

NIGERIA'S DEMOGRAPHIC DIVIDEND?

POLICY NOTE IN SUPPORT OF
NIGERIA'S ERGP 2017–2020

Rifat Hasan
Benjamin Loevinsohn
Corrina Moucheraud
S. Amer Ahmed
Israel Osorio-Rodarte
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Executive Summary

What is the demographic dividend and why is it important for accelerated economic growth and development?

A demographic dividend is the potential economic benefit associated with a country's demographic context.

- A demographic dividend is the economic benefit to a country that can take place when a country undergoes rapid declines in mortality and fertility, producing smaller, healthier families and a youth cohort that can be educated and empowered to enter the labor market.
- East Asian countries took advantage of this demographic window of opportunity to drive macroeconomic growth and poverty reduction.

The key point underlying the demographic dividend is that population age structure—dependency ratio—is critically important—and even more so than population size.

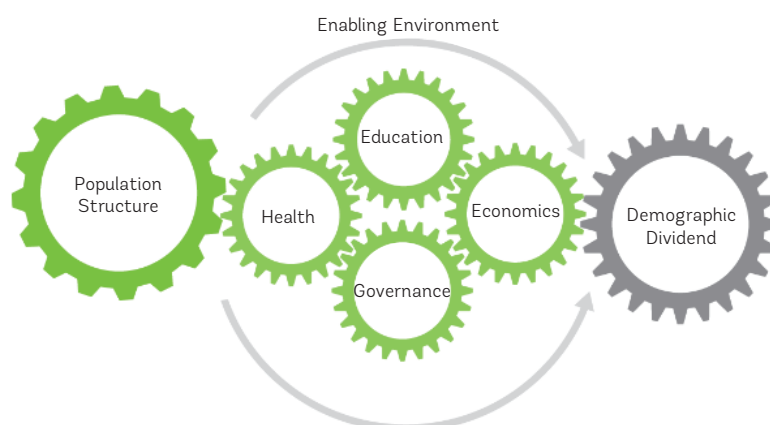
People are at the heart of the demographic dividend, and the extent to which countries reap these dividends varies and depends on

policies. The first demographic dividend—or extra boost to the economy based on a productive labor supply—focuses on the labor supply effects of changes in age structure. It can be captured if three things happen.

1. The demographic transition needs to be catalyzed and accelerated: Slow fertility decline leads to a lower ratio of working age adults to dependents. Hence, rapid fertility decline is key in maximizing the ratio of working age adults to dependents.
2. Investments in health and education need to increase.
3. An economic environment has to be fostered so that this bulge cohort can find well-paying jobs, rather than simply be unemployed or forced into low-productivity work.

A slow or stagnating demographic transition poses considerable risks to countries.

- Speeding up the fertility decline in sub-Saharan Africa is critical not only for increasing the chance of a dividend, but



Source: Population Reference Bureau.

more importantly for decreasing the risk of a demographically driven disaster.

- Fertility rates and youth dependency ratios in the region remain among the highest in the world, resulting in lower investments in children, lower labor productivity, lower female labor force participation, high unemployment or under-employment, higher poverty rates and higher risk of political instability.
- Thus, demographics and demographic shifts are key to development in sub-Saharan Africa.

What is Nigeria's progress toward the demographic dividend?

Nigeria is a pre-dividend country due to its high fertility, declining mortality and skewed young age structure.

Nigeria has experienced only modest declines in mortality and fertility—and rates remain high, posing risks for population age structure and the potential for a demographic dividend. Note that there are important urban/rural/ geographic differences in fertility rates, and across women's education levels.

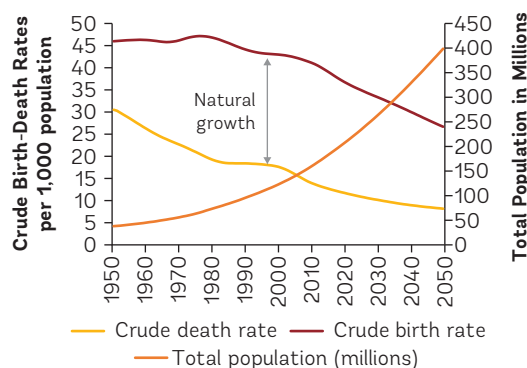
- The incomplete demographic transition may hinder Nigeria's growth prospects, as population growth exacerbates the demand for social services and outstrips the capacity of the economy to generate jobs.
- Death rates have been progressively declining over several decades, but the total fertility rate (TFR) remains persistently high. The 2017 MICS (Multiple Indicator Cluster Surveys) places TFR at 5.8. Fertility

is substantially higher in North-West and North-East regions (6.7 and 6.3, respectively) compared to South-South where it is 4.3 (DHS, 2013). The 2017 MICS survey shows even greater differences (7.2 in North-West, 6.3 in North-East, 4.3 in South-South).

- Women with more education or living in urban areas tend to have a much lower number of children as compared to their counterparts with lower levels of education or those who live in rural areas. TFR is 1.5 children per woman higher in rural areas compared to urban areas. Women with no education have more than twice as many children as compared to women with at least high school education (DHS). The 2017 MICS survey paints a similar picture: TFR is 1.4 children per woman higher in rural areas compared to urban areas—and 3.5 children higher among women with no education compared with women with higher education.
- While wanted fertility is lower than actual fertility, the gap between actual and wanted fertility is very small, reflecting both a desire for large families and relative realization of desired family size.

Use of modern contraceptives remains very low, lagging considerably behind other countries in the region. Fewer than 10% of married women reportedly use a modern method (DHS, 2013) with little to no progress since 1999. The 2017 MICS survey confirms minimal progress in this regard, finding modern contraceptive use to be less than 11%.

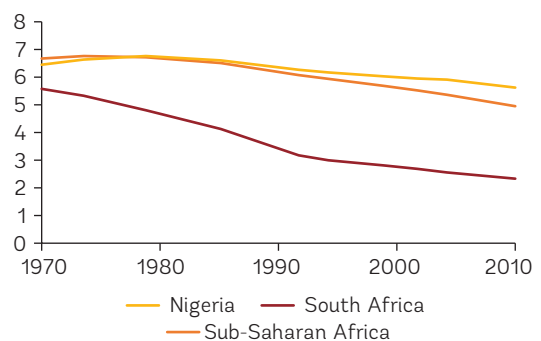
Figure ES1. Demographic Transition in Nigeria



Source: UN Population Division, World Population Prospects 2015 Revision.

Note: Data after 2015 are projections based on UN medium-variant fertility.

Figure ES2. Total Fertility Rate (TFR) in Nigeria, South Africa, and sub-Saharan Africa



Source: UN Population Division, World Population Prospects 2015 Revision.

Note: Data after 2015 are projections based on UN medium-variant fertility.

Furthermore, gender inequality continues to be a challenge in Nigeria—and gender dynamics and women’s empowerment affect the use of modern contraception.

- Women who participate more in household decision-making tend to have higher use of modern contraceptives. In 2013, 18.2% of women who participated in making at least 3 household decisions used modern contraceptives compared to only 3.5% of women who participated in none (DHS).

Despite some improvements in maternal survival, under utilization of maternal health services remains, which may cause persistently poor outcomes.

- 2017 MICS data suggests some improvement in skilled birth attendance (66%). This contrasts with 2013 DHS data (40%).
- The use of skilled birth attendance is lowest among young mothers indicating a need to target adolescents for maternal health services, especially as adolescent childbearing carries higher risks to both the young mother and her child.

Nigerian children suffer widely from both chronic and acute malnutrition with 37% of children under 5 being stunted, and low coverage of preventative and curative child health care puts children at risk for infectious diseases, which are the main causes of child mortality worldwide (i.e. diarrhea, malaria and pneumonia) (DHS). The 2017 MICS data is even more sobering, finding 43.6% of children under 5 to be stunted.

- The coverage of childhood vaccines experienced a massive decline during the 2000s, and is now back to near-similar levels as 1990 (25% of children have been fully vaccinated by age 2) (DHS). The 2017 MICS paints an even bleaker picture, finding childhood vaccination to be only 23%.
- Only 1/3 of mothers seek health services when their children have diarrhea or respiratory illness (DHS). The 2017 MICS data suggests this figure is closer to 1/4.
- The 2013 DHS found only 17% of children were breastfed, although the 2017 MICS suggests some improvement (24%).

Girls’ secondary education in Nigeria is particularly concerning given that ample

evidence shows that girls’ secondary education lowers fertility and unwanted pregnancy, reduces infant mortality, increases childhood immunization and nutrition, and reduces childhood stunting.

Adolescents and their decisions have implications for harnessing the demographic dividend.

- High levels of fertility reflect young age at marriage, early and frequent childbearing as well as low levels of contraceptive use: approximately 28% of girls between the ages of 15–19 are already married, and 23% are already mothers or pregnant with their first child.
- There are also regional differences, with the youngest ages of marriage seen in the North-West, North-East and North-Central regions. These are the same regions where age of marriage has been relatively stagnant over time with very little (if any) progress.

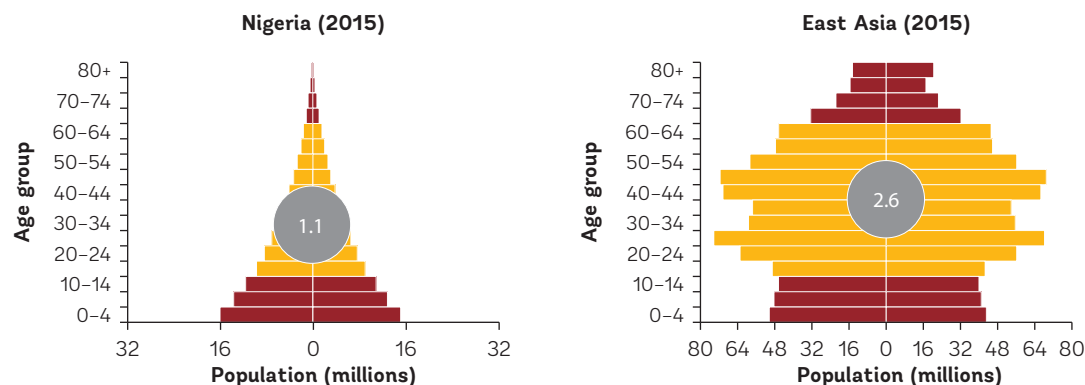
Adolescents make up a substantial 23 percent of Nigeria’s population, and the already large number of adolescents is expected to more than double in the upcoming decades from 41 million to 84 million in 2050 (under a medium fertility scenario), posing challenges for provision of health, education, and job training services to prepare them for a productive future—but also has implications for the next generation given patterns of early marriage and early childbearing, and correlations between unemployed youth and political instability.

- Children born to adolescent mothers are at higher risk of mortality, malnutrition, and onset of illness than are children of older mothers.
- Poor health and nutrition adversely affect cognitive and socioemotional development and learning, putting children of teenage mothers at higher risk of poor development outcomes...prolonging the intergenerational cycle of poverty.
- Research shows that youth unemployment is linked with political instability, especially in countries with large income inequality and lower levels of education among the youth.

How is the demographic transition linked to economic growth and poverty reduction?

Due to slow fertility and mortality declines, Nigeria will experience rapid population

Figure ES3. Population Pyramids and Working Age to Dependent Population Ratios in Nigeria and East Asia



Source: UN (2015).

growth and an age structure that is heavily skewed toward young dependents.

- The current population age structure in Nigeria is considerably skewed toward young ages; this can be contrasted with a typical age structure from East Asia, where the working age population is proportionately greater than the share of dependents.
- The ratio of working age to dependents is expected to progressively increase from 1.1 (2015) to a range of 1.4 to 1.7 (2050) under the three fertility scenarios—which implies that there will be increasingly more working age adults per every dependent.

Nigeria is a high-fertility country and modest accelerations in its fertility decline can lead to substantial changes in its projected age-structure.

- Children currently account for 43 percent of the population, and will remain more than 40 percent in 2030 and more than 35 percent in 2050.
- The working-age population currently accounts for 53 percent of the population, and this age cohort will account for more than 60 percent of the population by 2050 under the medium fertility scenario.

Economic simulation modeling suggests that a one child difference in Nigeria's fertility rates by 2050 can lead to differences of 29 percent in real GDP per capita.¹ Lower fertility will also result in lifting 53 million people out of poverty by 2050.²

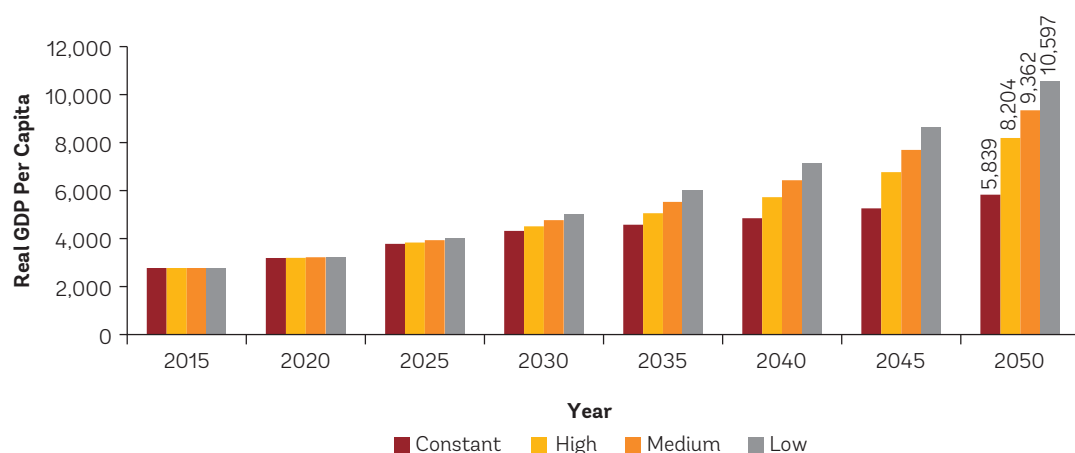
What policies and strategies can Nigeria adopt to seize the demographic dividend, spur economic growth and reduce poverty?

- These dividends are not automatic, and good policies are necessary to turn the window of demographic opportunity into demographic dividends.
- In support of Nigeria's Economic Growth and Recovery Plan (EGRP) 2017–2020, coordinated multi-sectoral actions are

¹ The LINKAGE model has been used for analysis of the growth and poverty impacts of age-structure changes as in Ahmed et al. (2016), which showed that demographic change could explain 11 to 15 percent of GDP volume growth and approximately 40 to 60 million fewer poor by 2030 for Sub-Saharan Africa. The analytical framework was also used to examine the impact of demographic change on the global economy (World Bank 2015a), South Africa (World Bank 2015b), and the Southern African Customs Union economies (Ahmed and Cruz 2016). Additional details on the methodology can be found in technical annex A. It should be noted that the scenario analysis does not account for the discrete structural changes in Nigeria's economy, such as those that may occur due to unanticipated infrastructure investments. As such, the simulation results should be considered illustrative and highlighting the marginal impacts of demographic change rather than as forecasts. Please also note that this analysis uses the 2009 HNLSS data as recommended and used by the Government of Nigeria for estimating poverty rates, but more recent survey data are available (GHS 2015/16).

