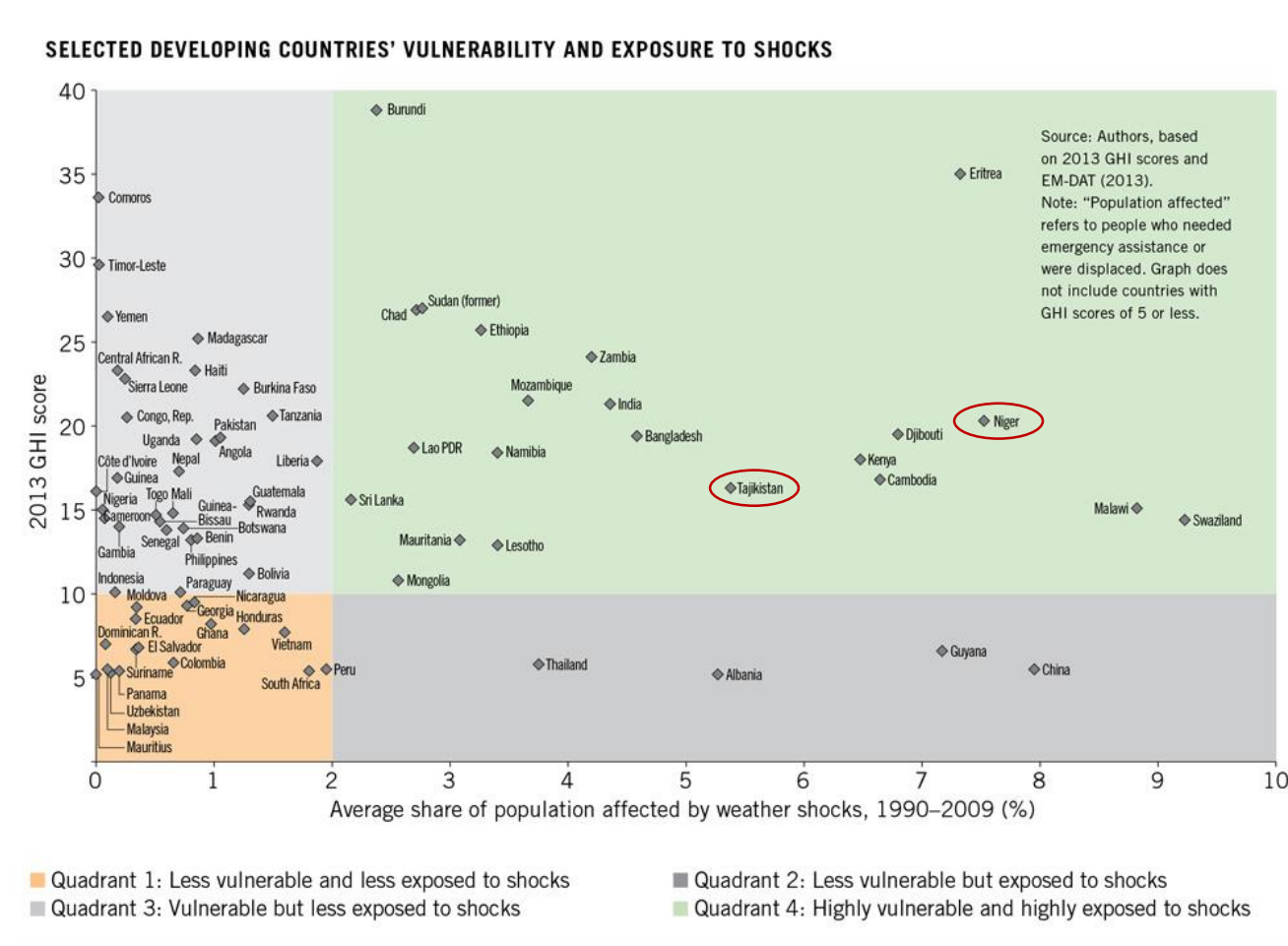


The World Bank made its first safety net loan to Bolivia in 1987. Since that time, its safety net portfolio has grown to over 40 countries, including the well-known Progres/Oportunidades program in Mexico and the Productive Safety Net Program in Ethiopia (December 2013 Social Safety Nets Core Course, The World Bank).

Safety nets may be a particularly useful tool for countries plagued with recurrent shocks which weaken food security. The Bank estimates that two-thirds of developing country safety net programs strengthened their implementation during the 2008 financial crisis, during which global food and fuel prices spiked (World Bank Safety Nets Core Course, December 2013). Figure 1.5 shows the relationship between the International Food Policy Research Institute's (IFPRI) Global Hunger Index (GHI, food security metrics discussed in greater detail below) and exposure to weather shocks over a twenty year period (IFPRI, Concern Worldwide, Welthungerhilfe, & Institute of Development Studies, 2013). In a chapter on building **resilience**, the 2013 GHI report proposes a two-dimensional typography of vulnerability to food insecurity and exposure to shocks. Countries with both high vulnerability and high shock exposure, falling in Quadrant 4, are at particular risk of becoming entrenched in poverty traps. In subsequent chapters, this dissertation will investigate the cases of two such countries with safety net programs: Niger and Tajikistan.



Figure 1.5: Food Insecurity and Exposure to Shocks<sup>22</sup>



In practice, it is difficult to determine what the right eligibility threshold for safety net programs should be. The trade-off between per household transfer amounts and broader inclusiveness is the subject of much debate. Individually tailored transfer amounts which reflect the precise welfare level of a given household at a particular moment in time also represent a substantial administrative burden and cost, in addition to being subject to measurement error. In practice, many national programs provide the same transfer to all eligible beneficiaries.

Given a political impulse to provide transfers to as many constituents as possible with limited resources, and without reliable empirical information on where poverty trap thresholds may actually lie (not to mention what types of potentially benefit-offsetting behavioral responses program transfers may trigger), it is possible that many current safety net programs provide transfers which are insufficient to move vulnerable households over that threshold, out of the poverty trap and onto a virtuous trajectory of wealth building (for example, if set at the level of Poverty Line 1 in Figure 1.3, above).

<sup>22</sup> Source: 2013 Global Hunger Index, Chapter 3: Understanding resilience for food and nutrition security (IFPRI, 2013)

Another less-considered possibility (at least within the safety nets community) is that wealth holdings are not the only salient difference between Category A and Category B households deterministic of welfare outcomes. In fact, there is ample evidence that household and individual traits which may drive economic and welfare gains differ systematically across the wealth spectrum. Within a given country, upper wealth quintiles are more likely to have better health status, more and better education, better social and employment networks, and also lower fertility/smaller family sizes. When the impetus of a safety net program is to spur productive economic engagement through the removal of barriers, the opportunity cost of childcare demands must be carefully examined as one such barrier. Women's empowerment and women-centered agricultural growth have been buzzwords in both Food for Peace and Feed the Future circles, but when the author asked the acting head of Feed the Future about the apparent contradiction between childcare burdens and interventions designed to draw women into the formal economy (and away from their households) at the launch of the IFPRI 2013 Global Food Policy Report, the question was deflected.<sup>23</sup>

Indeed, graduation from many safety net programs has proven elusive. The World Bank's Consultative Group to Assist the Poor (CGAP), in partnership with the Ford Foundation, has overseen the Graduation Program since 2006 ("CGAP Ford-Foundation Graduation Program," 2014). The Program manages 10 pilot projects in eight countries to better "understand how safety nets, livelihoods, and access to finance can be sequenced to create sustainable pathways for the poorest out of extreme poverty" ("CGAP Ford-Foundation Graduation Program," 2014). The Program defines graduation as follows:

Graduation refers to the move out of extreme poverty and into food security and sustainable livelihoods. Criteria that indicate people are ready to graduate are context-specific, but usually include measures of nutrition, stable and diversified incomes, increased assets, better access to healthcare and education, and improved self-confidence. These criteria are used to assess not only the status of an individual at a specific point in time, but also aim to incorporate a predictive measure of **resilience** to future shocks ("CGAP Ford-Foundation Graduation Program," 2014)

A coalescence of energy around a "resilience" development agenda has both fed into and emerged from the growth of safety net programs. Development experts have come to terms with the fact that a subset of poor countries have failed to make significant progress out of poverty despite substantial investment over the decades, due at least in part to their high levels of exposure to both natural and political/financial shocks. USAID launched a Resilience Strategy in December 2012 which prioritizes investments in "the ability of people, households, communities, countries, and systems to mitigate, adapt to, and recover from shocks and stresses in a manner that reduces chronic vulnerability and facilitates inclusive growth" (USAID, 2012a, p. 5). A steady stream of resilience papers, conferences, and programmatic solicitations (requests for applications or proposals) have busied the development practitioner community since that time. Cross-sectoral USAID Joint Planning Cells largely tasked with the design and coordination of resilience programming have been established in the Sahel (Dakar) and Horn of Africa (Nairobi). Food for Peace multi-year development programs have increasingly taken up the resilience mantle, with recent programming explicitly designed to build the capacity or expand the coverage of national safety net programs (including in Ethiopia and Haiti).

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<sup>23</sup> This even took place on March 12, 2014.

#### IV. Measuring Food Security

Before proceeding, it is important to acknowledge the lack of consensus around the most basic of questions: “who is food insecure?” and “how do we know?” As a development community, we cannot respond to conditions we are unable to detect. The first of eight Millennium Development Goals (MDG1) pledges to eradicate hunger worldwide. To measure progress, MDG1 adopted the target of halving the prevalence of undernourishment (PoU) by 2015, relative to a 1990 benchmark (FAO et al., 2013). In that year, 23.6 percent of people living in developing regions were estimated to be undernourished. This implies a PoU target of 11.8 percent in developing areas by 2015.

According to the PoU metric, there are 17 million fewer hungry people today than in 1990 despite a world population increase of nearly two billion over the same period.<sup>24</sup> A 2013 FAO report estimated that, if progress continues apace through 2015, the PoU would approach 13 percent in developing countries, not far off of the MDG1 target (FAO et al., 2013).

But this aggregate reduction in global hunger masks stark regional variance. In sub-Saharan Africa, the PoU has declined but, given substantial population growth, the *number* of undernourished people has increased by 50 million<sup>25</sup> to reach a total of 223 million today – still a full quarter of the region’s population<sup>26</sup> (FAO et al., 2013). In Western Asia,<sup>27</sup> the PoU itself has risen from 6.6 to 9.8 percent (FAO et al., 2013).

While the PoU is the official MDG1 metric, its adequacy to capture chronic hunger has been the subject of substantial debate (Gabbert & Weikard, 2001; Gentilini & Webb, 2008; Headey & Ecker, 2013; Nubé, 2001; Smith, 1998; Smith, Alderman, & Aduayom, 2006; Svedberg, 1999). Calculated annually by the Food and Agriculture Organization (FAO), the PoU is constructed with national-level data to estimate sub-national consumption distributions and has been criticized for its strong methodological assumptions and distance from conditions at the individual and household levels where food insecurity is experienced. Its calculation is based on a probability distribution<sup>28</sup> of the statistically average person’s habitual daily caloric intake and a threshold called the minimum dietary energy requirement (FAO et al., 2013). Parameters for the skew-normal distribution include its mean, a coefficient of variation, and a coefficient of skewness. The mean is set at the per capita dietary energy supply available in a country over a one year period, based on caloric conversions of food commodity production, trade, and

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<sup>24</sup> The UN Population Division estimate a global population of 5.3 billion in 1990 and of 7.2 billion in 2013. (United Nations, Department of Economic and Social Affairs, Population Division, 2013)

<sup>25</sup> There were 173 million undernourished people in sub-Saharan Africa in 1990. There are an estimated 223 million today (FAO, IFAD, & WFP, 2013).

<sup>26</sup> Down from 33% in 1990.

<sup>27</sup> Defined as Iraq, Jordan, Kuwait, Lebanon, Saudi Arabia, the Syrian Arab Republic, Turkey, the United Arab Emirates, and Yemen (FAO et al., 2013).

<sup>28</sup> The functional form of the probability distribution was assumed to be log-normal from 1996 through 2011. In the 2012 methodological revision, a more flexible model was adopted; skew-normal and skew-lognormal distributions were introduced. See FAO (2013) for further details. The International Food Policy Research Institute (IFPRI) proposed a non-parametric distribution based solely on household survey data on consumption and expenditures which was rejected by the FAO in a 2007 working paper. See Ricardo et al. (2007) for further discussion.

utilization data available in the FAO's Food Balance Sheets.<sup>29</sup> The coefficients of variation and of skewness are derived from nationally representative household surveys. See FAO (2013) for additional methodological detail.

The indicator relies upon caloric cut-offs defined by nutritionists for the minimum dietary energy requirement to maintain even a sedentary lifestyle (FAO, WFP, & IFAD, 2012). As such, the PoU presents an extreme, and thus minimally inclusive, prevalence of dietary inadequacy as many of the poor are far from sedentary.<sup>30</sup> It assumes that there are no salient regional differences in other factors affecting energy requirements (or biological utilization of food), including disease prevalence, proportions of women who are pregnant or breastfeeding, geographical or ethnic differences affecting metabolism, or metabolic adaptation to low caloric intake (Nubé, 2001). The PoU further fails to incorporate any dimension of nutritional quality or dietary diversity and, constructed with a full year reference period, it is unable to capture the seasonal variance in food availability and access which differentially impacts many of the world's poorest. In sum, the PoU endeavors to reflect food availability and access, however imperfectly. It makes no claims to illuminate food utilization or stability.

More comprehensive food security indicators predicated upon fewer distributional assumptions require both objective and, arguably, subjective<sup>31</sup> data reflecting the four tenets of food security at the individual or household level. Such data is labor and resource-intensive to collect at frequent intervals and simply unavailable for many countries and regions. Acknowledging the empirical complexity at hand, the FAO presents a suite of complementary food security indicators but takes no steps to aggregate or triangulate across them (FAO et al., 2012).

Less inclusive alternatives have been proposed. Nubé (2001) compared the PoU with another proxy for food insecurity: anthropometric measurements. Drawing upon several anthropometric indicators for both children and adult women, he found a weak correspondence between the two sets of data at both country and regional levels. Stunting figures reflect the prevalence of having a height for (month of) age more than two standard deviations below the WHO Child Growth Standards mean among children under five years old (WHO, 2006, n.d.). Underweight is the analogous indicator of low weight for age. Figure 1.6 plots the relationship between the PoU and prevalence of stunting and underweight for all developing countries with available data from the years 2004 through 2012 (see Appendix A for a plot relating two widely used anthropometric

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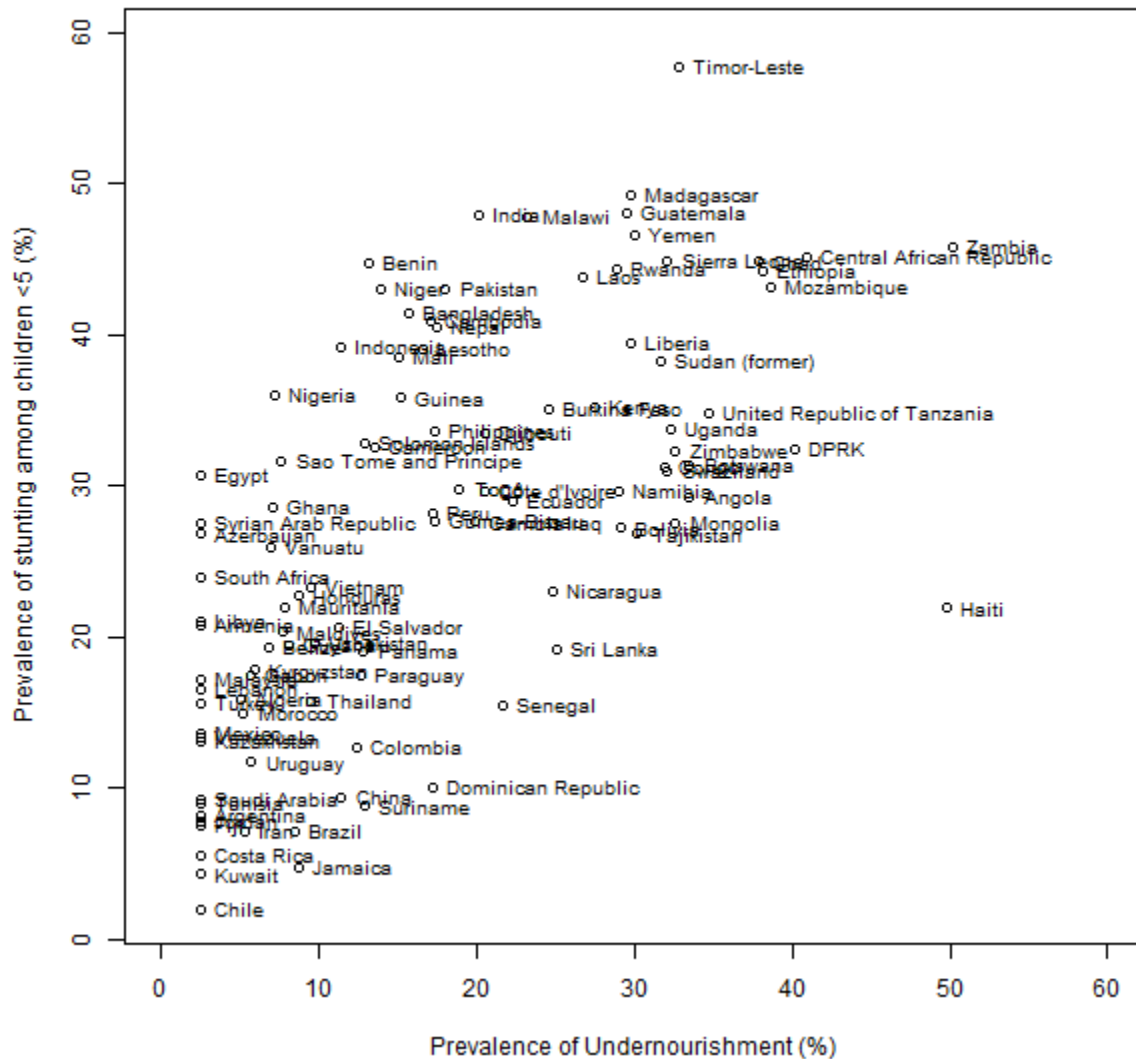
<sup>29</sup> In 2012, a new parameter of food loss was introduced to capture lost calories through distribution and retail processes. A region-specific food loss coefficient reduced the per capita dietary energy supply beginning in that year and previous estimates from 1990 were revised with the new methodology, resulting in substantial changes in the historical trend. See FAO (2013) for further details.

<sup>30</sup> The State of Food Insecurity in the World 2012 report presents a sensitivity analysis to the caloric thresholds employed, presenting alternative estimates for higher physical activity levels from 1990-92 through 2010-12 (FAO, WFP, & IFAD, 2012, p. 58). The PoU uses a physical activity level (PAL) multiplier of 1.55, reflective of a sedentary lifestyle. The modified indicator, the prevalence of food inadequacy, sets PAL multipliers of 1.75 (moderate activity), 1.85 (normal activity), and 2.25 (strenuous activity). The PoU for the 1990-92 period is estimated at 23.2 percent globally (subsequently revised slightly upwards in 2013) while the adoption of "normal" activity energy requirements raises the estimate to 35.4 percent. In 2010-2012, the PoU stood at 14.9 percent, benchmarking reasonable progress towards the goal of halving undernourishment, while the prevalence of food inadequacy for a "normal" activity level stood at 26.5 percent. The FAO has continued to produce the prevalence of food inadequacy in its food security suite.

<sup>31</sup> See Barrett (2010) for a brief discussion of the importance of both retro- and prospective measurement.

measurements, stunting and underweight, to each other).<sup>32</sup> The PoU from the anthropometric data reference year is used for the comparison. In cases where the PoU is measured as “<5”, a value is set at 2.5 for plotting purposes. It is notable that countries which fall within this low range exhibit a particularly wide array of stunting levels. While the PoU assesses them comparably, more than 30 percent of Egyptian children are stunted while fewer than 3 percent of Chilean children are.

**Figure 1.6: Relationship between Stunting of Children under 5 and Prevalence of Undernourishment (PoU)<sup>33</sup>**



<sup>32</sup> No anthropometric data from after 2012 were available from the WHO as of 8/20/14.

<sup>33</sup> Sources: FAOSTAT (n.d.),

While, as noted above, the highest regional prevalence of undernourishment is found in sub-Saharan Africa, Nubé observed that the prevalence of underweight children was nearly twice as high in South Asia as in sub-Saharan Africa (Nubé, 2001, p. 1276). He goes on to substitute the PoU with mean per capita energy availability<sup>34</sup> within a country and finds that, after relaxing any distributional assumptions, there remains no significant relationships between energy availability and adult women's weight. In contrast, there are strong correlations both between women's and children's anthropometric data at the national level and also between the same anthropometric indicators from different representative surveys within a given country. While it is acknowledged that anthropometric outcomes depend on a variety of factors beyond food availability and consumption, including care practices, activity levels, and disease burdens, given the complexity and burdensome data requirements of the PoU and the relative straightforwardness of anthropometric measurement, Nubé concludes that the latter are more suitable for assessing levels of undernutrition in developing countries.

Headey and Ecker (2013) assess the cross-sectional and inter-temporal validity of four other types of metrics: calories, dietary diversity, poverty, and subjective indicators. They conclude that the dietary diversity class of indicators outperforms other groups in its predictive power of economic status and malnutrition and in its sensitivity to shocks, thereby illuminating some aspect of household "resilience." Indicator values are taken from the FAO Food Balance Sheets, using the share of dietary energy supply derived from cereals, roots, and tubers (FAO et al., 2013).<sup>35</sup> Like the PoU, this indicator reflects national availability but not individual or household consumption habits. The FAO does not highlight complete dietary diversity or food consumption scores<sup>36</sup> in its suite of food security indicators.

Finally, several composite indicators have emerged in recent years. The International Food Policy Research Institute launched the Global Hunger Index (GHI) in 2006 (employed in Figure 1.5 in Section III, above) and Gentilini and Webb proposed the poverty and hunger index (PHI) in 2008. The GHI combines three indicators: the PoU, the prevalence of underweight among children under five, and the mortality rate of children in the same age range (Wiesmann, 2006). Data for the three components are drawn from the most recent year available (the 2013 update includes data from between 2008 and 2012) and each is weighted equally (IFPRI et al., 2013).

The PHI is modeled after the UNDP's Human Development Index (HDI). Both are composites of several indices designed to encapsulate different underlying dimensions of a complex concept (Gentilini & Webb, 2008). The PHI and HDI are then calculated as the average of standardized transformations of each index to reflect a given country's achievement relative to the full range of outcomes within a specified domain. With five indices, the PHI is based on the following equation:

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<sup>34</sup> Note that the FAO revised its methodology for calculating the PoU in 2012 to reflect food losses (FAO et al., 2012). The mean of the national distribution of caloric consumption was adjusted to be lower than the average dietary energy supply, derived from food balance sheets, by a coefficient estimating food losses at the distributional and retail levels. This adjustment had a substantial impact on both current and historical estimates.

<sup>35</sup> See Swindale and Bilinsky (2006) for details on the Household Dietary Diversity Score (HDDS).

<sup>36</sup> The World Food Programme's Food Consumption Score may be a superior indicator to the Dietary Diversity Score; see Wiesmann et al. (2009) for a comparison of the two.

$$PHI = \sum_{i=1}^5 [(x_i - min_i)/(max_i - min_i)] * 1/5$$

where  $i$  represents the index, and  $x$  its value (Gentilini & Webb, 2008). Final PHI levels are thus constrained to fall between zero and one, with better outcomes implied by higher numbers. The PHI adopts the five official MDG1 indicators as its five dimensions: the proportion of population living on less than \$1/day, the poverty gap ratio, the share of the poorest quintile in national income or consumption, the prevalence of underweight (<5), and the PoU. Table 1.2 lists the 20 most food insecure countries by each metric.

Given its greatest proximity to household-level conditions, its straightforwardness to measure, its inclusion in Food for Peace and Feed the Future targeting, and its implications for individual welfare outcomes (mediated by schooling and employment), stunting is the preferred food security indicator of this volume. A recent UNICEF report estimated that 195 million children under age five in developing countries suffer from stunting (UNICEF, 2009).

**Table 1.2: The 20 most food insecure countries by five metrics<sup>37</sup>**

Rank	PoU 2013	Stunting (most recent, 2004-2014)	Underweight (most recent, 2004-2014)	GHI 2014	PHI 2008	Dietary Diversity <sup>38</sup> (2009-2011 avg.)
1	Haiti	Timor-Leste	India	Burundi	Sierra Leone	Bangladesh
2	Zambia	Burundi	Timor-Leste	Eritrea	Central African Republic	Lesotho
3	Central African Republic	Madagascar	<b>Niger</b>	Timor-Leste	Burundi	Madagascar
4	Democratic Republic of Korea	India	Nigeria	Comoros	<b>Niger</b>	Afghanistan
5	Namibia	Malawi	Bangladesh	Sudan (former)	Zambia	Ethiopia
6	Ethiopia	Pakistan	Burkina Faso	Chad	Madagascar	Mozambique
7	Chad	Ethiopia	Eritrea	Ethiopia	Uganda	Benin
8	Tanzania	Rwanda	Mali	Yemen	Zimbabwe	Cambodia
9	Rwanda	<b>Niger</b>	Gambia	Zambia	Nigeria	Lao People's Democratic Republic
10	<b>Tajikistan</b>	Benin	Comoros	Haiti	Rwanda	Togo
11	Zimbabwe	Congo Democratic Republic	Nepal	Sierra Leone	Gambia	Zambia
12	Congo Democratic Republic	Mozambique	Cambodia	Madagascar	Tanzania	Malawi
13	Madagascar	Tanzania	Pakistan	Central African Republic	Mozambique	Indonesia
14	Liberia	Bangladesh	Maldives	<b>Niger</b>	Cambodia	Nepal
15	Timor-Leste	Nepal	Sao Tome and Principe	Mozambique	Bangladesh	Timor-Leste
16	Mozambique	Zambia	Senegal	Lao PDR	Namibia	Democratic Republic of Korea
17	Botswana	Cambodia	<b>Tajikistan</b>	Burkina Faso	Lesotho	Chad
18	Swaziland	Lesotho	Ethiopia	Djibouti	Mali	Mali
19	Uganda	Mali	Guinea	Pakistan	Nicaragua	Solomon Islands
20	Yemen	Sierra Leone	Sierra Leone	Bangladesh	India	Côte d'Ivoire

<sup>37</sup> Sources: (FAO Statistics Division, n.d.; Gentilini & Webb, 2008; ICF International, 2012; IFPRI, Concern Worldwide, Welthungerhilfe, & Institute of Development Studies, 2013)

<sup>38</sup> Based on share of calories derived from cereals, roots, and tubers



## **V. Case Study Introduction: Food Security and Population Growth in Tajikistan and Niger**

Much of this dissertation will draw from a comparative case study analysis of two countries: Tajikistan and Niger. While not an obvious pairing, these countries furnish illustrative examples of food security challenges in Asia and Africa. Both countries have limited arable land for domestic agricultural investment and will be disproportionately negatively affected by climate change in the coming decades. Both have limited natural resources to exchange on global markets for food and other goods and have highly restricted access to those markets given their landlocked geography with conflict-ridden neighbors. The population of Tajikistan is growing at a medium pace while that of Niger is growing very rapidly. As such, the two encompass a range of countries whose growth rates may trigger policy concern and response in the presence of chronic food insecurity. Both also have nascent social safety net programs designed to ameliorate food security which are discussed in Chapter 3.

### **A. Tajikistan**

Tajikistan has by far the highest prevalence of undernourishment (PoU) in Central Asia and is arguably among the world's most food insecure countries. The 2014 State of Food Insecurity in the World reported that 2.7 of its 8.2 million<sup>39</sup> people, or about a third, were undernourished in the 2012-2014 period (FAO, IFAD, & WFP, 2014).

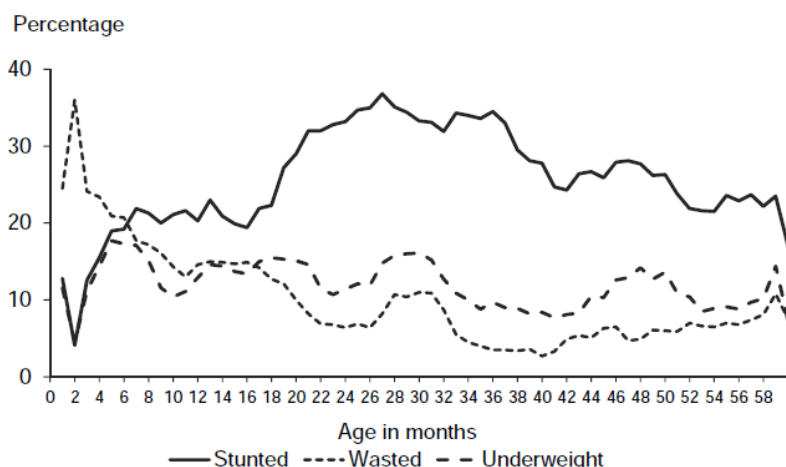
Tajikistan is an extreme outlier in its region. Its neighbors to the north and west, Kyrgyzstan and Uzbekistan, record PoU figures of 6 percent and 5.8 percent, respectively, in the most recent period. The World Bank regional classification of 44 "least developed countries" collectively posts an average PoU of 27.5 percent for the same period. While Tajikistan is not included in this group, its PoU is only surpassed by that of nine countries: the Central African Republic, Chad, Ethiopia, Namibia, Rwanda, Tanzania, Zambia, North Korea, and Haiti.

UNICEF's most recent State of the World's Children Report (2014) estimates that only 19.6 percent of children age 6 to 23 months had a minimum acceptable diet in the 2009 – 2013 period. Wheat contributes three-fifths of the calories in the average Tajik's diet (USAID, 2012d). The 2012 Tajikistan Demographic and Health Survey (DHS) finds that 26.2 percent of children under five are stunted (with z-scores at least two standard deviations below the reference population median) and 9.7 percent are severely stunted (three standard deviations or more below the reference median) (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013). Figure 1.7 shows stunting, wasting, and underweight prevalence by month of age. Rates of stunting increase dramatically between 16 and 20 months of age which may correspond with the cessation of breastfeeding. For children over 6 months of age, stunting levels, a proxy for chronic malnutrition, are substantially higher than wasting levels, which indicate acute malnutrition.

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<sup>39</sup> The population of Tajikistan for 2013, the mid-point of the PoU indicator reference period, is taken from the World Bank (The World Bank, 2015)

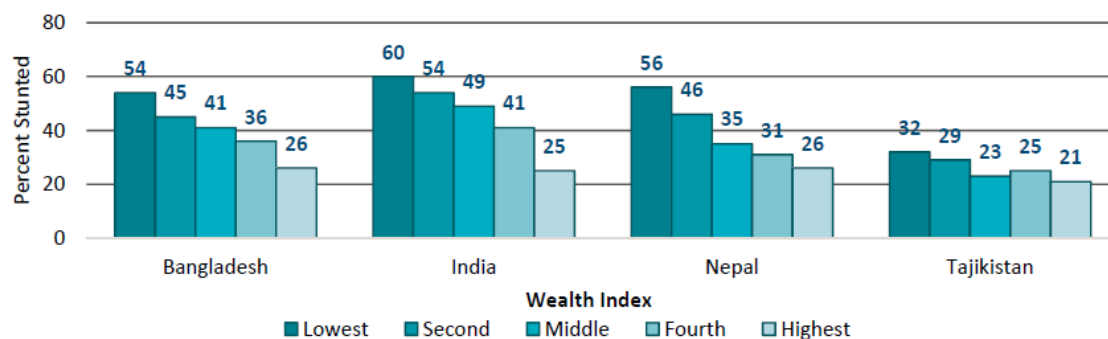
**Figure 1.7: Tajik Children’s Nutritional Status by Age<sup>40</sup>**



Note: *Stunting* reflects chronic malnutrition, *wasting* reflects acute malnutrition; *underweight* reflects chronic or acute malnutrition or a combination of both. Plotted values are smoothed by a 5-month moving average.

Chaparro et al. (2014) analyze nutritional status across four Asian countries: Bangladesh, India, Nepal, and Tajikistan. Their analysis of stunting levels by wealth quintile is reproduced in Figure 1.8.

**Figure 1.8: Stunting Prevalence of Children Under 5 by Wealth Index in Four Asian Countries<sup>41</sup>**



The wealth gradient of stunting prevalence is much steeper in the three South Asian countries than it is in Tajikistan. In Bangladesh, India, and Nepal, children from the poorest quintile of households are more than twice as likely to be stunted as those from the wealthiest quintile. In Tajikistan, the least well off are still more likely to be stunted, but the probability increases by about 50 percent rather than doubling. It is also notable that the cross-national variance of stunting rates *within* the wealthiest quintile of households is much less than any within-country variance *across* wealth quintiles.

While the proportion of Tajiks confronting undernourishment has fallen from a peak of 43 percent in 2005 (FAO Statistics Division, n.d.), the absolute number of undernourished people

<sup>40</sup> Source: 2012 Demographic and Health Survey (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013)

<sup>41</sup> Source: Chaparro et al. (2014)

has remained nearly constant (the 2005 – 2007 estimate stood at 2.8 million) due to population growth. The population of Tajikistan increased by 23 percent between 2000 and 2010 according to national census figures (USAID, 2012d). Its annual growth rate was 2.5<sup>42</sup> percent in 2013 with a total fertility rate (TFR) of 3.8 births per woman (The World Bank, 2015). In 2012, 58 percent of the population was under 25 years old and 38 percent was under 15 (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013).

