Prospects for Economic Growth in Nigeria: A Demographic Perspective[a]

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We quantify the economic growth opportunity created by Nigeria's demographic transition and make policy recommendations on how to realize this growth, focusing particularly on investment in Nigeria's human capital. Using a cross-country growth model, we first estimate the size of the demographic dividend Nigeria could enjoy; how it might be increased by health and institutional improvements; and how it might affect poverty. Using an original analysis of Nigeria's economic lifecycle, we then try to understand the conditions needed to realize the dividend, focusing particularly on the challenges and opportunities in increasing Nigeria's labor productivity, and investments in health and education. We conclude with policy recommendations.

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1 Introduction

Motivated partly by Nigeria's importance in Africa and potentially the world, and partly by the observation that Nigeria is on the threshold of a major demographic transition, this paper seeks to answer three related questions: Can Nigeria expect added economic growth from its demographic change and if so, how much? What conditions need to be created to realize this additional growth and to sustain higher standards of living once the demographic dividend is gone? And what are the challenges Nigeria will face in creating those conditions?

To answer the first question, we use an econometric model to estimate the following effects of demographic change: the added per capita income Nigeria could enjoy by 2030, the additional size of the economy in 2030, and the number of people who can be lifted out of poverty because of the added growth. We also estimate the number of jobs Nigeria will need to create to realize this growth. To answer the second question, we use an economic lifecycle analysis as well as simulation models. We describe some surprising features of Nigeria's economy that must be overcome. To answer the third question, we build on the insights gained from analyses and other literature to propose concrete policy recommendations for Nigeria to utilize its demographic potential.

The remainder of this section explains the general notion of a 'demographic dividend' and its relation to economic growth, Nigeria's economic and demographic situation as well as challenges, and our key findings.

1.1 The Demographic Dividend

Our work is premised on the known phenomenon of a 'demographic dividend'—the idea that economic growth in a country is related to an increase in the share of its working-age population. In Asia, an increase in this share has been shown as a significant driver of economic growth between 1960-1990 (Bloom, et al., 1998), and more recently from 1960-2005 (Bloom, et al., 2009). In East Asia, it has been shown that demographic change could account for one-quarter to one-third of the region's economic 'miracle' (Bloom, et al., 2000; Mason, 2001). In Ireland, a similar result has been documented following the legalization of contraception (Bloom, et al., 2003). The increase in working-age share results from a lag between declines in mortality and fertility, creating a 'baby boom' generation, which tends to be substantially larger than others in the population. This swollen generation must be fed, clothed, housed, and educated when it is young, placing a substantial burden on families and the wider society. But as this generation enters its working years and as the number of dependents decline due to falling fertility, there is potential for a sizeable boost to economic growth.

However, a dividend from a favorable demographic transition is not automatic. It requires good governance and judicious public policies, as evidenced by Latin

America when it experienced demographic conditions similar to East Asia after 1970, but GDP per capita grew by only 0.7% annually over 1975-1995, compared to 6.8% in East Asia (World Bank, 2008). A combination of rigid labor markets, a relatively closed economy, and weak governance led to a period of stalled growth. Similarly, it is not clear which way the demographic transition will go in countries, like Pakistan, which face a demographic transition similar to Nigeria's and struggle with weak institutions (British Council Pakistan, 2009). In general, a demographic dividend seems collectable only if young people are healthy and have been properly educated, if the economy offers opportunities to earn and save. There is some evidence that if it is not the case, countries can face potential social unrest caused by an under-employed generation of adults (Cincotta, et al., 2003).

1.2 Nigeria's Economy, Demographic Transition and Challenges

One of the most salient features of Nigeria's economy in that since 1980, it has not grown: the GDP per capita in 2006 was almost the same as it was in 1980 (Figure 1). This is starkly brought out in a comparison with peer countries like Indonesia and Pakistan.[b] In 1980, Nigeria's GDP per capita was slightly higher than that of Indonesia and Pakistan. Since then, Nigeria's economy has stagnated, while Pakistan, and especially Indonesia, have grown considerably (Figure 2). Indonesia's income per person is now roughly twice Nigeria's. Nigeria's economy in general has performed similar to SSA as a whole. Meanwhile, East Asia in particular and the rest of the world have zoomed ahead (Figure 3).

Part of the drag on Nigeria's economy has been demographic. Since independence, Nigeria has struggled against very high fertility rates (Figure 4) and high mortality (Figure 5), resulting in a high ratio of children in the population. Only since the 1980s have fertility rates begun to decline, albeit very slowly. Nigeria's current fertility rate remains higher than in Sub-Saharan Africa as a whole and is more than twice the world average fertility rate. The burden on society is reflected in the ratio of working-age to non working-age population (Figure 6) which has declined since independence. Today, with around 3% of the population over 65+ (United Nations, 2007), this implies that only around 1.2 working-age people are available to care for Nigeria's children.