² The levels and trends in poverty, growth, and fertility vary significantly in the North and South which means that the impact of lowering fertility is heterogeneous across these regions. Note that poverty rates, number of people below the poverty line and fertility rates are higher in the North. Hence, lowering fertility in the North will likely have a higher impact on reducing poverty in the region as compared to the South.

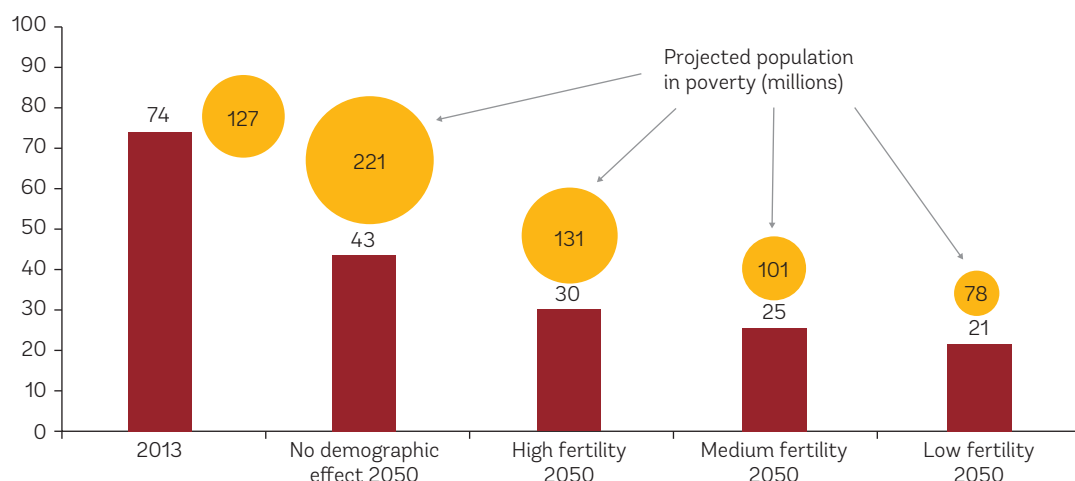
Figure ES4. Real GDP per capita by fertility scenario constant 2011 US\$)



Source: Simulation results from LINKAGE and Global Income Distribution Dynamics model.

Note: The scenarios consider the age-structure changes projected in the medium, high, low, and constant fertility scenarios of United Nations (2015).

Figure ES5. Poverty headcount (%) by fertility scenario by 2050 (PPP\$3.10)



Source: Simulation results from LINKAGE and Global Income Distribution Dynamics model.

Note: The scenarios consider the age-structure changes projected in the medium, high, low, and constant fertility scenarios of United Nations (2015).

needed for investing in people to drive economic gains.

- The EGRP prioritizes reviewing the current status of the Population Policy and developing and implementing a revised Population Policy. In order to meet the goals of the EGRP and take advantage of the demographic window of opportunity, the revised Population policy should emphasize the needed changes in the population age structure—rather than only focusing on population size.

These dividends are not automatic. Prudent short and medium-term policies are

necessary to turn the window of demographic opportunity into demographic dividends.

In the short run, the government of Nigeria should consider a 3-pronged approach in order to first spark the demographic transition (see table below).

Without effectively implementing the three short-term strategies to accelerate fertility decline, other investments in skills development, jobs and savings in the longer term will not be able to harness the economic benefits of a demographic dividend. On the other hand, sparking the demographic transition alone does not automatically lead to demographic dividend.

**Sparkling the Demographic Transition:
Policy priorities to improve human development outcomes to accelerate the fertility decline**

1. Expand access to comprehensive family planning programs (including addressing social norms).
2. Improve maternal and child health and nutrition.
3. Increase female education and empowerment (including reducing child marriage and teenage childbearing, and addressing gender norms).

To reap the first demographic dividend, the large youth cohort brought on by the demographic transition should be educated, healthy and gainfully employed. To reap the second dividend, the income generated by the population of working age should contribute to increasing domestic investments. Hence, **to benefit from the demographic dividends, Nigeria should institute fiscal, labor and social policies in the medium-term** by:

- i. improving business environment to build labor demand;
- ii. improving education and human capital;
- iii. encouraging female employment in the formal sector; and
- iv. improving institutions for domestic investments and savings.

The optimal strategy depends also on the time horizon: some actions will have short-term returns on investment (e.g. expanding access to comprehensive family planning programs & improving maternal and child health and nutrition) while others would have medium- to long-term returns on investment (e.g. increasing female education).

To take advantage of the demographic window of opportunity, immediate and concerted efforts are needed to change the

age structure of the population, invest in Nigerian people and drive productivity through coordinated multi-sectoral actions.

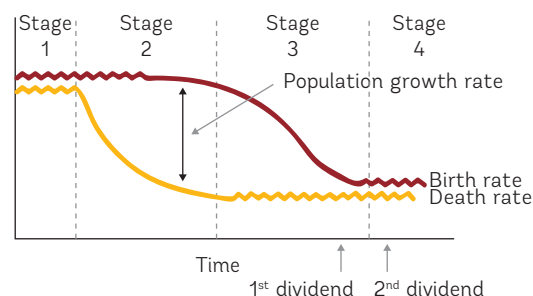
Based on implementation challenges reviewed from Nigeria, several things would increase the likelihood of successful implementation of existing policies and programs to accelerate demographic transition and create an enabling environment to reap demographic dividends:

- Increased and stable financial commitment from the government to keep pace with growing population needs, and full disbursement of budgeted funds;
- Greater coordination by the government, particularly given the decentralized governance structure;
- Continued and/or increased engagement of a range of stakeholders in decision-making and implementation, including stronger government leadership of such partnerships;
- Institution strengthening and capacity building, including greater training and deployment of skilled workers for policy implementation; and
- Greater focus on results, data collection, and monitoring for results and impact.

What is the demographic dividend and why is it important for accelerated economic growth and development?

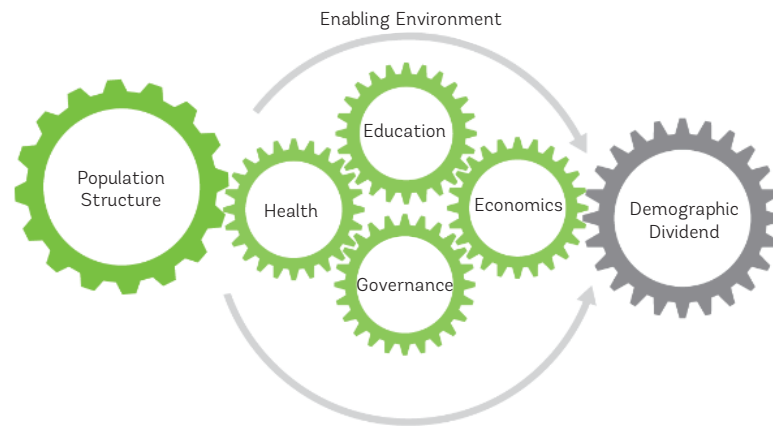
A demographic dividend is the economic benefit to a country that can take place when a country undergoes a rapid decline in mortality followed by a rapid decline in fertility, thus producing smaller, healthier families and a youth cohort that can be educated and empowered to enter the labor market. Smaller families result in increased public and private per capita investment in health, education and other forms of human capital. The concept of a demographic dividend was introduced in the late 1990s to describe the interplay between changes in population age structure and fast economic growth in East Asia—i.e. South Korea, Singapore, Thailand (Bloom, Canning, and Malaney 2000; Bloom and Williamson 1997). The concept links population dynamics to accelerated economic growth. The figure below illustrates the different stages of the demographic transition (Figure 1). Declines in mortality are followed, with a lag, by declines in fertility. This lag, during which mortality is low but

Figure 1. The four stages of the demographic transition



Demographic dividends are potential economic outcomes associated with a country's demographic context. The extent to which countries reap these dividends varies and depends on policies. These dividends are not automatic.

Figure 2. Changes in population age structure, combined with an enabling policy environment, leads to a demographic dividend.



Source: Population Reference Bureau.

fertility remains high, produces a population bulge and a once-only opportunity for a demographic dividend. The key point underlying the demographic dividend is that population age structure is critically important—and even more so than population size.

People are at the heart of development, and the extent to which countries reap the dividends varies and depends on policies, and the dividends will not occur if fertility does not decline rapidly. The demographic dividend corresponds to a 20–30 year period in a country’s demographic transition when the proportion of working age population compared to the number of dependents increases rapidly. This change in the age structure can lead to an extra economic boost through increased savings and private investments. Figure 2 illustrates the critical inputs needed for the demographic dividend to take place: a change in population age structure and an enabling policy environment.

The first demographic dividend—or extra boost to the economy based on a productive labor supply—focuses on the labor supply effects of changes in age structure. It can be captured if three things happen.

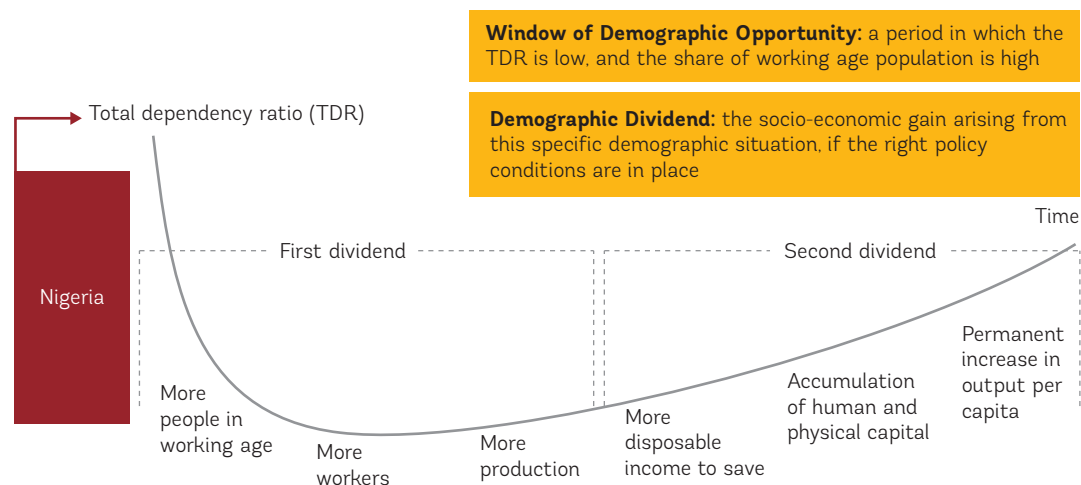
- 1. First, the demographic transition needs to be catalyzed and accelerated.** Improvements in health, especially child health, increase child survival. Combined with investments in family planning, this leads to families giving birth to fewer children while ensuring that the total desired number of children survive. The

combination of higher child survival rates in one cohort and fewer children in the following cohorts produces a population bulge—a large cohort that works its way through the age structure—with large macroeconomic effects.

- 2. Second, investments in health and education need to increase.** Generally, investments in health and education are higher in cohorts following the bulge. As families have fewer children, they and the government have more resources per child to invest in the education and health of the surviving children – due to this quantity-quality tradeoff, human capital increases (Becker 1960; Kalemli-Ozcan, Ryder, and Weil 2000; Schultz 2007). In addition, the labor supply gets an additional boost, as lower fertility allows more women to enter the labor force (Bloom et al. 2009).
- 3. Third, an economic environment has to be fostered so that this bulge cohort can find well-paying jobs, rather than simply be unemployed or forced into low-productivity work.** If all three steps are successful and well timed, a substantial economic dividend is produced as the large youth cohort moves into highly productive jobs, boosting household and national income while supporting a smaller share of young dependents.

Further in the demographic transition, a possible second dividend results from the savings and investments of the bulge

Figure 3. Good policies are necessary to turn the window of demographic opportunity into demographic dividends



cohort as it matures and saves for retirement. This dividend can take place only if policies to promote saving are established and the financial sector is developed enough to attract savings and translate them into productive investments. Later, the bulge cohort ages, leading to a high old-age dependency rate, so savings have to be sufficient to finance this cohort's retirement and health care needs. Figure 3 illustrates what policies have worked globally to achieve the demographic dividends.

A slow or stagnating demographic transition poses considerable risks to countries. *Africa's Demographic Transition: Dividend or Disaster* argues that speeding up the fertility decline in the region is critical not only for increasing the chance of a dividend, but more importantly for decreasing the risk of a demographically driven disaster (Canning, Raja and Yazbeck 2015). Fertility rates and youth dependency ratios in sub-Saharan Africa remain among the highest in the world, resulting in lower investments in children, lower labor productivity, lower female labor force participation, high unemployment or under-employment, higher poverty rates and higher risk of political instability. Thus, demographics and demographic shifts are key to development in sub-Saharan Africa. In fact, the Africa region has identified demography as one of three structural challenges facing the region, with the other two being the need to boost productivity and promote inclusiveness (World Bank 2015).

The *Global Monitoring Report (GMR) 2015/16* (World Bank 2016) uses two criteria drawn from the demographic dividend framework to identify four types of countries, characterized by whether their potential for a first demographic dividend is in the past, present, or future (Box 2). The first criterion is whether the working age share is likely to be rising or not over the next 15 years (2015–30, the time horizon for several development goals). To distinguish two subgroups within these broader groups, the current fertility rate and the fertility rate from 1985 are used to identify how far along countries are in the initial and final phases of demographic transition. Most countries in Sub-Saharan Africa are in pre-dividend phase and a few (mostly in Southern Africa) are early-dividend countries.³ To reap the benefits of the demographic dividend, the GMR indicates that countries at different phases of the demographic transition require different policy priorities—tailored to their economies, societies and culture:

³ Pre-dividend countries will account for most of the global population growth through 2050. The population of this group of countries will grow by 49 percent (or 413 million people) by 2030 and by 132 percent (or 1.1 billion people) by 2050. Children as a share of the population will remain above 40 percent until 2030 and above 34 percent until 2050.