The FAO estimates that food supply per capita stood at 2,101 calories per day in 2011, the latest year for which data is available (FAO Statistics Division, n.d.). Of those, 59 were fat calories and just 53 were protein calories (FAO Statistics Division, n.d.). In computing the PoU, the FAO assesses the sex and age distribution of a population to calculate the basic metabolic rate (BMR) for the statistically average reference person. Minimum energy requirements are then derived by multiplying the country-specific BMR by sex-specific physical activity level factors (FAO Statistics Division, 2008; Wanner, Cafiero, Troubat, & Conforti, 2014).

Tajikistan is one of 19 countries targeted for Feed the Future (FTF) investments. Sharing an 800-mile border with Afghanistan, Tajikistan is identified for its strategic importance to support regional stability which promotes cross-border trade and deprives extremists of a safe haven (USAID, 2012d). The geographical focus of FTF programming in Tajikistan, its “zone of influence,” is half of the southern Khatlon Province. Khatlon borders Afghanistan and is both the most populous and the poorest region in the country with the highest prevalence of stunting among children under five (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013). Khatlon is comprised of 24 administrative districts, 12 of which are targeted by Feed the Future.<sup>43</sup>

Feed the Future originally committed to three high-level targets across its 19 countries: poverty reduction, reduced prevalence of underweight, and reduced prevalence of stunting (USAID, 2013a). The prevalence of poverty indicator measures the percent of people in the zone of influence with average per capita expenditures of less than \$1.25 (PPP<sup>44</sup>) per day (USAID, 2013b). This metric is drawn from one of three official indicators for Millennium Development Goal 1 and is defined by the UN as a state of extreme poverty. Feed the Future clarifies, “[a]lthough we don’t use the word ‘extreme’ in this [indicator] title, we are referring to the same measure used by the UN for the MDGs” (USAID, 2013b, p. 29). In 2012, it assessed that aiming to reduce the prevalence of poverty by 20 percent in each target country’s zone of influence within five years represented an “aggressive yet reasonable goal” (USAID, 2012b, p. 1). Feed the Future staff and advisors in Washington stated that a 20 percent poverty reduction target should be more easily attainable than in other FTF countries given an observed 4.5 percent average rate of annual poverty reduction (at the national level) between rounds of previously conducted

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<sup>42</sup> Or 2.3 percent according to Government of Tajikistan annual population figures for January 1, 2012 and January 1, 2013 (Agency on Statistics under President of the Republic of Tajikistan, 2013)

<sup>43</sup> Yovon, Jomi, Khuroson, Sarband, Bokhtar, Vakhsh, Rumi, Qumsangir, Jilikul, Qubodiyon, Shahrtuz, and Nosiri Khusrav

<sup>44</sup> Purchase power parity (PPP) exchange rates are based on 2005 calculations which apply to “individual consumption expenditures by household” or “private consumption” and are distinct from PPP measured over GDP. They are then adjusted from cumulative inflation from 2006 through 2011 based on the local consumer price index (CPI) (USAID, 2013b, p. 29).

household surveys. It thus recommended that the Tajikistan country-level program management set a target range of 20 to 25 percent.

The second and third global targets pertain to child anthropometry: 20 percent reductions in the prevalence of both underweight and stunting among children under five. Feed the Future staff calculated that, in target countries with two DHS data points for stunting, there had been an average 10.6 percent reduction in stunting prevalence over five years, or a 2.1 percent annual rate of decline. For the subset of countries with a 2010 DHS,<sup>45</sup> it found an average stunting prevalence reduction of 9.6 percent and an average underweight prevalence reduction of 15 percent over an average period of five years since the previous DHS survey (USAID, 2012b). On the basis of this analysis, staff suggested reductions of between 20 and 30 percent for both underweight and stunting prevalence in all countries (at the population level in zones of influence) (USAID, 2012b). Population structure and growth is not considered in the analysis which is problematic for an indicator that exclusively measures 0-5 year-olds. The 2012 DHS found that 15 percent of the rural population fell into the 0-5 year age range and 90 percent of the Zone of Influence is rural (see below for ZoI population by district) (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013).

Feed the Future issued this initial guidance on target setting in March 2012 (Volume 9 of its M&E Guidance Series), prior to the completion and analysis of baseline surveys. At that time, it estimated that in the Tajik zone of influence, the prevalence of (extreme) poverty could be reduced to 16 percent, and that the prevalence of stunting and underweight could decline to 23 percent and 6 percent, respectively (USAID, 2012b). It further emphasized the reasonableness of these targets based on assessed trends in GDP growth, making implicit assumptions about the distributional benefits of ongoing growth.

In January of 2013, Feed the Future issued an update on target setting for poverty reduction within its M&E Guidance Series (Volume 9.1). The Tajikistan baseline household survey was fielded in December 2012 and January 2013 so this document did not reflect that updated data on the zone of influence (Malapit et al., 2014). The updated guidance also specified that the five year performance period had been updated to 2012 through 2017, with a mid-term assessment in 2015 (USAID, 2013a). The 2012 guidance (Volume 9) referenced a 2010 to 2015 performance period. The 2013 update also suggested a more ambitious poverty target for Tajikistan than recommended the year before: a 30 percent prevalence reduction to supplant the previously suggested range of 20-25 percent. The 2013 update deals with poverty targets only and notes that additional updated guidance on anthropometric targets is forthcoming.

The 12 districts which form the zone of influence were oversampled in the 2012 Demographic and Health Survey in order to ensure stand-alone representativeness of children's nutritional status (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013). Stunting prevalence in the ZoI was found to be lower than previously assumed (24.6 percent vs. 28.9 percent) while underweight prevalence was found to be higher (13.1 percent vs.

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<sup>45</sup> While FtF authors do not specify in this document the countries to which they refer, DHS Surveys were conducted in seven of the 19 Feed the Future countries in 2010 according to <http://dhsprogram.com/What-We-Do/survey-search.cfm?pgtype=main&SrvyTp=year>. These were Cambodia, Kenya, Malawi, Mali, Rwanda, Senegal, and Tanzania.

8.4 percent) among 782 children under five (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013). Target reductions of 20 percent imply 2017 endline targets of 19.7 percent stunting prevalence and 10.5 percent underweight prevalence. The Demographic and Health Survey did not collect income, expenditure, or consumption data with which to calculate the prevalence of poverty.

It is notable that FTF Tajikistan does not prioritize agricultural production or market linkages within its top level program objectives although they are the primary mechanism through which it seeks to achieve its poverty reduction and child health goals. Between 2011 and 2015, FTF Tajikistan aimed to reach 201,000 vulnerable Tajik women, children, and family members with targeted assistance to meet these goals (USAID, 2012d). It seeks to improve the income and nutritional status of additional rural populations via strategic policy and institutional reforms (USAID, 2012d). The total population of the ZoI was over 1.5 million in 2013. With just 201,000 direct beneficiaries,<sup>46</sup> or 13 percent of the ZoI population, substantial indirect transmission of program benefits is critical to achieving targets at the population level.

The FtF Tajikistan strategy has three pillars (USAID, 2012d):

1. “Assistance to household and small commercial farms to increase income and the production of food for home consumption, as well as support to improve nutritional and health outcomes” (USAID, 2012d, p. vii)
2. Capacity building of local institutions and community-based organizations, including public and private agricultural extension services, village organizations, local government, and community-based health interventions.
3. Effective agrarian reform, including land and water rights.

While pillar one focuses on household-level agricultural production, its health services component highlights the need for family planning services in addition to improved feeding and care practices. It cites a recent World Bank brief linking poor child health in Tajikistan to low contraceptive usage, among other factors (Bakilana & Msisha, 2009). However, the inclusion of family planning is rationalized purely on the basis of health benefits: “FTF/T will also promote family planning as an optimal birth spacing intervention and one that will facilitate a recuperative period during which a mother can rebuild energy and micronutrient stores” (USAID, 2012d, p. 52). There is no discussion of facilitating a more favorable household dependency ratio or reducing the childcare and home production burden which competes for women’s time in the labor force, despite a strong emphasize on women’s economic empowerment.

## **B. Niger**

Like Tajikistan, Niger is a highly food insecure landlocked country with limited agricultural productive capacity, disproportionate vulnerability to climate change, and “bad neighbors.” The FAO reports a PoU of just 11.3 percent in the 2012 - 2014 period, down from a high of 27.7

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<sup>46</sup> The Modernizing Extension and Advisory Services (MEAS) program of the University of Illinois at Urbana-Champaign references a target of 44,000 farming households. [http://www.meas-extension.org/meas-offers/country\\_studies/country-overview/tajikistan](http://www.meas-extension.org/meas-offers/country_studies/country-overview/tajikistan)

percent in the 1990 – 1992 period and in excess of the 2015 MDG1 target (FAO et al., 2014). However, this low figure is belied by a stunting prevalence of 43 percent and evidence that just one in 18 children age 6 to 23 months receives a minimum acceptable diet (UNICEF, 2014). While Niger’s PoU is identical to the world average in the most recent period, placing it in the company of China (10.6 percent), Colombia (11.4), and the Philippines (11.5), its stunting prevalence suggests that Cambodia (41 percent), Liberia (42), the DRC (44), and Pakistan (45) make for more appropriate comparisons.

Unlike Tajikistan, which has a documented high unmet need for family planning services (defined as over 20 percent), Niger is considered to have medium unmet need (defined as 10-19 percent) despite its much higher fertility rate given a prevailing cultural preference for very large family sizes (Cleland et al., 2006). Niger’s population has more than tripled since the 1960s while its arable rain-fed land has declined by half due to drought (Cleland et al., 2006). In the 1990s, grain production was 15 percent lower than needed and a 2005 famine was only averted by international relief efforts (Cleland et al., 2006).

Niger’s growth rate from 2012 to 2013 stood at 3.9 percent, a slight increase over previous years and the fourth highest in the world after Oman (9.2), Qatar (5.6), and South Sudan (4.1) (The World Bank, 2015). The growth of Oman and Qatar is driven by large inflows of migrant labor; Qatar’s TFR of 2.0 is below replacement (The World Bank, 2015). Niger recorded the highest TFR in the world in 2012. At 7.6 births per woman, it is precisely twice that of Tajikistan and has not declined at all since 2004 (The World Bank, 2015).

The FAO estimates that food supply per capita stood at 2,546 calories per day in 2011, the latest year for which data is available (FAO Statistics Division, n.d.). Of those, 59 were fat calories and 81 were protein calories (FAO Statistics Division, n.d.). These figures suggest that Niger’s overall level of food security is substantially greater than that of Tajikistan. Annual estimates of daily per capita caloric availability in the former have consistently exceeded that of the latter by at least 300-400 calories since the year 2000 (FAO Statistics Division, n.d.). Outcome-level measurements discussed above, particularly stunting, suggest that such data have limited value for predicting the household level experience of food security.

## **VI. Conclusion and Road Map**

Donors, thought leaders, and program implementers working diligently to achieve a more food secure world bristle at the mention of population size, structure, or growth as a contributing factor to food insecurity. The 2013 FAO report, *The State of Food Security in the World*, makes no mention of it. A section entitled “Why do hunger trends differ across regions?” references economic conditions, infrastructure, food production, social provisions, and political stability (FAO et al., 2013). It cites natural resource scarcity, price volatility, and constraints to broad economic growth, but never once discusses a growing number of mouths to feed or the care provisioning which competes with productive labor allocation.

The remainder of the dissertation is structured as follows: Chapter 2 furnishes a comprehensive literature review of the design, efficacy, and potential effect sizes of comprehensive family planning programs. It proceeds to deepen the comparative case study of two landlocked, natural

resource-poor, water-scarce, conflict-proximal countries<sup>47</sup> facing severe food security challenges: Niger and Tajikistan.<sup>48</sup> It explores the population growth trajectories forecast for each country under different fertility scenarios and compares the statistically derived estimates for each country with observed fertility declines in paired comparison countries. It concludes that fertility declines estimated in stochastic forecasts are more plausible than those estimated by the 2012 UN World Population Prospects low fertility variant which assumes a constant fertility level of .5 births per woman below the country-specific median fertility variant.

Chapter 3 focuses on the design of current large-scale social safety net programs which provide food or cash transfers to vulnerable segments of rapidly (Niger) and moderately (Tajikistan) growing populations.<sup>49</sup> I detail the specific design elements of each national program, including transfer types and the resulting implementation costs based on actual and “best practice” per capita benefits levels and more and less inclusive targeting criteria. The chapter estimates the net present value of safety net cash transfers over 25 and 40 year periods under a.) each country’s medium fertility population growth variant and b.) each country’s stochastic low fertility variant (the 10<sup>th</sup> percentile of 60,000 Bayesian forecasts). It then calculates the present value of the savings associated with shifting from the medium to low fertility variants. Chapter 3 proceeds to estimate the contraceptive commodity costs required to achieve the low fertility trajectory. It demonstrates that savings accrued to national safety net cash transfer programs as a consequence of slower population growth are adequate to cover most contraceptive commodity costs over the 25 year period in each country. Over the longer 40 year period, these savings are more than adequate to fully cover contraceptive commodities in Niger and nearly adequate to offset contraceptive costs in Tajikistan. It discusses potential reallocation of savings associated with slower population growth to increase benefit levels, to expand coverage, or both. Discount rate sensitivity is also explored. The chapter closes with a brief discussion of the implications of slower population growth on dependency ratios and the income tax base in each country.

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<sup>47</sup> In his widely popular book, *The Bottom Billion* (2007), Paul Collier identifies being landlocked with “bad neighbors” as a distinct type of poverty trap given the severe challenges it poses to accessing global markets and trade.

<sup>48</sup> Niger has the highest total fertility rate (TFR) in the world, 7 births per woman, while Tajikistan posts more moderate growth with a TFR of 3.2. Source: United Nations Children’s Fund, data.un.org, accessed 2/24/14.

<sup>49</sup> Note: I also review the tremendous global increase in national social safety net programming over the past decade, led primarily by the World Bank Group, and challenge the growing view in development practitioner circles that such programs represent an effective and comprehensive new solution to food security challenges. National social safety net programs are increasingly supported with Food for Peace Title II funds.

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## **Chapter 2:**

# **Family Planning Program Efficacy and Population Growth**

The objectives of this chapter are a) to illuminate the links between family planning programs, fertility reduction, and decreased population growth and b) to examine the strength of existing evidence to estimate effect sizes with some degree of confidence and precision. The discussion proceeds as follows:

- I. An Overview of Mechanisms by which Reduced Fertility May Improve Food Security at the Household Level
- II. Is development the best contraception, or is contraception the best development?
  - A. Case Studies of Effective Family Planning Programs
  - B. A Consensus on Contraception and Development
- III. USAID's Family Planning Budget
- IV. How much could effective family planning programs reduce fertility in Tajikistan and Niger?
  - A. A Direct Approach: Levels of Unmet Need
  - B. An Indirect Approach: Applications of Results from Successful Family Planning Programs
    - i. Model Family Planning Programs Relevant to Tajikistan
    - ii. Model Family Planning Programs Relevant to Niger
- V. How precise are UN fertility and population growth projections for Tajikistan and Niger?
- VI. How consistent are the UN's low fertility variants with the fertility declines implied by indirect estimation approaches associated with successful family planning programs?

### **I. An Overview of Mechanisms by which Reduced Fertility May Improve Food Security at the Household Level**

The welfare implications of smaller family sizes and slower growth in developing countries for the lives of the poor at both micro and macro levels have been discussed at length elsewhere.<sup>1</sup> As a point of departure, this volume assumes the position that the adoption of smaller family sizes in medium to high fertility contexts has health, nutritional, educational, and long-run economic benefits for children, their mothers, and other members of their households. Positive externalities for the broader society in terms of favorable dependency ratios and reduced pressure on natural resources are also likely (R. D. Lee & Miller, 1990).

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<sup>1</sup> See Coale and Hoover (1958); Davis (1967); National Academy of Sciences (1986); Rosenzweig and Schultz (1987); Birdsall (1988); Lee and Miller (1990); Becker, Murphy, and Tamura (1990); Mankiw, Romer, and Weil (1992); Cassen (1994); Ahlburg, Kelley, and Oppenheim Mason (1996); Bloom, Canning, and Malaney (2000); Birdsall, Kelley, and Sinding (2003); Bloom and Canning (2003); Bloom and Canning (Bloom & Canning, 2008); Lee (2009); Lee and Mason (2010); Ashraf, Weil, and Wilde (2013)

The potential of smaller family sizes to improve food security and nutrition takes several pathways. First, longer birth intervals are associated with higher birth weight (Rosenzweig & Schultz, 1987), itself a predictor of subsequent health in addition to positive cognitive (Black, Devereux, & Salvanes, 2007; Torche & Echevarría, 2011), schooling (Behrman & Rosenzweig, 2004), and earnings (Black et al., 2007) outcomes. Alderman and Behrman (2004) discuss the benefits of decreasing the prevalence of low birth weight in seven distinct categories: reduced infant mortality,<sup>2</sup> reduced neonatal care, reduced costs of infant/child illness, productivity gains from reduced stunting, productivity gains from increased ability, reduction in costs of chronic diseases, and intergenerational benefits (as low birth weight girls have a higher probability of giving birth to low birth weight children later in life). They find that the present discount value of the economic benefits derived from moving an infant from low birth weight to non-low birth weight status are on the order of magnitude of \$580.

Second, the presence of fewer children in the household implies larger individual shares of children's consumption goods, including food, assuming that such endowments do not themselves vary in family size. While it may theoretically be the case that some parents work harder to provide more for larger families, empirical studies in developing countries have found little or no evidence of this (Mueller, 1984; Tiefenthaler, 1997). As children grow older, their own labor may provide some productive contribution to the household but this potential swell in consumption does not align with the critical window for nutrition in the first two to three years of life. Using DHS data from 15 countries, Desai (1995) finds consistent within-country associations between family size and the stunting prevalence of children 6 to 36 months old. Particularly strong relationships in cases where the preceding birth interval was 18 months or less suggest that maternal depletion and care practices may also play a contributing role to poor outcomes. Rutstein (2005) finds significant relationships between stunting and shorter birth intervals in 6 of the 14 DHS surveys in his analysis which included anthropometric data. In that subset of countries, children born after an interval of less than 18 months are 43 percent more likely to be stunted than children born after an interval of 60 months or more.

Third, the reduced burden of childcare theoretically enables caretakers, usually women, to allocate their time in other productive ways, including formal and informal income generating activities. The empirical evidence on this point is mixed and context-specific. There are ample theoretical grounds to believe that fertility and labor supply are jointly determined (Schultz, 1981) and causal analysis has proven challenging. Angrist and Evans (1998) use an instrumental variable approach which exploits a preference for a mixed-sex composition of children in the United States as a plausibly exogenous driver of family size. They find that the presence of a third child reduced women's probability of working by about 10 percentage points in 1990. But this effect may not be generalizable to the developing world. In Nicaragua, Behrman and Wolfe (1984) find that the presence of young children affects labor force participation less than in developed countries due to extended family childcare provisions, the relative informality of the labor market, and the need for women to work. Abdulai and Delgado (1999) similarly find that the number of young children in agrarian households in northern Ghana is not a significant predictor of women's off-farm labor supply at conventional significance levels. Tiefenthaler

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<sup>2</sup> See Bongaarts (1987) for a discussion of declines in infant mortality rates associated with the uptake of contraception in developing countries. For more general studies on the relationship between infant mortality and birth spacing, see Koenig, Phillips, Campbell, and D'Souza (1990); Boerma and Bicego (1992); Miller, Trussell, Pebley, and Vaughan (1992); Rutstein (2005)

(1997) finds that the substantial amount of time devoted to childcare by new mothers in the Philippines comes from time previously spent on market work and on leisure, but that the displacement of market work is largely temporary. She reports that new mothers' labor market time allocation returns to roughly prenatal levels by about 14 months postnatal for all but first-time mothers, implying a fixed cost to labor market activity across parity levels.<sup>3</sup> In contrast, Bloom, Canning, Fink, and Finlay (2009) use abortion legislation as an instrument for fertility in 97 countries (with a very wide range of income and female labor force participation levels) and find that *each* additional birth reduces a woman's labor force participation by nearly two years. Their results imply that a typical fertility reduction of about four births per woman during the demographic transition increases female labor supply by around 18 percentage points (or 8 additional years out of a lifetime labor supply of 48).

Fourth, given that smaller family sizes are also associated with higher educational completion (Rosenzweig & Schultz, 1987) and that higher educational attainment among women is itself associated with delayed marriage, fewer children, and better caretaking practices (Schultz, 1997), particularly with regards to nutritional outcomes, girls who grow up in smaller families are less likely to have malnourished children when they become mothers themselves. Behrman and Wolfe (1987) find evidence that the positive effect of mothers' education on family health and nutrition outcomes evaporates once the maternal endowment (abilities, habits, and health status related to childhood family background) is accounted for, suggesting that higher completed education may be a proxy for educated mothers' superior childhood health and nutrition. In an earlier paper, they find that nutrition has positive impacts on employment sector and earnings later in life (Behrman & Wolfe, 1984) so, while the precise pathways may remain unclear, the intergenerational relationship holds.

Chapter 5 discusses an additional public policy benefit of reduced fertility for food security: smaller populations with more favorable dependency ratios allow developing country governments, and international donors, to better allocate scarce resources and to better afford social safety net programs and other similar means-tested entitlements.

## **II. Is development the best contraception, or is contraception the best development?**

The efficacy of family planning interventions to reduce fertility rates has been the subject of much debate. Demographers often cite a measure of "unmet need" for family planning based on 15 standard survey questions from the Demographic and Health Surveys and other data collection initiatives undertaken in developing countries worldwide.<sup>4</sup> The indicator gained both prominence and scrutiny since its incorporation into the Millennium Development Goals in 2006

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<sup>3</sup> The total labor market time allocation of women in this sample is only about 10 to 13 hours per week for households that already had a child under five present before the new birth.

<sup>4</sup> It draws from 15 survey questions posed to married women and its methodology was revised in 2012 for standardization across DHS, UNICEF Multiple Indicator Cluster Surveys (MICS), and Reproductive Health Surveys (RHS). The revision incorporates several changes, most prominently the exclusion of retrospective calendar data which was collected irregularly and which led to inconsistent estimates even within the same country (Bradley, Croft, Fishel, & Westoff, 2012). It distinguishes between an unmet need for spacing and an unmet need for limiting and produces estimates which are similar to, but slightly higher than, the previous methodology but now comparable across countries and over time.

(PATH, 2008). Its calculation is based on married women's reports of whether they want to delay or stop having children and whether they are currently using a modern form of contraception. In practice, the interpretation often implies that women who wish to space or limit childbearing lack physical or financial access to contraceptive services and would adopt them under improved healthcare conditions.

An influential 1994 article by Lant Pritchett challenged that assumption, finding that three measurements<sup>5</sup> of women's desired family sizes were each very strong predictors of the cross-country variance in average actual fertility outcomes (Pritchett, 1994). On the basis of that finding, he concluded that investments in girls' education and women's employment prospects would more effectively lead to fertility decline than investments in reproductive health services, by influencing the circumstances of women's preference formation and subsequent decision making (Pritchett, 1994).

Pritchett is particularly critical of the use of contraceptive subsidies, observing that even the highest cost incurred for contraceptive services pales in comparison to the lifetime direct and indirect costs of caring for a child:

Some would argue that the cost of contraception is irrelevant for many couples since they cannot afford it. However, being so poor as to not afford contraception would also imply, a fortiori, that another unwanted child is not affordable either. Moreover, if costs per couple-year of protection are \$15.5, then even for a household of four at an international poverty line of \$1 per person per day contraception would cost 1 percent of household income. While this expenditure is a burden, it is not an impossible one, as 1 to 3 percent is roughly the fraction of income that low-income households in poor countries devote to expenditures on tobacco.<sup>6</sup>

While this point on tobacco expenditure equivalency is empirically correct, it fails to account for the complex social and cultural norms and processes which mediate women's (and men's) behavior, assuming a particular type of rational decision-making couched within specific notions of agency and self-determination for which no data are furnished. Indeed, the comparison of family planning and tobacco expenditures invokes the canonical exchange between Gary Becker and Judith Blake concerning whether babies are just another type of consumer durable (Becker, 1960; Blake, 1968).

The tobacco analogy lends itself to highlighting several major flaws in Pritchett's argument. First, the cost of tobacco is incurred in very small doses rather than in a large lump sum, as may be the case with an investment in contraception. There is ample evidence that people in poor countries are not efficient savers due to economic, social, and psychological factors. Such contributing factors include a lack of appropriate financial services (Banerjee & Duflo, 2007; Dupas & Robinson, 2013; Tarozzi et al., 2012), a cultural expectation to share resources across families and kinship groups (Dupas & Robinson, 2013), an environment of risk and uncertainty which drives high intertemporal discount rates and "present-bias" (Banerjee & Mullainathan, 2010; Karlan, McConnell, Mullainathan, & Zinman, 2010), and poverty-driven depression (Lund

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<sup>5</sup> Average ideal number of children, desired total fertility rate, and wanted total fertility rate

<sup>6</sup> Pritchett (1994, p. 25)



et al., 2010, 2011)<sup>7</sup> and fatalism (Bernard, Dercon, & Taffesse, 2012) which lead to higher rates of substance abuse in the first place (Saffer & Dave, 2005).

Second, the benefit of tobacco is enjoyed immediately and for a brief time. The entire transaction occurs within a single period, negating the need to weigh future value against current. There is no long tail of (positive) returns to smoking a cigarette. Pritchett concludes that the present value of averted future births is minimal for many potential parents in developing countries. We might equally conclude that smokers in wealthier countries today place no value on their longer term health, particularly given the ubiquity of anti-smoking campaigns and public policy leading to high taxation, highly restrictive smoking areas, and social stigma. In reality, we intuitively understand that other socioeconomic and psychological factors lead to a persistent proportion of the population smoking.

Third, there is a meaningful psychological difference between allocating resources to obtain something desirable, with certainty, and allocating resources to avoid the possibility of an uncertain outcome (Kahneman, 2003; Kahneman & Tversky, 1979).

Fourth, the decision to smoke a cigarette is an individual one. The enjoyment of tobacco is not contingent upon the successful negotiation of complex social relationships fraught with gendered expectations and power imbalances. Bongaarts (2014) describes additional “noneconomic” costs which impede contraceptive takeup, including social disapproval, spousal resistance, health concerns, and unnecessary medical barriers.

And fifth, smoking prevalence in developing countries is much higher among men than among women (Pampel, 2006). It is also men who are much more likely to control household financial resources.

The food security framework of availability, access, utilization, and stability is useful to illuminate this discussion. Pritchett’s point that contraceptive availability alone, particularly at the national level, is insufficient to reduce fertility rates absent attention to other factors is accurate but his interpretation is misleading. Availability is not access, and access is not utilization or stability. To reduce fertility, women and their male partners must not only live in a place where modern contraceptives are available, but they must also have physical, economic, social, and psychological access to them.<sup>8</sup> Methods must be both affordable and permissible to other household and community members wielding decision-making power, particularly male community and religious leaders and mothers-in-law in many patrilocal societies. The risks of various methods must be accurately understood by both women and men, as well as by other community members, to mitigate the propagation of inaccurate rumors which suppress uptake. The advantages of smaller family sizes must be clearly communicated and any disadvantages should be simultaneously confronted. A reduction of transfers from grown children to their elderly parents is one such disadvantage which has been discussed at length elsewhere (Caldwell, 1976, 2005; R. D. Lee, 2007). In part for this reason, Goldstone (draft) posits that parents are less likely to reduce fertility when trust in state institutions is weak. Both of these factors suggest that the pairing of family planning programs with broader social safety net or entitlement programs

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<sup>7</sup> There is some debate about whether consumption poverty is a direct driver of poor mental health once other factors are adequately accounted for. See Das, Do, Friedman, McKenzie, and Scott (2007) and Corrigan, Lund, Patel, Plagerson, and Funk (2008) for further discussion.

<sup>8</sup> See Campbell, Sahin-Hodoglugil, & Potts (2006) for a review of barriers to contraceptive uptake.

may augment their efficacy. Finally, to round out the food security framework analogy, contraceptive methods must be properly and regularly used and their availability, access, and utilization must be reliable over time.

A recent Science article (Kaiser, 2011) providing an updated synopsis of the contraception-or-development-first debate cites two examples furnished originally by Pritchett himself: Kenya and Bangladesh. Pritchett, writing in 1994, noted that Kenya's 1989 TFR was 6.4 while 91 percent of DHS respondents knew of a modern contraceptive method. He concluded that "modern contraceptive knowledge has actually run far ahead of desires to limit fertility," conflating basic awareness with culturally and socially sanctioned access and utilization (Pritchett, 1994, p. 11). Science's 2011 review describes Kenya's substantial fertility decline following aggressive government family planning efforts. Desired family size fell from 7.2 to 4.8 in a little over a decade (Cleland et al., 2006). By 2012, Kenya's TFR had fallen from 8<sup>9</sup> to 4.5 (The World Bank, 2015).

Pritchett also describes the randomized distribution of contraceptives and family planning information in the Matlab region of Bangladesh, noting that desired fertility declined by the same amount (1.3 children per woman) in treatment and control districts between 1975 and 1990.<sup>10</sup> By 1996, however, actual fertility was 15 to 16 percent lower in study villages than in control villages (Joshi & Schultz, 2007). Indeed, thanks in part to policies first tested in Matlab, Bangladesh has witnessed one of the most rapid fertility declines globally: its TFR fell by 4.2 children per woman in just 30 years (Bloom, 2011) and now hovers near replacement at 2.2 (The World Bank, 2015).

But the presence of family planning programs alone does not guarantee such radical shifts; evidence on the direct impact of contraceptive access to fertility outcomes is mixed at best. Many early studies focused on the relationship between family planning programs and contraceptive prevalence but lacked careful identification of even this first link in the causal chain. In a discussion of observed fertility declines in Asia and Latin America, Bongaarts, Mauldin, and Phillips write, "these fertility declines are, not surprisingly, attributable to the rapidly spreading practice of contraception" (1990, p. 301). While they acknowledge the simultaneous importance of socioeconomic development, their analytical approach to gauging the relative contribution of each factor is not persuasive.<sup>11</sup>

Gertler and Molynaux (1994) find that 75 percent of fertility decline in parts of Indonesia between 1982 and 1987 resulted from increased contraceptive usage but that increased take-up

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<sup>9</sup> According to the 1979 census (Cleland et al., 2006)

<sup>10</sup> Pritchett's data comes from an original study by

<sup>11</sup> They proceed to describe the correlation, at the level of world regions, between contraceptive prevalence and fertility decline but conclude that "investments in socioeconomic development and family planning programs have much more than simply additive effects on fertility" (Bongaarts, Mauldin, & Phillips, 1990, pp. 302–303). To illuminate the contribution of each, they devised two composite indices which seek to capture key elements of broader development on the one hand and "family planning program effort" on the other. The index of socioeconomic development places equal weight on four variables: GNP per capita, infant mortality rates (which are themselves influenced by fertility levels), gross education enrolment ratios, and a composite number of televisions, radios, and cars per capita. The index of family planning program intensity equally weights 30 variables which span the domains of policy, service activities, recordkeeping and evaluation, and supply and service availability. The latter index is developed in a previous study, Lapham and Mauldin (1985), and the distinction between service activities and service availability is not explained in this paper.

was driven by demand-side factors including higher educational attainment and improved economic opportunities for both women and men. The Indonesian TFR fell from 5.6 to 4.1 between 1970 and 1980 and to 3.2 by 1985 while the proportion of women using contraception rose from 27 percent in 1980 to 47 percent in 1987 (Gertler & Molyneaux, 1994). Growing demand could only be met given the establishment and maintenance of a robust system of supply and service delivery. The authors also rightly observe that “family planning programs cannot be characterized accurately by a single measure of program inputs or effort. Rather, the programs generate a whole arsenal of institutions, programs, and infrastructure designed to have multiple effects on contraceptive use and fertility” (Gertler & Molyneaux, 1994, p. 34). As a result of this complexity, they note that the reduction of diverse family planning programs into a simple input metric does not characterize them accurately or usefully. This singular measure, “availability” in the food security framework analogy, fails to capture the potential array of program services which improve the “enabling environment” for behavioral change, thereby augmenting demand.

Increased demand for services resulting in higher rates of contraceptive usage may still not lead to fertility declines if the women adopting new methods are not those at high risk of pregnancy. A working paper by Ashraf, Field, and Leight (2013) finds no impact of a simple supply-side intervention on fertility outcomes in Lusaka, Zambia a year after program roll-out despite significant uptake. The study randomly allocated vouchers for a variety of contraceptive methods to women in a low-income community within a clinical catchment area of the capital city. Women were guaranteed minimal wait times in an environment characterized by reasonably high contraceptive demand but long, unpredictable waits and frequent stock-outs. While usage increased within the first month, the period of voucher validity, and the higher prevalence of modern method usage among treatment groups persisted two years later, it did not translate into reduced fertility within the first year. The authors conclude that, in this context, underlying fertility preferences are the primary determinant of fertility outcomes and interventions which do not seek to act upon those preferences directly are insufficient to drive meaningful behavioral change. It is notable in this capital city context, however, that 63 percent of sample women had previously used or were currently using contraceptive pills at baseline, indicating that contraceptive availability and access were already much higher than in other high fertility contexts.

The authors identify ten other microeconomic studies with experimental or quasi-experimental designs which look specifically at fertility trends in seven countries: Ghana, Tanzania, Bangladesh, Colombia, Ethiopia, Indonesia, and Uganda. Family planning program impacts on fertility outcomes are detected in the former four and not the latter three. They caution that, with expensive and costly interventions in these countries acting on both supply and demand sides of contraceptive prevalence, it is difficult to parse the causal mechanisms at play, but the growing evidence base, including their own findings, suggests that it is precisely such comprehensive, multi-pronged program designs which are necessary to drive change. So what did these more successful programs include and what effect sizes did they achieve?