But the demographic tide is turning as Figure 4-Figure 9 show. With falling crude birth and death rates beyond 2010, fertility rates are also expected to continue falling. As a result, the share of working-age people in the population is expected to rise significantly from 2010 (Figure 8) to 2050 (Figure 9), the ratio of working-age to non-working age

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[b] Indonesia and Pakistan are comparable to Nigeria because they started out with a similar GDP/capita in 1980; all three have large populations which are heavily Muslim (although Nigeria less so), have a history of inter-group conflict, hot climate, ample coastline. Indonesia and Nigeria are also major oil producers. Pakistan and Nigeria have a history of British rule, and Indonesia a history of Dutch rule. All three have also had a history of authoritarian and/or military rule.

population rising to around 2 by 2050 (Figure 6). If productively employed, these extra adults create a window of opportunity for significant economic growth in Nigeria.

But demographic change was not the only drag on Nigeria's economy in the past. Other factors which have hindered Nigeria's previous growth threaten its ability to realize its demographic dividend in the future. In particular, Nigeria's institutions (e.g., rule of law, government capabilities in numerous realms, corporate ethics, civil liberties, interaction between private actions and public goals) are mediocre in African terms and poor when compared to countries from other regions (Nigeria: The Next Generation, 2010). Similarly, regional and ethnic inequalities, very low levels of investment in education and health (Mason, et al., 2010), and a culture of youth violence pose significant challenges to Nigeria's ability to benefit from its demographic transition (Alao, 2010).
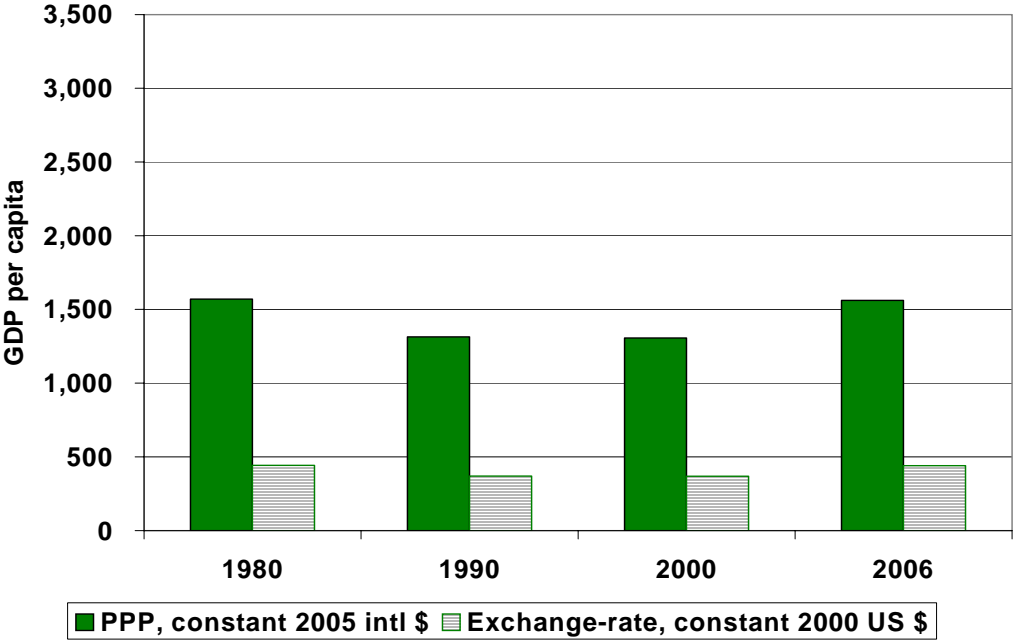
Figure 1: Nigeria's GDP per capita 1980-2006 (Source: World Development Indicators 2008).
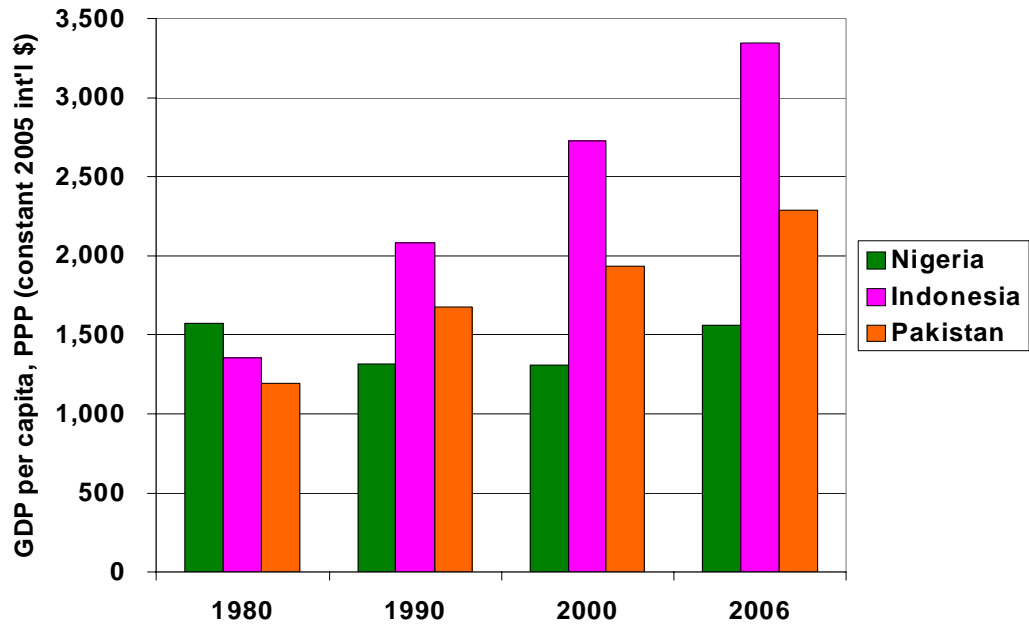
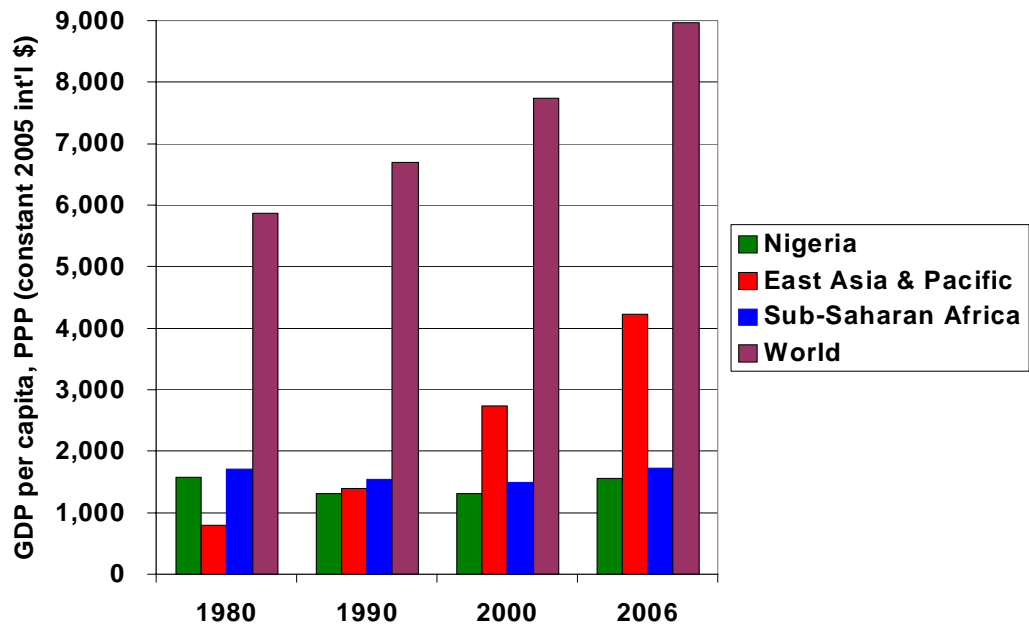Figure 2: GDP per capita for Nigeria, Indonesia and Pakistan (Source: World Development Indicators 2008).