Box 1. South Korea's demographic dividend resulted in 40 years of 6.7% annual growth

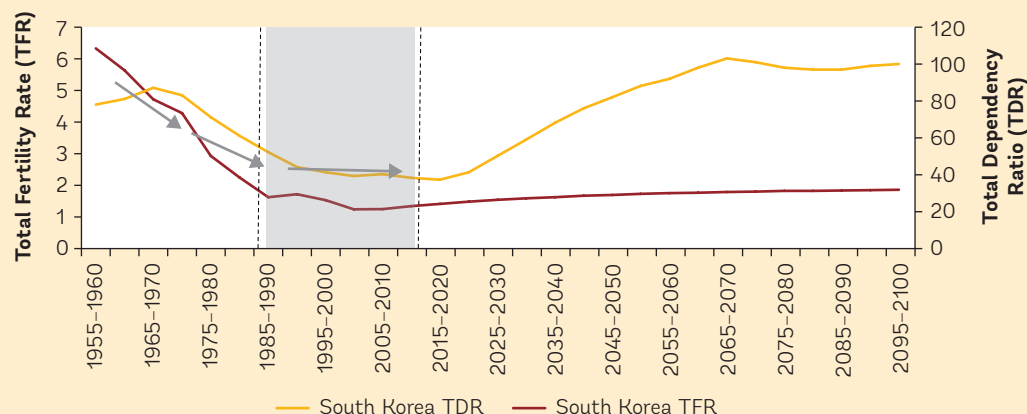
Over a 40-year period, South Korea underwent a transition in which fertility declined rapidly, the age structure started to change, and the total dependency ratio (TDR) declined to yield a large share of the population of working-age adults. The TDR is the ratio of total dependents (ages 0–14 and 65+) to those in working ages (ages 15–65). This transition created a window of opportunity to accelerate economic growth, and South Korea undertook policy measures across sectors to harness this opportunity and translated this into growth in GNI per capita:

1. Comprehensive population policy leading to rapid decline in dependency ratios. Implemented through public and private sectors: (i) Comprehensive family planning programs; (ii) Investments in training of providers on supply of contraceptives; (iii) Increases in CPR among married couples; (iv) Mothers' clubs.

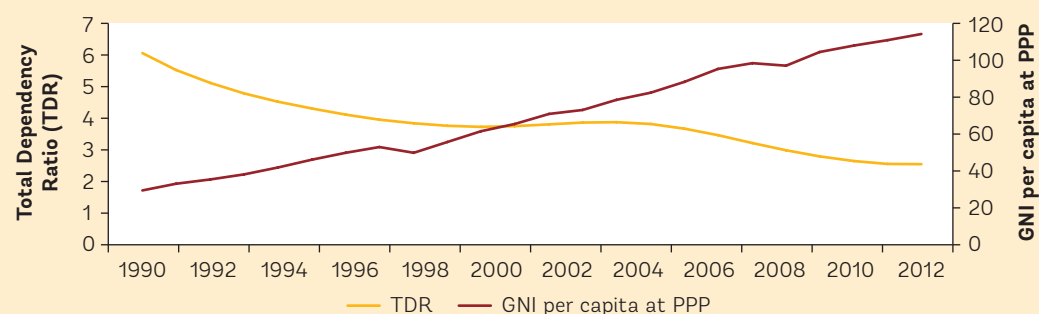
2. Shifting the education and skills development strategy resulting in a higher skilled labor force. From compulsory primary education to "Production-oriented education" to provide people with knowledge and skills needed for economic development.
3. Comprehensive economic plans.
 - (i) Investments in labor-intensive sectors (agriculture, manufacturing, chemical, iron, steel);
 - (ii) Investments in infrastructure and rural construction programs;
 - (iii) Creation of favorable business environment brought in foreign direct investments (FDI).

It should be noted that South Korea made the deliberate decision to enact both family planning and economic growth policies at the same time (1962), enabling the two efforts to be mutually reinforcing and possibly more effective than if they had been sequentially implemented.

Korea's Total Fertility Rate (TFR) and Total Dependency Ratio (TDR), 1955–2100



Korea reaping the benefits of the DD, 1990–2015



Phase	Policy priority
Pre-Dividend	Sparkling the demographic transition Improving human development outcomes to accelerate the fertility decline
Early-Dividend	Accelerating job creation Creating productive jobs for the growing share of the population in working ages to reap the first demographic dividend
Late-Dividend	Sustaining productivity growth Creating conditions necessary to reap the second demographic dividend and beginning to prepare for aging
Post-Dividend	Adapting to aging Maintaining and improving welfare in the context of a declining working-age share and a growing old-age share

Box 2. Total fertility rate and working age population share help define four types of countries vis-à-vis the opportunities to realize the demographic dividend

Growth of Working Age Population Share 2015–2030		TFR 2015		TFR 1985	
		≥4	<4	≥2.1	<2.1
>0		Pre-dividend	Early-Dividend		
≤0				Late-dividend	Post-dividend

Pre-dividend countries have fertility levels above four births per woman and face very rapid population growth. Although their high dependency ratios are expected to decline as more and more children reach working age, the child dependency ratio will likely be too high and the working-age population share too low to realize the first demographic dividend.

Early-dividend countries are further along the fertility transition. Fertility rates have fallen below four births per woman and the working-age share of the population is likely rising considerably. They have very favorable age structures to realize the first demographic dividend.

Late-dividend countries are where fertility rates are typically above replacement levels of 2.1 births per woman, but fertility continues to decline. Even as their working-age shares

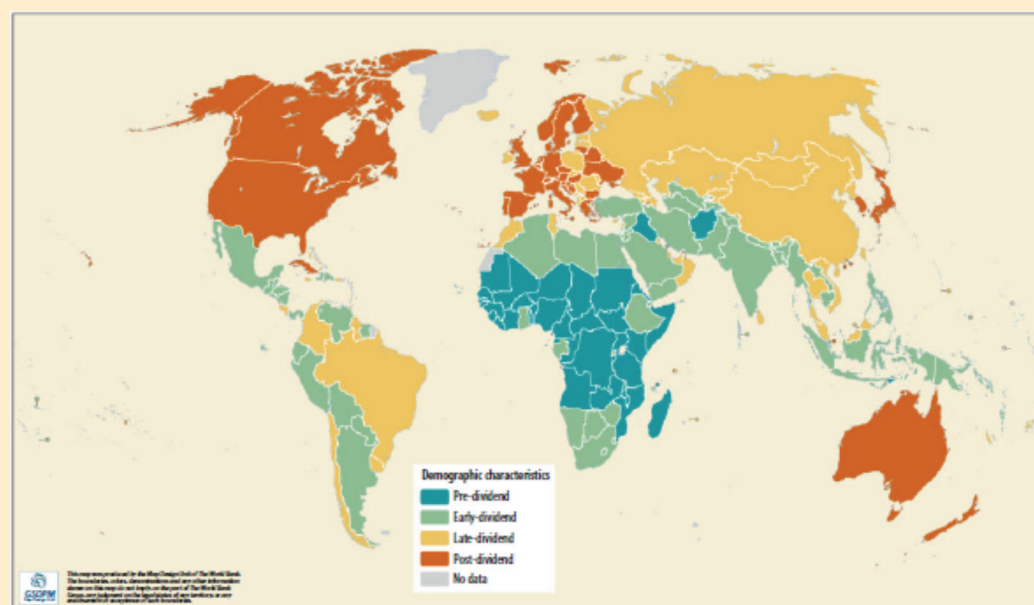
of the population shrink, their overall age structures are still favorable for the first demographic dividend. They are also likely to be experiencing rapid population aging.

Post-dividend countries transitioned below replacement fertility levels some time ago (before 1985 in the GMR definition). These countries continue to see shrinking working-age shares of the population and have some of the highest shares of elderly in the world. While they are past the point of additional benefits from the first demographic dividend, they can still reap a second dividend from rising savings and investments.

For each phase of countries, there are different challenges and policy priorities that require implementing a unique set of programmatic recommendations:

(continued on next page)

Box 2. Total Fertility Rate and Working Age Population Share Help Define Four Types of Countries vis-à-vis the Opportunities to Realize the Demographic Dividend (*continued*)



Phase	Policy priorities	Recommendations
Pre-Dividend	Sparking the demographic transition Improving human development outcomes to accelerate the fertility decline	<ul style="list-style-type: none"> Improve maternal and child health and nutrition by strengthening provision of basic health care services Expand comprehensive reproductive health & family planning Increase education, especially for girls Empower girls and women
Early Dividend	Accelerating job creation Creating productive jobs for the growing share of the population in working ages to reap the first demographic dividend	<ul style="list-style-type: none"> Invest in human capital (education, vocational & technical training) Enhance labor market mobility Reduce barriers to female labor force participation Strengthen conditions conducive to domestic savings and job creation
Late Dividend	Sustaining productivity growth Creating conditions necessary to reap the second demographic dividend and beginning to prepare for aging	<ul style="list-style-type: none"> Continue mobilization of savings for productive investment Ensure public policies encourage labor force participation of both sexes Design cost-effective and sustainable systems for welfare and human development to address needs (health, child care, education, and support to the vulnerable elderly)
Post Dividend	Adapting to aging Maintaining and improving welfare in the context of a declining working-age share and a growing old-age share	<ul style="list-style-type: none"> Complete reforms of welfare systems—including pensions, health care, and long-term care—that ensure fiscal sustainability and, as part of integrated approaches, protection of the vulnerable, elderly and others, and encouragement of work among those who are able Raise labor force participation and productivity (including incentives for participation targeted at women and older cohort; and lifelong learning) Pursue policies that encourage higher birth rates by making it easier for men and women to combine child rearing and participation in the labor market

Source: World Bank 2016.

What is Nigeria's progress toward the demographic transition?

Fertility and Mortality

Nigeria has experienced declines in mortality and fertility—but rates remain high, and this may pose a risk for population size and age structure. The incom-

plete demographic transition (i.e. transition from high birth and death rates to low birth and death rates) (Figure 4a) may hinder Nigeria's growth prospects, as population growth exacerbates the demand for social services and outstrips the capacity of the economy to generate jobs. Death rates have been progressively declining over several decades (Figure 4a) but remain high. The under-5 mortality rate approximately halved between 1990 and 2015, to approximately 109 deaths per 1000 live births; but this remains higher than the sub-Saharan Africa regional average (UN Inter-Agency Group for Child Mortality Estimation, 2015).

Additionally, Nigeria has the fourth-highest maternal mortality ratio in the world, at 576 maternal deaths (per 100,000 live births) (DHS 2013); it was classified as having made "no progress" toward its Millennium Development Goal (World Health Organization, 2015). The country also currently has a total fertility rate (TFR) of 5.74 (Figure 4b) (the MICS survey supports this, placing TFR at 5.8)—and under the median fertility scenario of the United Nations World Population Prospects' (UN WPP) population projections, the TFR is projected to fall to only 4.74 by 2030 and 3.59 by 2050 (UN Population Division, 2015). As a result of these trends, Nigeria is experiencing an annual population growth

398.5 million

Estimated population of Nigeria in 2050, more than double what it is currently

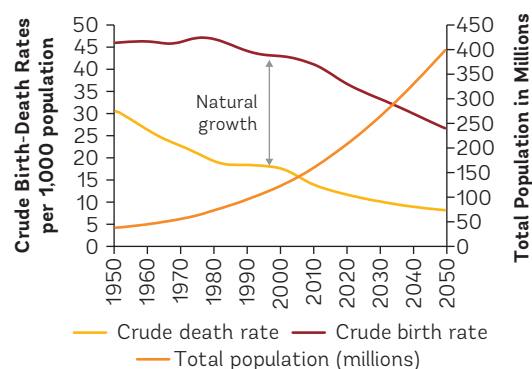
576 maternal deaths (per 100,000 births)

Nigeria's maternal mortality ratio, the fourth-highest in the world. Nigeria made "no progress" toward its maternal health Millennium Development Goal

rate of 2.5 percent, and it is estimated that the population will more than double from 187 million in 2016 to 398.5 million in 2050.

There are important differences in fertility rates across groups in Nigeria (Figure 5). The total fertility rate in rural areas is 1.5 children (per woman) higher than in urban areas; and there are substantial differences across socioeconomic groups, education groups, and regions (DHS, 2013). MICS survey findings are very similar (for example MICS found TFR is 1.4 children per woman higher in rural areas compared to urban areas). The TFR among women in the highest quintile is nearly half that of women from the poorest households. The largest differences exist between education groups where there is a 3.8 child difference between women with no education and higher education. (The 2017 MICS survey paints a similar picture) TFR was found to be 3.5

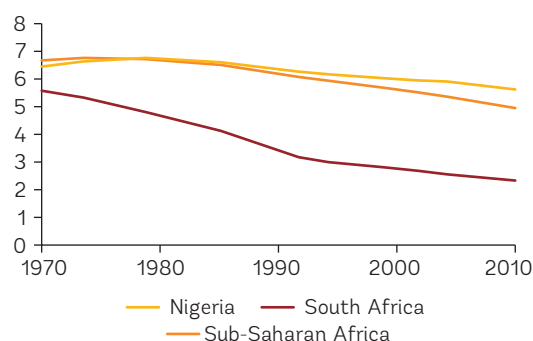
Figure 4a. The demographic transition in Nigeria



Source: UN Population Division, World Population Prospects 2015 Revision.

Note: Data after 2015 are projections based on UN medium-variant fertility.

Figure 4b. Total Fertility Rate (TFR) in Nigeria, South Africa, and sub-Saharan Africa



Source: UN Population Division, World Population Prospects 2015 Revision.

Note: Data after 2015 are projections based on UN medium-variant fertility.

Total Fertility Rate (TFR) is **1.4 children** per woman higher in rural areas compared to urban areas—and **3.5 children** higher among women with no education compared with women with higher education

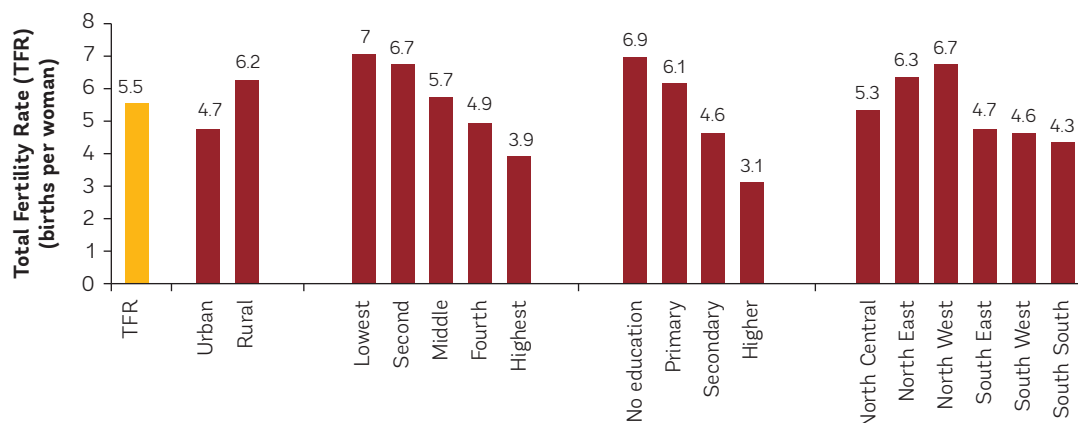
> 6 children is the wanted fertility rate among women in North-East and North-West regions compared to ~4 children among women in the Southern regions

children higher among women with no education compared with women with higher education. In terms of regional variation, fertility is substantially higher in North-West and North-East regions (6.7 and 6.3, respectively) compared to South-South where it is 4.3 (DHS, 2013). The 2017 MICS survey shows even greater differences (7.2 in North-West, 6.3 in North-East, 4.3 in South-South). However, since 2008, the north is also where the most noticeable decreases in TFR have occurred; there has been little (if

any) decline in lower-fertility Southern areas (DHS, 2008, 2013). Additionally, none of these socio-geographical zones are at replacement fertility. Even women at the highest wealth quintile, or women from the South South zone, or women with at least high-school education have fertility rates at least one child higher than the replacement fertility rate of 2.1 children per woman.