### **A. Case Studies of Successful Family Planning Programs**

Particularly notable are the relatively low levels of human development observed in some of the successful program case studies identified by Ashraf, Field, and Leight (2013) for their rigorous causal analysis. This suggests that broad-based educational and economic development may not

be necessary to advance family planning program goals; let us examine these country cases in descending order of their 2014 Human Development Index (HDI) scores<sup>12</sup> (Malik, 2014).

In Colombia (HDI = .711), Miller (2010) examines effects of the national PROFAMILIA family planning initiative which commenced in 1965 but had a remarkably uneven geographic rollout over the following decades (and one that did not correlate with assessed need or local demand). Using census data from 1993, he constructs cohorts of women with differential access to family planning services by age and municipality. Notably, the program included a strong focus on community engagement from its inception via radio advertising and the recruitment of local community members as outreach workers (G. Miller, 2010). In the 1960s and 1970s, fertility rates in Colombia declined more rapidly than those of any other Latin American country despite the fact that Colombia's social and economic development was in step with that of its neighbors. Between the early 1960s and late 1980s, the Colombian TFR fell by 3.5 births per woman. Miller finds that women with full access to family planning programs over their reproductive years have 13 percent fewer births than women with no program access until age 45 or later. This corresponds to an average individual fertility reduction of approximately .75 children per woman. Women first exposed to the program in the middle of their reproductive years, between ages 30 and 34, exhibited a 4 percent fertility decline which is consistent with the near completion of reproductive behavior by this age. He further finds that family planning programs influenced not only the total number of births, but also their timing. Women first exposed to the program between the ages of 15 and 19 were more likely to postpone their first births than those lacking program access. Related to this result, he also finds that women exposed to programming at the youngest ages also completed approximately .14 additional years of schooling and were more likely to have formal employment in 1993. He goes on to estimate small but positive intergenerational effects on children's schooling (more) and labor supply (less) which are qualified as merely suggestive. Perhaps as impressive as the direct fertility outcomes is the cost effectiveness of the program. In contrast to the case of Bangladesh, discussed below, the program cost about .1 percent of per capita GDP per fertile woman and about .25 percent of per capita GDP per birth averted. But the terms of comparison may themselves be misleading as per capita GDP was approximately 6 times higher in Colombia than in Bangladesh in 1980 (The World Bank, 2015).

In Ghana (HDI = .573), Debpuur et al. (2002) find even larger effects on fertility over just the first three years of a new program in a traditional, rural area of northern Ghana. The Navrongo Community Health and Family Planning Project combined service delivery, the deployment of skilled nurses, and educational outreach to communities in this remote area, the socioeconomic development levels of which would not suggest an advancing demographic transition. The combination of nurse presence and successful engagement of traditional leaders and local male volunteers to promote program participation resulted in a fertility reduction of one full birth per woman, on average (a 15 percent decline), over a very short period. Two coauthors of the original evaluation documented the program's ongoing efficacy approximately a decade later (Phillips et al., 2012). They found that, despite such an auspicious beginning, the magnitude of effect sizes did not hold. When the initially successful project expanded, critical social

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<sup>12</sup> HDI scores are themselves very highly correlated with poverty as reflected in GNI per capita, adjusted for purchase power parity (itself a component of the index). They are calculated as a composite of life expectancy at birth, mean years of schooling, expected years of schooling, and GNI per capita. See <http://hdr.undp.org/en/data-explorer>

mobilization components engaging men were neglected and, consequently, the longer-term impacts of program scale-up were negligible.

Perhaps the most widely heralded example of family planning program success, the Matlab experiment in Bangladesh<sup>13</sup> (HDI = .558), began in 1977. Set within a relatively homogenous region of just 70 square miles, 70 of its 142 villages were randomly assigned to a family planning program while the other half remained a control group. The intervention involved extensive community outreach by female healthcare workers who visited women in their homes with maternal and child health information and provided a variety of contraceptive services. Notably, the comparison villages do not constitute a pure control as family planning services and health worker home visits were also introduced there beginning in the early 1980s, though with much less intensity (Ginneken & Razzaque, 2003). Koenig et al. (1992) report results from a 1990 knowledge, attitudes, and practice (KAP) survey of approximately 8,000 married women across treatment and control villages which constituted the first data collection initiative in untreated villages since 1984. In 1990, married women between 15 and 49 in treatment areas were more than twice as likely as control village counterparts to use any form of contraception (57 vs. 27 percent) and nearly three times as likely to a.) use a modern method (54 vs. 20 percent) and b.) practice any form of contraception for spacing rather than stopping objectives (42 vs. 15 percent). By 1990, takeup in treatment areas was so diffuse that differences in practice by educational levels were no longer discernible, while in control areas the educational gradient remained stark. While usage levels also increased in control areas over the six year period, the trend paralleled that observed in rural areas across the country.

Koenig et al. don't examine the fertility trends resulting from the observed shifts in contraceptive prevalence, but Van Ginneken and Razzaque (2003) look directly at fertility outcomes with data from the later 1990s. They present both cohort (children ever born) and period (TFR) fertility from Matlab's vital registration system. The treatment area TFR stood at 6.5<sup>14</sup> in 1977 and had already declined to 3 by 1991. The comparison area, in contrast, saw a TFR decline from 6.9 to 4.3 in 1991, or of 2.6 rather than 3.5 births per woman, on average. This difference of about one child is corroborated with cohort measures of children ever born. Data from 40-49 year-old women in 1996 reflect 5.6 average lifetime births in the treatment area and 6.6 in the control area. The authors opine that even this substantial difference understates true program effects given that some degree of family planning services did become available in the control area over the period. It is also notable that substantial resource allocations were necessary to generate these effects. As Pritchett (1994) observes, the Matlab "treatment" cost approximately 10 percent of per capita GDP per fertile woman and about 120 percent of per capita GDP per averted birth.

Finally, it is worth highlighting that the control area TFR continued to fall throughout the 1990s to reach 3.3 by 1999 while that of the treatment area stagnated over the same period. It may be the case that supply of, and demand for, services became more widespread in the comparison area over the period but the authors also note that differences in ideal family size are negligible across areas, implying the alternative possibility that women in both sets of villages became better able to achieve somewhat static desired family sizes. Those desires may have shifted little

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<sup>13</sup> See Cleland, Phillips, Amin, and Kamal (1994) for a very comprehensive study of fertility decline in Bangladesh.

<sup>14</sup> This baseline treatment area TFR may have been lower than the control TFR given that the Contraceptive Distribution Project was implemented in more households in the former than the latter between 1975 and 1977 (Ginneken & Razzaque, 2003).

over the course of the 1990s given quantitative and qualitative data suggesting only a modest degree of economic and social shifts, particularly in rural areas, of the type which have precipitated a desire for smaller family sizes in other parts of the world (Ginneken & Razzaque, 2003).

Cleland et al. (2006) and Bongaarts et al. (2012) highlight the contrasting fertility trajectories of Bangladesh and comparable Pakistan (HDI = .537), parts of the same country until 1971. The two countries had similarly high fertility in the 1970s, each with a TFR of 6.8 in the 1975-1980 period. Bangladesh scaled up its national family planning program on the basis of evidence generated in Matlab; programming entailed both contraceptive distribution at the household level and community outreach, including national radio-based communications campaigns and direct outreach to husbands, *bari* leaders, and religious leaders to align support and augment demand for contraceptive uptake (Bongaarts et al., 2012). Meanwhile, Pakistan's program remained weak, lacking both government commitment and funding. By the late 1990s, Bangladesh's TFR had fallen to 3.3 while Pakistani women still had 5 births, on average. By 2012, the gap had closed somewhat but Bangladesh's TFR has declined to near replacement, 2.2, while Pakistan's remains at 3.3 (The World Bank, 2015). While Pakistan counted 5 million fewer citizens than Bangladesh in 1970, by 2050 its population is projected to be 62 million greater despite a fertility rate convergence (Cleland et al., 2006).

In Tanzania (HDI = .488), Angeles, Guilkey, and Mroz (1998) employ a simultaneous equations framework to account for the geographical endogeneity of family planning program rollout.<sup>15</sup> They integrate an individual-level model of timing and spacing of children, using 1991/92 DHS data on 15 to 49<sup>16</sup> year-old women in 235 rural villages, with the dynamic scale-up of program placement, using data from a separate 1994 health facilities survey.<sup>17</sup> Three types of facilities are separately accounted for: hospitals, health centers, and dispensaries. While the empirical specifications and underlying distributional assumptions in this article are exceedingly careful, minimal attention is given to program quality and consistency, none at all to community outreach. The authors model the dates of facilities opening and of first FP service provision and assume that services are consistent thereafter if available at all (Angeles et al., 1998, p. 886). They note that “despite efforts to develop outreach programs and to promote information, education, and communication (IEC) campaigns, the Tanzania FP program has remained largely clinic based” although village health workers and representatives from the Family Planning Program of Tanzania (UMATI) are other possible sources of FP services (Angeles et al., 1998, p. 889). Given unavailability of historical data and the finding that only 16.5 percent of rural communities were visited by UMATI field workers in 1991, the presence of community-based programs is not incorporated into the model. To estimate the effects of lifetime exposure to different sources of FP services, the authors simulate the number of children ever born by age 34 by taking the statistically average woman in 1991 and summing predictions of age-specific birth

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<sup>15</sup> The authors are critical of previous work relying on fixed effects to account for geographical endogeneity, e.g. Gertler and Molynaux (1994) and Rosenzweig and Wolpin (1986), given the general non-linearity of fertility and restrictions imposed by the approach, including the presumed time-invariance of other explanatory factors and the inability to interact observed and unobserved factors.

<sup>16</sup> They further restrict this sample to women entering reproductive years after 1969 (72 percent of the rural sample), defining reproductive years to begin at age 12, thus effectively excluding women over age 34 at the time of the survey. The relative youthfulness of the sample may also reduce the recall error associated with birth histories.

<sup>17</sup> A total of 89 hospitals, 118 health centers, and 230 dispensaries were visited for this survey.

probabilities from age 12 to age 34. They estimate that hospital services alone reduce fertility by 6.1 percent while health center services alone reduce fertility by 11 percent and dispensaries alone reduce it by just 1.8 percent. The relative magnitudes of their simulated findings are consistent with logical correlations between facility type and community outreach activities. With lifetime exposure to the existing mean distribution of facilities in 1991, the authors estimate 4.13 births by age 34, vs. 4.7 in the absence of all programs, a 12 percent reduction in the presence of multiple facility types.

Tanzania shares a colonial legacy and general level of development with two neighboring countries which themselves make for an interesting juxtaposition in fertility trajectories: Uganda (HDI = .484) and Kenya (HDI = .535). Kenya was one of the first African countries to develop a population policy in the 1960s and its family program, initially weak, gained strength in the decades that followed (Bongaarts et al., 2012). It provided access to low-cost contraceptive distribution coupled with information, education, and communications campaigns advocating small family sizes. Between 1989 and 2009, its TFR fell from 6.7 to 4.6 (ICF International, 2012). Uganda, in contrast, made minimal investment in family planning over the same period and its TFR declined more modestly, from 7.4 in 1989 to 6.2 in 2011 (ICF International, 2012). While this comparison crops up fairly often in the literature, it also bears mentioning that, at 6.4, Ugandan wanted TFR far exceeded Kenya's 4.5 in 1989 (ICF International, 2012).

Finally, though also not experimental in evaluation design, the success of Iran's national family planning program is worth highlighting. In 1989, the Iranian government initiated a strong family planning program which combined free contraceptives, provided by a network of village healthcare workers, with aggressive educational campaigns promoting smaller family sizes (Bongaarts et al., 2012). Fertility fell precipitously from 5.5 births per woman in 1988 to 2.2 in 2000 and 1.9 in 2003 (The World Bank, 2015). Bongaarts et al. (2012) propose Jordan as a plausible counterfactual case with comparable levels of development and a similar lack of commitment to family planning in the 1980s despite general health gains in both countries. Jordan's TFR stood at 5.9 in 1988 and declined more modestly thereafter. By 2000, it had reached 4.1, still nearly double that of Iran (The World Bank, 2015).

## **B. A Consensus on Contraception and Development**

Bongaarts and Sinding (2009) directly address several arguments made by detractors of (funding) family planning programs, including that programs have limited direct effect on fertility. Their response is more nuanced than some earlier work, noting that gains in human development, particularly child survival, and women's empowerment, particularly through universal education, are instrumental in driving demand for contraception. In contexts where large family sizes are still favored, they acknowledge that "there will have to be declines in the number of children desired before sustained fertility decline can occur" (Bongaarts & Sinding, 2009, p. 40).

In sum, the evidence to date supports a less polarizing position than framed in the early literature: neither contraception availability nor (some form of) development alone is sufficient to drive fertility declines in the absence of the other. Cleland et al. (2006) articulate the following recipe for successful and sustainable programs: "high-level political commitment; a broad coalition of support from elite groups; adequate funding; legitimisation [*sic*] of the idea of

smaller families<sup>18</sup> and modern contraceptives through mass media, etc.; and making a range of methods available through medical facilities, social marketing, and outreach services” (Cleland et al., 2006, p. 1810). Widespread contraceptive availability is *necessary but insufficient* to reduce fertility rates. Family planning program success hinges on increased community demand for contraceptive services. But that increased valuation may come about via different avenues, including the two usual suspects of (1) broad economic development, with improved labor markets increasing both the value of women’s time and the cost of “quality” children; and (2) large-scale improvements in public education which delay marriage, improve women’s ability to capitalize on better employment opportunities, and likely have direct effects on women’s autonomy and agency. In reality, it may be the case that the two often coincide.

However, increased demand for contraception and smaller families need not depend on, nor wait for, the occurrence of such macro changes. Comprehensive family planning programs with strong elements of community outreach have been similarly effective at driving demand in environments with relatively static economic and educational conditions (e.g. Bangladesh and Ghana) and Bongaarts (2011) finds substantial evidence of program potential to reduce desired family sizes in sub-Saharan Africa. Programs thus achieve the dual effects of meeting “unmet need” while concurrently spurring demand (Bongaarts, 2014). They have largely achieved this with carefully considered and precisely targeted complementary programming designed to increase knowledge of the advantages of longer birth intervals and smaller family sizes among both women and other decision-makers, including husbands, mothers-in-law, and community leaders.

### **III. USAID’s Family Planning Budget**

While adequate funding is a main ingredient in Cleland’s successful program recipe, Bongaarts and Sinding (2011) inform us that international funding support for family planning programs declined by 30 percent between 1995 and 2008. The Kemp-Kasten Amendment, first enacted in 1985, prohibits U.S. foreign assistance to organizations which support coercive abortion or involuntary sterilization. In 2002, the Bush administration withheld \$34 million from the UNFPA under the pretext of this Amendment following the report of a blue-ribbon panel commissioned to study the matter. Funds were withheld for all subsequent years of the Bush administration but restored under President Obama in 2009 (O’Hanlon, 2009).

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<sup>18</sup> There is some evidence to suggest that fertility declines in some developing countries, including Ghana, Kenya, and Bangladesh, have stalled in recent years despite early progress (Bongaarts, 2008). While this observation suggests that scrutiny of both supply and demand side factors is in order, it is also possible that social campaigns can only reduce desired family sizes to a certain degree, anecdotally to around 3-3.5 children per woman, in the absence of broader economic development which increases both the direct costs of (and returns from) educated children as well as the opportunity costs of women’s time. This observed leveling off of fertility, for example in Matlab, may be an artefact of women using contraceptive services primarily to space rather than to stop childbearing. But it may also be related to differential program intensity and funding. In Kenya, USAID support for family planning fell from \$12 million to \$8.9 million annually between 1995 and 2006 while funding for HIV/AIDS programming was augmented over 50 fold (Cleland et al., 2006). See Bongaarts (2011) for a fuller discussion of the efficacy of family planning programs to reduce desired family size.



Family planning and reproductive health investments have also been displaced by a priority shift to HIV/AIDS allocations, which grew from about \$125 million in 1998 to over \$2.5 billion in 2007 while population program funding roughly flatlined (O'Hanlon, 2009).

In a 2006 *Lancet* piece calling on wealthy countries to fund key developing country programs where sound population policy and programmatic will exist alongside a dearth of resources, Cleland et al. (2006) point out that leadership on this agenda may need to come from Europe in the future despite the US's historical dominance.

#### **IV. How much could effective family planning programs reduce fertility in Tajikistan and Niger?**

Bongaarts et al. (2012) assess that family planning programs can reduce fertility by as much as 1.5 births per woman, but of course this effect size must be highly context-specific. Taking a different approach, Bloom, Canning, Fink, and Finlay (2009) estimate that, over the period 1960-2000 and with a panel of 97 countries, moving from an abortion policy of the most restrictive type (no legal abortion in any circumstances) to the least restrictive lowers the total fertility rate by about .4 births per woman, on average.

There are two obvious approaches to estimating the potential effect size of a hypothetical aggressive (non-coercive) family planning program in a given country, each with its own advantages and disadvantages. The first entails direct assessments of local "unmet need," reported desired fertility, and/or contraceptive prevalence. The strength of this approach is its base in data drawn from the specific cultural and economic context in question. Major weaknesses arise in attempts to translate hypothetical, self-reported fertility desires into predicted, observable actions under modified circumstances. Additionally, as noted above, programs may themselves augment demand for services with the incorporation of information, education, and communications (IEC) campaigns designed to shift family size preferences. Bongaarts (2011) finds a strong negative relationship between family planning program efforts and desired family size in 59 DHS-surveyed countries.<sup>19</sup>

The second approach involves gauging effect sizes of successful programs in comparable countries and imposing them, potentially with some adjustments, on the (age-specific) fertility schedule of the country of interest. The obvious drawback to this approach is that it could never fully incorporate many of the (often unobservable) latent and structural differences which characterize the different environments, be they economic, cultural, political, or institutional. But are there countries which have witnessed successful fertility declines and which are also comparable to the two case studies at hand? In both cases, there are.

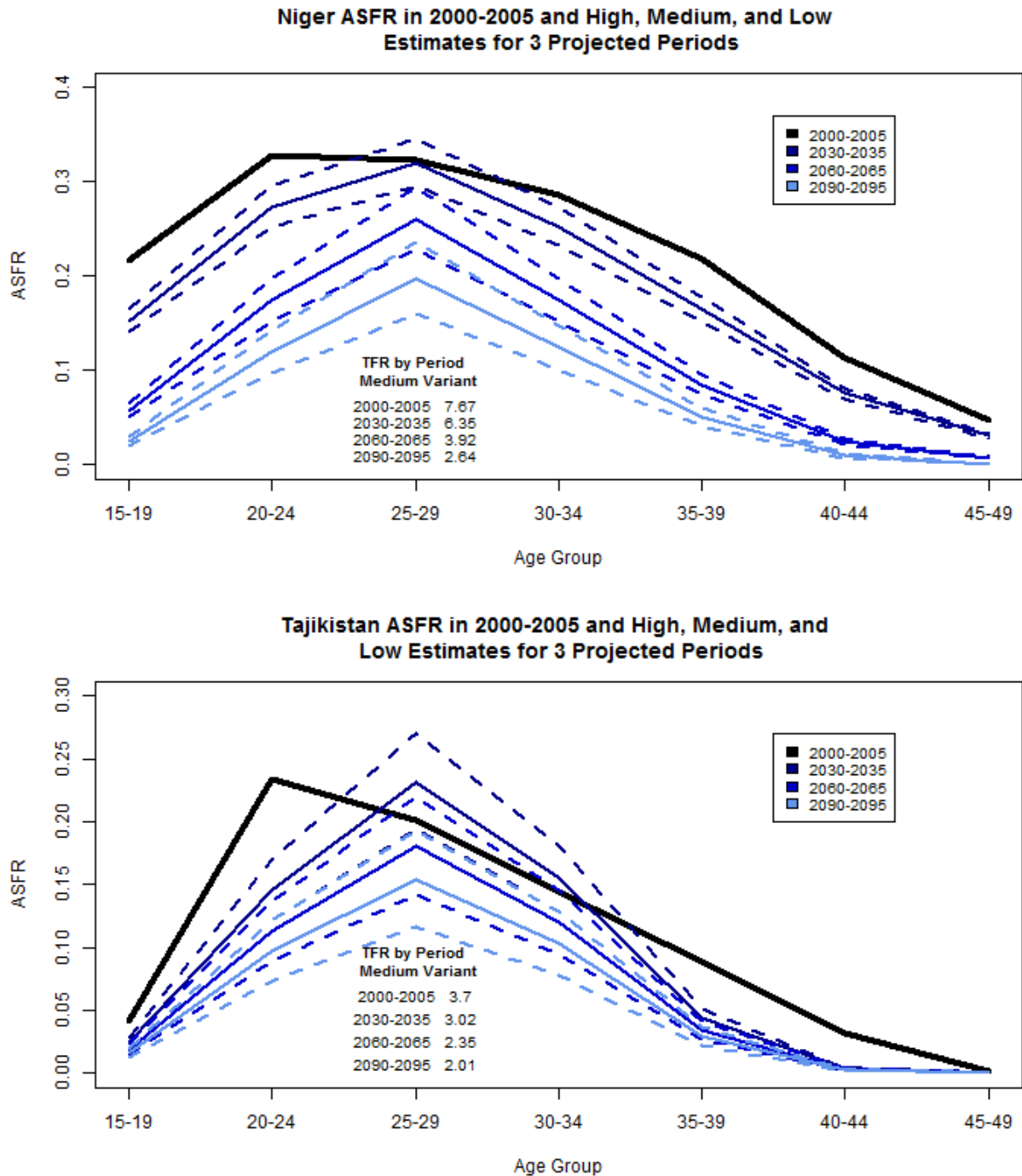
Both approaches are discussed further below in application to Tajikistan and Niger. But first, let us examine the fertility rates in each country from recent observation and future projection to provide a frame of reference for the thought exercise which follows. Figure 2.1 shows the age-

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<sup>19</sup> See also Van de Walle (1992) for a discussion of conscious choice and fertility outcomes and Committee on Population, National Research Council (1999) for more on diffusion theory and fertility decline.

specific fertility rates for each generated by the UN Population Division's World Population Prospects (WPP) 2012 Revision (not the 2014 probabilistic ranges discussed in the next section):

Figure 2.1: Age-Specific Fertility Rates in Niger and Tajikistan<sup>20</sup>



<sup>20</sup> Source: UN Population Division (2015)

The TFR of Tajikistan, currently 3.85 (up from a decade ago), is about half Niger's 7.6. An obvious distinction between the two national patterns, and driver of this difference, are much higher fertility levels among women at the periphery of the reproductive age distribution in Niger, consistent with very high overall fertility. In Tajikistan, only 14 percent of married women 20-49 were married by age 18 in 2012 and fertility among unmarried women is minimal (ICF International, 2012). In Niger, 77 percent were married by age 18; 30 percent were married by age 15 (vs. .5 in Tajikistan) (ICF International, 2012).

### **A. A Direct Approach: Levels of Unmet Need**

Both Tajikistan and Niger had DHS Surveys in 2012 and both employed the recently revised, standardized definition of unmet need for family planning described above (Bradley, Croft, Fishel, & Westoff, 2012). In Tajikistan, data show that 23 percent of currently married women have an unmet need for modern contraceptive services for either spacing or stopping fertility (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013). An additional 28 percent currently use modern contraceptives, bringing total demand to 51 percent among married women, a potential usage level at the lower end of that observed in comparable neighboring countries with better family planning program infrastructure and significantly lower fertility (discussed below).

In Niger, unmet need is much lower, at 16 percent of married women. Only 14 percent of married women currently use a modern form of contraception, bringing total demand to 30 percent (ICF International & Niger National Institute of Statistics, 2013). Also notable is stark variance by region: unmet need ranges from 12 to 22 percent at the regional level and *positively* correlates with current usage. As a result, total demand for family planning services varies from about 23 percent in Tahoua and Maradi to over 50 percent in Niamey (ICF International & Niger National Institute of Statistics, 2013).

Given that total demand itself can be observed to increase significantly over time, particularly in the presence of robust, community-engaging family planning programs (discussed below), an approach to estimating fertility decline on the basis of fulfilling "unmet need" is not pursued.

### **B. An Indirect Approach: Applications of Results from Successful Family Planning Programs**

#### **i. Model Family Planning Programs Relevant to Tajikistan**

The majority of Tajiks are ethnically Persian, although there is a substantial Uzbek minority, and the country shares a cultural and linguistic history with both Iran and Uzbekistan (as well as Afghanistan, where the TFR remains over five births per woman). Unlike Iran (HDI = .749), Uzbekistan (HDI = .661) also shared in the secularizing, Russifying, and economy-transforming experience of Soviet Union membership. Figure 2.2 compares Tajikistan's (HDI = .607) age-specific fertility rates since 1960 with those of these two neighbors.

Both the age-specific and total fertility rates across all three countries are highly comparable in the 1960-65 period, with TFRs in excess of six births per woman. By 1980-85, Uzbekistan's TFR had already fallen to 4.7 births per woman, a difference of over two births in just two decades. Tajikistan's TFR also declined, though more modestly, by about .8 births while Iran's declined by only .4 births over the same period.

In the context of Iran's aggressive family planning program, introduced in December of 1989 (Aghajanian & Merhyar, 1999) and described briefly above, its TFR fell by an additional 4.5 births per woman, and below replacement, between the early 1980s and early 2000s, an astounding decline. The UN estimates that its 1985-90 TFR stood at 5.6 but fell by more than three births per woman to 2.6 a mere decade later (UN Population Division, Department of Economic and Social Affairs, 2015). Its TFR today is recorded at 1.9.<sup>21</sup>

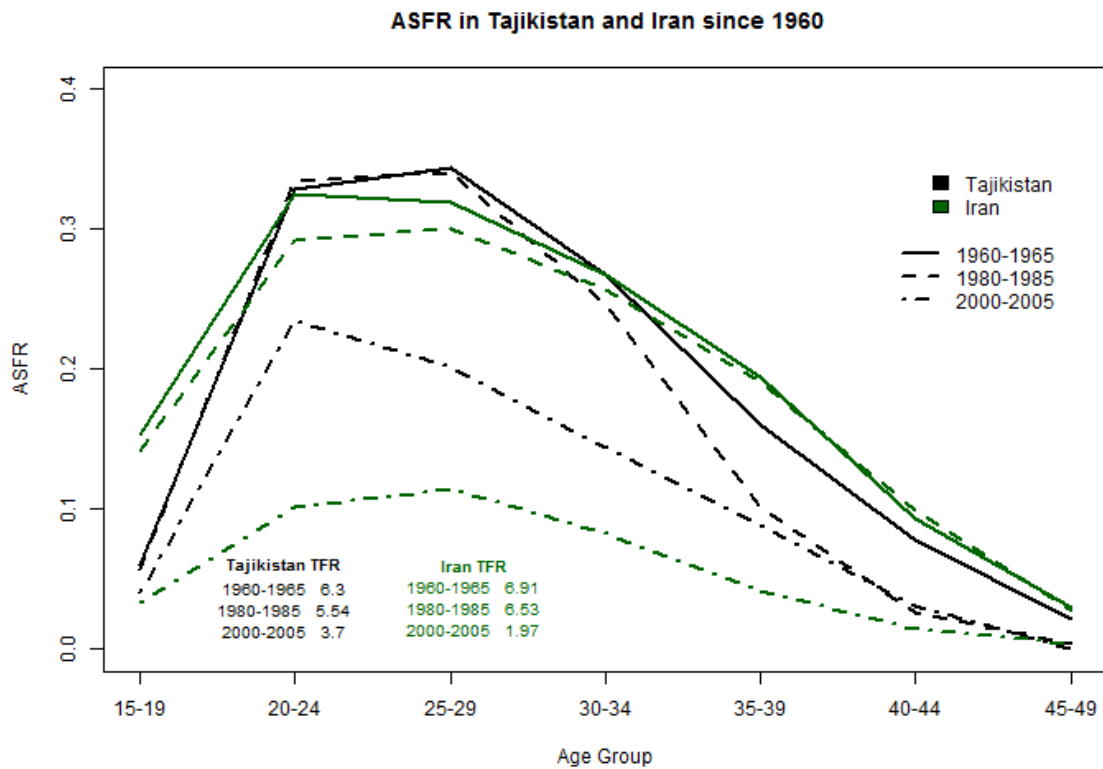
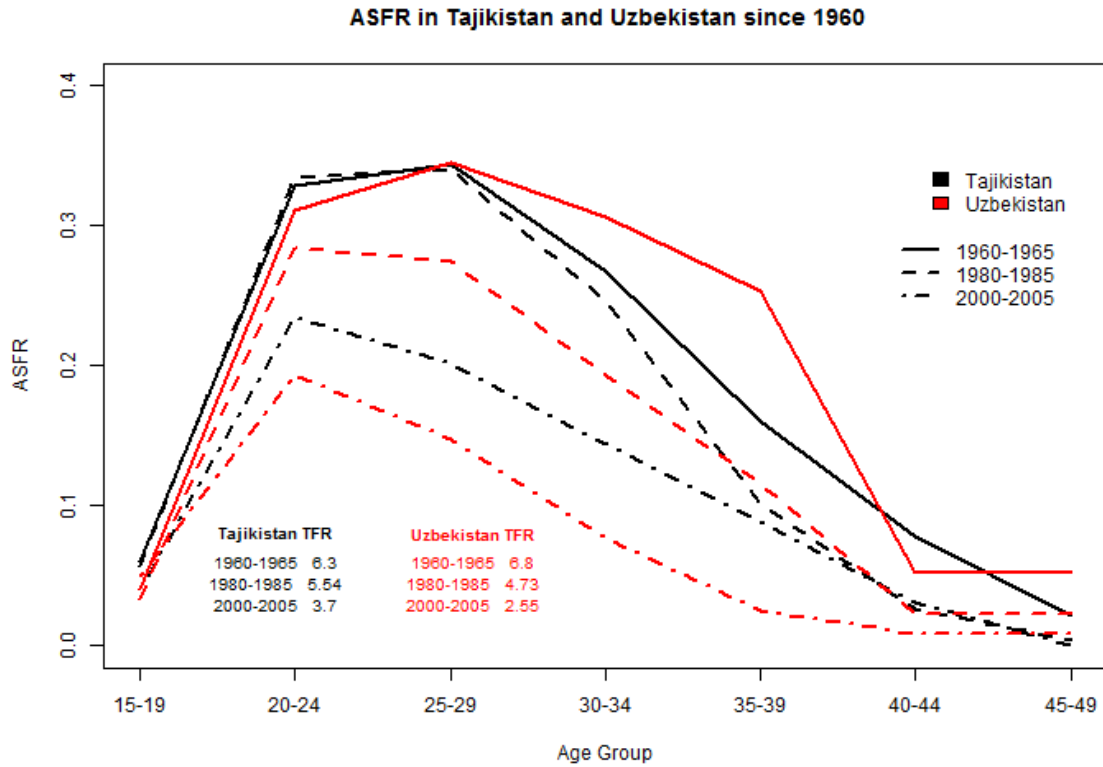
Fertility in Uzbekistan and Tajikistan also continued to decline over the period, though more slowly, by about 2.2 and 1.8 births per woman, respectively, between the early 1980s and early 2000s. While abortion was the primary form of birth control in the Soviet period, Uzbekistan's extensive, state-sanction family planning program has led to a dramatic increase in contraceptive usage since its 1991 independence (Barrett & Buckley, 2007). Its TFR declined by 1.35 births per woman (from 4.4 to 3.05) between the late 1980s and the late 1990s and stands at 2.3 today<sup>22</sup> (UN Population Division, Department of Economic and Social Affairs, 2015).

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<sup>21</sup> For the 2010-2015 period

<sup>22</sup> For the 2010-2015 period

Figure 2.2: Fertility Trends in Tajikistan, Uzbekistan, and Iran since 1960



By the time of a 1996 DHS Survey, just over half of all married Uzbek women were using a modern form of contraception and the difference in usage rates between urban and rural areas was startlingly negligible (52 vs. 50 percent) (Institute of Obstetrics and Gynecology [Uzbekistan] & Macro International Inc., 1997). Sixty-five percent of married women had used a modern form of contraception at some point in their lives. By 2002, 99 percent of married women had knowledge of modern contraceptive methods, 82 percent had ever used one, and 63 percent were currently using one (Analytical and Information Center, Ministry of Health of the Republic of Uzbekistan, State Department of Statistics, Ministry of Macroeconomics and Statistics [Uzbekistan], & ORC Macro, 2004).

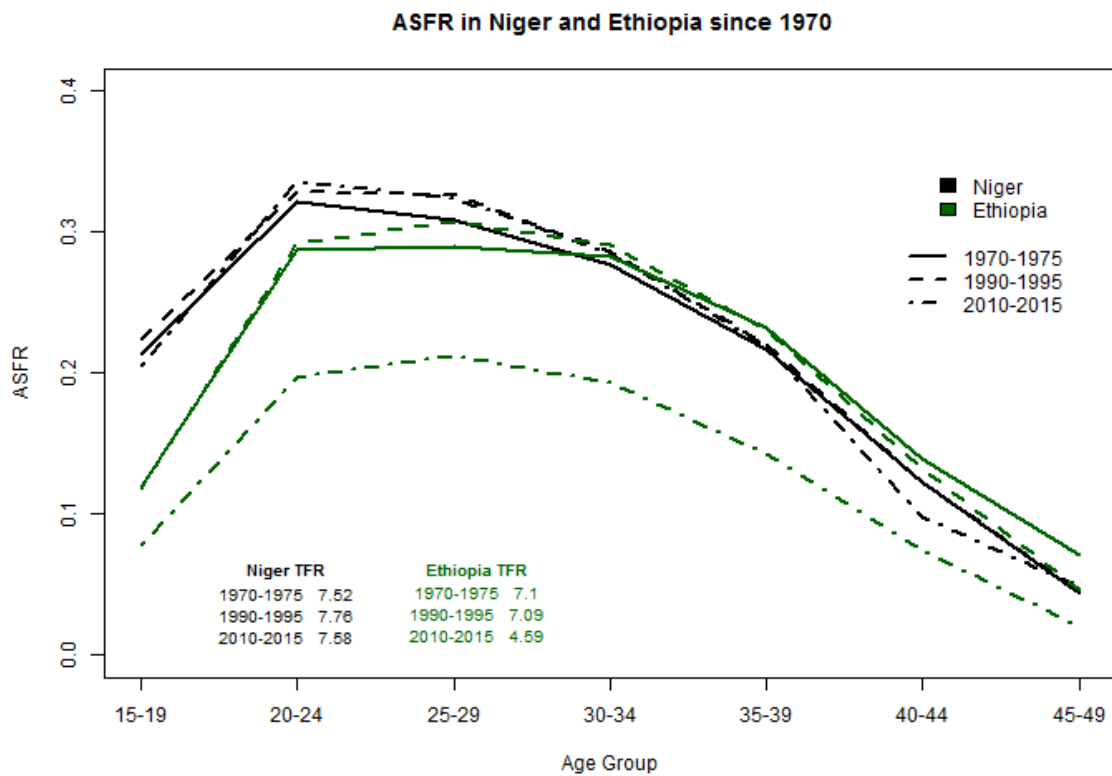
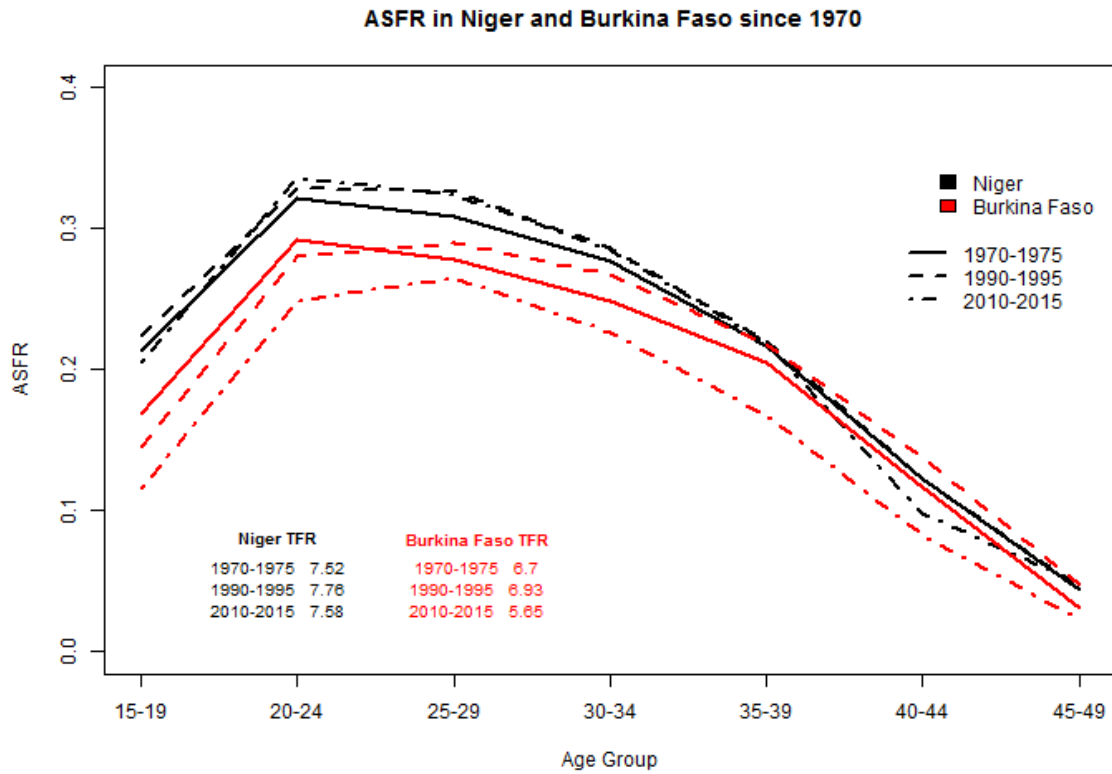
While no DHS surveys are available for Iran, the Ministry of Health and Medical Education conducted annual knowledge, attitudes, and practice (KAP) surveys from 1992 through 1997 (Aghajanian & Merhyar, 1999). In 1992, 45 percent of married women (age 15-49) currently used a modern form of contraception; by 1997 the rate had reached 55 percent. At the time of Tajikistan's 2012 DHS Survey, just under 26 percent of married women were using a modern form of contraception (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013).

Given the observed fertility declines of three births per woman in Iran and 1.35 births per woman in Uzbekistan in the space of just a decade, along with Bongaarts' and coauthors' (Bongaarts et al., 2012) assessment that family planning programs can reduce fertility by 1.5 births per woman, it seems plausible that even an imperfectly implemented, though well-resourced, family planning program could reduce Tajikistan's current TFR of 3.85, still well above replacement, by up to one birth per woman. In the next section, I describe how the UN Population Division calculates its high and low fertility variants and their implications for population projections. But first let us turn to the case of Niger.

## **ii. Model Family Planning Programs Relevant to Niger**

With the lowest Human Development Index in the world (.337), Niger has not yet begun its fertility transition. But there are similar countries which have succeeded in lowering their fertility rates despite comparable levels of development. Like Niger, the two examined here are land-locked, highly rural, and comprised of diverse ethnic groups including a substantial proportion of pastoralists. They are its neighbor, Burkina Faso (HDI = .388), and an East African counterpart, Ethiopia (HDI = .435). Figure 2.3 compares age-specific fertility trends across Niger and each of the former over twenty year intervals starting in 1970.

Figure 2.3: Fertility Trends in Niger, Burkina Faso, and Ethiopia since 1970



Like Niger, the majority of the Burkinabe population is settled agriculturalists but both countries have substantial (semi-)nomadic minorities, most prominently the Fulani ethnic group. The two also share a French Colonialist history and legacy; both became independent from France in 1960. In the early 1970s, Niger's total fertility rate, at 7.5 was already higher than Burkina Faso's 6.7 although the two trace a similar age pattern. Notably, both countries had posted a slight *increase* in fertility by the early 1990s, likely due to public health gains. The two trends diverge, however, over the second twenty-year period and most of Burkina's subsequent fertility decline has occurred since the year 2000.<sup>23</sup> Its current fertility rate has fallen by more than 1.5 births per woman, on average, since its peak in the early 1980s<sup>24</sup> to reach an average of 5.6 today. Burkina Faso is still very much a high fertility country, but there is ample evidence that its transition is underway.

Burkina Faso's most recent DHS Survey was conducted in 2010. In that year, 15 percent of married women were found to currently be using a modern form of contraception, up from five percent observed in the 1998-99 DHS Survey (Institut National de la Statistique et de la Demographie (INSD) & ICF International, 2012; Institut National de la Statistique et de la Demographie (INSD) & Macro International Inc., 2000). In rural areas, usage rates more than quadrupled, from 2.6 to 11 percent. A recent report from the London School of Hygiene and Tropical Medicine explains that, in the last decade, the government of Burkina Faso has recruited and trained a large number of *accoucheuses auxiliaires* (auxiliary birth attendants) for deployment to its 1,495 rural primary care centers (Daniele, 2014). The total number of midwives in the country has also almost doubled since 2008 but nearly all midwives live in cities and there are still more than twice as many *accoucheuses auxiliaires* (Daniele, 2014). Midwives, *accoucheuses auxiliaires*, and community health workers are all authorized to administer barrier and oral contraceptives. Midwives can additionally administer injectibles and, in practice, *accoucheuses auxiliaires* do as well, though community health workers do not (Daniele, 2014). The growth of rural reproductive health infrastructure may explain much of Burkina's recent fertility decline, but for one inconvenient fact: contraceptive usage rates are nearly identical in Niger. Among married women, 12 percent used a modern form of contraception in 2012, including just under 10 percent of rural married women<sup>25</sup> (ICF International & Niger National Institute of Statistics, 2013).

The salient difference between these two cases, then, appears to be in levels of demand for children and in the resulting details of contraceptive usage in practice. Wanted fertility in Burkina Faso was measured at 5.8 children in 1993 and 5.4 in 2010 (ICF International, 2012). In Niger, wanted fertility has actually risen over the same period, from 6.8 in 1992 to 7.4 in 2012 (ICF International, 2012).

In a study examining why the strong negative correlation between contraceptive usage rates and fertility rates observed in many countries is not as discernible in sub-Saharan Africa (even when the type of contraceptive used is limited to a modern method), Westoff and Bankole (2001) explored various hypotheses to explain the outlier region. Data for their study was drawn from 59 DHS surveys conducted between 1985 and 1998. Little to no more of the association was

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<sup>23</sup> The UN estimates Burkina Faso's TFR at 6.7 in 1995-2000, 6.4 in 2000-2005, and 6.0 in 2005-2010.

<sup>24</sup> TFR = 7.17 for 1980-1985

<sup>25</sup> As in Burkina Faso, this proportion had also increased from 4.6 percent of all married women in 1998 (Attama, Seroussi, Kourgueni, Koche, & Barrere, 1999)



explained when restricting observations to married women, when accounting for longer postpartum insusceptibility, when distinguishing between spacing and limiting behavior, or even when substituting a measure of the total demand for family planning for the prevalence of contraceptive usage (Westoff & Bankole, 2001). They conclude that the difference must be attributable to the fact that most sub-Saharan African countries were at the beginning of their fertility transition while comparison countries in Asia and Latin America were much further advanced in their demographic transition. By comparing the within-region correlation over multiple survey periods, they find an increasing trend which suggests that the relationship in this region may converge to that found in other parts of the world in the future:

At the beginning of the transition, there is little variation in fertility or contraceptive prevalence and thus limited association between the two variables. As the transition develops, the variation of both measures and their covariance increases leading to higher correlations. Support for this interpretation comes from the low correlation between fertility and contraceptive prevalence in the subset of regions of countries in Asia and Latin America still in the early stage of their transition.<sup>26</sup>

In Burkina, reasonably high levels of demand for contraceptive services were already observed over two decades ago in the 1993 DHS Survey. In 1998-99, unmet need was recorded among 26 percent of married women and total demand for family planning services increased only slightly in the following decade, from 38 to 40 percent of married women in 2010 (Institut National de la Statistique et de la Demographie (INSD) & ICF International, 2012; Institut National de la Statistique et de la Demographie (INSD) & Macro International Inc., 2000). Demand is considered to be met when women employ traditional as well as modern contraceptive methods, explaining why unmet need is largely static despite the dramatic uptick in modern method usage.

DHS surveys fielded prior to 2012 employ an outdated methodology to calculate unmet need for family planning, so direct comparisons to figures produced with the new approach, including those from Niger, must be interpreted cautiously. However, the new methodology yields estimates which are slightly higher than did its predecessor which, in this case, implies a conservative estimate of the difference between these two countries (Bradley et al., 2012). In Niger, as noted above, unmet need was found among just 16 percent of married women, contributing to a combined (met and unmet) demand for contraception among 30 percent of them (ICF International & Niger National Institute of Statistics, 2013). Niger also had a previous DHS Survey in 1998 (and another in 2006). In 1998, with the old methodology, unmet need was recorded among 17 percent of married women and a total of 25 percent of married women indicated (met or unmet) demand for contraceptive services, about two thirds of the levels observed in Burkina Faso (Attama, Seroussi, Kourgueni, Koche, & Barrere, 1999).

Ethiopia's TFR has declined much more starkly than Burkina's, from 7.1 in the early 1970s to 4.6 today (UN Population Division, Department of Economic and Social Affairs, 2015). As in Burkina, most of that change has transpired in the past decade. In the late 1990s, the Ethiopian TFR stood at 6.8 (rounded down) births per woman. In just a decade, it fell by over 1.5 children to 5.3 (rounded up).<sup>27</sup> Wanted fertility declined even more drastically, from

Though family planning services in Ethiopia began in 1966 with a local affiliate of the International Planned Parenthood Federation, they were not widely available until much later

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<sup>26</sup> Source: Westoff and Bankole (2001, p. vii)

<sup>27</sup> Author's calculations based on UN Population Division Department of Economic and Social Affairs (2015)

(USAID, 2011). The Government of Ethiopia mounted a robust family planning program in the 1990s, with substantial attention to community outreach, and contraceptive usage increased ninefold between 1990 and 2011 (Olson & Piller, 2013). The 2002 Health Sector Development Program II prioritized family planning services, introducing a Health Extension Package which targeted village women in their households (USAID, 2011). Massive government investments in both clinical infrastructure and paid Health Extension Workers (HEW) dramatically expanded access to contraceptive services (USAID, 2011). Much credit for the doubling of contraceptive prevalence between 2005 and 2011 is given to the extension worker system, which recruits and trains women to be based in health posts in their own communities. HEWs spend just two days per week at the post and the remaining three in the community, conducting household visits (with a ratio of approximately 500 households per HEW) (USAID, 2011). A primary objective of those visits is to address misconceptions about family planning services as a community insider and to provide a variety of short-acting methods.

In the year 2000, demand for family planning services was found among 45 percent of married Ethiopian women and almost all of this demand was unfulfilled (unfortunately, no earlier DHS surveys are available). By the 2011 DHS, demand itself had increased to 58 percent and half was met (USAID, 2011). This suggests that levels of demand can be successfully increased over a relatively short period of time with adequate attention to community outreach.

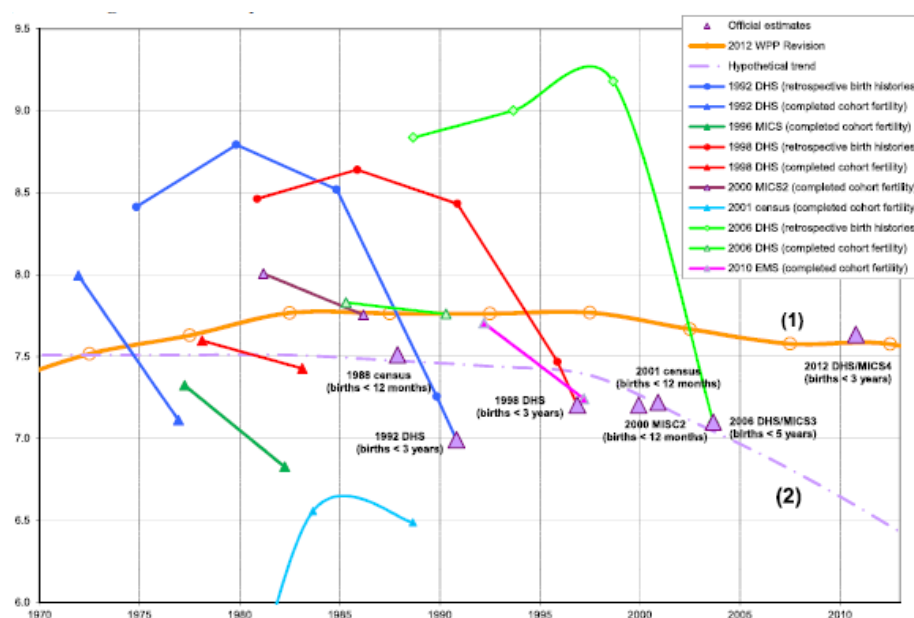
As with the case of Tajikistan and its neighbors, it seems plausible that Niger could be nudged to follow a trajectory similar to that observed in Burkina Faso or in Ethiopia if demand for smaller families could successfully take root. How similar are the pathways implied by this indirect approach to estimating Tajikistan's and Niger's potential fertility declines to the fertility variants produced by the United Nations?

## V. How precise are UN fertility and population growth projections for Tajikistan and Niger?

The 2012 World Population Prospects (WPP), produced by the UN Population Division, represents the twenty-third round of global population estimates since 1951. It is also the first year in which probabilistic methods have been introduced for both fertility and mortality projections (UN Population Division, Department of Economic and Social Affairs, 2014). The exercise generates eight variants of population growth through the year 2100 for 233 countries or areas, the medium version of which is calculated as the median of several thousand projected country-level trajectories of fertility and mortality trends with additional adjustments for international migration.

In less developed countries lacking robust vital registration systems, data is drawn from a variety of sources and analyzed for consistency. Fertility estimates for Niger are furnished in the methodological documentation as an illustrative example. Figure 2.4, produced by the Population Division, depicts fertility levels reflected in a range of sources between 1970 and 2012. The thick orange line represents the 2012 trend revision.

**Figure 2.4: Niger Total Fertility Rate Estimates from Various Data Sources, 1970-2012<sup>28</sup>**



Population growth is also determined by mortality and migration regimes. Under-five mortality in the WPP is estimated following the analytical approach of the UN Inter-Agency Group for Child Mortality Estimation, which similarly fits a robust trend to multiple data sources (Hill, You, Inoue, Oestergaard, & Technical Advisory Group of the United Nations Inter-agency Group for Child Mortality Estimation, 2012).<sup>29</sup> Adult mortality is estimated idiosyncratically by country depending on data availability and quality and expert determination of the most

<sup>28</sup> Source: UN Population Division, Department of Economic and Social Affairs (2014, p. 5)

<sup>29</sup> See also [www.childmortality.org](http://www.childmortality.org)

appropriate method, including model-based, direct, and indirect approaches.<sup>30</sup> See UN Population Division (2014) for further details. Migration data drawn from various sources were similarly assembled and the methodology attempts to account for undocumented migrants as well as stocks and flows of refugee populations. The relative paucity of international migration data is nonetheless identified as a factor limiting estimate precision (UN Population Division, Department of Economic and Social Affairs, 2014, p. 12).

Fertility, mortality, and migration rates are then integrated into a cohort-component projection framework and first used to produce an estimated baseline population, in this case for July 1, 2010. A number of validity and consistency checks are employed, particularly where reliable census data for multiple periods are available (in some cases, such checks led to revisions of the baseline populations themselves). Additional measures are taken once country data is aggregated by region to identify and potentially reassess any regional outliers as well as to ensure that total net international migration sums to zero.

The baseline population is then projected forward to generate age<sup>31</sup>- and sex-specific population counts for each year between 2010 and 2100.<sup>32</sup> Eight different variants are produced, five of which vary only in their fertility components (high, medium, low, constant, and immediate replacement<sup>33</sup>), relying on the same mortality and migration assumptions. The remaining three variants are prepared to reflect scenarios of constant mortality, zero migration, and “no change.” The methodological approaches to the projection of mortality and migration rates are well-documented elsewhere and not discussed here.

The medium fertility variant corresponds to the median of 60,000 projected country trajectories using the stochastic model first introduced in the WPP 2010 Revision (see Alkema et al., 2011). In previous WPP revisions, it was assumed that all countries with above replacement fertility would approach a fertility floor of 1.85 children per woman regardless of current observed levels. The transition was then modeled with a double-logistic function which was informed by six deterministic parameters.

Since 2010, the probabilistic process has consisted of two steps (UN Population Division, Department of Economic and Social Affairs, 2014). The first decomposes the sequence of change from high to low fertility into a systematic decline and random distortion terms. The pace of decline is modeled as a function of observed or estimated starting levels. A Bayesian hierarchical model estimates country-specific distributions of parameters for the double-logistic decline. It is hierarchical because a second level of world experience from all country information also informs country-specific parameter distributions. The approach better accounts for the historical experiences of individual countries as well as the higher degrees of uncertainty for countries in earlier stages of their fertility transitions.

The second step of the model deals with countries once they have reached low fertility. For these countries, a time series model which assumes that, over the long term, fertility will approach and

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<sup>30</sup> Recent adult mortality rates were unavailable for over a billion people (only 106 of the 201 published countries had data from 2005 or later), constituting the most significant weakness in the construction of 2010 baseline populations.

<sup>31</sup> In five-year age groups. Interpolation is subsequently used to produce estimates by single year of age.

<sup>32</sup> Projections are produced for five year intervals and subsequent interpolation techniques produce annual estimates.

<sup>33</sup> In which fertility rates may vary slightly but the net reproduction rate is set to always equal 1.

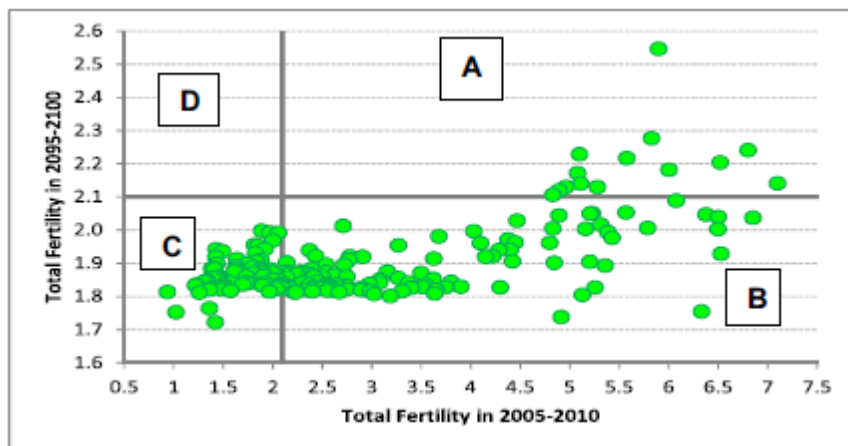
fluctuate around a country-specific low level also determined by a Bayesian hierarchical model to draw from the experience of countries which have recently experienced fertility increases from a sub-replacement level. This is a departure from the 2010 Revision, which assumed a long-term replacement level of 2.1 children per woman globally.

In the high and low fertility variants, total fertility is projected to reach a level of .5 births above or below the medium variant by the 2020-2025 period and to remain at that margin for the remainder of the projection. Particularly in high fertility countries, these high and low variants may fall within a narrow range of the full probabilistic prediction interval (see Gerland et al., 2014), which often implies a higher degree of uncertainty than reflected by the 2012 Revision’s preferred one-birth range. More recently published probability-derived ranges are discussed below.

The age pattern of fertility is also modeled by interpolating linearly between a starting proportionate age pattern and a target model pattern. Age-specific fertility rates are produced by applying the projected TFR to these age patterns which, in practice, reflect a mean age at childbirth which shifts from 24 to 28.5 in medium to high fertility countries (UN Population Division, Department of Economic and Social Affairs, 2014).

Figure 2.5 depicts the relationship between 2005-2010 fertility levels and the median projection for 2095-2100 across all countries. Only 15 countries with fertility above 2.1 in the former period are project to have fertility remaining at that level by the end of the century (quadrant A). At 2.5 in the medium variant, Niger is among them.

**Figure 2.5: The Relationship Between Fertility in 2005-2010 and 2095-2100 based on the Medium Variant<sup>34</sup>**

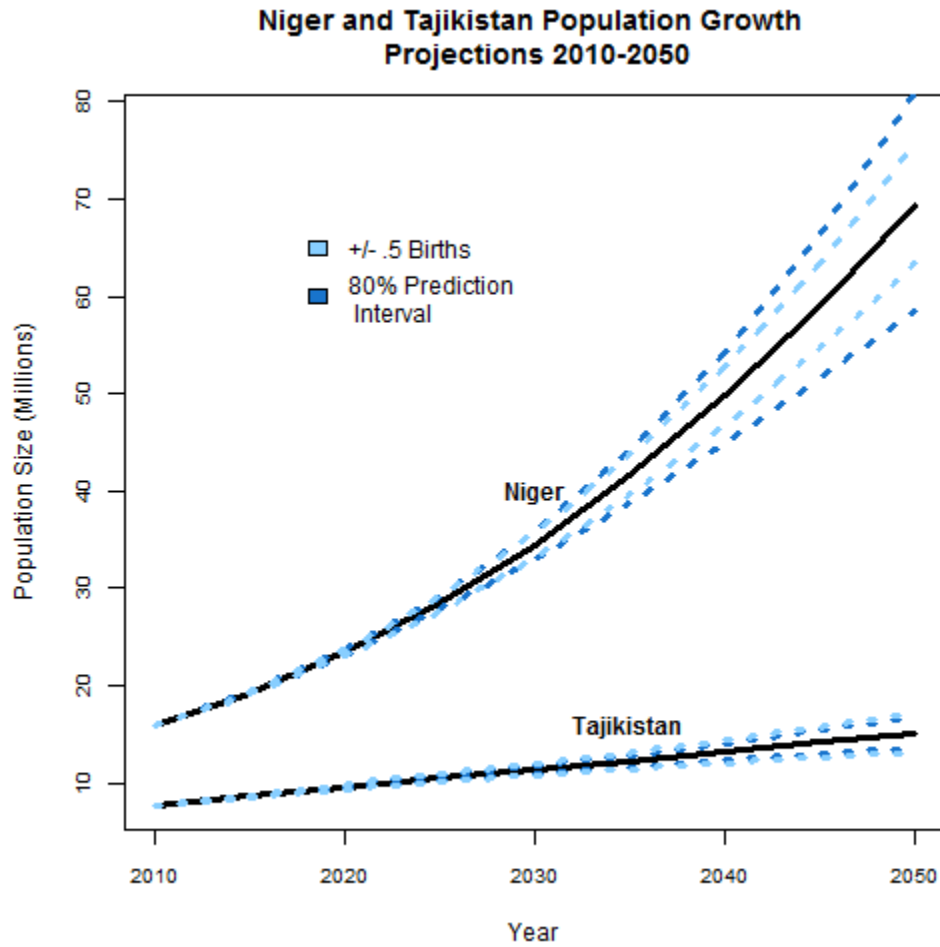


In 2014, a *Science* article highlighting the probabilistic fertility and population projections based on the same data ignited a debate around the potential for global population stabilization this century (or at least brought it into the mainstream) (Gerland et al., 2014; KC & Lutz, n.d.; Kunzig, 2014). A previously published article describing the probabilistic methodology notes that standard UN high and low fertility variants greatly understate uncertainty for high fertility countries while overstating it for medium to low fertility countries (Raftery, Li, Ševčíková, Gerland, & Heilig, 2012). This generalized finding is borne out in the comparative case studies at

<sup>34</sup> Source: UN Population Division, Department of Economic and Social Affairs (2014, p. 24)

hand. Figure 2.6 depicts the range of population projections for Tajikistan and Niger from both the +/- .5 births approach of the 2012 Revision and subsequent probabilistic ranges.

**Figure 2.6: Population Projections for Tajikistan and Niger through 2050**



The 2012 high and low ranges reflecting +/- .5 births per woman are plotted in light blue while the probabilistic ranges encompassing 80 percent of the prediction interval are dark blue. In Tajikistan, a medium fertility country, the two ranges are very similar but the +/- .5 births range of potential outcomes is somewhat wider than the probabilistic range. In Niger, the two diverge radically and the probabilistic approach yields a much higher range of uncertainty than the +/- .5 births approach.

The next two figures show the magnitudes of difference between the medium and the two low variants for each country through the end of the century. In Tajikistan, the implied difference in population size ranges from 1.5 to 1.9 million people by 2050, or a 10 to 13 percent reduction from the medium projection variant of 15.1 million. By 2070, the low estimates are 18 to 22 percent smaller than the medium variant.

Figure 2.7: Medium and Low Population Projections for Tajikistan

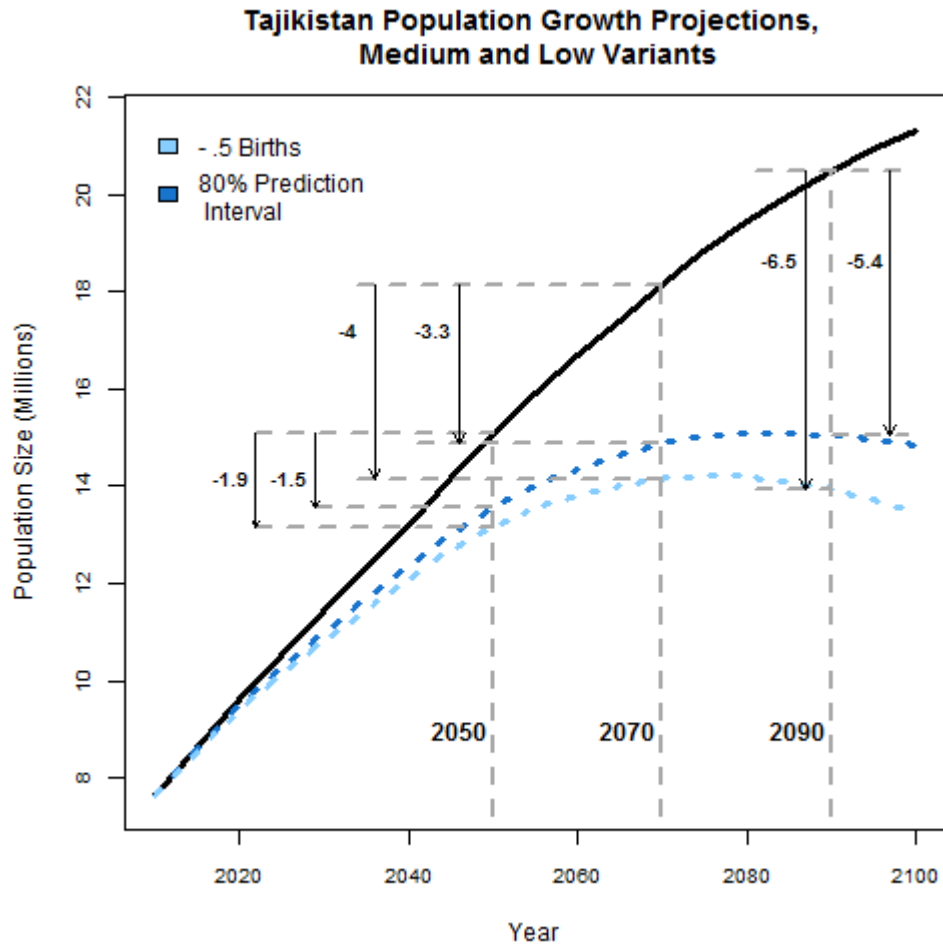
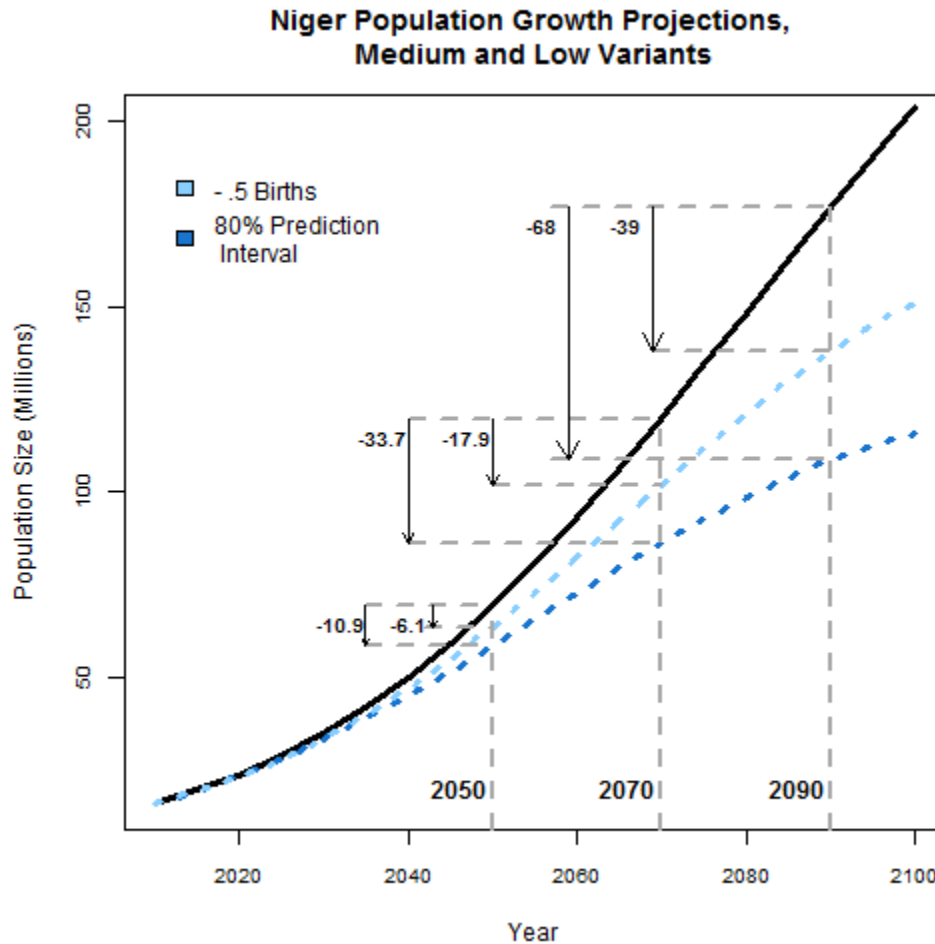


Figure 2.8: Medium and Low Population Projections for Niger



In Niger, both absolute and proportional differences are starker. In 2050, the low fertility estimates generate populations which are 9 to 16 percent smaller than the medium variant, a potential difference of nearly 11 million people. By 2070 the difference grows to between 15 and 28 percent, or up to 34 million people. While there is inherent uncertainty around these estimates, they furnish the grounds for a useful thought exercise and point of departure.