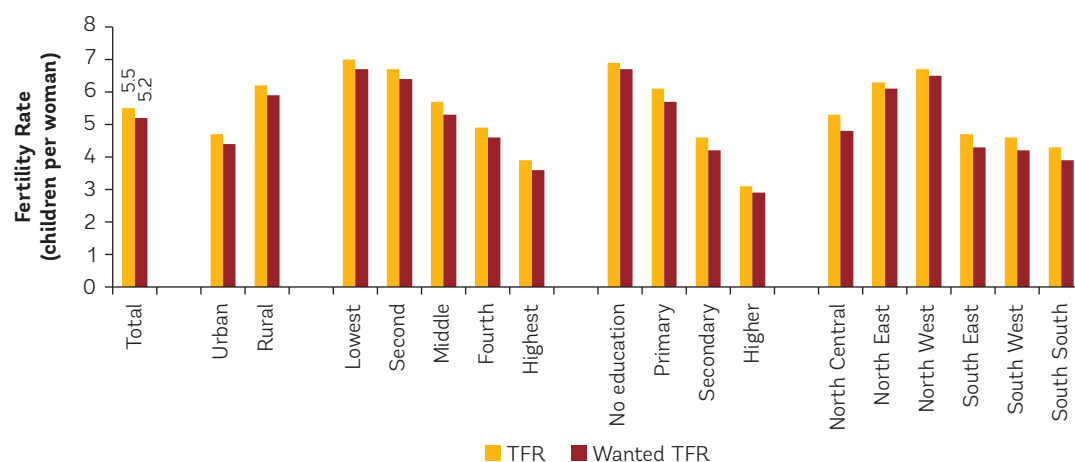
Strikingly, while wanted fertility is lower than actual fertility across all groups, the gap between observed and

Figure 5. Total Fertility Rate (TFR) in 2013, national and disaggregated



Source: Demographic and Health Survey 2013.

Figure 6. Total fertility rate and wanted total fertility rate, national and disaggregated



Source: Demographic and Health Survey 2013.

wanted fertility is very small (Figure 6), reflecting both a desire for large families and relative realization of desired family size. On average, wanted fertility is only 0.3 children less than actual fertility. The largest difference between actual and wanted fertility is in North Central region where actual fertility is 5.3 and wanted fertility is 4.8 children per woman. (DHS 2013).

Family Planning

Use of modern contraceptives remains very low, lagging considerably behind other countries in the region. Fewer than 10% of married women reportedly use a modern contraceptive method (Figure 7) (DHS, 2013). The 2017 MICS survey confirms minimal progress in this regard, finding modern contraceptive use to be less than 11%. Furthermore, there are substantial variations between groups. At a

< 11 percent
of married women reportedly use a modern contraceptive method

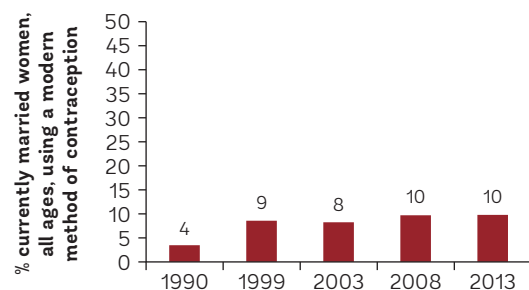
disaggregated level, the largest differences exist across socioeconomic groups: while 23% of married women in the highest wealth quintile use modern contraceptives, only 1% of women in the lowest wealth quintile do. Similarly, a large gradient exists between education groups. Among women with no education, the contraceptive prevalence rate (CPR) is only 2%—compared to 22% among women with higher education. The national average also masks regional differences—in South-West, 25% of married women currently use modern methods compared to only 3% and 4% in North-East and North-West, respectively.

Figure 7. Current use of modern methods of contraception, national and disaggregated, in 2013



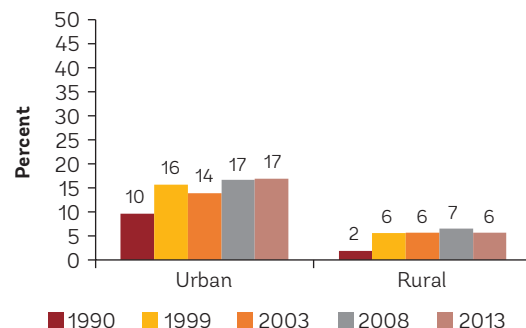
Source: Demographic and Health Survey 2013.

Figure 8a. Modern contraceptive prevalence rate, 1990–2013



Source: Demographic and Health Surveys.

Figure 8b. Modern contraceptive prevalence rate by place of residence, 1990–2013



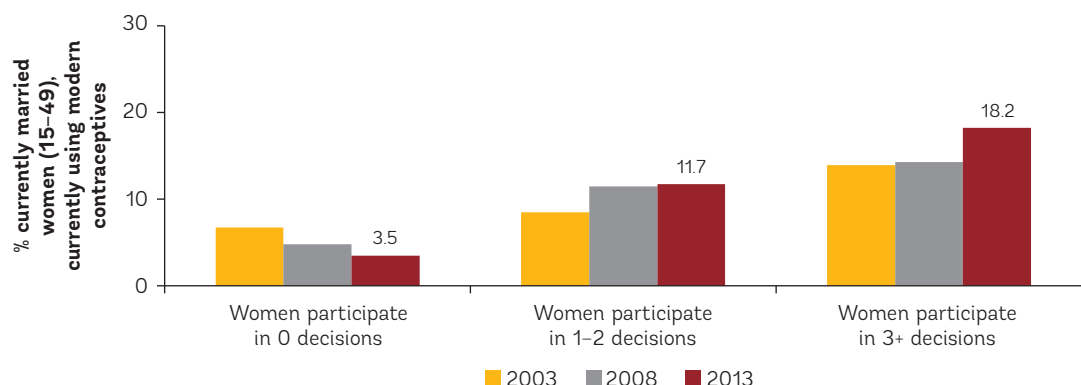
Source: Demographic and Health Surveys.

While CPR is higher now than in 1990, there has been little to no progress since 1999 (Figure 8a). Gains over this period were particularly dramatic among women in rural areas (Figure 8b) (DHS, 1990, 1999, 2003, 2008, 2013). Though still very low, use of modern contraceptives tripled in relative terms in rural areas in the 1990s compared to urban areas where the gains were less than double. This indicates that efforts are needed in both urban and rural areas given the low absolute uptake of contraceptives and relatively slow progress. Gains were also seen among women in middle-income households and among those who had completed primary school.

Furthermore, gender inequality continues to be a challenge in Nigeria—and gender dynamics and women’s empowerment affect the use of modern contraception. As shown in Figure 9, women who participate more in household decision-making tend to have higher use of modern contraceptives. In 2013, 18.2% of women who participated in making at least 3 household

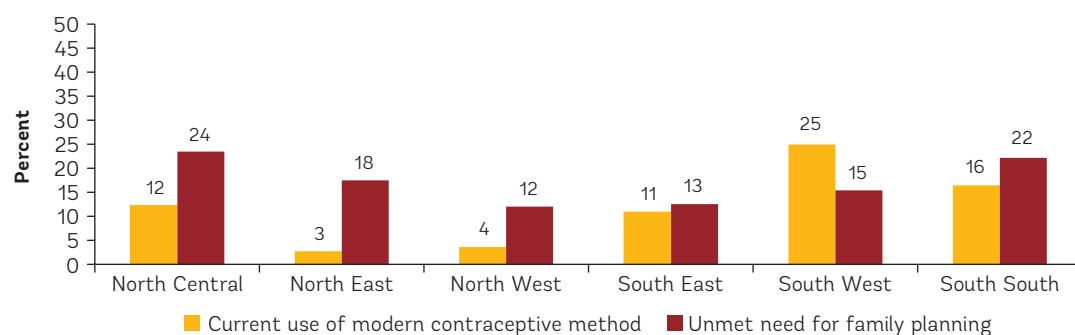
decisions used modern contraceptives compared to only 3.5% of women who participated in none. Moreover, while the modern CPR has increased over time for women participating in decision-making, CPR has actually decreased among women who have not participated at all, indicating that disempowered women have become increasingly disadvantaged. Evidence indicates that higher levels of women’s autonomy, education, wages, and labor market participation are associated with improved reproductive health outcomes. This is important given the significant differences in school enrollment between males and females in Nigeria. In 2015, the literacy rate among females aged 15–24 was 65.3%, compared with 79.9% for males (World Bank WDI, 2015). In 2016 48.5% of adult women participated in the labor force (that mostly involves work in agriculture), compared with 64.1% of males (World Bank WDI, 2016). Gender inequalities are reflected in the UNDP Gender Development Index; in 2015 Nigeria ranked 152 of 187 countries.

Figure 9. Modern contraceptive prevalence rate among married women by women’s participation in household decision-making



Source: Demographic and Health Surveys.

Figure 10. Current use of modern contraceptive methods and unmet need for family planning by region



Source: Demographic and Health Survey 2013.

Reported unmet need for family planning has declined since 1990 (from 21.5% to 16.1%) but remains substantial.

There is variation across educational groups (7.6 percentage points higher among women with primary-level education compared to those with greater than secondary education) and income groups (highest among middle-income women) (DHS, 1990, 1999, 2003, 2008, 2013). Women in North-Central and South-South also report higher unmet need (by almost double) than women in North-West and South-East (Figure 10), highlighting the need for supply-side efforts particularly in these regions (DHS, 2013).

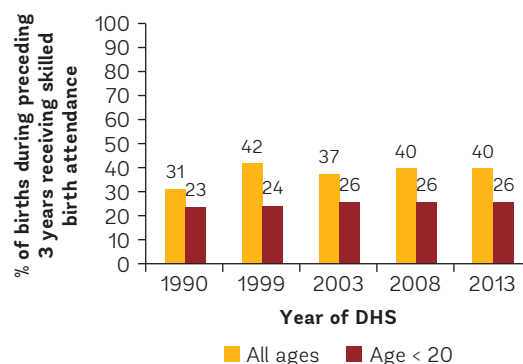
Health and Nutrition

Despite some improvements in maternal survival, low utilization of maternal health services remains, which may cause persistently poor outcomes.

Attendance at 1 or more antenatal visits has increased among women in Nigeria, from 56.9% in 1990 to 62.7% in 2015—but attendance at 4 or more visits declined over this period, from 50% of women to 44.1% in 2008 (DHS, 1990, 1999, 2003, 2008, 2013, 2015). Utilization of antenatal care (at least 1 visit) is near-universal among urban women, those with greater household wealth, and higher educational attainment (DHS, 2015). Approximately 18% of women receive a first antenatal check during their first trimester; this rate is higher in urban areas (23.3%) than rural (14.6%) (DHS, 2015). Skilled birth attendance is very low (40%) and has increased only slightly since 1990 (31%), putting both women and their newborns at risk for death and disability (Figure 11a) (DHS, 1990, 1999, 2003, 2008, 2013). However, it should be noted that the 2017 MICS data shows some improvement in skilled birth attendance (66%), suggesting

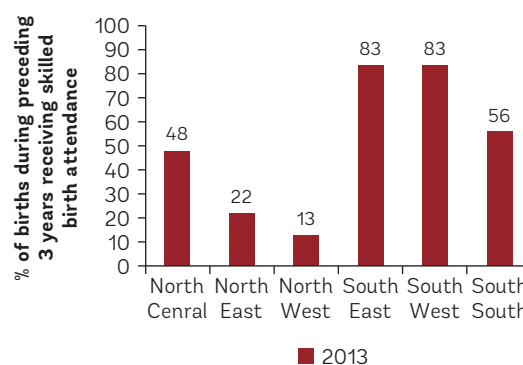
value in boosting postpartum family planning services in facilities. Considerable differences exist by region: only 12.8% of women in North-West reported skilled delivery for a recent birth, versus 83.3% of women in South-East and South-West (Figure 11b) (DHS, 2013). The use of skilled birth attendance is lowest among young

Figure 11a. Use of skilled birth attendance, by year and age group



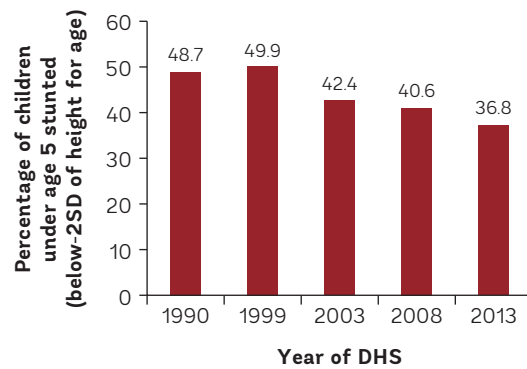
Source: Demographic and Health Surveys.

Figure 11b. Use of skilled birth attendance, by region



Source: Demographic and Health Surveys.

Figure 12a. Prevalence of stunting among children under age 5



Source: Demographic and Health Surveys.

43.6 percent

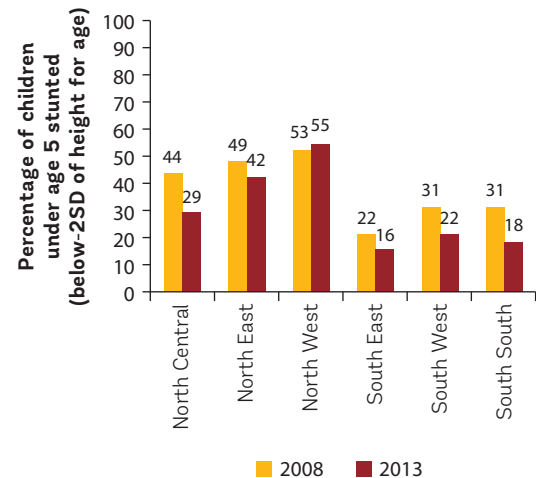
of children under age five are stunted (with rates near or above 50 percent in North-East and North-West regions)

mothers (26.1% versus approximately 40% for women below and above age 20, respectively) (Figure 11a), indicating a need to target adolescents for maternal health services, especially as adolescent childbearing carries higher risks to both the young mother and her child (DHS, 2013).

Children suffer widely from both chronic and acute malnutrition with 37% of children under 5 being stunted (Figure 12a) (DHS, 1990, 1999, 2003, 2008, 2013). The 2017 MICS data is even more sobering, finding 43.6% of children under 5 to be stunted. These rates are higher among boys than girls (39% versus 25% in 2013), as well as children in rural locations (in 2013, 43% versus 26% in urban areas) (DHS, 2013). There are also strong gradients by mother's educational attainment and household wealth. Rates by geographic region have declined dramatically in North-Central, South-West and South-South; lesser improvements have been seen in North-East and South-East, while North-West has seen a slight increase since 2008 (Figure 12b) (DHS, 2008, 2013).