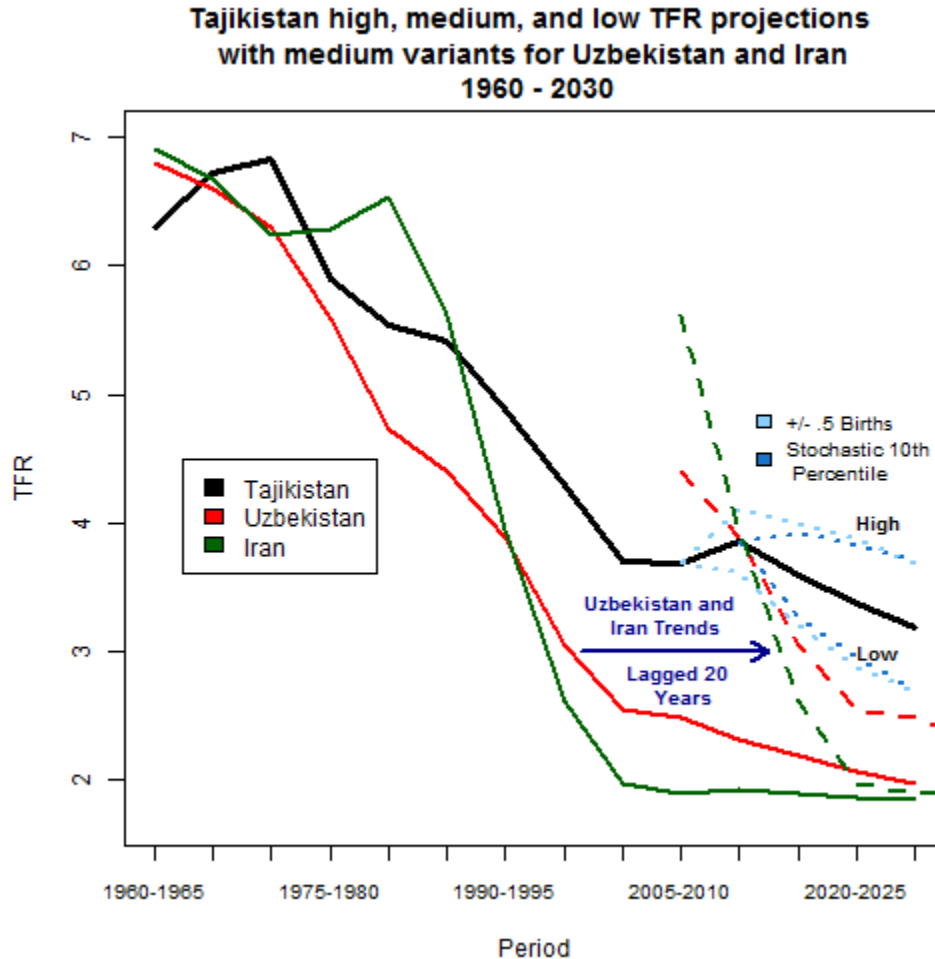
**VI. How consistent are the UN’s low fertility variants with the fertility declines implied by indirect estimation approaches associated with successful family planning programs?**

Might either or both of the two UN low fertility variants constitute suitable representations of growth scenarios in the presence of robust family planning programs? Figure 2.9 compares historical and projected total fertility rates across Tajikistan, Uzbekistan, and Iran from 1960 through 2050. Solid lines represent the medium fertility variants for each country; high and low estimates are illustrated only for Tajikistan. While all three countries were already well underway with fertility transitions by the 1980s, Tajikistan’s rate of decline slowed in the 1990s and ultimately stalled in the 2000s. Its 2010 TFR is slightly up from the previous decade.



Meanwhile, Uzbekistan and Iran both continued their transitions at accelerating rates in the late 1990s before slowing down in the 2000s.

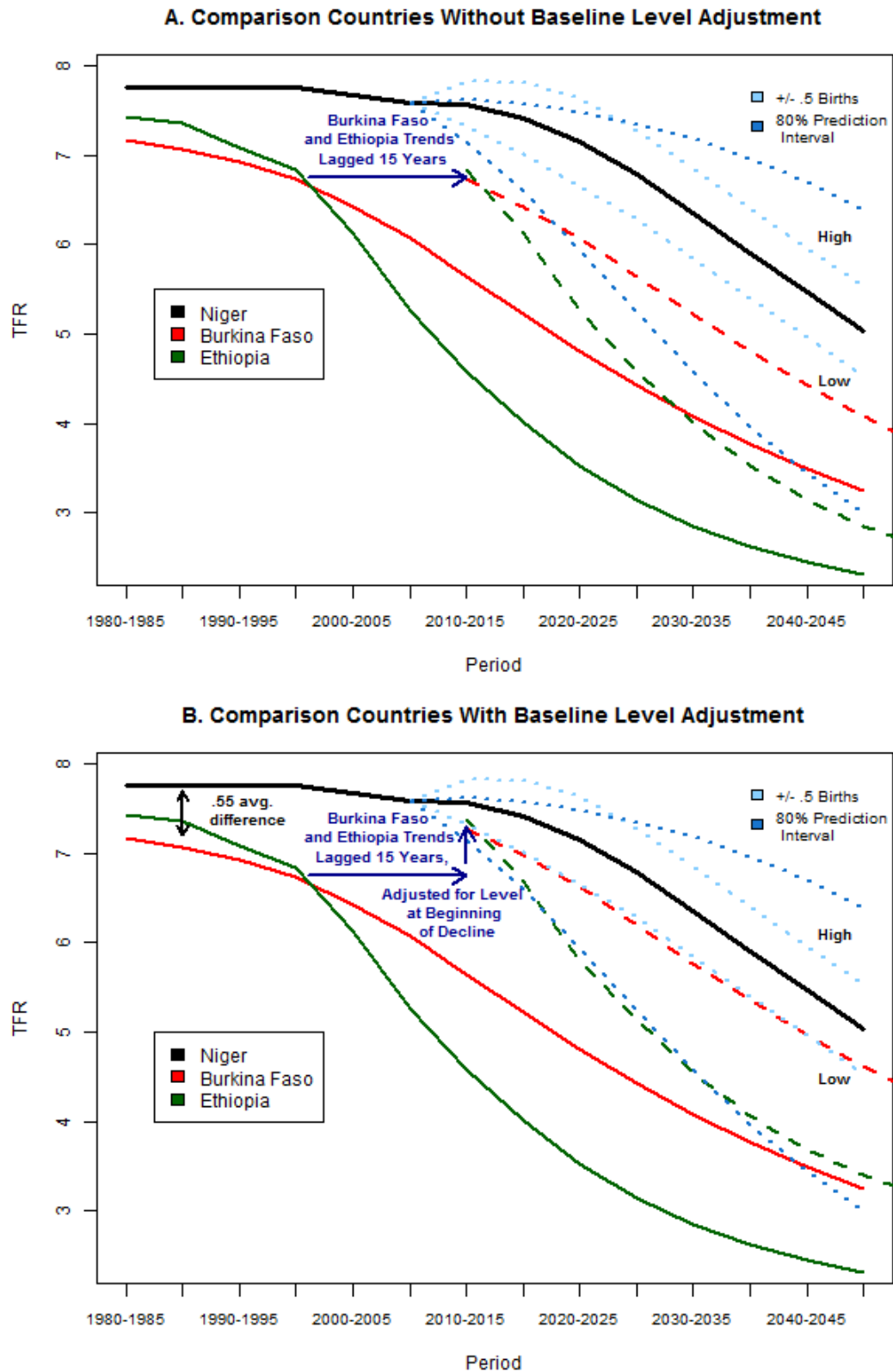
**Figure 2.9: TFR Trends and Projections in Tajikistan, Compared to Observed Declines in Uzbekistan and Iran**



The red and green dashed lines represent a 20 year lag in the fertility declines of Uzbekistan and Iran, respectively. Comparing those trends with the low fertility variants generated by the UN, it is apparent that UN low fertility estimates constitute a more conservative trajectory of fertility decline than that implied by the indirect approach of transposing trends from similar countries. It seems plausible that, given the right mixture of programming initiatives, Tajik fertility could decline at least as quickly as the UN suggests.

Figure 2.10 undertakes a similar exercise for Niger, Burkina Faso, and Ethiopia. Fertility levels in the latter two were never observed to be as high as in Niger, although they were close, so a vertical as well as a temporal adjustment of trends is examined. The figures show a clear acceleration of the fertility decline in Ethiopia in the late 1990s coinciding with the government's ratcheted up commitment to family planning programs.

Figure 2.10: TFR Trends and Projections in Niger, Compared to Observed Declines in Burkina Faso and Ethiopia



In Burkina Faso, the decline is continuous but gentler. This figure depicts a very wide range of potential fertility trajectories for Niger, with the probabilistic high and low variants encompassing a broader set of possible outcomes than the conventional high and low variants. What is striking in this figure is that the slopes of the probabilistic and conventional low fertility variants correspond astoundingly well to those of the recently observed fertility experiences of Ethiopia and Burkina, respectively. As above, this suggests that the UN-generated low fertility variants both constitute realistic potential fertility pathways to represent the influence of a hypothetical family planning program in Niger. In Niger, the case is complicated somewhat by the persistence of high wanted fertility, but we have seen that the desire for large families has proven itself quite malleable in very similar contexts.

Accepting these two low fertility pathways as a plausible, and in the case of Tajikistan perhaps a conservative, range to represent the potential influence of family planning programs, Chapter 3 discusses cost implications from a public policy perspective. It quantifies the implied investment commitments in a) high quality family planning programs and b) food security-oriented social safety net programs in each country through the year 2050 under two population growth regimes: 1) the 2012 World Population Prospects' medium fertility variant (no augmented family planning investment assumed) and 2) the probabilistic low fertility variant (the 10<sup>th</sup> percentile of 60,000 stochastic forecasts undertaken for each country). A financial case is made for the incorporation of family planning programs within social safety net programs which cleave to food security mandates by comparing a) the present value of savings accrued to safety net program due to slower growth and b) the present value of plausible contraceptive commodity costs required for robust family planning investments over the same period to reduce fertility.

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## Chapter 3: Adding It Up

### Comparative Costs of Food Security-Focused Social Safety Net Programs with and without Comprehensive Family Planning Interventions

#### I. Introduction

This chapter estimates the present discount value of social safety net programming costs which are designed to improve food security over a period of twenty-five to forty years. The former costs are then contrasted with potential investment streams in voluntary family planning services over the same period. The findings presented here are illustrative rather than predictive as they are subject to great measurement error; caution should therefore be exercised in their interpretation. They nonetheless provide a useful starting point for discussion. The furnished estimates do not constitute a cost-benefit analysis as they do not strive to incorporate any comprehensive metric of impact within or beyond the domains of either food security or family planning. There are potentially many additional benefits to successfully implemented social safety net and family planning programs alike which are difficult to quantify and are not modeled at all in this exercise. For social safety net programs, such benefits may include improved trust in state institutions; reduced anxiety about the future which may in turn lead to improved savings and investment behavior; improved resilience to (cyclical and non-cyclical) correlated shocks, as well as to idiosyncratic shocks, via reduced asset depletion and less harmful coping mechanisms; improved community-level social capital; improved agency, decision-making, and bargaining power of women; more equitable female labor force participation (particularly through public employment schemes); and improved political and social stability. For family planning programs, benefits beyond the cost savings accrued to safety net budgetary commitments include greater women's autonomy in health-seeking behavior; improved linkages between rural populations and healthcare facilities; reduced childcare burdens which may facilitate women's formal and informal labor supply; improved infant and young child nutrition and caretaking practices; and subsequent intergenerational gains in cognitive ability, human capital formation, and productive labor. There is also evidence that family planning programs have been successful in driving down trends in maternal mortality (Ahmed, Li, Liu, & Tsui, 2012). These diffuse effects were discussed in somewhat greater depth in Chapter 2.

Chapter 2 documents the current investment footprint of food security programming in Tajikistan and Niger with attention to both USAID initiatives (primarily Feed the Future and Food for Peace) and to nascent social safety net programs supported by the World Bank, both of which aspire to national scale-up. This chapter estimates the present values of the stream of transfer benefits associated with those safety net programs under the different population growth scenarios described in Chapter 2. While it is plausible that fertility decline may itself spur growth and quell poverty at the household level, dynamic poverty trends are not explored in this exercise. Rather, constant proportional targeting of the population is assumed over the periods in question; this assumption is further justified below.

The chapter then proceeds to estimate a parallel costing stream for robust family planning program investments in each country. Throughout these stylized exercises, age-specific mortality rates, including infant mortality, are kept constant. This approach is consistent with the UN 2012 WPP methodology, despite evidence linking reduced fertility with increased early childhood

survival (i.e. Bongaarts (1987), see Chapter 4). In both the safety net and family planning intervention budgetary analyses, the sensitivity of results to the selection of an intertemporal discount rate is explored.

The chapter closes with a comparison of safety net and family planning costs under different population growth scenarios and a discussion of the many simplifying assumptions which likely exert a collective downward bias on effect sizes. The structure of Chapter 5 thus proceeds to address the following questions in turn:

- II. How much do safety net programs cost under different population growth trajectories, assuming constant per capita transfer levels and proportional targeting?
  - A. Benefit Levels in Theory
  - B. Design Parallels Across Safety Net and Family Planning Programs
  - C. The Safety Net Program in Tajikistan
  - D. The Safety Net Program in Niger
  - E. Methodology
  - F. Results
- III. How much would effective family planning programs cost under the stochastic low fertility population forecasts in each country?
  - A. Contraceptive Costs by Method
  - B. Methodology
  - C. Results
- IV. How do safety net and family planning programming costs compare over the two projection periods?
- V. Additional Considerations
- VI. Tax Implications
- VII. Conclusion

## **II. How much do food security/safety net programs cost under different population growth trajectories assuming constant per capita transfer levels and proportional targeting?**

In their comprehensive volume, *For Protection and Promotion*, Grosh et al. (2008) provide a rich discussion of factors to consider when setting benefit levels within a safety net program. They emphasize that benefits should be set below any level which disincentivizes labor supply. In practice, they advise that social assistance payments should fall below unemployment insurance and minimum pension levels, that targeting mechanisms should not be directly tied to earnings, and that exit thresholds should be set higher than entry thresholds, potentially with a sliding scale of benefit levels and/or a lump sum graduation payout to cover transition costs and to promote more than temporary independence from the program. The authors discuss the potential of public transfers to crowd out private ones but find empirically, across a number of national contexts with significantly divergent benefit levels, that crowding out is not a significant policy concern (Grosh, 2008, p. 39).

There is of course a plausible causal pathway linking public transfer benefits with fertility outcomes, but it is one that could potentially exert either positive or negative effects. If underlying fertility preferences are high, a relaxed budget constraint and the security-inducing insurance function of social protection transfers may result in increased levels of fertility. However, transfers, and particularly those with some set of conditionalities, may also reduce fertility through a number of mechanisms, including a) by providing women (and men) with access to employment and other market opportunities (e.g. access to skills training, credit, and/or other income generating inputs) which increase the value of their time outside the home (a first generation effect) and b) by promoting or requiring girls' schooling which increases their subsequent earnings potential, and the opportunity cost of child rearing, while simultaneously delaying their average age at first marriage (second generation effects). Empirically, there is little evidence of effect sizes of meaningful magnitudes in either direction. As reviewed in Grosh et al. (2008),<sup>1</sup> a minimal positive effect on fertility is observed in OECD countries (a 25 percent benefit increase would result in a fertility uptick on the order of .07 children per woman). Small positive effects are also found in Honduras, none are observed in Nicaragua, and in Turkey a small negative effect is identified (the CCT program reduced fertility by two to three percent). It is possible to design a program with a per-household rather than a per-capita benefit level in seeking to eliminate any fertility incentives, but this design feature is likely to disadvantage poorer, larger households and potentially also to systematically discriminate against ethnic, religious, or racial subgroups (Grosh, 2008).

### **A. Benefit Levels in Theory**

The selection of an appropriate benefit level for a particular program is informed by a sound understanding of both the targeted beneficiaries and the intended pathways of those beneficiaries to eventually achieve independence from the program (if graduation is an objective). Grosh and coauthors explain:

The benefit level should be consistent with program theory, that is, the stylized model of how policy makers think the program's output will affect the outcomes they are trying to influence. A benefit level compatible with program theory will be the smallest transfer necessary to achieve the

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<sup>1</sup> See Gauthier and Hatzius (1997), Stecklov et al. (Stecklov, Winters, Todd, & Regalia, 2006), and Bollen et al. (2006) for additional details.

desired impact on intended outcomes (consumption, income, earnings, school enrollment, or use of nutritional or health services) (Grosh, 2008, p. 128).<sup>2</sup>

In the face of government and/or donor budgetary limitations, it is generally sounder in principle to provide a fuller benefit to a subset of the poor than to offer a smaller benefit to a broader swathe of the population. Targeting should begin with the most needy as the marginal value of a transfer is higher for the least well off.

A strong potential perverse incentive emerges when international financial institutions or bilateral donors contribute to safety net programs in that they are often tasked with demonstrating poverty reduction (as are national governments). The most widely understood metric of poverty is the proportion of a population living below a given poverty line, whether it be the nationally defined poverty line or an internationally standardized adjustment of purchasing power. To achieve the greatest impact on the proportion of a population living in poverty, a program may seek to target those prospective beneficiaries who are only marginally below the given threshold, the least rather than the most in need among the potential target group. Sound theory dictates the opposite approach and this potentially misaligned incentive must be squarely addressed. Relying on a “depth of poverty” metric to gauge impact circumvents this problem, though it has the disadvantage of being less well understood by a broad policy audience.

Program budgetary limitations generally do require a trade-off between eligibility thresholds/inclusiveness and the level and duration of benefits. Grosh et al. (2008) furnish a case study of Peru, arguing that if 16 percent of the total population is poor but full coverage at an appropriate transfer level would cost four percent of GDP while the available resources sum to just one percent of GDP, the targeted population should be constrained to the quarter of the poor with the greatest need without diluting the per capita or per household benefit level. Eligibility may be further restricted by a household’s dependency ratio (or a simple count of children or elderly), by housing condition (or other non-income or consumption-based welfare metrics), or other criteria depending on the program design and intent.

Budget constraints often make for hard trade-offs between coverage and benefit level. Programs with benefits that are too small will have little impact on beneficiaries and administrative costs will be high relative to the level of benefits. Programs with high benefits will have a larger impact on recipient households, but will have a higher fiscal burden, require more care in relation to design and targeting, and may induce greater work disincentives. In general in developing countries, programs with benefits that are too low are more frequent than programs with benefits that are too high (Grosh, 2008, p. 127).

But even with an appreciation of the fact that insufficient benefits are likely to render a program ineffective, how is the ideal benefit level determined? In an early assessment of the safety net project in Niger, described in detail below, the Bank recommends a transfer level of approximately 15 percent of the rural poverty line (Social Protection Unit, Human Development Department, & Africa Region, 2011).

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<sup>2</sup> The trade-offs between cash and in-kind transfers to promote food security are not considered at length here but merit serious consideration. See Hoddinott et al. (2014) and Grosh (2008, p. 130) for useful discussions.

In Nicaragua and Mexico, CCT program benefits are equivalent to between 15 and 25 percent of household income while in Honduras benefits amount to about 4 percent of annual household expenditures (Grosh, 2008).

Few safety net programs attempt to top up the consumption of their beneficiaries to the poverty line. Many programs provide benefits to bring beneficiaries up to a fraction of the poverty line or to some arbitrary level lower than the poverty line, but the utility of this approach is limited. Extremely low benefits do not protect beneficiaries from poverty – that is, they are not cost-effective – and may not justify their administrative costs – that is, they are inefficient. Peru used such a model in 2004, covering a large fraction of the population with a food-based transfer with low transfers per beneficiary unit. Lindert, Skoufias, and Shapiro (2006), in their review of the redistributive power of social protection programs in Latin America, characterized the Peruvian safety net model as “giving peanuts to the masses.” Not surprisingly, country-specific studies summarized in World Bank (2007) find that such programs have had almost no impact on extreme poverty or nutritional status” (Grosh, 2008, p. 131).

In Ethiopia’s Productive Safety Net Program, the labor market in some areas is so thin that it is difficult to select a wage rate that is both below the prevailing wage and also delivers sufficient consumptive value. The benefit package is therefore designed to fill the food gap during the three months of the hunger season. A disadvantage of this approach is that the wage may be too high to induce adequate self-targeting, so the number of permitted work days per person is capped at five per month (Grosh, 2008, p. 130).

Consideration must also be taken in the selection of a flat versus a variable benefit formula, e.g. as described above when household age composition is (at least in part) deterministic of benefit levels. Other formula variables may include poverty level, other demographic characteristics (such as gender balance or the number of school-age children), local cost of living, or regional variance in exposure to shocks.

The appropriate duration of benefit eligibility is not straightforward and must follow from sound theory around the deficit to be offset or the risk to be insulated against. Seasonal benefits may track the lean or hunger season while educational benefits may track calendar months or years of schooling. Programs designed to alleviate general poverty and/or chronic food insecurity may require recertification at some interval which balances the operational burden of frequent recertification with the mandate to reach the most vulnerable while minimizing leakage. In the case of Tajikistan, described in detail below, the World Bank recommended eligibility recertification at two to three year intervals (World Bank, 2011a).

The benefit determination is further influenced by any conditionalities laid upon it:

Conditional cash transfer (CCT) programs encourage poor beneficiaries to invest in children’s human capital by conditioning the benefit on the use of school, nutrition, and/or health services. The level of benefit will thus reflect two objectives: reducing current poverty among beneficiaries and providing incentives for human capital accumulation. The principles for the first objective are similar to those for last resort programs. For the second objective, the level of benefits is set to compensate households for the opportunity cost of using the services. The total benefit to a household may include a few components. An education grant will compensate households for the opportunity cost of the time children spend in school and not working, plus for the direct costs of schooling. A health and/or nutrition grant will compensate families for the cost of the time they spend taking their children for health checks and/or attending nutritional education events (Grosh, 2008, pp. 128–129).

Some programs with soft or hard conditionalities may simultaneously invest in the supply side infrastructure of coordinated services, particularly health posts, to increase physical access to services, to decrease stock-outs, to reduce wait times, etc.

It may seem self-evident that benefits should be indexed to inflation but in practice that has not always been done. In Brazil's Bolsa Familia program, the nominal benefit was held constant from 2003 until July 2007 despite a 16.7 percent cost of living increase. The benefits were adjusted that month to restore their original value<sup>3</sup> (Grosh, 2008, p. 135).

Benefits may be reported in local currency; in purchase power parity; or as a share of the poverty line, minimum wage, or other social assistance. Grosh et al. recommend measuring benefits relative to the total consumption of beneficiary households as estimated in household surveys (Grosh, 2008, p. 135).

## **B. Design Parallels Across FP and Safety Net Programs**

A note on design and efficiency: like successful family planning programs, Grosh and coauthors emphasize that effective safety net programs require aggressive and creative outreach and social marketing at both the community and the household levels. There is an obvious efficiency gain when household outreach efforts for safety net and reproductive health programs are combined.<sup>4</sup>

With particular relevance to family planning services, Grosh observed the following in 2008:

Experience is emerging with linking transfer programs to other services – voluntary or mandatory – that are designed to help households become independent. This is a promising field for experimentation. Tentative lessons suggest that mandatory links should be limited to cases where the supply of required services is ample, the services will be useful to all, or most transfer recipients already use the services. In a wide range of other cases, voluntary links through information, referrals, one-stop shops, and the like may be applicable (Grosh, 2008, p. 127).

Safety net and (successful) family planning programs both require parallel activity streams which a.) engage beneficiaries at the household level and b.) are organized around central/common points of distribution or service provision. Safety net programs distribute cash or in-kind transfers, often on a monthly basis. They may also distribute supplementary nutrition rations and/or provide other nutrition/food security or livelihoods services, potentially including pre- and post-natal health screenings, breastfeeding education, cooking demonstrations, hygiene training, new crop or fertilizer demonstration plots, value chain/marketing training, access to formal or informal financial services, etc. Family planning programs often link beneficiaries visited in their households to local health centers or clinics or to skilled providers of family planning services (for a family planning program in Zambia which coordinates supply and demand-side interventions, see Ashraf, Field, and Leight (2013)).

In addition to efficiency gains stemming from the overlapping physical and human infrastructure of safety net and family planning programs, there is also the potential for economies of scale in administrative/financial, management/operational, and accountability systems. High quality electronic household registry databases which record, retain, and update detailed socioeconomic,

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<sup>3</sup> This modification presents a compelling research opportunity, any exploitation of which the author is unaware of.

<sup>4</sup> See Grosh (2008) for a useful comparative discussion of survey sweep and application approaches to household registration.



demographic, and health data for beneficiary populations are immensely useful for program management and staffing, targeting, dynamic proxy means testing, community-level transparency, reduced leakage to non-vulnerable groups and greater inclusion of vulnerable groups which may be harder to reach (minimizing different types of targeting errors), performance monitoring, impact evaluation(s), and donor accountability. Due primarily to resource constraints, family planning programs almost never incorporate such registration systems while safety net programs targeting the poor rely on them for eligibility determination.

Given these numerous infrastructural parallels, the costing exercises which follow compare only the values of the transfer benefits themselves in each type of program, i.e. cash transfers for safety net programs (neither of the two case studies supply food commodities or vouchers with limited exchangeability) and contraceptive services for FP programs. The projections do not incorporate per capita cost estimates of fixed infrastructure, management, or staffing. This omission may be particularly problematic if there is an insufficient number of skilled family planning service providers or an inadequate network of healthcare centers. Substantial training costs to build a stock of qualified community health workers may constitute a significant proportion of a FP program's budget, at least in the early years of scale-up. FP program staff are likely more highly skilled than their safety net benefit distribution counterparts who are responsible for managing cash, vouchers, or food commodities.

However, the efficacy of family planning programs may hinge on their ability to spur demand for services, as overall demand is observed to increase over time in countries with successful programs structured around community outreach, i.e. Ethiopia (discussed in Chapter 4). That is, "unmet need" may remain constant or even grow as contraceptive usage rates increase (see Bongaarts (2011) on the influence of family planning programs on wanted fertility levels in sub-Saharan Africa). The results presented here suggest a potential "layering" approach to safety net and family planning program implementation by providing local safety net staff<sup>5</sup> (working in their own communities) with a basic and inexpensive level of FP training, consistent with the Ethiopian model. A relatively low level of training is required to safely distribute contraceptive pills, condoms, diaphragms, etc. at the household level, and to refer women to clinics for the administration of long-acting reversible contraceptives (LARCs), including implants and IUDs. An initial uptick in observable demand for family planning services may also generate greater political will within national governments and, perhaps equally importantly, among donors, to invest in reproductive healthcare infrastructure. An additional simplifying assumption of zero cost recovery from contraceptive service provision is discussed in Section III, below. The incorporation of partial cost recovery over time would of course reduce implementation costs, augmenting the gap between safety net transfer commitments for a population with persistently high fertility and those same (proportional) commitments paired with FP interventions in the context of reduced fertility.

### **C. The Safety Net Program in Tajikistan**

In 2008, social spending (education, health, and social protection) constituted 42 percent of the state budget of Tajikistan and a 2014 report from the World Bank's Independent Evaluation

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<sup>5</sup> One management challenge may be ensuring that women are sufficiently represented among this staff or are targeted exclusively for community-level roles as programs expand.

Group notes that this level, an equivalency of 7.3 percent of GDP, was maintained over the 2010-2014 period (Independent Evaluation Group, 2014).

A 2010/2011 World Bank report, *Tajikistan: Delivering Social Assistance to the Poorest Households* (World Bank, 2011b), concluded that existing social assistance programs were ineffective at reducing poverty. The largest social assistance program was for electricity and gas compensation<sup>6</sup> and the second largest targeted needy families with children in school. The report estimated that, together with a host of much smaller programs, the pre-existing social assistance portfolio lowered the poverty rate by only about .3 percentage points (though, as discussed above, it is worth reflecting on whether lowering the poverty rate is an appropriate indicator of success for programs targeting society's least well off). This lack of performance was primarily due to two factors, namely, that the overall social assistance budget stood at about .2 percent of GDP, the lowest in the region, and that poor targeting led to leakage into non-poor segments of the population. Among the poorest 20 percent of households, social assistance transfers amounted to less than three percent of per capita consumption expenditures (World Bank, 2011a). Additionally, only 23 percent of all social assistance payments reached the poorest quintile of households (while in Armenia, Azerbaijan, and Georgia, among others, over 50 percent of social assistance was allocated to the poorest quintile in 2007-2008) (World Bank, 2011a).

In May 2011, the World Bank appraised a US \$3.2 million project to strengthen Tajikistan's social safety net system between September 1, 2011 and December 31, 2015 (World Bank, 2011a). The national social assistance program is simultaneously supported by the European Union and the Asian Development Bank. The relatively low-investment World Bank project focuses on the discrete tasks of establishing a national registry for social protection (US \$1.4 million), building government capacity at the central and local levels to use the registry (US \$1.2 million), and managing and coordinating the project tasks associated with procurement, reporting, accounting, etc. (US \$.3 million). That is, the value of the transfers themselves, along with the infrastructure necessary to distribute them (and to sensitize the population to program eligibility and benefits), is not covered by the World Bank grant. The Appraisal notes that, in the absence of a functioning, centralized registration system, the Ministry of Finance (MoF) prepares the annual budget for the Electricity and Gas Compensation Program by adjusting the past year's budget rather than by basing it on beneficiary information. "More seriously, the central offices of the MoF cannot analyze how funds disbursed from the Treasury flow to beneficiaries, since there is no central and accurate registry to audit" (World Bank, 2011a, p. 3).

Also in 2011, the GoT launched a pilot of a means-tested consolidated social assistance benefit, with technical assistance from the EU, with US \$2.2 million from the Rapid Social Response (RSR) Multi-donor Trust Fund (P122039) (World Bank, 2011a). The total project cost summed to US \$4.53 million with about US \$1.1 million contributed by the EU and US \$1.2 million provided by the GoT (World Bank, 2015).

The pilot was launched in two districts in January 2011, Yovon and Istravshan, and was operational throughout 2012 to test both the new registry system and the proxy means test

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<sup>6</sup> Energy/utility subsidies are known for leakage into non-poor segments of society. See Grosh CITATION CHAPTER for further discussion.

formula developed by the World Bank in 2010, the aim of which was to target benefits to the poorest 20 percent of households (The World Bank Group, 2015; World Bank, 2011a). The intention of the pilot was to build capacity for a national rollout of the program with improved targeting, as the Government of Tajikistan recently agreed to the replacement of categorical benefits with the consolidated benefit (World Bank, 2012; World Bank Group, 2014b). An evaluation of the pilot also found that the proxy means test targeting formula was more than twice as effective in identifying poor households as the standard program (The World Bank Group, 2015). In 2013, the pilot was expanded from two to 10 districts, followed by the addition of 15 more in July 2014, covering about a third of the country (The World Bank Group, 2015). Recently revised targets reflect the intention to roll out the new Targeted Social Assistance (TSA) program nationally in 2017 (The World Bank Group, 2015).

Tajikistan's poverty rates at the internationally standardized levels of \$1.25 and \$2 per day (PPP) stood at 6.5 and 27.4 percent, respectively, in 2009, the most recent year for which data are available (The World Bank, 2015). While the Appraisal reports that 47 percent of the population lives below the national poverty line,<sup>7</sup> the poorest 20 percent of the population is targeted to receive program benefits using the piloted proxy-means test. The GoT had originally expressed a target of 20 percent in its electricity and gas program framework, but the effort to cover such a large proportion of the population with limited budgetary resources resulted in negligibly low per household transfers (World Bank, 2011a, p. 5; World Bank Group, 2014a). At the time of the safety net technical assistance Project Appraisal, the GoT had not yet determined a target number of beneficiaries and the World Bank estimated that 15 percent of the population would remain eligible to receive benefits. However, subsequent documents from 2012 reflect a renewed commitment to the 20 percent target (World Bank, 2012).

#### **D. The Safety Net Program in Niger**

Unlike in Tajikistan, where the World Bank is providing technical and central systems support (including beneficiary and payment tracking), the Niger loan, valued at US \$70 million,<sup>8</sup> funds a substantial volume of the beneficiary transfers themselves. The program design is outlined in the Project Appraisal Document (Report No. 59609-NE) published in April 2011 (Social Protection Unit et al., 2011). The implementation period was set from May 19, 2011 through June 30, 2017. The project's four components are 1) a central safety net system (US \$3.2 million), 2) cash transfers for food security (US \$48.6 million), 3) cash for work in a short-term, labor intensive program element targeting those affected by temporary food insecurity (US \$10.5 million), and 4) project management (US \$7.7 million).

The program has two benefit levels. Cash transfer recipient households receive 10,000 CFA on a monthly basis (Social Protection Unit et al., 2011). The program also includes a short-term cash-

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<sup>7</sup> The national poverty line was defined at that time as USD 37 in consumption expenditures per person per month. Gross national income (Atlas method) in 2009 was USD 700 per capita (World Bank, 2011a).

<sup>8</sup> The World Bank disburses loans in the IMF unit of Special Drawing Rights (SDR), a valuation calculated daily based on the U.S. Dollar, the Pound Sterling, the Euro, and the Japanese Yen (IMF, 2015). However, the Project Appraisal document values all project sub-components in US dollars, which are cited here.

for-work program operational during the lean season to address seasonal food insecurity. This second program component is not included in the present analysis.

At the time of the safety net project's Appraisal in 2008, 59.5 percent of Niger's population lived below the national poverty line (Social Protection Unit et al., 2011). By 2011, the poverty rate against the national poverty line had fallen to 48.9 percent of the population, but at the internationally standardized levels of \$1.25 and \$2 per day (PPP), the poverty rate stood at 40.8 and 76.1 percent, respectively, in 2011 (The World Bank, 2015).

The Republic of Niger calculates individual poverty lines separately for urban and rural populations. Levels for 2007-2008 and 2011 are shown in Table 3.1:

**Table 3.1: The Individual National Poverty Lines in Niger, 2008 and 2011<sup>9</sup>**

2008		2011	
Area	Individual Poverty Line (CFA)	Area	Individual Poverty Line (CFA)
Urban	150,933	Niamey	182,653
		Other Urban	163,543
Rural	110,348	Agricultural	150,755
		Agro-Pastoral	160,249
		Pastoral	161,698

The World Bank assumes a household size of seven in assessing the safety net program benefit level (Social Protection Unit et al., 2011). It states that transfer amounts should be approximately 15 percent of the rural poverty line to be effective, a percentage which suggests a monthly household transfer of 9,655 CFA in 2008, and of 14,022 CFA in 2011, based on the Agro-Pastoralist poverty line and an average household size of 7. The actual monthly transfer level, as noted above, is fixed at 10,000 CFA per household, which implies the emergence of a significant shortfall by 2011. The safety net program aspires to target 20 percent of the poor population of Niger, or about 12 percent of the full population as implied by the 60 percent poverty rate (Social Protection Unit et al., 2011).

In sum, the two countries' poverty and safety net program profiles are compared in Table 3.2.

**Table 3.2: Poverty and Safety Net Program Profiles of Tajikistan and Niger**

Indicator	Tajikistan	Niger
Poverty Rate, National Poverty Line (year)	47.2% (2009)	59.5% (2008); 48.9% (2011)
Poverty Rate, \$1.25/day PPP (year)	6.5% (2009)	40.8% (2011)
Poverty Rate, \$2/day PPP (year)	27.4% (2009)	76.1% (2011)
Targeted Percentage of the Population in Safety Net Program	20%	12% (20% of poor, based on 2008 national poverty line data)

<sup>9</sup> Sources: Social Protection Unit et al. (2011) and Institut National de la Statistique du Niger (2013)

## E. Methodology

Total annual population forecasts for each country are drawn from the UN 2012 World Population Prospects. All annual population figures correspond to estimates on July 1<sup>st</sup> of a given year. The 2012 Revision retains 2010 as the reference year and it is thus also adopted as the beginning of the forecast period for this study. That is, the results which follow are based on hypothetical safety net programs in each country which track actual program design but already operate at scale in 2010. The analysis draws on the annual total population estimates within the constant fertility, medium fertility, and low fertility (-.5 births per woman) variants. As discussed in Chapter 4, mortality rates used to calculate each WPP variant are held constant despite evidence that reduced fertility likely drives reductions in infant mortality.

Additional quinquennial population forecast data are drawn from the Bayesian probabilistic forecast models published in 2014 and based on the same historical data and reference year, 2010, as the 2012 WPP. Only the “artificial” population trajectories which corresponds to the annual lower bound encompassing 80 percent of the 60,000 country-specific stochastic forecasts is included here. Data are interpolated linearly to generate annual population estimates between each five-year interval. Results were compared with those based on exponential interpolation but the differences were very small. The population of Tajikistan is not projected to grow at a monotonically increasing rate over the 2010 – 2050 period so linear interpolation was deemed to be a more straightforward and consistent approach.

The annual per capita transfer amount in each country’s social safety net program is converted to 2010 U.S. dollars for comparison purposes. The main disadvantages of this approach are that currency conversion rates may be volatile over time, that foreign currency conversions may not accurately track local purchasing power, and that different foreign currencies may exhibit differential longer-term trends of appreciation or depreciation against the dollar. An advantage of the approach is that much of the funding support for both safety net and family planning programs is drawn in U.S. dollars.

Given that population counts are estimated for July 1<sup>st</sup> of a given year, it is logical to align transfer values with these dates. But in light of conversion rate volatility, the methodology employed here takes the midpoint of the high and low average weekly conversion rates between January 1<sup>st</sup> and July 1<sup>st</sup>, 2010, the reference year. The annual transfer in Niger’s program is 120,000 CFA per household, or 17,143 per capita with an average household size of 7. The low and high exchange rates over the first half of 2010 are 445.83 CFA per dollar (1/11/10 – 1/17/10) and 534.69 CFA per dollar (6/7/10 – 6/13/10), respectively (“Oanda,” 2015). With a midpoint of 490.26, this implies an annual per capita transfer of USD \$34.97.

As discussed above, a transfer equivalent to 15 percent of the rural Agro-Pastoralist poverty line amounted to a monthly transfer of 14,022 CFA per household, or 2,003 CFA per capita per month and 24,038 per capita per annum. Using the same conversion rate described above, this equates to an annual per capita transfer of \$49.03, implying a potential shortfall from the ideal program design of \$14 per beneficiary each year. Both the real and implied appropriate transfer levels are used in the analysis.

In Tajikistan, social assistance benefits are in the process of being consolidated into a targeted social assistance (TSA) benefit based on a proxy means test to target those in greatest need. The

benefit level of the new TSA program is 400 Somoni per household per year (World Bank Group, 2014a). For consistency, the same approach to currency conversion described above is adopted here. The low and high weekly exchange rates from the Tajik Somoni (TJS) to U.S. dollar in the first half of 2010 are 4.367 (3/8/2010 – 3/14/2010) and 4.382 (6/21/10 – 6/27/10), respectively. The midpoint between the high and low weekly average rates is 4.375 TJS per USD, the conversion rate used in this analysis. The USD equivalent of the 400 Somoni annual household benefit is thus \$91.44. The 2012 Tajikistan Demographic and Health Survey found that households had 6.3 members, on average (ICF International & Statistical Agency under the President of the Republic of Tajikistan, 2013). The average member count within TSA beneficiary households is not publicly available information and there are reasons to imagine that the types of households in receipt of benefits may skew larger (many dependent children) or smaller (absent men, elderly households with no productive members) than the national average. In the absence of further information, the average household size is assumed for this analysis. The average annual per capita benefit of the TSA program is thus USD \$14.51.

The most recent poverty profile for Tajikistan is based on the 2009 Tajikistan Living Standards Measurement Survey. Analysis of that data, using a national poverty line of 162 Somoni per person per month, yielded the estimate of 47 percent of the population living in poverty (World Bank Group, 2014a). The annual per capita poverty line in 2009 was thus 1,944 Somoni. The annual per capita TSA transfer equals just 3.3 percent of this consumption level, far less than the recommended range of 15 to 20 percent deemed appropriate to drive meaningful welfare improvements. The analysis which follows compares the actual annual program benefit level of \$14.51 per capita to a hypothetical transfer valued at 15 percent of the annual poverty line, or \$66.66 per capita.<sup>10</sup>

All benefit streams are calculated in real 2010 dollars for the periods 2010 – 2035 and 2010 - 2050. First, the annual midyear population for each of the four growth variants is multiplied by the proportion to be included in the safety net program. Targeting in each country's program is assumed to be proportionally constant over the period. In Tajikistan, 20 percent of the population is included; in Niger, 12 percent. Figure 3.1 shows the implied beneficiary streams for each country based on four variants of the fertility schedule.<sup>11</sup>

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<sup>10</sup> The monthly per capita poverty line in 2009 was 162 Somoni, implying an annual poverty line of 1944 Somoni. Fifteen percent of this level is 291.6 Somoni. With the currency conversion approach described above, this implies an adequate safety net transfer of \$66.66 per capita per year.

<sup>11</sup> As noted elsewhere, the UN 2012 WPP medium mortality variant is used in all calculations. Age-specific mortality rates are thus constant across fertility variants but not over time.

Figure 3.1: Future Safety Net Program Beneficiary Streams in Tajikistan

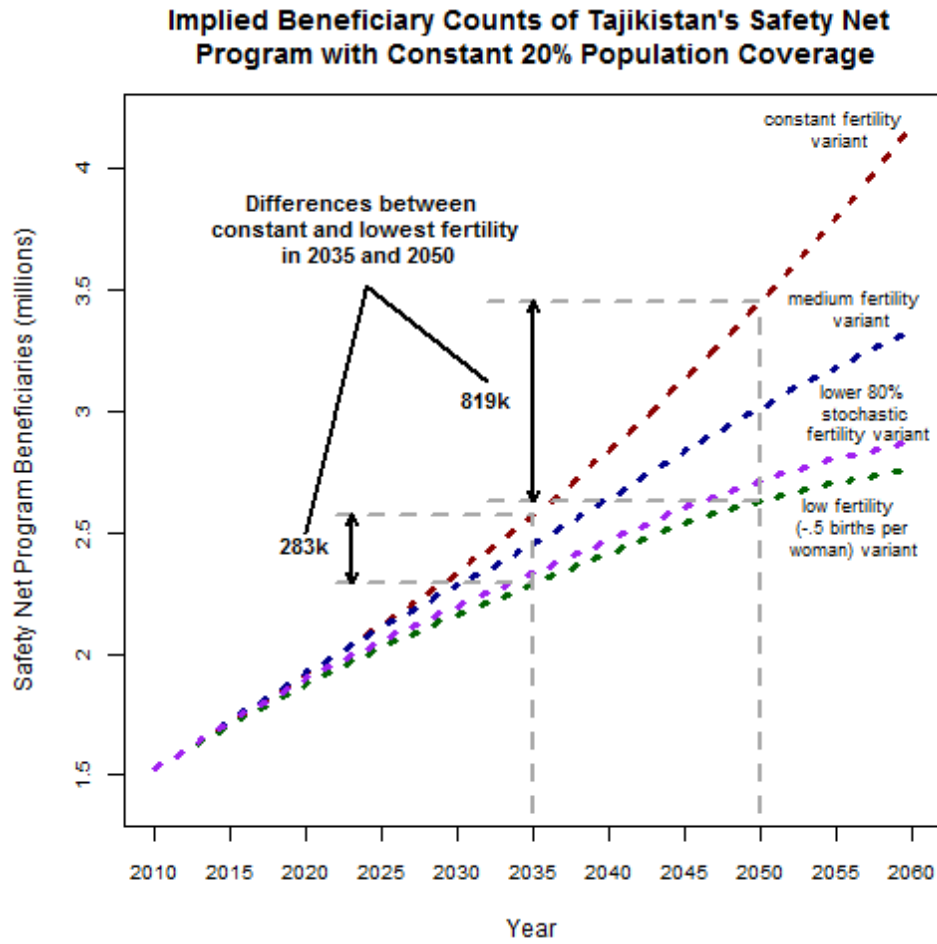
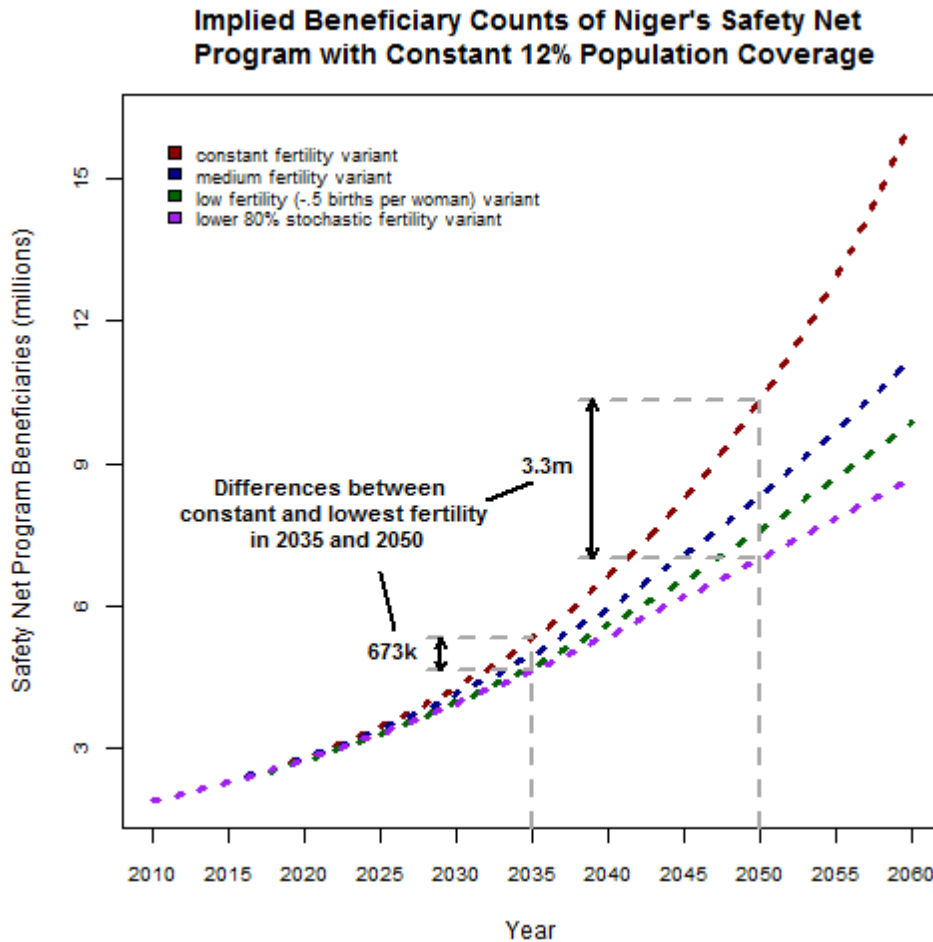


Figure 3.2: Future safety net program beneficiary streams in Niger



The relationship between overall economic growth and poverty trends over the medium to longer term is worth considering; perhaps the program should instead assume a steady decline in poverty incidence, and thus of safety net inclusiveness, over time. Alternatively, perhaps longer-term poverty decline is not monotonic. It has been hypothesized, most notably by Kuznets, that inequality grows in the early stages of a poor country's economic development but then begins to decline at some point of continued growth (Ravallion, 2009). However, in a review of 290 observations of change between two successive nationally representative household surveys from about 80 countries, Ravallion (2009) finds no empirical support for this hypothesis:

Taking this period as a whole, there is little or no correlation between changes in inequality and rates of economic growth. Comparing the changes in a measure of inequality, the Gini index, with changes in average real income shows that among growing economies, inequality rose about as often as it fell. That was also true of contracting economies [...] As a generalization across country experiences, it still appears that growth tends to be roughly distribution-neutral on average (Ravallion, 2009, p. 180).

Given that 47 percent and 49 percent of the populations of Tajikistan and Niger, respectively, fall below the national poverty lines, that the per capita transfers in both countries fall well below the



recommended levels of at least 15 percent of those poverty lines, and that no clear graduation process is articulated within either program design, constant proportional targeting seems the most reasonable of imperfect approaches.

The four vectors of annual beneficiary counts for each country are then multiplied by the annual per capita transfer in 2010 USD to determine annual program commitments in real 2010 dollars.

Finally, an annual discount rate is applied to generate the present discount value of the implied future cost streams of each program under different population growth trajectories, using the basic formula:

$$PDV = \sum_{i=2010}^{2050} Annual\ Commitment_i * e^{(-discount\ rate*(Year_i-2010))}$$

For cross-country comparability, the same discount rates are used in each country. In 2013, the annual growth rates of Tajikistan and Niger stood at 2.5 and 3.9 percent, respectively (The World Bank, 2015). A lower bound discount rate of 3 percent per year is thus employed in the analysis. Alderman and Behrman (2004) use a 5 percent real discount rate to calculate the present values of economic benefits stemming from a reduction in low birth weight prevalence. An upper bound discount rate of 5 percent is also applied to this analysis.

## **F. Results**

The narrative text focuses on the analysis based on a 3 percent annual discount rate but the full set of results is presented in Table 3.3.

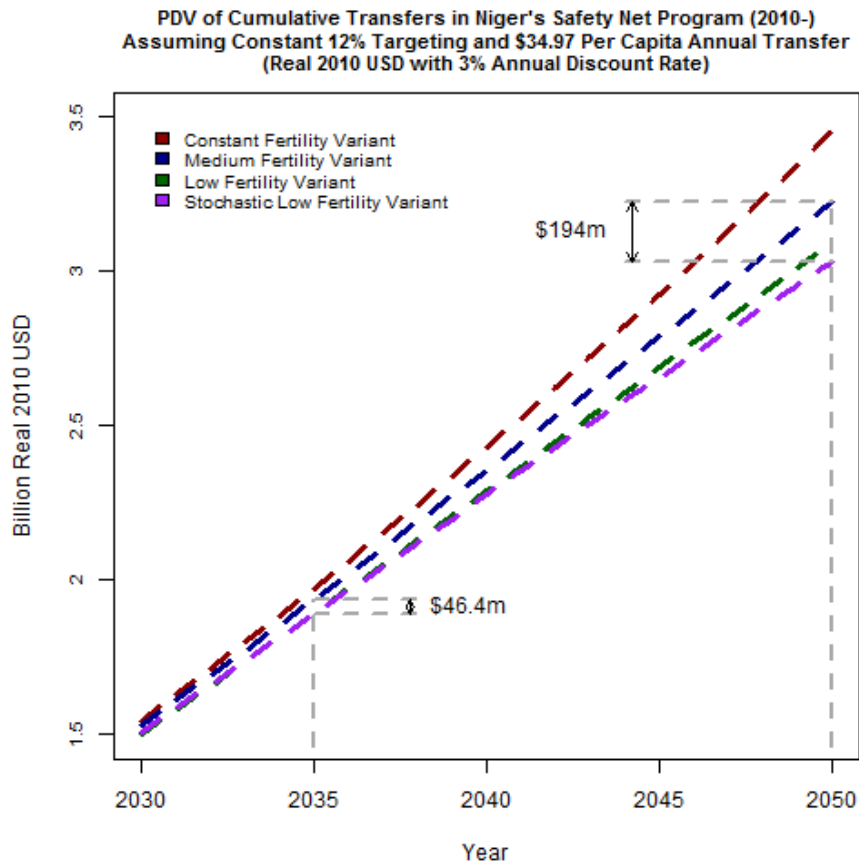
**Table 3.3: Present Discount Values (in 2010 USD) of Cumulative Safety Net Program Transfers in Niger and Tajikistan with Constant Proportional Targeting Criteria**

Country	Period	Annual Benefit Per Capita	Annual Discount Rate	Constant Fertility (a)	Medium Fertility Variant (b)	UN 2012 WPP Low Fertility Variant (-.5 births per woman) (c)	Stochastic Low Fertility Variant (80% lower bound) (d)	Difference Between Medium and Stochastic Variants (b – d)
Niger	2010-2035	\$34.97*	3%	1,974,531,242	1,937,834,596	1,892,519,836	1,891,388,660	<b>46,445,937</b>
			5%	1,535,837,894	1,511,411,674	1,479,452,923	1,479,949,399	<b>31,462,275</b>
		\$49.03†	3%	2,768,409,117	2,716,958,257	2,653,424,295	2,651,838,318	<b>65,119,939</b>
			5%	2,153,335,199	2,119,088,200	2,074,280,150	2,074,976,237	<b>44,111,963</b>
	2010-2050	\$34.97	3%	3,451,334,731	3,224,681,034	3,091,234,373	3,030,704,523	<b>193,976,511</b>
			5%	2,297,914,165	2,178,006,829	2,101,055,236	2,071,607,135	<b>106,399,694</b>
	\$49.03	3%	4,838,974,602	4,521,192,768	4,334,092,688	4,249,226,273	<b>271,966,495</b>	
		5%	3,221,811,024	3,053,693,876	2,945,803,209	2,904,515,237	<b>149,178,638</b>	
Tajik – istan	2010-2035	\$14.51*	3%	520,122,650	516,239,182	500,727,778	506,292,861	<b>9,946,321</b>
			5%	413,822,137	411,532,552	400,435,922	404,562,182	<b>6,970,370</b>
		\$66.66†	3%	2,389,481,450	2,371,640,515	2,300,379,991	2,325,946,390	<b>45,694,125</b>
			5%	1,901,129,130	1,890,610,607	1,839,631,880	1,858,588,217	<b>32,022,390</b>
	2010-2050	\$14.51	3%	763,803,182	739,401,388	702,235,253	712,768,661	<b>26,632,727</b>
			5%	540,726,479	528,002,814	505,779,215	512,473,850	<b>15,528,965</b>
	\$66.66	3%	3,508,967,618	3,396,863,990	3,226,120,054	3,274,511,297	<b>122,352,693</b>	
		5%	2,484,136,948	2,425,683,501	2,323,586,663	2,354,342,303	<b>71,341,198</b>	

\* Actual program benefit level; † 15% of the national poverty line

In Niger, the 2010 present value of safety net transfers over the 2010-2035 period to a constant 12 percent of the population under the medium fertility variant of population growth exceeds \$1.9 billion (2010 USD) using the program’s stated transfer level and a 3 percent annual discount rate. A slower rate of population growth, tracking either low fertility trajectory, would result in the savings of approximately \$46 million, discounting at 3 percent. Figure 3.3 depicts the same data graphically.

**Figure 3.3: Cumulative Safety Net Transfer Costs in Niger, Discounted at 3% per Annum to 2010 USD**



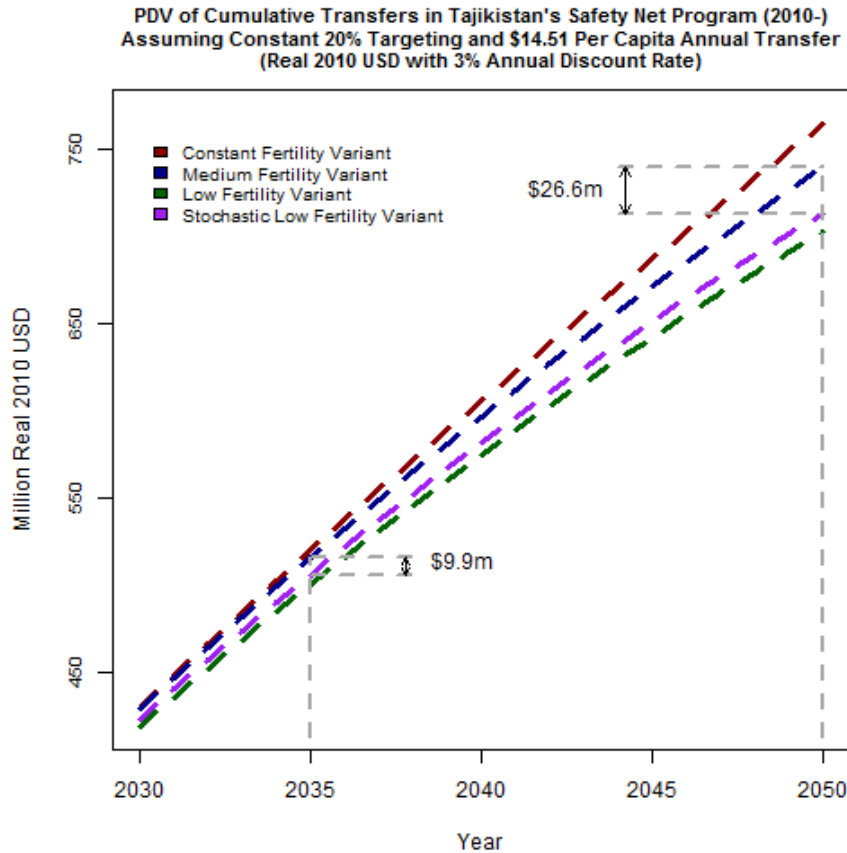
If the per capita benefit were to be augmented to a level approximating 15 percent of the rural poverty line (\$49.03), as recommended by the World Bank’s technical guidance, the present value of budgetary savings associated with slower population growth in the 2010-2035 period grows to \$65 million.

In general, the two low fertility variants produce safety net budget stream results which are similar over the shorter, 25-year period but diverge more significantly over the 40-year period. At the same (actual) transfer level and discount rate, the 2010 present value of total transfers through 2050 associated with the medium fertility variant exceeds \$3.2 billion. Savings over the period associated with shifting to the stochastic low fertility variant could approach \$194 million, a difference of 6 percent. Even at the higher 5 percent discount rate, the implied savings of \$106 million would reduce the budget commitment by nearly 5 percent over the period. At the higher, more technically sound per capita transfer level, savings associated with lower fertility accrued over the longer period could approach \$272 million. This is roughly 4 percent of Niger’s 2013 GDP (7.4 billion USD) (The World Bank, 2015).

In Tajikistan, safety net transfer commitments are significantly less substantial due to both a less generous per capita benefit and a smaller population which is growing more slowly. As discussed in Chapter 4, the probabilistic low fertility variant diverges less than the 2012 WPP low fertility variant from the medium projection in Tajikistan (as in many other medium fertility

countries). The probabilistic low estimates are still used to benchmark potential cost savings, but a difference of .5 births per woman from the medium variant would result in savings of a larger magnitude. Between 2010 and 2035, transfer commitments sum to \$516 million based on the medium fertility trajectory; the transfer budget through 2050 exceeds \$739 million 2010 dollars. Slower population growth in accordance with the probabilistic low fertility variant would result in savings of nearly \$10 million by 2035 and nearly \$27 million by 2050, or about 3.6% of total transfer costs over the longer period. Figure 3.4 depicts cumulative differences this graphically.

**Figures 3.4: Cumulative Safety Net Transfer Costs in Tajikistan, Discounted at 3% per Annum to 2010 USD**



Savings associated with slower population growth could be reinvested to expand program coverage. How many additional people might be reached with program benefits if lower fertility could be achieved? In the following formula,  $x$  represents the constant number of additional people to be targeted with program transfers,  $b$  represents the amount of the transfer benefit, and  $t$  represents the number of years over which the additional beneficiaries are to be included:

$$PDV(savings) = \sum_{t=0}^{t_{max}} xb * e^{-rt}$$

A simple rearrangement allows us to solve for  $x$ :

$$x = \frac{PDV(savings)}{\sum_{t=0}^{t_{max}} be^{-rt}}$$

Using the more conservative 5 percent discount rate, we find that the transfer savings in Niger associated with moving from the medium to the stochastic low fertility variant between 2010 and 2035 could be used to reach an additional 61,498 beneficiaries every year for the full twenty-five year period or an additional 111,517 beneficiaries each year for the first decade. These counts based on a 3 percent discount rate are 74,395 and 151,451, respectively. In the first year, 151,451 additional beneficiaries would constitute a 7.9 percent<sup>12</sup> coverage expansion in one of the poorest countries in the world.

In Tajikistan, the 5 percent discount rate yields potential savings of \$6.97 million over the first 25 years of the program. Reinvested over the full period, an additional 32,836 beneficiaries could be included each year. If priority was given to reaching more beneficiaries in the near term, an additional 59,543 beneficiaries could be included for each of the first ten years. Analogous figures based on a 3 percent discount rate are 38,396 and 78,165, respectively. In the first year, 78,165 additional beneficiaries would constitute a 5 percent<sup>13</sup> coverage expansion.

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<sup>12</sup> Based on 1,907,250 initial beneficiaries implied by the stated program design (20% of 60% who are poor, or 12% of the total population).

<sup>13</sup> Based on 1,525,465 beneficiaries in 2010, or 20% of the total population.

### **III. How much do effective family planning programs cost?**

The 1994 International Conference on Population and Development, held in Cairo, gave rise to global cost estimate projections for universal reproductive healthcare, including family planning, maternal health, and the prevention of sexually transmitted diseases (UNFPA Technical Division, 2009). These estimates, along with their underlying methodology, were revised in 2009 to incorporate the impact of HIV/AIDs, residually high levels of infant mortality, general increases in healthcare provisioning, and the growing secondary costs of adequate data collection, including census administration. The report estimated that an additional expenditure of \$317 million on family planning programs worldwide to address unmet need could yield savings of \$1.1 billion in maternal healthcare costs (UNFPA Technical Division, 2009).

In Chapter 4, we saw that direct approaches which seek to gauge the potential effect sizes of family planning programs on fertility rates via the assessment of “unmet need” are likely unreliable due to the diffusion effect of more widespread contraceptive adoption driving increases in demand, and thus in unmet need even while usage rates increase. We also saw that the indirect approach of drawing insights from the experience of neighboring countries may prove a useful alternative. The effect sizes in fertility reduction implied by neighbors’ experiences are also remarkably consistent with the range of outcomes encompassed by the 2012 WPP low fertility variant and the stochastic low variant at the 10<sup>th</sup> percentile of 60,000 Bayesian trajectories.

Analogous to the safety net transfer analysis above, this section estimates the cost of family planning program transfers. These transfers refer to contraceptive inputs but not to the attendant costs of skilled medical staffing or health systems strengthening. The estimation of these costs is a simple multiple of the average annual per capita contraceptive cost in each country and the number of women who require coverage in a given year. Let us take each in turn.

#### **A. Modern Contraceptive Costs**

The Reproductive Health Interchange (RHI) database maintained by the UNFPA records data on contraceptive orders and shipments for over 140 countries. The data reflect over 80 percent of donor-supplied contraceptives and are collected from the central procurement offices of major donors such as IPPF, MSI, PSI, USAID, and UNFPA (UNFPA, 2015).

The following data were available for contraceptive shipments to Tajikistan and Niger between January 1, 2014 and June 15, 2015:

**Table 3.4: Donor-Supplied Contraceptives in Tajikistan and Niger between January 2014 and June 2015:**

Country	Method	Quantity	Cost	Unit Cost	Annual Conversion Factor	Annual Cost
<b>Tajikistan</b>	Condoms - Female (pieces)	10,000	\$6,382	\$0.638	77	\$49.14
	Condoms - Male (pieces)	13,428,288	\$465,580	\$0.035	77	\$2.67
	IUDs (pieces)	40,000	\$18,035	\$0.451	0.217391 (4.6 years of coverage)	\$0.10
	Injectables (doses)	43,600	\$51,453	\$1.180	4	\$4.72
	Orals - Combined (cycles)	122,040	\$84,683	\$0.694	14	\$9.71
	Orals - Progestin Only (cycles)	92,160	\$38,122	\$0.414	14	\$5.79
<b>Niger</b>	Condoms - Male (pieces)	504,000	\$16,169	\$0.032	77	\$2.47
	IUDs (pieces)	13,925	\$6,039	\$0.434	0.217391 (4.6 years of coverage)	\$0.09
	Implants (pieces)	171,024	\$1,484,231	\$8.678	0.263158 (3.8 years of coverage)	\$2.28
	Injectables (doses)	1,472,800	\$0	\$0.464	4	\$1.86
	Orals - Combined (cycles)	3,919,620	\$1,151,542	\$0.294	14	\$4.11
	Orals - Progestin Only (cycles)	1,384,902	\$451,327	\$0.326	14	\$4.56

Note that injectables sent to Niger reflect zero cost. It is not clear whether this is an error in the data but neighboring Burkina Faso also posts zero cost for injectables imports. The unit cost estimated here is based on data from Ethiopia over the same period.

Conversion factors for annual usage are based on both USAID’s methodology to calculate its standardized Couple Years of Protection metric (USAID, 2015) and on the Guttmacher Institute’s assumptions about annual condom usage (Singh, Darroch, & Ashford, 2014). IUDs are assumed to provide 4.6 years of coverage on average. Specific types of imported implants and injectables are not disaggregated in the data. This analysis assumes that they are the longer-lasting product types in each line: the Jadelle implant (5 effective years, 3.8 average use years according to USAID) and three- rather than one-month injectables.

The average annual cost per user weighted by the proportion of total imported coverage years per method is \$1.73 in Tajikistan and \$2.58 in Niger. The analysis which follows draws on two annual cost levels in each country. These are the weighted average annual user costs and the cost for the modal method: \$0.10 for IUDs in Tajikistan (which provide 47.8 percent of all coverage years) and \$2.28 for implants in Niger (44.3 percent of all coverage years). The cost estimates for hormonal methods in particular are conservative; in 2012 MSI pledged to halve the price of Jadelle implants in order to reach 27 million additional women and girls globally (Marie Stopes

International, 2012). This followed on the heels of the July 2012 London Family Planning Summit which reignited global donor commitment to contraceptive access and pledged to reach an additional 120 million women and girls with contraceptive information and services.

## B. Methodology

The analysis which follows combines the two contraceptive price points for a year of coverage in each country described above with projections of total and marginal users over the 2010 – 2050 period. To estimate the contraceptive usage levels necessary to achieve fertility decline, let us draw insights from paired model countries with successful family planning programs. This approach is deemed superior to an examination of “unmet need” as the latter is found to be endogenous to family planning program intensity and saturation (see Chapter 4).

Chapter 4 shows that the experiences of Uzbekistan and Ethiopia are more aligned with the stochastic 10<sup>th</sup> percentile low fertility projections in Tajikistan and Niger, respectively, than are the observed declines in Iran and Burkina Faso. Table 3.5 compares both the distribution of modern contraceptive methods in each country and exposure to the risk of pregnancy. The reliance on IUDs in Central Asia and hormonal methods in sub-Saharan Africa (particularly when lactational amenorrhea is excluded in Niger) suggests that paired country experiences of overall contraceptive usage levels are not inappropriate to draw insight from.

**Table 3.5: Exposure to the Risk of Pregnancy and Distribution of Modern Contraceptive Methods Among All Women 15-49 in Tajikistan, Uzbekistan, Niger, and Ethiopia**

Country	Percent of All Women Currently in Union (Married or Cohabiting) (a)	Percent of All Women Currently Using a Modern Method (b)	Percent of Women Exposed to Risk of Pregnancy without Modern Method (a-b)	Method Distribution Among Users (may sum >100%)								
				Female Sterilization	Pill	IUD	Injectables	Implants	Male Condom	Foam/Jelly/Diaphragm	LAM	Other
Tajikistan (2012)	67.4	17.5	59.9	2.3	13.1	72.0	7.4	0.0	8.6	0.0	0.0	0.0
Uzbekistan (2002)	68.1	44.0	24.1	4.3	2.7	82.0	3.0	not asked	3.4	0.0	4.3	not asked
Niger (2012)	88.5	11.0	77.5	0.9	45.5	0.9	17.3	2.7	0.9	not asked	31.8	0.0
Ethiopia (2011)	62.3	18.7	43.6	2.1	8.0	1.1	74.9	12.3	1.6	not asked	0.0	0.0

However, simply modeling the contraceptive prevalence rates observed in paired countries is insufficient given divergent nuptiality patterns (particularly between Niger and Ethiopia) and age structures. The same contraceptive prevalence rate<sup>14</sup> across countries with disparate union patterns can yield meaningful differences in population-level risk of pregnancy.