While Nigeria has improved rates of exclusive breastfeeding from 17% to 24% (MICS, 2017), much more attention to this critical intervention is needed. The nutritional benefits of exclusive breastfeeding have long been established including reductions in infant

Figure 12b. Prevalence of stunting among children by region

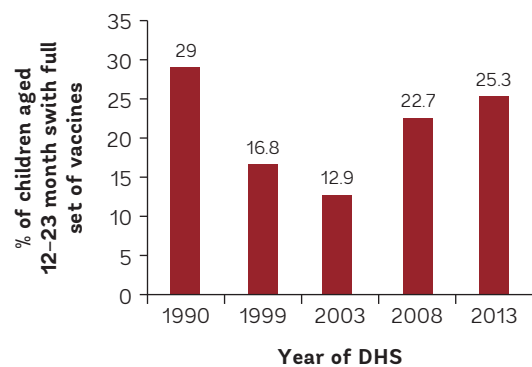


Source: Demographic and Health Surveys.

and under-5 mortality and in diarrhea incidence leading to reduced stunting; as well as improvements in cognitive development. Moreover, every \$1 invested in breastfeeding programs yields an estimated \$35 in economic returns, making breastfeeding one of the most effective public health interventions a country can support (Shekar, Kakietek, Eberwein, and Walters 2017). From a fertility perspective, exclusive breastfeeding in the context of lactational amenorrhea method (LAM) represents one of the strongest suppressants of fertility at a population level (Canning, Raja, and Yazbeck 2015). Hence, improvements in the rate of exclusive breastfeeding has the potential to yield further benefits in support of the demographic transition and dividend.

Low coverage of preventative and curative child health care puts children at risk for infectious diseases, which are the main causes of child mortality worldwide (i.e. diarrhea, malaria and pneumonia). The coverage of childhood vaccines in Nigeria experienced a massive decline during the 2000s, and is now back to near-similar levels as 1990 (25.3% of children have been fully vaccinated by age 2) (Figure 13a) (DHS, 1990, 1999, 2003, 2008, 2013). The 2017 MICS paints an even bleaker picture, finding childhood vaccination to be at only 23%. There is a large urban-rural disparity (42.5% versus 15.8% coverage of vaccines, respectively) as well as by educational attainment (6.9% among children of women with no educational attainment, versus 64.1% for mothers with post-secondary education) and by wealth index (3.6% and 57.7% for the lowest and highest wealth groups, respectively) (DHS, 2013). There is also a substantial

Figure 13a. Complete vaccination, children aged 12–23 months, 1990–2013



Source: Demographic and Health Surveys.

23 percent

The percentage of children fully vaccinated

1/4

of mothers seek health services when their children experience diarrhea or respiratory illness

24 percent

of children under 6 months are exclusively breastfed

difference between regions: only 9.6% of children in North-West have received all childhood vaccines, compared to 51.7% of children in South-East (DHS, 2008, 2013). Although polio vaccine is a well-publicized example of challenges around immunization coverage in Nigeria, it should be noted that these low coverage rates go beyond polio vaccine: coverage with DPT3 is only at 38.2% nationwide (DHS, 2013).

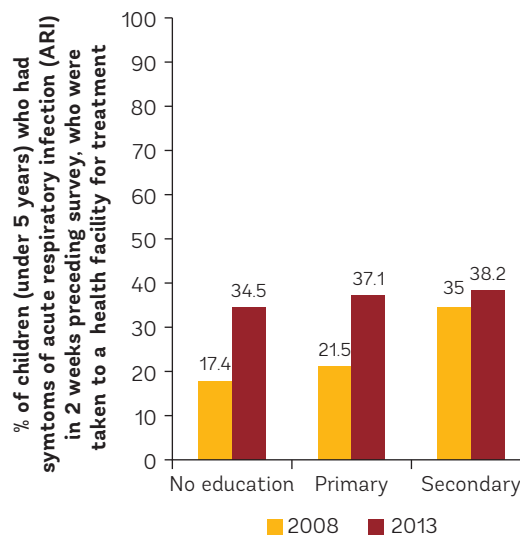
Moreover, there is low health care utilization for childhood illnesses: only one-third of mothers reported that they sought care at a health facility for their child with a recent case of diarrhea, or suspected acute respiratory infection (ARI) (DHS, 2013). The 2017 MICS data suggests this figure is closer to one-quarter. There were some relatively small differences by mother's wealth quintile, and educational attainment (Figure 13b) (DHS 2008, 2013).

Challenges for Adolescents

Adolescence (defined as ages 10 to 19 years) is a transformative time that fosters both challenges and opportunities.

Choices made during adolescence not only have immediate consequences but also

Figure 13b. Children (under 5 years) with recent ARI symptoms who were treated at a health facility, by mother's educational attainment



Source: Demographic and Health Surveys.

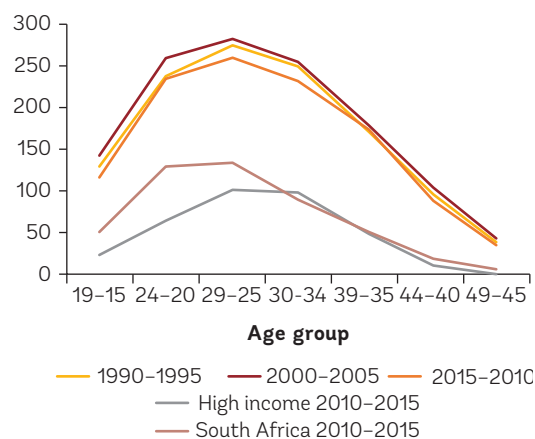
greatly influence the economic opportunities, health outcomes, and skill sets attained later in life. Adolescence is also a period when social norms create pathways defined largely by gender. During adolescence, gendered roles and responsibilities often create opportunities for males, but curtail them for girls. Adolescents—and their decisions—also have important implications for harnessing the demographic dividend.

In Nigeria, high levels of fertility reflect young age at marriage, early and frequent childbearing as well as low levels of contraceptive use.

Age specific fertility rates show the relatively high levels of childbearing in younger women (Figure 14a). Compared to SSA and other low-income countries, Nigeria has a much higher adolescent fertility rate (117 per 1,000 women 15–19) (UN Population Division, 2015)—with approximately 28% of girls between the ages of 15–19 already married, and 23% already mothers or pregnant with their first child (DHS 2013). This may reflect socio-cultural norms encouraging early marriage and childbearing and limited educational opportunities beyond primary education. The median age at first sexual intercourse, and at first marriage, increased by 1 year during the 1990s, and has not changed since then (Figure 14b) (DHS, 2013).

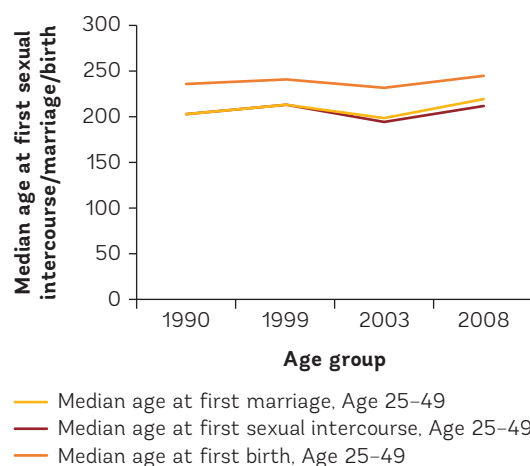
The adolescent fertility rate in rural areas is more than double than in urban areas—and is substantially higher among poorer households. The wealth gradient for

Figure 14a. Age-specific fertility rates (births per 1,000 women)



Source: UN Population Division, World Population Prospects 2015 Revision.

Figure 14b. Median age of key sexual health events



Source: Demographic and Health Survey, 2013.

Approximately 1/3
of girls age 15-19 are married

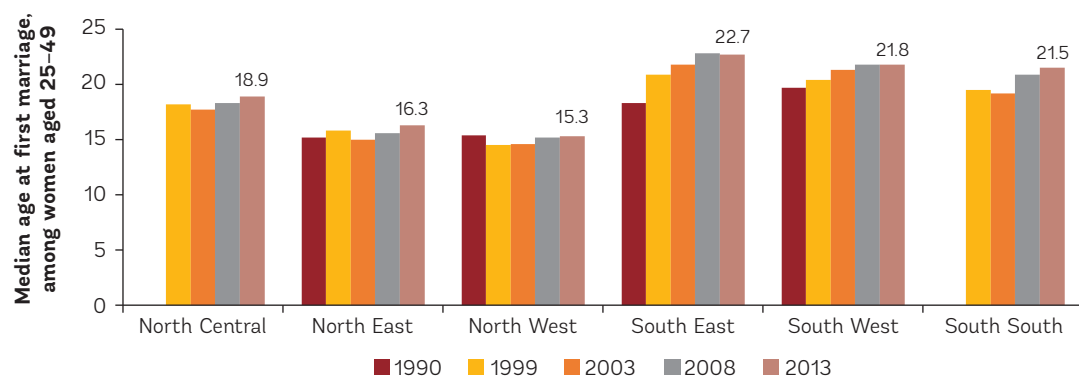
Approximately 1/4
of girls age 15-19 are already mothers or pregnant

adolescent fertility has intensified over time: in 1990 and 2003, the adolescent ASFR in the poorest wealth quintile was approximately three times higher than that in the wealthiest group; in 2013, this ratio increased to 6, and in 2015 it was over 4 (DHS, 1990, 2003, 2013, 2015). There are also regional differences, with the youngest ages of marriage (across survey years) seen in the North-West, North-East and North-Central regions (Figure 14c). These are the same regions where age of marriage has been relatively stagnant over time with very little (if any) progress. The regional differences in adolescent childbearing appear more dramatic than the regional

variation in TFR overall. There are also substantial gradients for age at first sex, at marriage, and at first birth by wealth index (e.g. an 8-year difference in age at marriage) and by educational attainment.

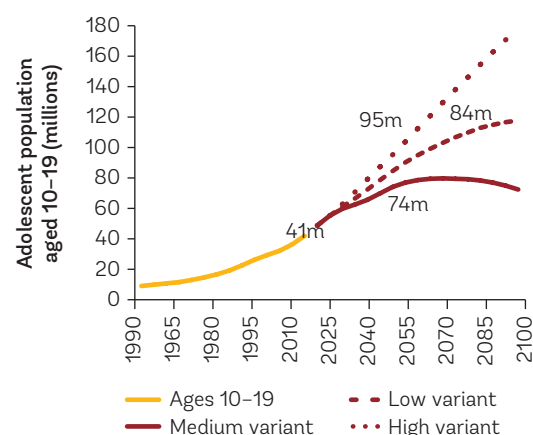
In Nigeria, adolescents make up a substantial 23 percent of the population, and the already large number of adolescents is expected to more than double in the upcoming decades from 41 million to 84 million in 2050 (under a medium fertility scenario). (Figure 15) If fertility does not decline as much, this figure would be even higher at 95 million. However, if fertility were

Figure 14c. Median age at first marriage, by region, 1990-2013



Source: Demographic and Health Surveys.

Figure 15. Actual and projected adolescent population (ages 10–19) by fertility scenario



to follow a lower variant scenario, the number of adolescents would be 74 million in 2050. Given links between youth unemployment and political unrest, and the high rates of early marriage and early pregnancy, these adolescent population projections are concerning.

These large numbers of adolescents need to be healthy, educated and enabled with job opportunities to create conditions necessary for demographic dividends. The alternate scenario in which lack of educational and job opportunities lead to high youth unemployment rates is not only damaging to the country's demographic dividend prospects, but could also create environment at high risk of civil unrest. A study using political instability and unemployment data from 40 developing countries between 1991 to 2009 finds that youth employment is linked with political instability and potentially armed conflict in these countries, with increasing levels of education of the youth reducing the magnitude of the relationship between youth unemployment and instability (Azeng and Yugo 2015).

These projections of the adolescent share of the population not only pose challenges for society to provide health, education, and job training services to adolescents to prepare them for a productive future—but also has implications for the next generation given patterns of early marriage and early childbearing.

Global evidence shows that children born to adolescent mothers are at higher risk of mortality (neonatal, infant and child mortality), poor nutrition (stunting and low birth weight), and onset of illness than are children of older mothers. Teenage mothers are less likely to take preventive measures for

ensuring better health of their children. Poor health and nutrition adversely affect cognitive and socioemotional development and learning, putting children of teenage mothers at higher risk of poor development outcomes...prolonging the intergenerational cycle of poverty. Thus, together with other policies that address high fertility, reducing child marriage and teenage pregnancy can contribute significantly to the fertility declines needed to accelerate the demographic transition and ultimately create better life outcomes for adolescent girls, better opportunities for the next generation, and the potential to harness a demographic dividend.

Education

Nigeria's level of educational development ranks No. 152 out of 187 countries in UNDP's (2015) Human Development Index—a ranking below that of Kenya,

Ghana, Botswana and Rwanda. The World Bank World Development Indicators provide further detail. School enrollment at primary level is low, even when compared to the average for Sub-Saharan Africa (SSA). In 2013 primary school enrollment stood at 93.7%, compared to 97.8% for SSA. Enrollment amongst boys (94.5%) was higher than girls (92.8%). At secondary and tertiary levels enrollment is above the average for SSA. Secondary level enrollment in Nigeria (latest data from 2013) stood at 55.7% (boys 57.8%, girls 53.5%) compared with 42.2% for SSA (boys 45.3%, girls 39.0%), and tertiary level enrollment (latest data from 2011) stood at 10.1% (boys 11.8%, girls 8.3%), compared with 8.1% (boys 9.5%, girls 6.6%) for SSA. These gender differences produce a school enrollment gender parity index (GPI) of 0.98 (2013 data) at primary level (0.92 SSA), 0.93 (2013 data) at secondary level (0.86 for SSA), and 0.71 (2011 data) at tertiary level (0.70 for SSA).

In terms of enrollment, the World Bank World Development Indicators show that Nigeria fairs poorly. In 2010 34.3% of children of primary school age were out of school, compared with 24.5% for SSA. There is a notable difference in gender, with 40.0% of girls out of school compared with 28.9% of boys. This difference is more dramatic than that observed for SSA (26.9% of girls out of school, compared with 22.2% of boys).

As in most other indicators, there are large differences in educational attainment of women across socio-geographic zones in Nigeria. For example, median years of schooling among women ages (15–49) in the

North East is 4.1 years as compared 11.2 years in the South West. The differences are even more severe across urban/ rural households or across wealth quintiles. Median years of schooling for women in rural households is zero years, as compared to 10.2 years among women ages 15-49 years in urban households.

Nigeria's girls' secondary education trends are particularly concerning given that ample evidence shows that girls' secondary education lowers fertility and unwanted pregnancy, reduces infant mortality, increases childhood immunization and nutrition, and reduces childhood stunting. Research has shown that rates of early marriage decline as girls attain higher levels of schooling. A World Bank 100-country study found that for every four years of education that girls attain, fertility drops by roughly one birth (World Bank 1999).

Within Nigeria, socio-geographical groups with higher educational attainment for women tend to have lower fertility. Women in the South West zone, who on the median have 11.2 years of schooling, have 4.6 children on average, whereas women in the North East Zone with 4.1 median years of schooling have 6.3 children on average (Figure 16). As seen before in Figure 5, women with no schooling have more than twice as many children as compared to women with at least high school education (6.9 versus 3.1 children).

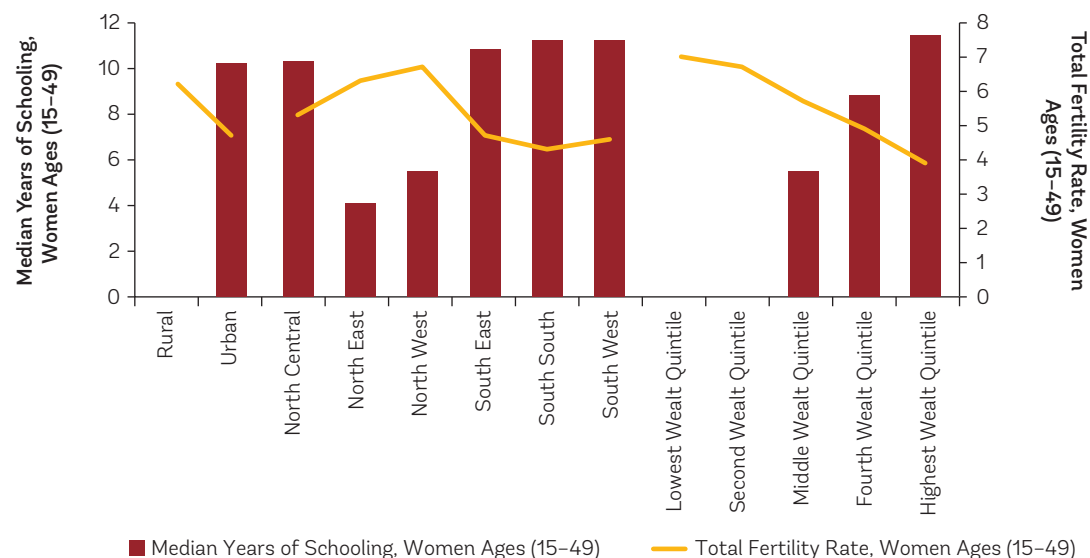
Changes in education policy have been shown to have a causal impact on both

female education and fertility. For example, an education policy reform in Nigeria—the 1976 Universal Primary Education (UPE) program—significantly increased women's educational attainment and decreased fertility (Osili and Long, 2008).

Additionally, programs targeted at lowering barriers to attending school have reduced teenage pregnancy in low and middle income countries (McQueston et al. 2012). A 1985 educational reform in Kenya that increased the period of primary schooling by a year increased educational attainment of girls and delayed marriage and childbearing (Chicoine 2012). Similarly, a school building program in Indonesia between 1974-1978 increased education levels and delayed childbearing (Breierova and Duflo 2004). The same paper showed that female education has a greater effect on delaying childbearing than male education. Finally, a randomized controlled trial that reduced the cost of school uniforms in Kenya found that the cost reduction not only reduced dropout rates, but also subsequently reduced teenage marriage and childbearing (Duflo et al. 2006).

Numerous studies have shown that girls' education also reduces risk of domestic violence. Reduced infant mortality illustrates how a mother's literacy affects the care she is able to provide to her children. An extra year of girls' education was estimated to cut infant mortality by five to ten percent (Schultz 1993). Multi-country data has also shown that educated mothers are about 50

Figure 16. Median Years of Schooling and Total Fertility Rates, Women Ages 15–49



Source: Demographic and Health Survey 2013.

percent more likely to immunize their children than uneducated mothers (Gage et. al. 1997).

Girls' secondary education results in social benefits to the whole society.

Secondary education equips students with critical thinking enabling civic participation and democratic change. As students pursue their education, they are less likely to engage in or become a victim of violence. In addition, secondary education reduces the risk of human trafficking by increasing economic opportunities and making children less vulnerable. Quality secondary education allows women to be more empowered and independent, and better able to shape decisions about sexuality and family formation.

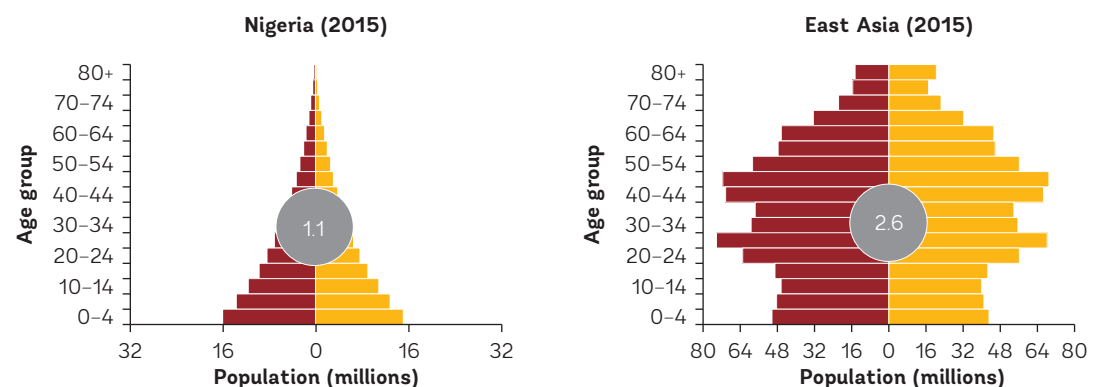
Girls' secondary education is a tool for poverty alleviation. Primary and secondary education produce high returns in terms of wage growth. Increasing the share of women with secondary education by 1 percentage point boosts annual per capita growth by 0.8 percentage points on average, according to a 100-country study conducted by the World Bank. Access to and successful completion of secondary education shapes the skills mix of the labor force and prospects for sustained growth (Bregman and Bryner 2003). The more women, and by extension their families, benefit from educational and economic opportunities, the greater their potential to contribute to economic growth.

How is the demographic transition linked to economic growth and poverty reduction in Nigeria?

Due to these slow fertility and mortality declines, Nigeria will experience rapid population growth and an age structure that is heavily skewed toward young dependents. Approximately 44% of the Nigerian population is currently under age 15, and this is projected to fall only slightly under all fertility projections (to 32% in the low fertility variant, and 38% in the high fertility variant by 2050). The dependency ratio (i.e. number of dependents, aged 0–14 and over

65, to the total working age population, 15–64) is 88, which is higher than the average for Sub-Saharan Africa (86) and for low-income countries (87). The current population age structure in Nigeria is considerably skewed toward young ages; this can be contrasted with a typical age structure from East Asia, where the working age population is proportionately greater than the share of dependents (Figure 17). This youthful population structure presents challenges in

Figure 17. Population pyramids and working age to dependent population ratios in Nigeria and East Asia



Source: UN (2015).

Figure 18. Population age structures and boats—which would you rather be on?

Nigeria's population age structure ("pyramid") leads to this boat



Nigeria: Working Age Ratio = 1.1

East Asia's population age structure ("pagoda") leads to this boat



East Asia: Working Age Ratio = 2.6

providing health care, education and jobs to the large cohorts surviving childhood and entering their reproductive ages.

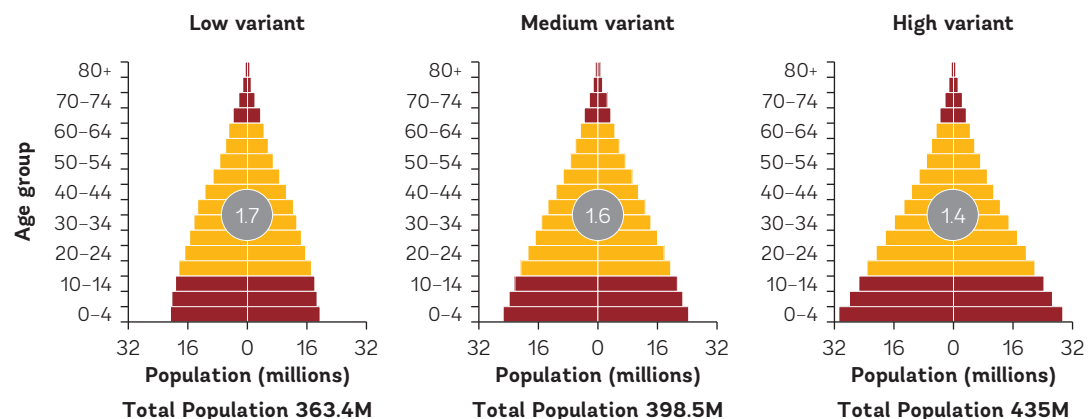
Another way to think about this is in terms of Figure 18 which illustrates population age proportions as boats. Nigeria's age structure (pyramid) is analogous to a boat where the working age share of the population is roughly equivalent to that of the dependent population. In comparison, in East Asia, the age structure (pagoda) is analogous to a more stable boat where there are more than twice as many workers as dependents, driving productivity and economic growth.

Even if fertility rates in Nigeria reached replacement level immediately, there would be several decades of residual population growth. As the absolute number of people born exceeds the number dying, there are large cohorts of children who then enter their reproductive years and bear children. But if fertility were to fall, this would cause substantial differences in the age structure and dependency ratios. The TFR is projected to drop to 3.9/4.4/4.9 (2032) and 2.9/3.4/3.9 (2050) under the UN's low/medium/high

fertility scenarios. As seen in Figure 19, the ratio of working age to dependents is expected to progressively increase from 1.1 (2015) to a range of 1.4 to 1.7 (2050) under the three fertility scenarios—which implies that there will be increasingly more working age adults per every dependent.

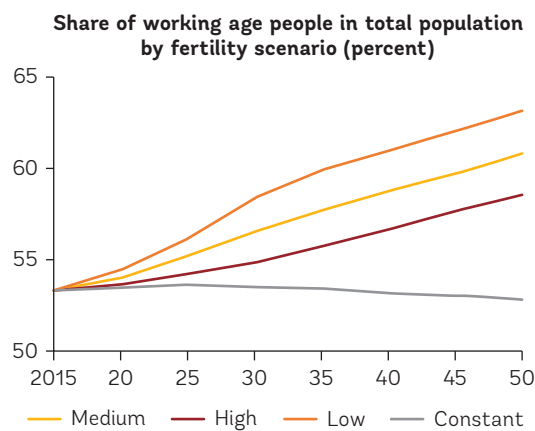
Nigeria is a high-fertility country and modest accelerations in its fertility decline can lead to substantial changes in its projected age-structure. Children currently account for 43 percent of the population, and will remain more than 40 percent in 2030 and more than 35 percent in 2050. The working-age population currently accounts for 53 percent of the population, and this age cohort will account for more than 60 percent of the population by 2050 (Figure 20). If fertility declines are slower, as under the WPP's high fertility scenario, then the future population share of children is even higher. In contrast, if fertility reductions are faster in the future, as under the WPP's low fertility scenario, then there will be more potential workers relative to dependents by 2050 due to the higher share of people aged 15 to 64.

Figure 19. Nigeria population projections and working age population shares under three fertility scenarios, 2050



Note: The TFR is projected to drop to 3.9/4.4/4.9 (2032) and 2.9/3.4/3.9 (2050) under the UN's low/medium/high fertility scenarios. Source: UN 2015.

Figure 20. Working-age population shares will continue to grow through 2050

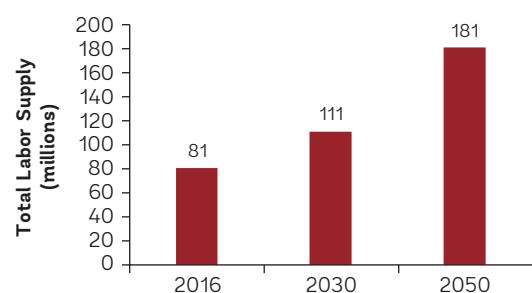


Source: Data from United Nations (2015).

Note: The scenarios consider the age-structure changes projected in the medium, high, low, and constant fertility scenarios of United Nations (2015). The TFR is projected to drop to 3.9/4.4/4.9 (2032) and 2.9/3.4/3.9 (2050) under the UN's low/medium/high fertility scenarios.

While the key demographic indicator for economic growth is the share of working age population relative to dependents, the absolute number of workers is also an important figure to assess the capacity of the labor market to delivering the demographic dividend. As illustrated below, even under a medium fertility scenario the absolute size of the workforce is set to more than double between now and 2050 (Figure 21a) which would require the creation of 86.4 million jobs just to keep unemployment at its already worrying level of 14 percent (NBS, 2017). If the current fertility rate were to remain constant (significantly above the medium variant),

Figure 21a. Total labor supply under medium fertility scenario, 2016–2050

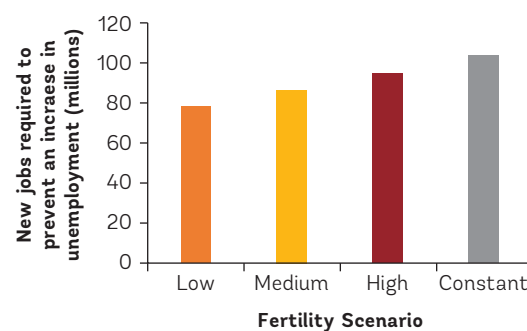


Data Sources: UN Population Projections 2015; Nigeria National Bureau of Statistics 2016. The TFR is projected to drop to 4.4 in 2032 and 3.4 in 2050 under the UN's medium fertility scenario.

104 million jobs would need to be created by 2050 to prevent unemployment from rising (Figure 21b). Under the constant fertility scenario, even in the highly optimistic case that job growth was sufficient to prevent increased unemployment, by then the number of dependent children will have reached 230 million, largely outstripping the impact of new entrants into the labor market, and thus severely mitigating the potential benefits from such job growth. Were job growth to fail to keep pace with new entrants, Nigeria could face mass youth unemployment and its negative impacts. Given the association of youth unemployment with insecurity, this is of particular concern. On the other hand, if fertility were to decrease according to a low fertility scenario, the pressure on the job market to absorb the new entrants will still be significant but more moderate (78 million jobs to be created to keep unemployment steady to 2050). However, with the number of dependent children being 46% lower than under the constant fertility scenario, the low fertility scenario will more likely see even moderate job growth translated into higher income and savings growth.