<sup>14</sup> regardless of whether the rate is measured among all women or among married women only



Let us instead model age-specific usage rates which, given observed (and presumed static) marriage and union patterns in Tajikistan and Niger, yield the same age-specific proportions of women exposed to the risk of pregnancy<sup>15</sup> which are observed in paired countries. Table 3.6 shows the computation of age-specific total and marginal contraceptive usage rates among all women, regardless of marital status, which would yield the same risk of exposure to pregnancy in case study countries as in paired countries.

**Table 3.6: Model Levels of Total and Marginal Contraceptive Usage**

Country	Age Group	Percent of All Women Currently in Union (Married or Cohabiting)	Percent of All Women Currently Using a Modern Method	Percent of All Women Exposed to Risk of Pregnancy	Modeled Percent of All Women Exposed to Risk of Pregnancy (observed levels of Uzbekistan and Ethiopia)	Modeled Percent of All Women Using a Modern Method to Achieve Low Fertility	Marginal Increase in Percent of All Women Using a Modern Method to Achieve Modeled Level
		(a)	(b)	(c)	(d)	(e)	(f)
				(a-b)		(a-d)	(e-b)
<b>Tajikistan (2012 DHS)</b>	15-19	13.2	0.2	13.0	5.4	<b>7.8</b>	<b>7.6</b>
	20-24	67.7	6.5	61.2	32.9	<b>34.8</b>	<b>28.3</b>
	25-29	82.8	20.6	62.2	28.2	<b>54.6</b>	<b>34</b>
	30-34	85.4	32.2	53.2	25.1	<b>60.3</b>	<b>28.1</b>
	35-39	89.6	39.6	50.0	16.3	<b>73.3</b>	<b>33.7</b>
	40-44	88.7	30.8	57.9	27.0	<b>61.7</b>	<b>30.9</b>
	45-49	88.0	15.4	72.6	46.7	<b>41.3</b>	<b>25.9</b>
<b>Niger (2012 DHS)</b>	15-19	61.0	3.7	57.3	13.9	<b>47.1</b>	<b>43.4</b>
	20-24	90.6	11.8	78.8	37.9	<b>52.7</b>	<b>40.9</b>
	25-29	95.0	15.5	79.5	54.2	<b>40.8</b>	<b>25.3</b>
	30-34	96.5	13.9	82.6	56.0	<b>40.5</b>	<b>26.6</b>
	35-39	95.9	14.6	81.3	57.2	<b>38.7</b>	<b>24.1</b>
	40-44	92.8	8.2	84.6	63.2	<b>29.6</b>	<b>21.4</b>
	45-49	91.2	3.0	88.2	65.3	<b>25.9</b>	<b>22.9</b>

The primary analysis relies upon the marginal age-specific percentages of women using a modern contraceptive method which match the age-specific exposures to the risk of pregnancy observed in paired countries. It assumes that contraceptive usage rates will immediately jump to the higher modeled levels and remain constant over the period. This is likely a problematic assumption. For example, in Ethiopia, observed marriage/union and contraceptive usage rates are drawn from the 2011 DHS, twenty years after the onset of fertility decline and a full decade after its precipitous drop. Certainly contraceptive usage rates were lower in the previous decade. At the same time, the Ethiopian TFR stood at 4.8 in 2011 while the 10<sup>th</sup> percentile of stochastic forecasts for Niger estimates a TFR of 3.43 for the 2045-2050 period (it is 7.58 for the 2010-2015 period). The implication is that, to achieve a growth path concordant with the 10<sup>th</sup> percentile of stochastic forecasts, exposure rates to the risk of pregnancy in Niger would be higher than those observed in Ethiopia at the beginning of the 2010 – 2050 period and lower by the end of the period. A future version of this analysis may seek to incorporate measurements of dynamic age-specific rates over multiple periods. In the present version, the upwardly-biased

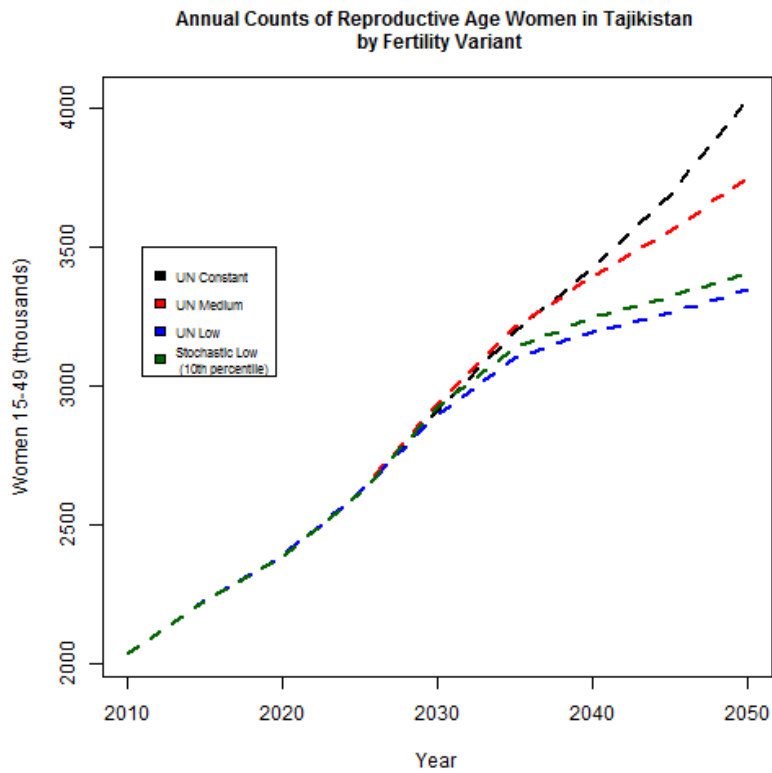
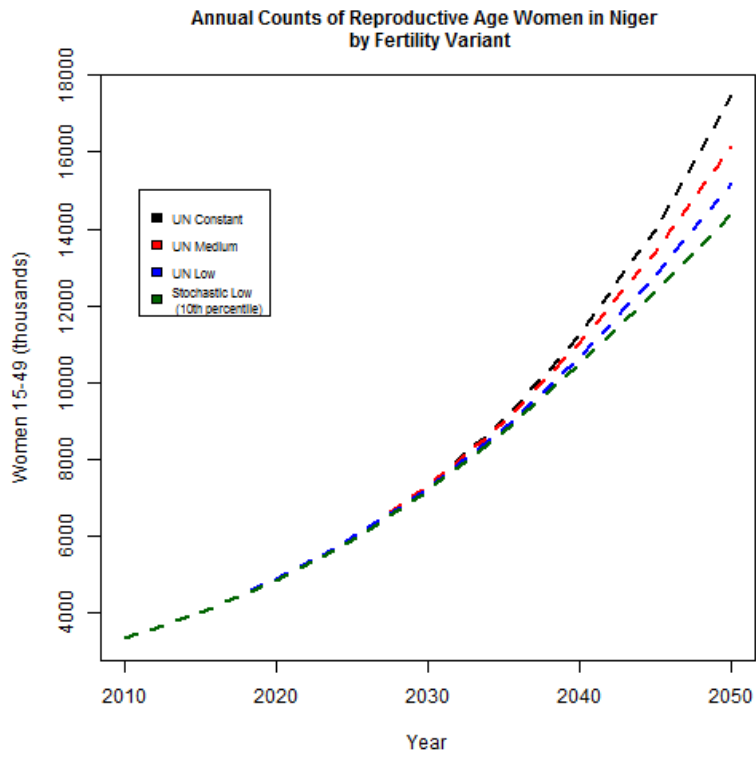
<sup>15</sup> without the protection of a modern contraceptive method

estimates in the beginning of the period, discounted over a shorter period, may offset the downwardly-biased estimates of contraceptive usage rates towards the end of the period. While these rates are applied to larger populations in more distant years, the discounting process diminishes their contribution to the present value tabulations. Additionally, it is plausible that further reductions in the cost of contraceptives would more than offset this downward bias in usage rates. The probabilistic low fertility forecast predicts that Niger's TFR won't reach Ethiopia's current level until the 2035-2040 period so the bulk of the analysis relies upon data from before this "tipping point" is achieved, further suggesting that overall cost estimates are conservative.

The main findings do not incorporate the associated costs of existing (currently observed, not modeled) contraceptive usage although results for the full group of users (current and new) are also furnished in the results section below.

The marginal age-specific percentages of new contraceptive users are then applied to annually interpolated counts of reproductive age women from the 10<sup>th</sup> percentile of 1,000 sex- and age-disaggregated, country-specific stochastic trajectories generously provided by Patrick Gerland of the UN Population Division (data are not publicly available). Figures 3.5a and 3.5b show that, even in Niger, counts of reproductive age women do not diverge radically by fertility variant given that most women of reproductive age in at least the first half of the examination period are already born.

**Figure 3.5a and 3.5b Annual Counts of Reproductive Age Women in Niger and Tajikistan by Fertility Variant**



Annual counts of marginal contraceptive users computed in the described manner are shown graphically in Figures 3.6a and 3.6b (age categories are collapsed in these figures but not in the underlying analysis). These marginal users are then multiplied by the average and modal method costs of annual contraceptive coverage in each country, discussed in Section a. The same discounting approach described in the first half of this chapter is then applied with annual discount rates of both three and five percent to estimate the present value (in 2010) of the contraceptive investment stream required over 25 and 40 year periods to shift population growth from the medium to the stochastic low (10<sup>th</sup> percentile) variants.

**Figure 3.6a: Counts of Reproductive Age Women in Tajikistan by Contraceptive Need**

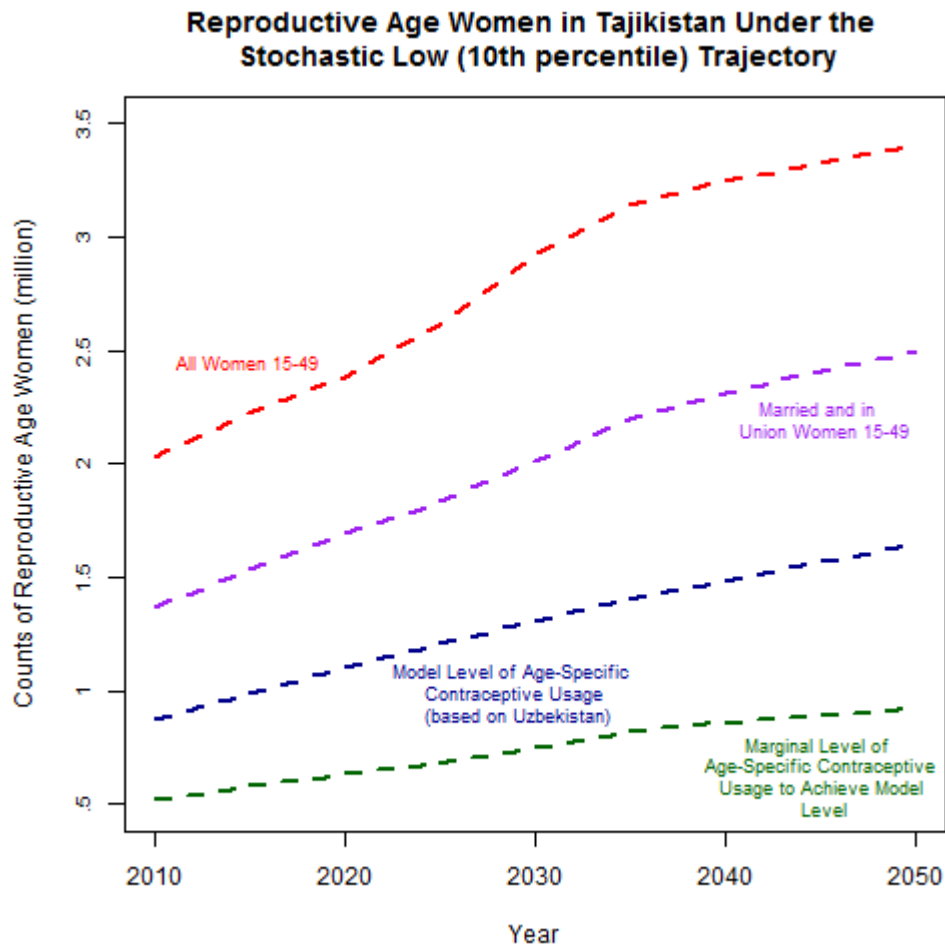
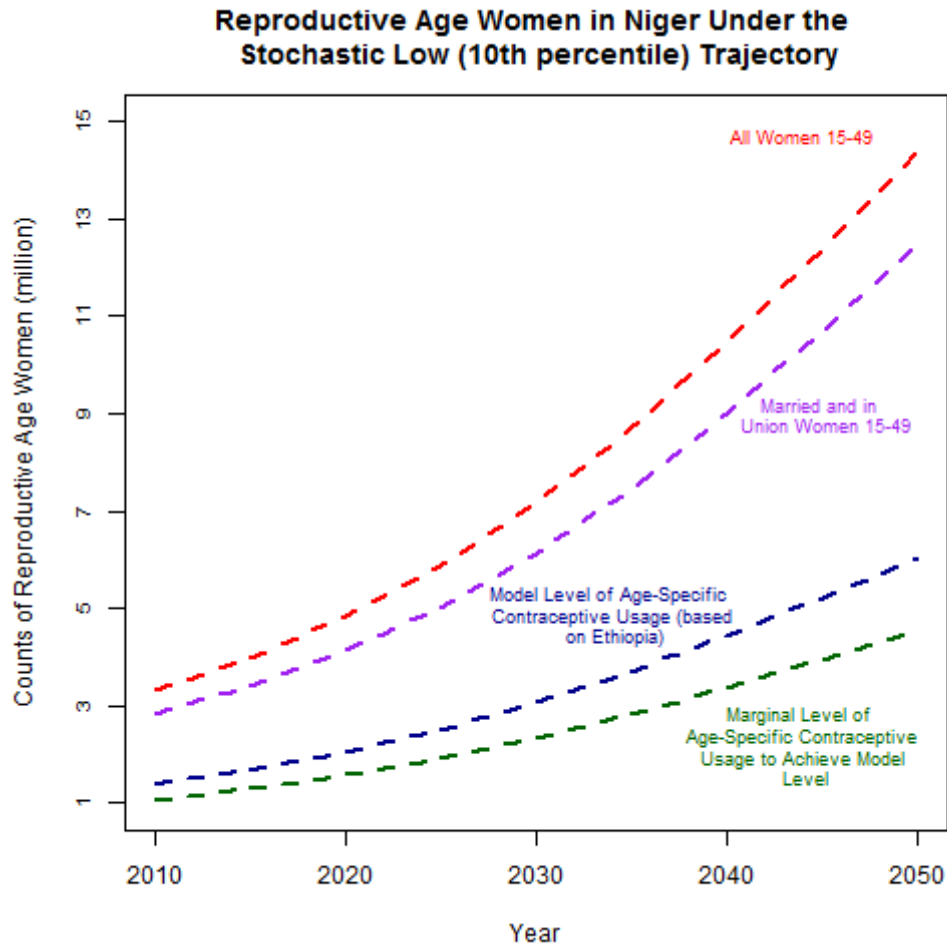


Figure 3.6b: Counts of Reproductive Age Women in Niger by Contraceptive Need



## C. Results

Table 3.7 shows the full results of the analysis.

**Table 3.7: Present Discount Values (in 2015 USD) of Cumulative Contraceptive Transfers in Niger and Tajikistan with Constant (2012 Observed) Age-Specific Nuptiality and Modeled Age-Specific Contraceptive Usage**

Country	Period	Annual Contraceptive Cost per User	Annual Discount Rate	Full Modeled Level (including the value of transfers to women already using a modern method)	Marginal Level (transfers required to raise observed usage rates to model levels)
Niger	2010-2035	\$2.28 (implant)	3%	93,089,964	<b>71,151,498</b>
			5%	72,554,713	<b>55,456,837</b>
		\$2.58 (avg. of all methods)	3%	105,338,644	<b>80,513,538</b>
			5%	82,101,386	<b>62,753,789</b>
	2010-2050	\$2.28	3%	155,091,077	<b>118,129,800</b>
			5%	104,696,775	<b>79,817,693</b>
		\$2.58	3%	175,497,798	<b>133,673,194</b>
			5%	118,472,666	<b>90,320,021</b>
Tajikistan	2010-2035	\$0.10 (IUD)	3%	2,039,760	<b>1,179,096</b>
			5%	1,626,228	<b>941,333</b>
		\$1.73 (avg. of all methods)	3%	35,287,840	<b>20,398,367</b>
			5%	28,133,739	<b>16,285,064</b>
	2010-2050	\$0.10	3%	2,896,804	<b>1,670,145</b>
			5%	2,074,062	<b>1,198,213</b>
		\$1.73	3%	50,114,714	<b>28,893,510</b>
			5%	35,881,269	<b>20,729,092</b>

If Niger's population structure were to conform to the 10<sup>th</sup> percentile of stochastic forecasts between 2010 and 2035, the estimated required marginal investment in contraceptives (excluding attendant services and systems) would fall in the range of \$71.1 to \$80.5 million, depending on the mix of methods, with a 3 percent discount rate. Over the longer 2010 – 2050 period, the corresponding range is \$118.1 to \$133.7 million, discounting at 3 percent.

In Tajikistan, assuming that total population growth tracks the 10<sup>th</sup> percentile of stochastic estimates, marginal contraceptive investments between 2010 and 2035 sum to a range of \$1.2 million (extremely inexpensive but difficult to insert IUDs only) to \$20.4 million for a mix of methods, discounting at 3 percent. Over the longer period, the corresponding range is \$1.7 million to \$28.9 million.

**A Note on Emerging Contraceptive Methods:** While injectables are not considered in the analysis above beyond their contribution to the average method costs in each country (and in Niger, those costs are based on Ethiopian data), injectables are overwhelmingly the most common modern method used in sub-Saharan Africa, accounting for 47 percent of all methods (Tsui, Brown, & Qingfeng, 2015). Progress has also been made in increasing their cost-effectiveness. Depo-Provera, the widespread injectable produced by Pfizer, must be drawn into a syringe from a glass vial and injected into the muscle, requiring trained professional

administration. In partnership with PATH, Pfizer is piloting a new product, the Sayana Press, in four African countries: Burkina Faso, Niger, Uganda, and Senegal. The Sayana Press combines Depo-Provera with a Uniject injection system, a small bubble of plastic attached to a short needle which contains a single dose of medication. The Sayana Press is administered beneath the skin rather than into the muscle, requires less training, and is light and easy to transport. However, as of November 2014, the typical dose cost about \$1.50 and was active for four months, implying an annual cost of \$6 per user (Thomas, 2014). That month, Pfizer announced that a new partnership would allow it to sell the Sayana Press for about \$1 per dose, or \$4 per year. Depo-Provera sells for about \$.75 per dose/\$3 per year, making it price-wise more competitive with longer-acting implants.

Recent years have also seen significant advancements in implant technology (see Association of Reproductive Health Professionals (2008) for a helpful overview). The cost of the longest-lasting implant, Jadelle (manufactured by Bayer), was reduced from \$18 to \$8.50 in 50 countries in January 2013 in the wake of the London Summit the previous July. Jadelle was first approved by the FDA in 1996 but never marketed in the United States. The Jadelle Access Program is a partnership between Bayer Healthcare AG, the Bill and Melinda Gates Foundation, the Clinton Health Access Initiative, the UNFPA, and several donor governments. The device provides effective contraception for up to five years, although USAID estimates 3.8 years of average usage. The annual costs, ranging from \$1.70 for five years to \$2.24 for 3.8, make the implant a more cost-effective alternative to injectables, at least for the time being. Implants may be somewhat more challenging to administer, requiring a higher skill level among community health workers. But in fact, technological advances have significantly mitigated this challenge. The first contraceptive implants were comprised of six rods, making them difficult to insert, but Jadelle has two rods and Implanon, first launched in Indonesia in 1998, has just one (Association of Reproductive Health Professionals, 2008). while it used to be the case that implants were only available in clinical settings, community health workers now insert them on a large scale in Ethiopia, Ghana, Rwanda, Malawi, and Zimbabwe (Tsui et al., 2015). Bayer HealthCare AG also works with partners to improve service delivery infrastructure and health worker training. Like injectables, implants may allow women to use contraceptives without the knowledge of their partners (although implants can be somewhat detectable). This factor has been cited as attractive by users (Thomas, 2014).

#### **IV. How do safety net and family planning programming costs compare over the two projection periods?**

Would the budgetary savings to social safety net programs associated with lower population growth be sufficient to cover the contraceptive investment costs described in the previous section? Table 3.8 reproduces cost savings estimates within safety net programs associated with lower fertility from the first half of the chapter. It includes actual program benefits levels only, despite the fact that they may be inadequate to drive meaningful change in the lives of the poor, particularly in Tajikistan.

**Table 3.8: Comparison of Cumulative Safety Net Program Savings and Contraceptive Investments with Actual Safety Net Benefit Levels**

Country	Period	Safety Net Annual Benefit Per Capita	Annual Discount Rate	Savings Associated with shifting from Medium to Stochastic Low Population Growth Trajectories (a)	Costs Associated with Contraceptive Investments for Marginal Users, based on country-specific average costs (b)	Difference between Savings to Safety Net Programs and Investments in Contraception (a-b)	Proportion of Contraceptive Investments which could be Covered by Savings to Safety Net Programs
Niger	2010-2035	\$34.97*	3%	46,445,937	80,513,538	-34,067,601	<b>57.7%</b>
			5%	31,462,275	62,753,789	-31,291,514	<b>50.1%</b>
	2010-2050	\$34.97	3%	193,976,511	133,673,194	60,303,317	<b>145.1%</b>
			5%	106,399,694	90,320,021	16,079,673	<b>117.8%</b>
Tajik – istan	2010-2035	\$14.51*	3%	9,946,321	20,398,367	-10,452,046	<b>48.8%</b>
			5%	6,970,370	16,285,064	-9,314,694	<b>42.8%</b>
	2010-2050	\$14.51	3%	26,632,727	28,893,510	-2,260,783	<b>92.2%</b>
			5%	15,528,965	20,729,092	-5,200,127	<b>74.9%</b>

\*Actual program benefit levels

In Niger, we observe that safety net program savings in the shorter period, 2010 – 2035, are inadequate to cover contraceptive investments over the same period. However, the savings would be sufficient to cover at least half of contraceptive costs. Over the longer period, however, the relationship is reversed. In the context of sustained fertility decline, the substantial savings to the safety net program would be more than sufficient to cover contraceptive costs. This could even be the case if the full margin of need was met with costlier Sayana Press injectables, depending on other assumptions. The Sayana Press has the advantage of requiring only a low level of training for community health workers to administer.

In Tajikistan, given the much less generous (and technically unsound) per capita benefit level coupled with more modest population growth, safety net program savings associated with lower fertility are never sufficient to fully offset contraceptive investments. However, discounting at 3 percent per year, the savings would cover nearly half of contraceptive costs in the shorter period and over 90 percent of them in the longer period.

How do results compare with those resulting from hypothetical safety net programs with technically sound/ideal benefit levels (approximating 15 percent of the national poverty line)? Table 3.9 furnishes this analogous set of results.



**Table 3.9: Comparison of Cumulative Safety Net Program Savings and Contraceptive Investments with Ideal/Technically Sound Safety Net Benefit Levels**

Country	Period	Safety Net Annual Benefit Per Capita	Annual Discount Rate	Savings Associated with shifting from Medium to Stochastic Low Population Growth Trajectories (a)	Costs Associated with Contraceptive Investments for Marginal Users, based on country-specific average costs (b)	Difference between Savings to Safety Net Programs and Investments in Contraception (a-b)	Proportion of Contraceptive Investments which could be Covered by Savings to Safety Net Programs
Niger	2010-2035	\$49.03†	3%	65,119,939	80,513,538	-15,393,599	<b>80.1%</b>
			5%	44,111,963	62,753,789	-18,641,826	<b>70.3%</b>
	2010-2050	\$49.03	3%	271,966,495	133,673,194	138,293,301	<b>203.5%</b>
			5%	149,178,638	90,320,021	58,858,617	<b>165.2%</b>
Tajik – istan	2010-2035	\$66.66†	3%	45,694,125	20,398,367	25,295,758	<b>224.0%</b>
			5%	32,022,390	16,285,064	15,737,326	<b>196.6%</b>
	2010-2050	\$66.66	3%	122,352,693	28,893,510	93,459,183	<b>423.5%</b>
			5%	71,341,198	20,729,092	50,612,106	<b>344.2%</b>

† Technically sound/ideal benefit levels

When safety net programs are designed to achieve successful outcomes through the provision of transfer levels adequate to insulate against correlated and idiosyncratic shocks, to invest in children’s health and human capital, and potentially to leverage, expand, and diversify productive livelihoods strategies, the savings associated with slower population growth tends to overwhelm the associated costs of family planning interventions. It is difficult to justify the creation and scale-up of programs which are not designed in this manner, both financially and ethically.

## V. Additional Considerations

It is plausible, and indeed the aspiration of most safety net programs, that (adequate) benefits may drive poverty reduction over the medium to long term. In 2013, the World Bank Group Board of Governors endorsed the goal of ending extreme poverty, measured as income or consumption levels of less than \$1.25 per day in 2005 purchasing power parity dollars.<sup>16</sup> A more sophisticated version of this exercise might seek to incorporate a rate of poverty decline which acts upon the proportion of national populations eligible for safety net benefits. In the case of Niger, one of the poorest countries in the world, it seems unlikely that less than 12 percent of the population would demonstrate a need for social assistance by 2050. In Tajikistan, a less inclusive program with higher per capita benefits seems prudent.

Cost recovery among contraceptive users has not been discussed and the preceding analysis assumes none. While definitive evidence on the price elasticity of contraceptive demand is scarce, Cleland et al. (2006) assess that “demand is surprisingly inelastic; a doubling of contraceptive prices results in declines in overall use of 0-15%” (Cleland et al., 2006, p. 1823). However, this low range may less aptly characterize rural beneficiaries in very poor countries, and particularly in countries with persistent large family size preferences. The implication of inelastic demand is that some degree of cost-sharing is appropriate to improve the financial viability and sustainability of family planning programs. Market segmentation has been proposed to recover costs from those who are able to afford services but poverty targeting is complex and a burdensome undertaking for a stand-alone family planning program. However, social safety net programs already incorporate such means testing into their fundamental operational strategy and family planning service provision could piggy-back off of such existing means tests to experiment with cost recovery where appropriate. The addition of any amount of cost-sharing, most appropriately from FP program beneficiaries which do not overlap with the safety net beneficiary pool in each country, would thus render contraceptive cost estimates presented here excessive.

Cleland et al. (2006) assessed that African family planning programs would cost more than \$270 million in 2006 and that annual costs would grow to nearly \$500 million by 2015 in order to achieve the UN medium fertility projections. In 2006, international donors had committed \$113 million and domestic resources were projected at \$87 million, leaving a gap of \$70 million in just one year. However, the authors also posit that the savings from obstetric and newborn interventions associated with universal family planning services in the region would exceed the required investment by a factor of three to one.

A hybrid model combining elements of full subsidization and means-tested market segmentation for cost-sharing may be most appropriate in an environment characterized by low usage rates. Contraceptives might be fully subsidized at the advent of a new program and for some period thereafter to maximize uptake. It is beyond the scope of this dissertation to explore the nuanced trade-offs of contraceptive cost-sharing at a national level. The position of the author is that contraceptive services should be provided to the extreme poor at no cost globally. Given that all

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<sup>16</sup> See Chen and Ravallion (2010) and Ravallion et al. (2009) for further details on this standardized extreme poverty benchmark which updates the \$1/day standard first proposed in 1990. The authors observe that a marked economic gradient only emerges above a consumption level of \$2/day and the \$1.25/day line thus represents a level of extreme deprivation.

safety net program beneficiaries in Niger are extremely poor and most in Tajikistan also are, cost sharing may only be appropriate for wealthier population segments in these countries.

Any potential financial advantage to the incorporation of family planning interventions within safety net programs would be conservatively estimated with a predominantly downward bias in safety net cost estimates and a predominantly upward bias in family planning cost estimates. The inverse set of biases would exaggerate any advantage.

Important potential sources of bias both in this exercise and in general which merit consideration include the following:

1. Upward bias in safety net programming costs:
  - a. No assumed efficiency improvements in program implementation over time, including via electronic financial transfers, shifts from food to cash where appropriate, improved market infrastructure and regional linkages, etc.
  - b. No assumed differential (higher) rate of poverty decline related to smaller family sizes
  - c. No assumed age-specific safety net program eligibility criteria or benefit levels (per capita benefits in the analysis are derived from household-level benefits, which may or may not actually be responsive to household composition)
2. Downward bias in food security programming costs:
  - a. No assumed improvements in mortality rates among infants and mothers. If mortality rates for these groups are improved by family planning programs, more women and children will survive to receive public transfers.
  - b. No consideration of possibly stagnating or even worsening poverty rates.
  - c. No consideration of acute food security shocks, i.e. droughts, famines, price spikes, etc., which are highly likely in these two countries over the 40 year period in question given their disproportionate vulnerability to climate change.
3. Unclear direction of bias in food security programming costs:
  - a. Food prices, and thus poor household consumption and the derivative appropriate safety net transfer levels, could increase or decrease depending on conditions of local production, infrastructure investment and market integration, regional and global commodity price swings, global warming trends, etc.
4. Upward bias in family planning program costs:
  - a. Full program subsidies are assumed with women bearing none of the costs of contraception. This is a very strong assumption and there is evidence that women and households are willing to pay for family planning services (Cleland et al., 2006).
  - b. An increasing age at first marriage is often associated with fertility decline in many countries which have undergone a fertility transition. In this analysis, age-specific marriage and union rates are presumed to be static. Given the very young age structure of Niger, an increase in age at first marriage could substantially reduce contraceptive need among 15-19 year-olds.
  - c. Similarly, other factors unaccounted for here may reduce exposure to the risk of pregnancy. These include both increased rates of divorce/separation but

also a hypothesized increase in regional and international labor migration, particularly in West Africa.

- d. No assumed further cost reductions in contraceptive methods despite a great deal of attention to and investment in this cause.
5. Downward bias in family planning program costs:
    - a. No assumed improvements in infant or maternal mortality. If infant and maternal mortality improve with fertility decline, more women survive to rely upon family planning services throughout their reproductive years.

On net, and in consideration of these factors, the estimates of cost savings furnished above are deemed to be conservative.

## **VI. Tax Implications**

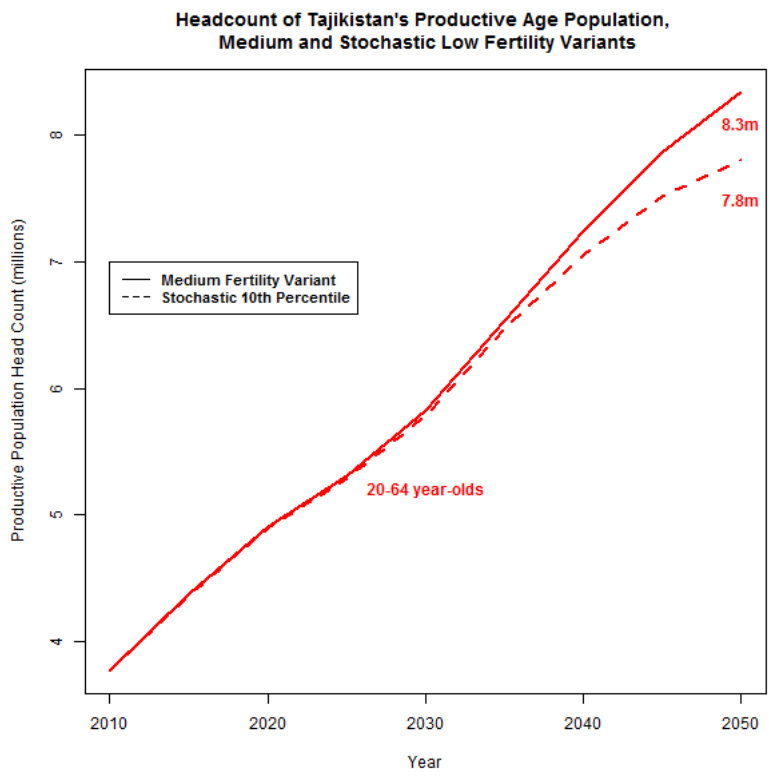
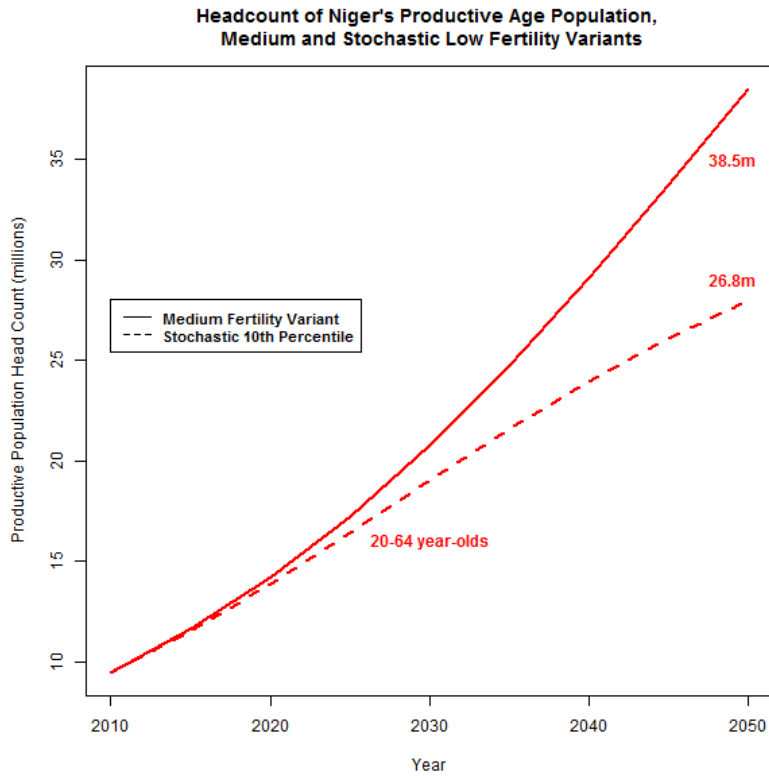
While the World Bank, USAID, and other multilateral public and private donors have made substantial financial, as well as technical, contributions to a growing global portfolio of safety net programs, their long-term sustainability may only be guaranteed by the identification of domestic funding sources. In developed countries, many public health and welfare programs are funded at least in part by income tax revenues.<sup>17</sup> Might a lower population growth rate then pose a challenge to the solvency of safety net programs in countries like Niger and Tajikistan given the resultant smaller populations? Figures 3.7a and 3.7b, below, show the differences in forecast counts of productive age individuals (ages 20-64) associated with the medium and stochastic low fertility trajectories which form the basis of the preceding analysis.