Economic simulation modeling suggests that a one child difference in Nigeria's fertility rates by 2050 can lead to differences of 29 percent in real GDP per capita (Figure 22). Under the medium fertility projection scenario, simulations of Nigeria's economic growth using the LINKAGE economic model suggest that real GDP per capita could grow from \$2777 (constant US\$) in 2015 to \$4775 by

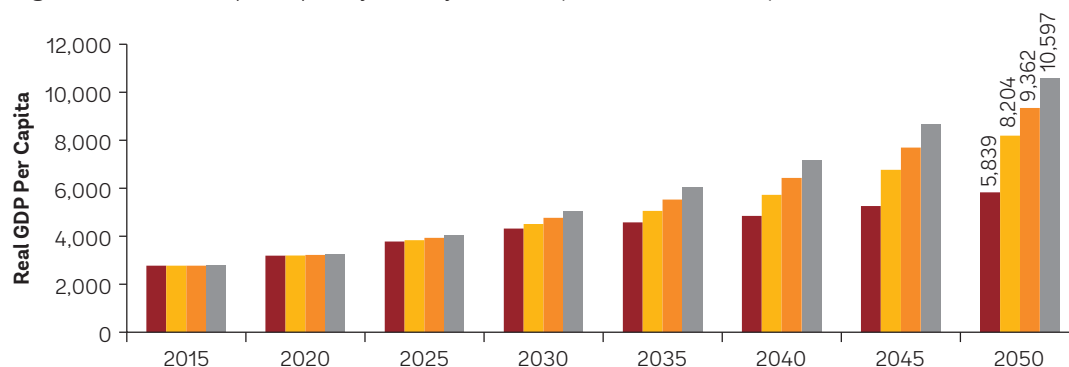
Figure 21b. Number of new jobs required to prevent an increase in unemployment in 2050 by fertility scenario



Data Sources: UN Population Projections 2015; Nigeria National Bureau of Statistics 2016.

Note: The TFR is projected to drop to 3.9/4.4/4.9 (2032) and 2.9/3.4/3.9 (2050) under the UN's low/medium/high fertility scenarios.

Figure 22. Real GDP per capita by fertility scenario (constant 2011 US\$)



Source: Simulation results from LINKAGE and Global Income Distribution Dynamics model.

Note: The scenarios consider the age-structure changes projected in the medium, high, low, and constant fertility scenarios of United Nations (2015). The TFR is projected to drop to 3.9/4.4/4.9 (2032) and 2.9/3.4/3.9 (2050) under the UN's low/medium/high fertility scenarios.

29 percent

The difference in GDP per capita produced by a one child difference in fertility rate by 2050

53 million Nigerians

The difference in number of people living in poverty in 2050 between the high- and low- fertility scenarios

2030 and \$9362 by 2050.⁴ However, under the WPP's high fertility scenario, growth is more modest, reaching \$8204 by 2050; while under the low-fertility scenario, per capita income in 2050 is \$10,597.

The marginal economic benefits of fertility reductions are likely understated by the model. The analysis makes the conservative assumption that the skill-share of the labor force remains constant into the future. If Nigeria manages to increase the stock of human capital, the growth implication of the demographic transition will be even greater as the additional working age population becomes more effective and participates more in production.

The impact of declining child-dependency ratios in boosting productivity is also not considered in the scenario analysis, and could also contribute to an underestimation of possible benefits. As the number of children per household falls, the public and household-level spending per child can be deepened. Since there will be fewer children to demand services, spending on education, healthcare, and early childhood development interventions can be increased with the same resource envelope. With greater investments in the human capital of children, there will be direct improvements in human development outcomes. The productivity of these children will experience

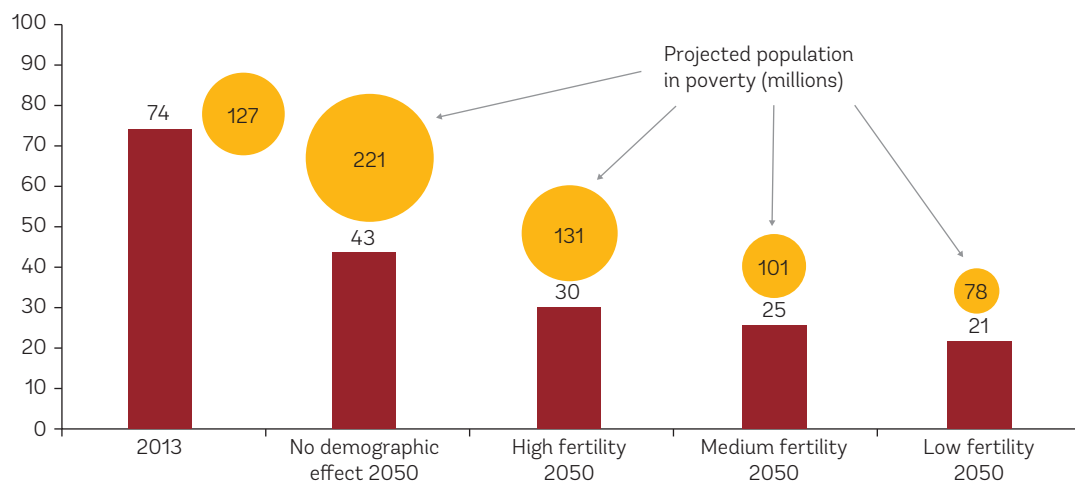
permanent improvements, leading to higher incomes over the life-cycle and also contributions to aggregate economic growth as well.

The impact of lower fertility rates in Nigeria includes a lifting 53 million people out of poverty by 2050. Figure 23 shows poverty headcount ratios at the PPP\$3.10 a day⁵ for the constant, high-,

⁴ The LINKAGE model has been used for analysis of the growth and poverty impacts of age-structure changes as in Ahmed et al. (2016), which showed that demographic change could explain 11 to 15 percent of GDP volume growth and approximately 40 to 60 million fewer poor by 2030 for Sub-Saharan Africa. The analytical framework was also used to examine the impact of demographic change on the global economy (World Bank 2015a), South Africa (World Bank 2015b), and the Southern African Customs Union economies (Ahmed and Cruz 2016). Additional details on the methodology can be found in technical annex A. It should be noted that the scenario analysis does not account for the discrete structural changes in Nigeria's economy, such as those that may occur due to unanticipated infrastructure investments. As such, the simulation results should be considered illustrative and highlighting the marginal impacts of demographic change rather than as forecasts. Please also note that this analysis uses the 2009 HNLSS data as recommended and used by the Government of Nigeria for estimating poverty rates, but more recent survey data are available (GHS 2015/16).

⁵ To better reflect the impact of poverty under the projected movement of Nigeria into upper-middle income status, the use of the World Bank PPP(2011)

Figure 23. Poverty headcount rate (%) by fertility scenario by 2050 (at PPP\$3.10 a day)



Source: Simulation results from LINKAGE and Global Income Distribution Dynamics model. Note: The TFR is projected to drop to 3.9/4.4/4.9 (2032) and 2.9/3.4/3.9 (2050) under the UN's low/medium/high fertility scenarios. Source: UN 2015.

medium-, and low-fertility scenarios. By 2050, 43 percent of Nigerians will remain in poverty if fertility stays constant. Under the high-fertility scenario (with only minimal reductions in fertility), 30 percent of Nigerians will remain in poverty. However, reducing fertility rates to the low fertility scenario will decrease the poverty headcount ratio by 8.5 percentage points. Adjusting for the different population totals, it is expected that 131, 101, and 78 million will remain in poverty under the high-, medium-, and low-fertility scenarios, respectively. This implies a difference of 53 million in poverty between the high- and low-fertility scenarios by 2050.⁶

\$3.10 a day poverty-line is preferred. Consider that under the set of assumptions laid out in the scenario analysis, Nigerian real GDP per capita grows annually in the range of 3.14 to 3.9 percentage points. At these rates of per capita growth, Nigeria's GNI per capita level of \$2,790 (in 2015) is expected to triple. Ravallion (2016) offers a more formal discussion on this topic. At a glance, empirical evidence shows that it is no surprise to observe higher national poverty lines in richer countries. In identifying who is considered poor within its borders, richer countries tend to use a more generous allowance for basic needs.

⁶ The levels and trends in poverty, growth, and fertility vary significantly in the North and South which means that the impact of lowering fertility is heterogeneous across these regions. Note that poverty rates, number of people below the poverty line and fertility rates are higher in the North. Hence, lowering fertility in the North will likely have a higher impact on reducing poverty in the region as compared to the South.

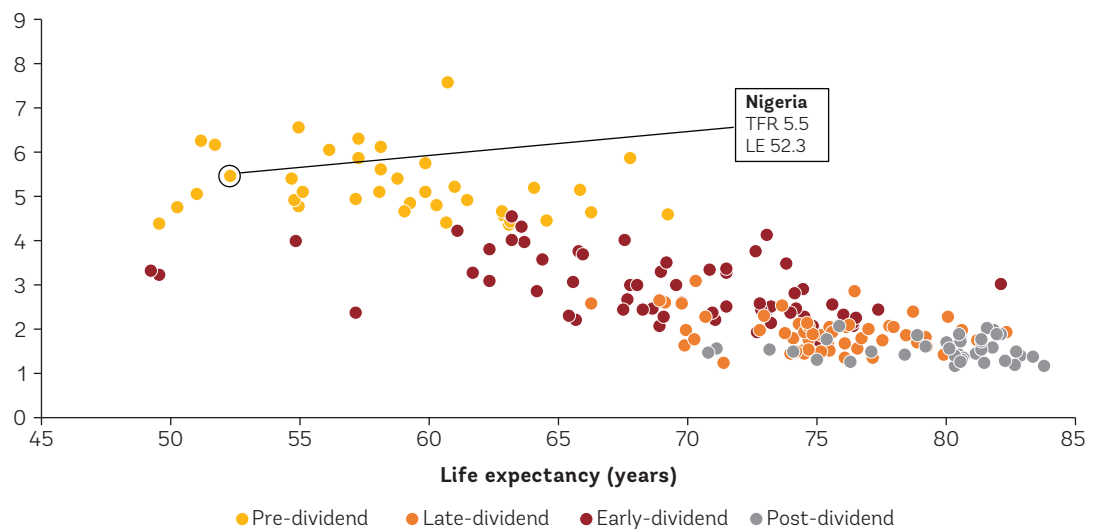
What policies and strategies can Nigeria adopt to seize the demographic window of opportunity, spur economic growth and reduce poverty?

To harness the demographic dividend, policies are required that both hasten the transition to smaller cohorts and enable cohorts to be more productive (Canning, et. al.). Countries at different stages of their demographic transition require different policy solutions tailored to their economies, societies and culture. According to the typology developed in the GMR 2015/16, Nigeria is currently a **pre-demographic dividend** country due to its high fertility levels, declining mortality levels and young age structure (Figure 24). For Nigeria, the priority is to spark the demographic transition—it can do so by improving human development outcomes to accelerate the fertility decline.

The government of Nigeria should consider a three-pronged approach to improve human development to accelerate the fertility decline in order to reap the

potential benefits of the demographic dividend (Table 1). First, Nigeria should expand access to comprehensive family planning programs (including addressing social norms and empowering women). Second, Nigeria needs to improve maternal and child health and nutrition. There is an opportunity to continue the progress made in bringing about a reduction in infant and child mortality by continuing to invest in programs that reduce morbidity and malnutrition. Improved survival of children will assist couples to attain their desired family size and contribute to a reduction in fertility. Third, stronger efforts are needed to increase female education and empowerment, which will help postpone marriage and childbearing and enable women to take informed decisions about their reproductive health. Without effectively implementing these three strategies, other investments in skills development,

Figure 24. Nigeria's progress toward the demographic dividend & strategies needed to catalyze progress



Source: Global Monitoring Report 2015/2016. Nigeria Demographic and Health Survey, 2013.

Table 1. Three-Pronged Strategy to Spark the Demographic Transition

Sparkling the Demographic Transition: Policy priorities to improve human development outcomes to accelerate the fertility decline	
1.	Expand access to comprehensive family planning programs (including addressing social norms and empowering women).
2.	Improve maternal and child health and nutrition.
3.	Increase female education and empowerment (including reducing child marriage and teenage childbearing, and addressing social norms).

jobs and savings in the longer term will not be able to harness the economic benefits of a demographic dividend.

There is an opportunity to learn from implementation experiences elsewhere to increase the likelihood that the above strategies will be effectively implemented.

Table 2 summarizes the implementation lessons learned for each of the strategies above and indicates investment priorities and recommendations. Options for increasing access to family planning include demand- and supply-side interventions; evidence suggests that community-based interventions are most successful when they include both supply and demand components. High-level political support for population and fertility issues is also important for achieving change. Interventions that aim to delay age at marriage, which can affect fertility by postponing childbearing, have incorporated community-based campaigns and mentorship programs. Fertility can be influenced by

girls' education and empowerment programs, including by encouraging retention in school (by lessening constraints, and/or incentivizing enrollment), providing reproductive health services, and improving girls' skills. Box 3 takes an in-depth look at the implementation experience in Bangladesh.

The optimal mix of policy options depends also on the time horizon. Some actions will have short-term returns on investment—for example, expanding access to comprehensive family planning programs & improving maternal and child health and nutrition. Others would have medium- to long-term returns on investment, such as increasing female education. Examining impact and assessing success for each strategy, over its appropriate time horizon, also involves different sets of indicators. A combination of strategies will be necessary for Nigeria to consolidate successes while catapulting it to overcome other challenges.

Table 2. Evidence-based global best buys to implement the priority strategies to improve human development

	Expand access to comprehensive family planning (FP) programs	Improving maternal and child health and nutrition	Increase female education and empowerment
Short-term	<ul style="list-style-type: none"> Strengthen community-based distribution of contraceptives and provision of FP services Develop social marketing/BCC strategy FP education and services into existing health services 	<ul style="list-style-type: none"> Integrate infant care into postpartum services Support community distribution of child health technologies via existing health system 	<ul style="list-style-type: none"> Expand youth programs to include FP & health topics Develop programs for peer-education among traditional leaders Provide in-kind financial incentives for schooling
Medium-term	<ul style="list-style-type: none"> Expand FP education method mix to ensure choice of method Facilitate community-level communications campaigns Introduce cost-reducing mechanisms, particularly for vulnerable groups Launch media campaigns about FP Promote postpartum FP counseling and service provision 	<ul style="list-style-type: none"> Develop mechanisms for community-based distribution of child health technologies Develop social programs for behavior change for child health care 	<ul style="list-style-type: none"> Create mentoring and peer programs for vulnerable girls Introduce community discussions about early marriage Strengthen infrastructure (school construction) Offset financial burden for vulnerable groups
Long-term	<ul style="list-style-type: none"> Develop subsidies for FP products and services Integrate FP into national insurance and/or strategic purchasing systems 	<ul style="list-style-type: none"> Introduce cost-reducing mechanisms for child health care Develop nutrition subsidies/supplements for poorest households 	<ul style="list-style-type: none"> Develop interventions that target families Change policies about required years of primary schooling

Source: Shekar, Yazbeck, Hasan, and Bakilana. 2016. Population and Development in the Sahel: Policy Choices to Catalyze a Demographic Dividend.

Box 3. Successful Experience of Bangladesh in Reducing Fertility

Context: In the early-1970s, a Bangladeshi woman had about 6.3 children on average. In combination with poor nutrition and lack of access to quality health services, this high fertility rate jeopardized the health of both the woman and her children. Beyond the health impact, high fertility and rapid population growth represented a major constraint to the country's economic development and social progress.

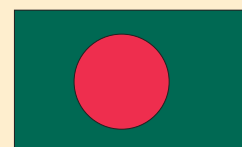
Program Implementation: In 1977, the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) initiated an experimental family planning and maternal and child health (FPMCH) program in the religiously conservative area of Matlab, which included 149 villages with a total population of 180,000. In the program's initial stages, community health workers made regular home visits to married women in the villages and offered them a choice of family planning methods. The field workers were married

women from influential families in the village with eight or more years of education and users of family

planning. Over time, the FPMCH expanded to include other cost-effective interventions, such as immunizations, to improve family health. The program used mass media to influence a change in attitudes about family size, and religious leaders were actively involved in the social and behavior change communication efforts.

Evaluation results showed families living in the program area were healthier and wealthier compared to those in a comparison area:

- a woman in the Matlab area had one less child (a 15 percent reduction in fertility)
- the time between her second and third births was nine months longer



(continued on next page)

Box 3. Successful Experience of Bangladesh in Reducing Fertility (*continued*)

- the family is more likely to obtain water from a source at home
- the family has greater assets and a more valuable home
- the children are more likely to be vaccinated against DPT, polio, and measles.

The Government of Bangladesh also added investments to improve girls' education and delay marriage. In 1994, the Female Stipend Programme (FSP) began giving stipends to girls in secondary school conditioned upon (a) attendance, (b) scores on achievement exams, and (c) remaining unmarried until reaching age 18 or completing secondary school. These efforts have resulted in an increase in girls' secondary school enrolment—between

1995 and 2005, the number of girls enrolled in secondary school tripled (Jones et al 2010). Furthermore, early marriage declined: among girls age 13–15, the proportion married dropped from 29% to 14%, and among girls age 16–19, the proportion married decreased from 72% to 64% (World Bank 2007), reflecting a delay in marriage.

Successes: As a result of strong political commitment, stakeholder engagement, sustained investments and successful implementation of appropriate policies and programs, the current TFR in Bangladesh is 2.2 children per woman. The population growth rate is 1.2% and total dependency ratio 52, yielding nearly 2 people in working ages per dependent.

Sources: Levine 2007, Gribble and Vos 2009, Jones et al 2010, World Bank 2006.

How can Nigeria ensure that implementation of these policies and strategies will be successful?

In support of Nigeria's Economic Growth and Recovery Plan (EGRP) 2017–2020, coordinated multi-sectoral actions are needed for investing in people to drive economic gains. The EGRP prioritizes reviewing the current status of the Population Policy and developing and implementing a revised Population Policy. The revised Population policy should emphasize the needed changes in the population age structure—rather than only focusing on population size. This will require investments in health, nutrition, population, water and sanitation, social protection, education and gender to help overcome the human development challenges currently faced by Nigeria (Ministry of Budget and National Planning 2017). The limited fiscal base of the country has curtailed expenditure on social sectors in recent years. Average spending on the social sectors overall in 2005–2010, consisting of health, education and social assistance (i.e. social protection less civil servant schemes), amounted to 5.8% of gross domestic product (GDP) and close to 20% of consolidated government expenditure (Hagen-Zanker, Tavakoli, 2012). In order to meet the goals of the EGRP and take advantage of the demographic window of opportunity, more

concerted efforts are needed to change the age structure of the population, invest in its people and drive productivity.

However, in addition to “what” priorities are identified for investment, the “how” of implementation is equally important. Thus, using the findings of Table 2 as a starting point, an additional analysis using newly developed tools and primary data collection was conducted to examine how Nigeria has designed, adopted, translated and implemented policies around sparking the demographic transition, and successes and challenges in implementation seen so far in the country.⁷ A survey instrument was developed and administered with data

⁷ A framework was developed to analyze the policy process (Shekar, Yagbeck, Hasan and Bakilana 2016). It is widely agreed that to achieve significant change, policies must be designed well and must be implemented fully and successfully. Many attempts have been made to disentangle the complex factors involved in policy implementation. The characteristics focused on in this analysis have been distilled from two key models (Crosby 1996; Sabatier and Magmanian 1980) and have been synthesized into a single framework to identify characteristics of policy implementation for analysis of sparking the demographic transition. The complete

analyzed according to the policy framework. Policies and programs in health, education, gender, youth, and population were analyzed to reflect the “global best buys” in Table 2. Based on implementation experience in Nigeria derived from the policy space analysis (Box 3)—particularly for health, population and youth policies and programs—several things would increase the likelihood of successful implementation of existing policies and programs:

- i. Increased and stable financial commitment from the government to keep pace with growing population needs, and full disbursement of budgeted funds;
- ii. greater coordination by the government, particularly given the decentralized governance structure (which may produce sub-nationally differential implementation and/or commitment to policies and programs);
- iii. continued and/or increased engagement of a range of stakeholders in decision-making and implementation, including stronger government leadership of such partnerships;

- iv. institution strengthening and capacity building, including greater training and deployment (with an emphasis on equitable geographic distribution) of skilled workers for policy implementation; and
- v. greater focus on results, data collection, and monitoring for results and impact.

These findings indicate that there is not only policy space for expanding investments in the global best buys (as outlined in Table 2) but also policy space for improving implementation for successful achievement of objectives based on the implementation challenges observed.

framework captures three stages of the policy process: (1) policy design and adoption, (2) policy translation for implementation, and (3) policy implementation. Characteristics were specified for each of these stages. For example, for policy design/adoption, a key aspect is the policy objective. For policy translation, an assessment of evidence-based choice of activities as well as an operational plan with specific activities are needed. For policy implementation, financial resources, stakeholder support, institution building and monitoring for results are key characteristics that determine success.

Table 3. Policy implementation analysis results: achievements and challenges

	Achievements	Challenges
Financial resources	Policies are accompanied by detailed implementation plans, including financial sources <ul style="list-style-type: none"> Government budget now has a health line item With exception of Vision 20:2020 which does not have such a plan 	Funds have been insufficient <ul style="list-style-type: none"> Problematic given increasing need Government funds are low and inconsistent, with an allocation-release mismatch Concerns about unsustainable and/or volatile donor funds
Stakeholder support	Champions for youth & health, within and outside the government (also private sector, civil society, religious groups) <p>Policy development process includes consensus-building</p> <p>Leadership & support have increased over time</p>	Government support is not uniform (especially low in Parliament, Legislature) <p>Slow behavior/attitude changes due to literacy, tradition, religion</p> <ul style="list-style-type: none"> Under-developed commitment to development issues by government
Institution building/strengthening	Creation of new structures to implement policies (e.g. NPOPC) <p>There are clear roles and responsibilities for parties, and coordination is improving</p>	Shortage of skilled workers <ul style="list-style-type: none"> Perceived to be getting worse Major geographic disparities Coordination challenges <ul style="list-style-type: none"> Groups are not meeting regularly Government needs to increase its capacity for leadership/coordination Weak public sector <ul style="list-style-type: none"> Problems with, and perceptions of, corruption Lack of a national population council
Monitoring for results	Evidence-based planning and policy development, including situation assessment and use of survey data	Data do not exist for policy evaluations <ul style="list-style-type: none"> Lack of a new census is seen as particularly challenging <p>Priorities are still set by donors' interests and programs (not necessarily evidence-based, locally-led or transparent)</p>
Other	Broad social determinants also matter (poverty, security, unemployment) <p>States vary widely in policy implementation, commitment</p>	

Technical Annex A: Demographic Dividend in Africa

Following the approach applied in Ahmed et al. (2016), Ahmed and Cruz (2016) and World Bank (2015a, 2015b), the LINKAGE the recursive dynamic computable general equilibrium (CGE) model of van der Mensbrugghe (2011) is used to examine the economic impact of demographic change on growth. The model is then used to consider the marginal impacts of different fertility rates on nine Sub-Saharan African economies, by considering the age-structure changes under the UN WPP's medium, high, low and constant fertility scenarios. These economies are Benin, Burkina Faso, Cote d'Ivoire, the Democratic Republic of the Congo, Malawi, Niger, Nigeria, Sudan, Tanzania, and Togo.

LINKAGE is supported by globally consistent data on production, consumption, investment, and trade from the GTAP Database Version 9. This is a global database covering 140 economies. Sudan, the Democratic Republic of the Congo, and Niger were not covered within the database, and the database had to be augmented using Social Accounting Matrices (SAMs) for these countries.

LINKAGE is a multi-sectoral, multi-country and multi-agent dynamic recursive CGE model that assumes perfect competition, with equilibria in a given year being dependent on current year prices and quantities, and the previous year's equilibria. Household demand behavior is modeled using the Constant Difference of Elasticities function, while production is assumed to be based on a

multi-nested CES function. At the top of the multi-nested structure, an aggregate of intermediate inputs is combined with an aggregate value added under Leontief technology. Unskilled labor is substitutable for a skilled labor and capital composite, while skilled labor and capital are themselves complementary. The model takes a vintage approach to capital in production, so production can occur with either 'old capital' or 'new capital'. The key difference being that 'new capital' is slightly more substitutable (or slightly less complementary) with skilled labor than 'old capital'.

Output is produced by different production streams—differentiated by capital vintage. Each production stream has an identical production structure based on a multi-nested Constant Elasticity of Substitution functional form, but with different technological parameters and substitution elasticities. At the top of the nest, a value-added bundle is combined with an intermediate inputs bundle under the Leontief technology assumption. The intermediate inputs bundle is combined with different inputs, with an Armington assumption applied to specific inputs. That is, for a given type of intermediate input, there is substitutability between domestic and imported inputs, and then again between imported inputs from different source countries. The value added bundle is made up of unskilled labor being slightly substitutable with a capital and skilled labor bundle. Skilled labor and capital are highly substitutable.

LINKAGE also considers segmented labor markets in developing countries, i.e. there are separate labor markets for unskilled labor in agriculture and non-agriculture. Endogenous migration of unskilled labor from one market to another within a country is modeled as a function of the wage of unskilled workers in agriculture relative to the wages received by unskilled workers in the non-agriculture market.

Since LINKAGE is a structural micro-foundations model that is consistent with neo-classical growth theory, aggregate growth depends on changes in the labor force, the capital stock, and total factor productivity. The economic impact of demographic change must therefore occur through one of these channels, and the key neo-classical growth drivers in LINKAGE that will be sensitive to demographics are the labor force and the capital stock. As a simulation is implemented over time, the skilled and unskilled labor forces for a given country are exogenously changed. At the same time, the model keeps track of the young (less than 15 years of age), working age (15–64 years of age), and aged (over 64 years of age) populations, following the values of the medium fertility scenario of the UN (2015). These data are used to calculate the youth and elderly dependency ratios in each year of a given simulation, and are in turn used to help determine domestic savings behavior.

Domestic savings as a share of GDP (μ^s) is a linear function of three factors (excluding the persistence effect) and has the following functional form:

$$\mu^s = \alpha^s = \beta^s \mu_{-1}^s + \beta^g \ln \left(\frac{GDP / POP}{GDP_{-1} / POP_{-1}} \right) + \beta^y \left(\frac{POP^{l15}}{POP^{WAP}} \right) + \beta^e \left(\frac{POP^{g65}}{POP^{WAP}} \right) \quad \text{EQ. 2}$$

The first factor is for the growth of GDP per capita. The second and third terms are for the youth and elderly dependency ratios, respectively. The function is parameterized following the empirical estimates of Loayza et al. (2000). These coefficients are constant over the time horizon of the simulations. The coefficients for the growth term are positive for all countries which imply that as countries grow they save more. The coefficients on the dependency ratio terms are negative for all countries. So, as dependency ratios rise, the propensity for households to consume rises and savings as a share of GDP fall, with the magnitudes of

the elderly dependency ratio coefficients being greater than that of the young dependency ratio coefficients. Since investment is modeled as being savings driven, total global investment is driven by total global savings, with the amount of investment in a given country being a function of both domestic savings as well as the current account balance, which is determined exogenously. The additional implication of the savings driven investment assumption is that as dependency ratios fall in a given country, domestic savings will rise, which in turn will boost investment. The opposite would hold true for a country where dependency ratios are rising.

While the numerical analysis will ultimately account for the full effect of all the different drivers of consumption, savings and investment, it may be useful to see how sensitive the μ^s parameter is to dependency ratios. This is done by applying youth and elderly dependency ratios calculated from the United Nations (2015) to the β^y and β^e coefficients considered in LINKAGE. β^y and β^e are the same for all countries, and so differences in the savings share parameter values across regions are driven solely by the differences in dependency ratios.

A few observations can be made. First, the contribution of the elderly dependency ratio to savings stays almost constant over time for African countries, while it rises for the other regions. The second observation is that the contribution of the youth dependency ratio to African countries' savings as a share of GDP is two to three times greater than the contribution of the elderly dependency ratio. Finally, the overall effect of youth and elderly dependence ratios on the savings as a share of GDP is rising, despite the large 'youth burden' that Africa is carrying into the future. This means that African households can be expected to save more due to just the demographics, while households in other regions will be saving less.

The impact of the changing dependency ratios while modulated by the β^y and β^e (which are the same for all developing countries) will of course vary across countries, since countries have different dependency ratios in the benchmark year and undergo demographic change at different paces.

Four scenarios with differing age-structure changes are considered. The four scenarios are identical in regard to their labor productivity growth rates but differ in their demographic projections. The scenarios

consider demographic projections from four UN WPP's fertility scenarios – the medium fertility, high fertility, low fertility, and constant fertility scenarios. From each UN WPP scenario, data for three variables are determined: the average working-age population growth rates for every year till 2050, and the child and aged dependency ratios for every year till 2050.⁸ The first variable is used as a proxy for the labor supply growth rate, under the assumption that current employment ratios remain constant. The second and third variables are used as inputs to determine savings and hence investment in a given year. Moreover, all scenarios assume fixed employment ratios, implying that unemployment rates and labor force participation rates at least stay the same.

The medium fertility scenario is considered the “baseline” or “business-as-usual” scenario. In this scenario, the real GDP per capita growth rates of the different economies are allowed to grow along a targeted pathway. Till 2018 they follow the growth projections of the World Bank's Global Economic Prospects June 2016. After 2018, they follow the long-term growth projections of Dellink et al. (2015) under the assumptions of the Shared Socio-Economics Pathways Scenario 2, till 2050. The income per capita growth in this baseline scenario provides an endogenously determined labor productivity growth rate. This labor productivity growth rate will then be applied exogenously in the other fertility scenarios (high, low, and constant). The other macroeconomic and behavioral parameter assumptions are kept the same across scenarios. So, the only difference across scenarios is thus the demographics. Different working-age population growth rates provide different labor supply growth rates, and different age-structures, which influence savings and investment. The differences in income per capita growth across scenarios can thus be considered to arise from just the demographic differences across scenarios, within the context of LINKAGE.

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⁸ The child dependency ratio is the ratio of the under-15 population to the population aged between 15 and 64. The aged dependency ratio is the ratio of the over 64 population to the population aged between 15 and 64.

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