The divergence in working age population sizes associated with reduced fertility is much greater in Niger than it is in Tajikistan. By 2050, the forecast difference in Niger exceeds 30 percent of the 38.5 million working age people implied by the medium fertility variant, or 11.7 million people. In Tajikistan, the difference of half a million people represents a much more modest 6 percent reduction.

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<sup>17</sup> For example, the U.S. Social Security program is funded by a payroll tax assessed on wages. See Goss (2010) among many other sources.

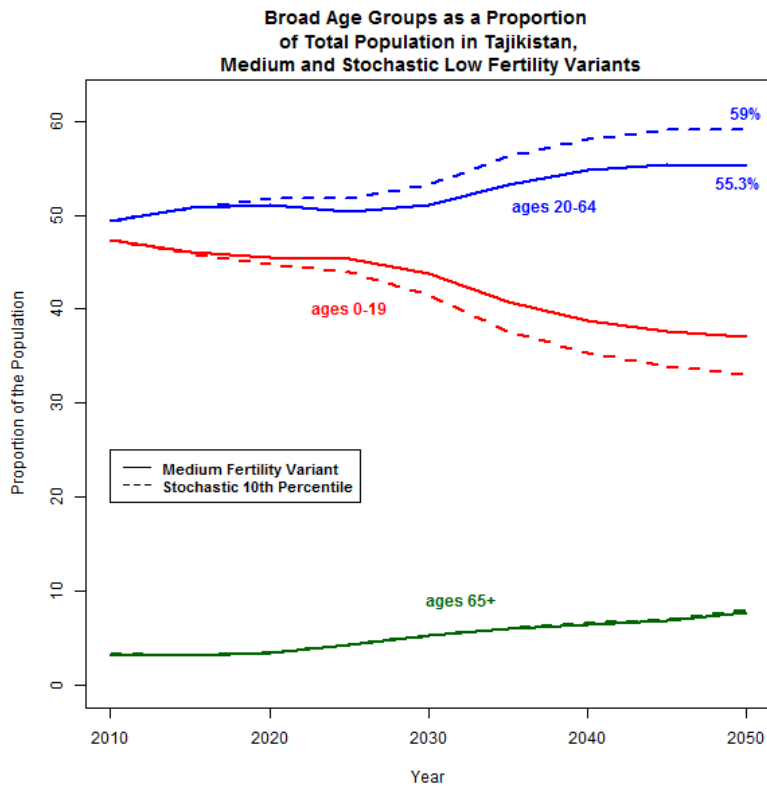
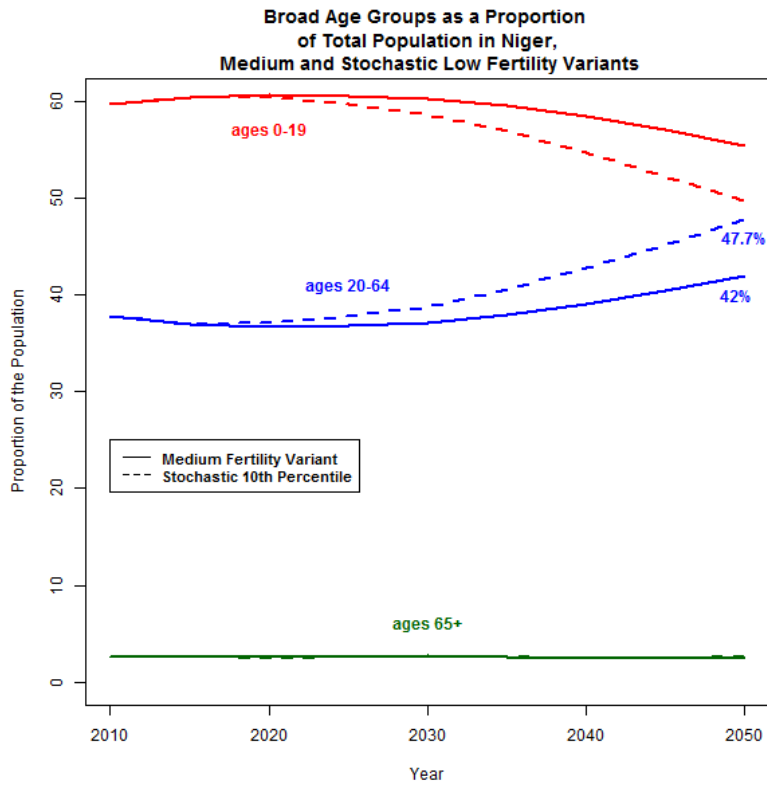
**Figures 3.7a and 3.7b: Productive Age Population Forecasts in Niger and Tajikistan by Fertility Variant**



While there would be fewer workers under the low fertility scenario, it is important to acknowledge that there will also be fewer children, who merit special consideration in food security investments, in both absolute and proportional terms. Figures 3.8a and 3.8b show the proportional changes in productive age (20-64) populations relative to younger and older groups under different fertility variants. In both countries, reduced fertility results in approximately a ten percent increase in the proportion of the working age population with an attendant proportional reduction in children and youth (note that proportions of elderly citizens remain largely unchanged over this forecast period). Particularly in Niger, where people under age 20 now constitute approximately three fifths of the total population, a ten percent proportional increase in the workforce associated with reduced fertility could potentially generate an increase in tax revenues per capita despite the absolute decline in people of this age group.

It is worth recalling that today's children are tomorrow's labor force. It is plausible that children raised in an environment of declining fertility and smaller households will enjoy better health and nutrition investments which better prepare them for school. Improvements in both health and human capital endowments will render them a more productive work force, potentially lifting not only themselves and their families out of poverty, but also their countries.

**Figures 3.8a and 3.8b: Proportional Productive and Dependent Age Group Forecasts in Niger and Tajikistan by Fertility Variant**



In developing countries, however, the extent to which differences in the *potential* domestic tax base, whether proportion or absolute, constitute a threat to domestic welfare programming is complicated by the substantially smaller contributions of income tax (and, indeed, other tax revenues) to GDP. By one recent estimate, 14.5 percent of Niger's GDP is derived from any type of tax burden (Heritage Foundation, 2015). That proportion stands at 19.9 percent in Tajikistan, 24.3 percent in the United States, and over 44 percent in Finland, Sweden, Italy, France, Belgium, and Denmark. By contrast, many of the world's poorest countries find that less than 10 percent of their GDP comes from tax revenue streams due to a combination of labor market informality, very low earnings levels, and inefficient or functionally nonexistent tax collection systems.

Bird and Zolt (Bird & Zolt, 2014) observe that, even when collected, personal income taxes in many developing countries are neither comprehensive nor progressive while their administrative costs may exceed those associated with other types of taxes. Agricultural work for household consumption is nearly always informal and thus difficult to tax. In Niger, the International Labor Organization estimates that 57 percent of all employment was in agriculture in 2005, the latest year for which data is available. In Tajikistan, the most recent data point is 2004, at which time 56 percent of employment was in agriculture (The World Bank, 2015). In the United States and Germany, by contrast, that proportion stands at just two percent.

Thus, many of the same factors which contribute to chronic food insecurity in the world's poorest countries make an income tax-financed safety net program untenable. To ensure safety net sustainability in the places where the need for one is greatest, alternative funding mechanisms, including but not necessarily limited to grants and concessionary loans, must be identified.

## **VII. Conclusion**

This dissertation examines both the causes of food insecurity and its consequences which undermine the health, the social and economic development potential, and the dignity of those who are most marginalized in our global economy. The majority of both the chronically undernourished and those who face acute food security crises, often on a recurring and increasingly predictable basis, are children. The intergenerational transmission of poverty and disadvantage mediated by food insecurity and malnutrition is substantial.

Cash transfer programs for the poor have expanded rapidly in the past decade and have become a powerful political tool to combat food insecurity. Much has been made of their potential to help eradicate the most pernicious forms of entrenched, structural poverty. This dissertation has examined nascent safety net programs in two food insecure, landlocked countries with medium and high levels of population growth: Tajikistan and Niger. It estimates the cumulative present discount value of public budgetary commitments to cash transfers over the medium term under



different population growth trajectories and calculates the cost savings in each country associated with reduced fertility. It then estimates the family planning program investments required to achieve slower growth. Results demonstrate that the medium-term cost savings to national safety net programs are more than adequate to cover contraceptive commodity needs in each country. Surplus savings could be reinvested in the safety net programs to increase benefit levels, to expand coverage, or both.

It is worth reiterating that a substantial literature exists on the relationship between fertility reductions and poverty decline. While causal identification has proven challenging, it is plausible that the many other welfare-enhancing effects of reduced fertility and greater reproductive agency dwarf the effects explored in this exercise. Smaller families allow for a greater share of resources, including food but also health investments, to be allocated to children at critical stages in their early development. Investments in the health and nutrition of children in the first two years of life have been shown to spur better health and economic outcomes decades later. Mothers who are able to space births at intervals of at least 18 months see better outcomes for their children and themselves. Women who are able to control their fertility are much less likely to die in childbirth and can capitalize on more time for productive investments outside of childrearing throughout their adult lives.

There is great potential for national safety nets and comprehensive family planning programs to benefit from shared management, staffing, infrastructure, and data collection resources, thereby driving down costs that each might incur on its own. At this time of heightened international donor interest in cash transfers and food security, the substantial complementary contributions of voluntary family planning programs should not be overlooked.

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## Appendices

### Appendix A: 20-Year Population Growth in Feed the Future Priority Countries<sup>1</sup>

Country	2014 Population (thousand)	2034 Projected Population (thousand, medium fertility variant)	Population Increase (thousand)	Proportional Increase
Bangladesh	158,513	189,940	31,427	20%
Cambodia	15,408	19,915	4,507	29%
Ethiopia	96,506	148,132	51,626	53%
Ghana	26,442	37,466	11,023	42%
Guatemala	15,860	24,331	8,472	53%
Haiti	10,461	12,983	2,521	24%
Honduras	8,261	11,406	3,145	38%
Kenya	45,546	72,164	26,618	58%
Liberia	4,397	6,968	2,571	58%
Malawi	16,829	28,704	11,875	71%
Mali	15,768	29,341	13,573	86%
Mozambique	26,473	42,725	16,252	61%
Nepal	28,121	33,808	5,687	20%
Rwanda	12,100	19,288	7,188	59%
Senegal	14,548	23,924	9,376	64%
Tajikistan	8,409	12,099	3,690	44%
Tanzania	50,757	88,189	37,432	74%
Uganda	38,845	70,774	31,929	82%
Zambia	15,021	28,150	13,129	87%
<b>Total:</b>	<b>608,265</b>	<b>900,307</b>	<b>292,042</b>	<b>48%</b>

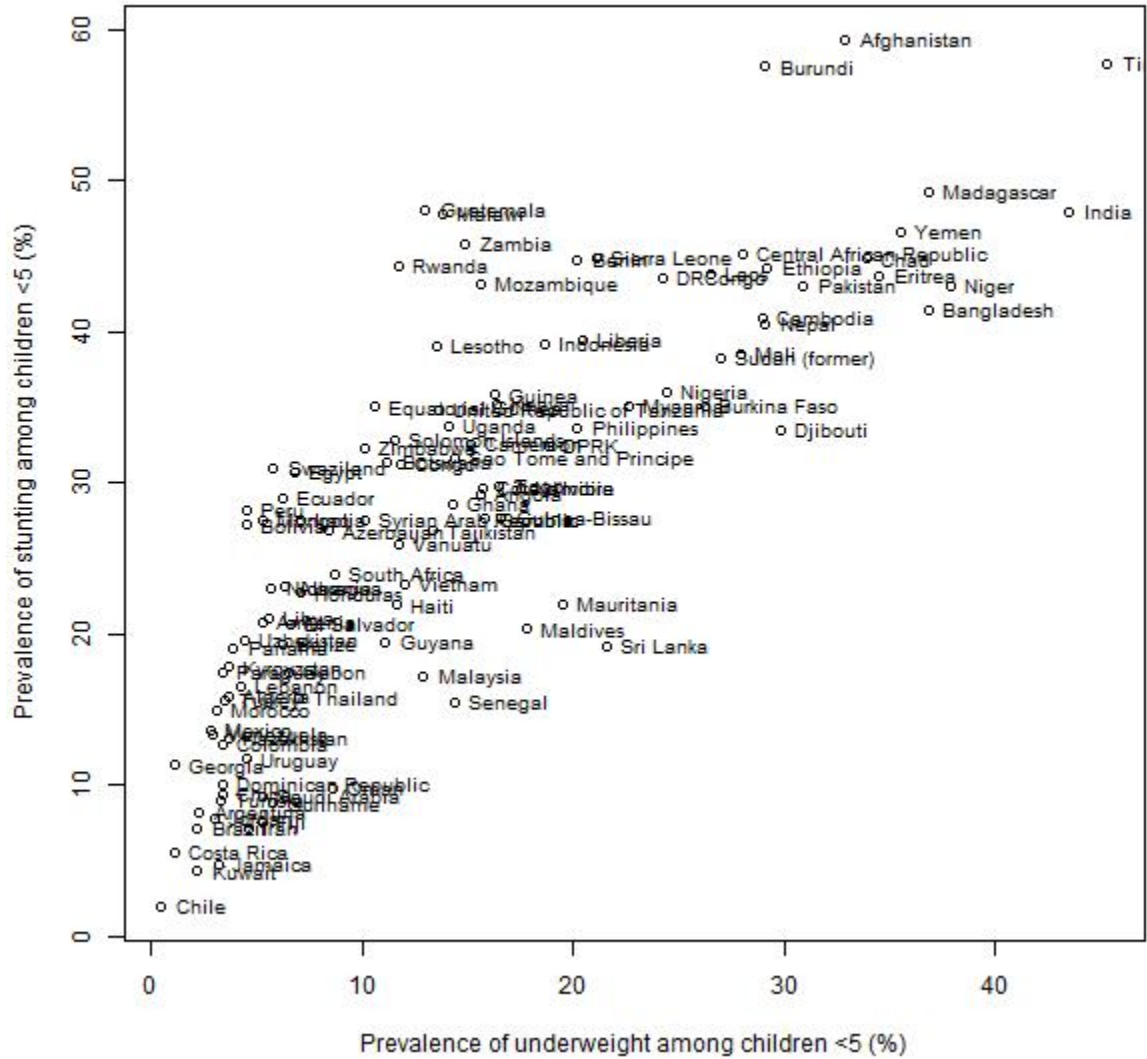
#### Annual Growth Rate Calculation:

$$\text{All Countries: } \left( \frac{900,307}{608,265} \right)^{1/20} - 1 = 1.98\%$$

$$\text{Mali, Uganda, and Zambia: } \left( \frac{128,265}{69,634} \right)^{1/20} - 1 = 3.10\%$$

<sup>1</sup> Source: UN Population Division (United Nations, Department of Economic and Social Affairs, Population Division, 2013).

## Appendix B: The Relationship between Stunting and Underweight<sup>2</sup>



<sup>2</sup> Source: FAOSTAT (2015)

## Appendix C: Feed the Future Projects in Tajikistan

Project Name	Award No.	Main Objectives	Award Amount	Life of Award	Main Implementer	Working Outside ZoI?
Enabling Agricultural Trade (EAT)	Task Order No. AID-OAA-TO-1000055	To promote inclusive agricultural sector growth by creating enabling environments for agribusinesses that encourage private sector investment and promote food security <sup>i</sup>	\$9,255,236* <sup>†</sup> (across 18+ countries)	September 30, 2010 – February 28, 2015	Fintrac Inc.	Not directly (see footnote †)
Family Farming Program	Contract No. EDH-I-00-05-00004, Task Order AID-176-TO-10-00003	To improve food security by increasing a) the volume of agricultural production, b) the income of food-insecure households, and c) household nutrition	\$29 million <sup>ii</sup>	September 30, 2010 - September 29, 2014 (extended through February 27, 2015 <sup>iii</sup> )	Development Alternatives, Inc.	No
Farmer Advisory Services in Tajikistan (FAST)	Cooperative Agreement No. AID-176-LA-13-00003	To improve the nutrition and family income of smallholder commercial and subsistence farmers by developing and supporting an agricultural extension and advisory system <sup>iv</sup>	\$8 million <sup>v</sup>	August 2013 – April 2017; Revised to end August 2015 <sup>vi</sup>	University of Illinois at Urbana-Champaign	No
Farmer-to-Farmer Program	Cooperative Agreement No. EDH-A-00-08-00019-00	To provide for the transfer of knowledge and expertise of U.S. agricultural producers and businesses on a voluntary basis to middle-income countries and emerging democracies <sup>vii</sup>	\$7,490,575 <sup>viii</sup> (across X countries)	October 1, 2008 – September 30, 2013	Citizens Network for Foreign Affairs (CNFA)	Yes. Only 14% (9 of 63) volunteers were posted to Khatlon while 71% were sent to Sughd. <sup>ix</sup>
Maternal and Child Health Project	Cooperative Agreement No. AID-119-A-000800025	To improve infant and young child feeding, care, and health seeking practices; to increase the coverage and quality of maternal and newborn care; to increase the capacity of facilities to deliver quality health services (especially counseling and nutrition support to mothers) <sup>x</sup>	\$7,580,287*	September 30, 2008 – September 29, 2015	Mercy Corps	Yes but moved to Khatlon in July 2013
Modernizing Extension and Advisory Services (MEAS)	Cooperative Agreement No. AID-OAA-L-1000003	To promote and assist in the modernization of rural extension and advisory services; the services are expected to benefit developing country policymakers and technical specialists, development practitioners, other donors, and USAID projects	\$9,549,470* <sup>†</sup> (across 13+ countries)	September 15, 2010 – September 14, 2015	University of Illinois at Urbana-Champaign	Not directly (see footnote †)
Productive Agriculture in Tajikistan	Contract No. 119-C-00-09-00021	Increase farmers' incomes by 25% via crop expansion, livestock production, improved access to inputs (seeds, fertilizer, etc.), and financial services <sup>xi</sup>	\$9.7 million <sup>xii</sup> (\$477,000 in direct grants by January 2014 <sup>xiii</sup> )	October 2009 - 2015	ACDI/VOCA, MEDA, IFDC, and E-NOETEC Consulting	Yes; Sughd and districts around Dushanbe in addition to western Khatlon <sup>xiv</sup>
Land Reform and Farm Restructuring Project	Task Order: AID-176-TO-13-00004; Contract No. AID-OAA-I-12-00027	To strengthen GoT capacity to introduce progressive land legislation and policies, to enhance farmers' awareness of land-related rights, and to provide technical training on land rights issues to local government officials and members of the judiciary <sup>xv</sup>	\$5,400,000 <sup>xvi</sup>	October 1, 2013 – September 30, 2016	Chemonics International, Inc.	Yes; aims to augment central government capacity but there is also reference to activities in Khatlon Province

**Appendix D: Current Marital Status of Women in Tajikistan (2012) and Uzbekistan (2002)<sup>3</sup>**

Country	Age	Never Married (a)	Married (b)	Living Together (c)	Divorced/ Separated/ Widowed (d)	Total in Union (b + c)
Tajikistan (2012 DHS)	15-19	86.7	13.2	0.0	0.1	13.2
	20-24	29.4	67.4	0.3	2.9	67.7
	25-29	12.8	82.6	0.2	4.4	82.8
	30-34	6.8	85.2	0.2	7.8	85.4
	35-39	2.6	89.5	0.1	7.7	89.6
	40-44	1.1	88.2	0.5	10.2	88.7
	45-49	.5	87.5	0.5	11.6	88.0
<b>Total:</b>		<b>27.4</b>	<b>67.1</b>	<b>0.2</b>	<b>5.2</b>	<b>67.4</b>
Uzbekistan (2002 HES)	15-19	92.9	6.9	0.1	0.1	7.0
	20-24	30.9	66.0	0.4	2.8	66.4
	25-29	4.7	88.7	1.0	5.5	89.7
	30-34	1.8	89.5	1.2	7.5	90.7
	35-39	2.3	87.5	0.7	9.6	88.2
	40-44	1.8	87.1	1.1	10.0	88.2
	45-49	1.0	83.2	2.1	13.7	85.3
<b>Total:</b>		<b>26.0</b>	<b>67.3</b>	<b>0.8</b>	<b>5.9</b>	<b>68.1</b>

**Appendix E: Current Marital Status of Women in Niger (2012) and Ethiopia (2011)**

Country	Age	Never Married (a)	Married (b)	Living Together (c)	Divorced/ Separated/ Widowed (d)	Total in Union (b + c)
Niger (2012 DHS)	15-19	37.0	60.9	0.1	2.0	61.0
	20-24	6.7	90.2	0.3	2.8	90.6
	25-29	1.8	94.9	0.1	3.1	95.0
	30-34	0.7	96.4	0.1	2.8	96.5
	35-39	0.7	95.4	0.5	3.4	95.9
	40-44	0.4	92.8	0.0	6.8	92.8
	45-49	0.5	91.2	0.0	8.3	91.2
<b>Total:</b>		<b>7.9</b>	<b>88.4</b>	<b>0.2</b>	<b>3.5</b>	<b>88.5</b>
Ethiopia (2011 DHS)	15-19	77.0	17.6	1.5	4.0	19.1
	20-24	31.9	55.0	5.1	8.0	60.1
	25-29	9.7	74.5	5.3	10.6	79.8
	30-34	4.1	78.7	5.0	12.2	83.7
	35-39	1.8	77.6	5.4	15.1	83.0
	40-44	1.4	76.2	5.8	16.6	82.0
	45-49	0.6	72.3	3.4	23.8	75.7
<b>Total:</b>		<b>27.1</b>	<b>58.1</b>	<b>4.2</b>	<b>10.6</b>	<b>62.3</b>

<sup>3</sup> Sources: Analytical and Information Center, Ministry of Health of the Republic of Uzbekistan, State Department of Statistics, Ministry of Macroeconomics and Statistics [Uzbekistan], & ORC Macro (2004); Central Statistical Agency [Ethiopia] & ICF International (2012)



**Appendix F: Modern Contraceptive Usage by Age Among All Women and Among Married Women in Tajikistan and Uzbekistan (proportion of married women in parentheses)**

Country	Age	Female Sterilization	Pill	IUD	Injectables	Implants	Male Condom	Foam/Jelly/Diaphragm	LAM	Other	Any Modern Method
<b>Tajikistan (2012 DHS)</b>	15-19	0.0 (0.0)	0.0 (0.0)	0.1 (0.9)	0.0 (0.0)	0.0 (0.0)	0.1 (0.4)	0.0 (0.0)	0.1 (0.5)	0.0 (0.0)	0.2 (1.8)
	20-24	0.0 (0.0)	0.6 (0.9)	4.6 (6.8)	0.3 (0.3)	0.1 (0.1)	0.8 (1.2)	0.0 (0.0)	0.1 (0.2)	0.0 (0.0)	6.5 (9.5)
	25-29	0.2 (0.3)	1.5 (1.8)	16.2 (19.6)	0.4 (0.5)	0.1 (0.1)	2.0 (2.4)	0.0 (0.0)	0.1 (0.1)	0.0 (0.0)	20.6 (24.8)
	30-34	0.7 (0.8)	3.7 (4.4)	21.7 (25.2)	2.5 (2.9)	0.0 (0.0)	3.5 (4.0)	0.0 (0.0)	0.0 (0.0)	0.1 (0.1)	32.2 (37.4)
	35-39	1.0 (1.1)	4.2 (4.6)	27.4 (30.3)	3.7 (4.1)	0.0 (0.0)	3.2 (3.6)	0.1 (0.1)	0.0 (0.0)	0.1 (0.0)	39.6 (43.9)
	40-44	0.9 (1.0)	2.3 (2.6)	22.2 (25.0)	3.4 (3.8)	0.0 (0.0)	2.1 (2.3)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	30.8 (34.6)
	45-49	1.1 (1.0)	0.4 (0.5)	11.5 (12.9)	1.9 (2.1)	0.0 (0.0)	0.5 (0.5)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	15.4 (17.0)
<b>Total:</b>		<b>0.4 (0.6)</b>	<b>2.3 (2.3)</b>	<b>12.6 (18.5)</b>	<b>1.3 (2.0)</b>	<b>0.0 (0.0)</b>	<b>1.5 (2.2)</b>	<b>0.0 (0.0)</b>	<b>0.0 (0.0)</b>	<b>0.0 (0.0)</b>	<b>17.5 (25.8)</b>
<b>Uzbekistan (2002 HES)</b>	15-19	0.0 (0.0)	0.2 (2.2)	0.6 (7.9)	0.0 (0.0)	not asked	0.1 (0.5)	0.0 (0.0)	0.8 (11.7)	not asked	1.6 (22.4)
	20-24	0.1 (0.1)	1.1 (1.5)	25.5 (38.0)	0.4 (0.6)	not asked	1.6 (2.1)	0.0 (0.0)	4.8 (7.1)	not asked	33.5 (49.4)
	25-29	0.6 (0.6)	1.2 (1.4)	53.1 (58.1)	1.8 (2.0)	not asked	1.6 (1.5)	0.0 (0.0)	3.2 (3.6)	not asked	61.5 (67.1)
	30-34	2.6 (2.2)	1.8 (2.0)	55.5 (59.7)	1.5 (1.6)	not asked	2.4 (2.6)	0.0 (0.0)	1.8 (2.0)	not asked	65.6 (69.9)
	35-39	5.1 (5.8)	2.1 (2.2)	59.5 (64.6)	2.5 (2.9)	not asked	1.8 (1.9)	0.0 (0.0)	0.8 (0.9)	not asked	71.9 (78.4)
	40-44	4.0 (4.6)	1.6 (1.8)	49.8 (55.7)	3.4 (3.8)	not asked	2.1 (2.2)	0.0 (0.0)	0.2 (0.2)	not asked	61.2 (68.3)
	45-49	4.4 (4.1)	0.5 (0.6)	30.7 (34.5)	1.1 (1.3)	not asked	1.7 (1.9)	0.1 (0.1)	0.0 (0.0)	not asked	38.6 (42.5)
<b>Total:</b>		<b>1.9 (2.6)</b>	<b>1.2 (1.6)</b>	<b>36.1 (51.8)</b>	<b>1.3 (2.0)</b>		<b>1.5 (2.0)</b>	<b>0.0 (0.0)</b>	<b>1.9 (2.8)</b>		<b>44.0 (62.8)</b>

**Appendix G: Modern Contraceptive Usage by Age Among All Women and Among Married Women in Niger and Ethiopia (proportion of married women in parentheses)**

Country	Age	Female Sterilization	Pill	IUD	Injectables	Implants	Male Condom	LAM	Other	Any Modern Method
<b>Niger (2012 DHS)</b>	15-19	0.0 (0.0)	1.8 (3.0)	0.0 (0.0)	0.1 (0.2)	0.0 (0.0)	0.0 (0.0)	1.8 (2.8)	0.0 (0.0)	3.7 (5.9)
	20-24	0.1 (0.1)	5.3 (5.9)	0.1 (0.1)	1.6 (1.8)	0.3 (0.3)	0.3 (0.1)	4.1 (4.4)	0.0 (0.0)	11.8 (12.6)
	25-29	0.0 (0.0)	8.1 (8.4)	0.0 (0.1)	2.1 (2.2)	0.4 (0.4)	0.0 (0.0)	4.7 (4.9)	0.1 (0.1)	15.5 (16.0)
	30-34	0.1 (0.1)	5.6 (5.8)	0.0 (0.0)	2.7 (2.8)	0.3 (0.3)	0.1 (0.1)	4.9 (5.0)	0.1 (0.1)	13.9 (14.3)
	35-39	0.3 (0.3)	6.2 (6.4)	0.1 (0.1)	3.5 (3.6)	0.6 (0.6)	0.0 (0.0)	3.9 (3.9)	0.0 (0.0)	14.6 (15.0)
	40-44	0.5 (0.5)	3.2 (3.5)	0.0 (0.0)	2.3 (2.4)	0.0 (0.0)	0.1 (0.1)	2.1 (2.2)	0.0 (0.0)	8.2 (8.8)
	45-49	0.2 (0.2)	1.0 (1.1)	0.3 (0.3)	1.0 (1.1)	0.2 (0.2)	0.0 (0.0)	0.2 (0.3)	0.0 (0.0)	3.0 (3.2)
<b>Total:</b>		<b>0.1 (0.1)</b>	<b>5.0 (5.6)</b>	<b>0.1 (0.1)</b>	<b>1.9 (2.1)</b>	<b>0.3 (0.3)</b>	<b>0.1 (0.0)</b>	<b>3.5 (3.9)</b>	<b>0.0 (0.0)</b>	<b>11.0 (12.2)</b>
<b>Ethiopia (2011 DHS)</b>	15-19	0.0 (0.0)	0.6 (2.5)	0.0 (0.0)	4.1 (18.9)	0.4 (1.6)	0.1 (0.0)	not asked	0.0 (0.0)	5.2 (23.0)
	20-24	0.1 (0.0)	1.4 (1.9)	0.1 (0.1)	18.5 (28.5)	1.8 (2.9)	0.3 (0.0)	not asked	0.0 (0.0)	22.2 (33.4)
	25-29	0.2 (0.1)	2.1 (2.2)	0.4 (0.5)	18.9 (21.7)	3.5 (4.2)	0.5 (0.2)	not asked	0.0 (0.0)	25.6 (28.9)
	30-34	0.1 (0.1)	2.3 (2.7)	0.2 (0.2)	21.2 (23.9)	3.4 (3.8)	0.5 (0.5)	not asked	0.0 (0.0)	27.7 (31.2)
	35-39	1.0 (1.1)	1.9 (2.2)	0.7 (0.8)	18.3 (19.7)	3.7 (4.1)	0.2 (0.1)	not asked	0.0 (0.0)	25.8 (28.0)
	40-44	1.3 (1.6)	2.0 (2.3)	0.4 (0.5)	11.2 (13.5)	3.4 (3.6)	0.3 (0.4)	not asked	0.2 (0.2)	18.8 (22.1)
	45-49	1.0 (1.0)	0.3 (0.3)	0.1 (0.1)	7.5 (9.2)	1.5 (2.0)	0.2 (0.0)	not asked	0.0 (0.0)	10.4 (12.5)
<b>Total:</b>		<b>0.4 (0.5)</b>	<b>1.5 (2.1)</b>	<b>0.2 (0.3)</b>	<b>14.0 (20.8)</b>	<b>2.3 (3.4)</b>	<b>0.3 (0.2)</b>		<b>0.0 (0.0)</b>	<b>18.7 (27.3)</b>

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- <sup>i</sup> Source: <http://eatproject.org/#abouteat>
- <sup>ii</sup> Source: USAID Office of Inspector General (2014)
- <sup>iii</sup> Source: Svendsen and Sharofiddinov (2014)
- <sup>iv</sup> Source: USAID (2014d)
- <sup>v</sup> Note: The source of this figure is USAID (2014d). Transactions recorded in USASpending.gov reflect total disbursements of \$4,474,607 as of 3/2/2015. The budgetary implications of the project ending in 2015 rather than 2017 are unclear.
- <sup>vi</sup> Source: Personal correspondence with FAST Chief of Party, Don Van Atta, 3/4/2015
- <sup>vii</sup> Source: Weidemann Associates, Inc. (2012)
- <sup>viii</sup> Source: CNFA (2013)
- <sup>ix</sup> Source: CNFA (2013)
- <sup>x</sup> Source: USAID (2014c)
- <sup>xi</sup> Source: [http://dushanbe.usembassy.gov/pr\\_01212010.html](http://dushanbe.usembassy.gov/pr_01212010.html)
- <sup>xii</sup> Source: [http://dushanbe.usembassy.gov/pr\\_01212010.html](http://dushanbe.usembassy.gov/pr_01212010.html); As of 3/2/2015, \$9.5 million in disbursements were reflected in USASpending.gov records
- <sup>xiii</sup> Source: USAID (2014a)
- <sup>xiv</sup> Source: ACDI/VOCA (2010)
- <sup>xv</sup> Source: Chemonics International, Inc. (2014)
- <sup>xvi</sup> Source: USAID (2014b)