Figure 3: GDP per capita for Nigeria in comparison (Source: World Development Indicators 2008).

1.3   Our Findings

If Nigeria is able to overcome its challenges and collect its demographic dividend, we estimate that:

- Nigeria can obtain almost 12% increased GDP per capita over the default scenario by 2020, and more than 29% increased GDP per capita by 2030.[c] With additional modest institutional improvements,[d] the extra GDP per capita over the default scenario could be almost 13% by 2020 and about 31% by 2030.

- With the demographic dividend, Nigeria's economy can be 3 times larger than today in 2030, instead of only 2 times larger without the demographic dividend.[c]

- By realizing the demographic dividend, Nigeria can lift about 5.8 million more people out of poverty by 2020 and about 31.8 million by 2030, over and above the default scenario. With institutional improvements, the number of additional people lifted out of poverty can be 34 million by 2030.

- By increasing investment in human capital as fertility rates decline, Nigeria could increase GDP by nearly 50% and sustain that gain indefinitely.

But to realize its demographic dividend, we estimate that Nigeria will need to create around 24 million new jobs in the next decade and around 50 million new jobs over 2010-2030. Further, the jobs will have to be productive. This will require increasing Nigeria's human capital which cannot be achieved without strong investments in health, education, gender parity, and institutions. In particular, the role of education is so closely tied together with health, gender parity and institutions that any specific intervention that ignores the other three aspects is very unlikely to work. Even if some benefits are realizable in the short term, they will not be sustainable.

[c] Based on UN population projections and estimates for improvements in life expectancy, and assuming that the default scenario is for Nigeria is to enjoy the same growth from 2010-2030 as it did from 2000-2008.
[d] And a further life expectancy increase to reach the world average life expectancy by 2030.
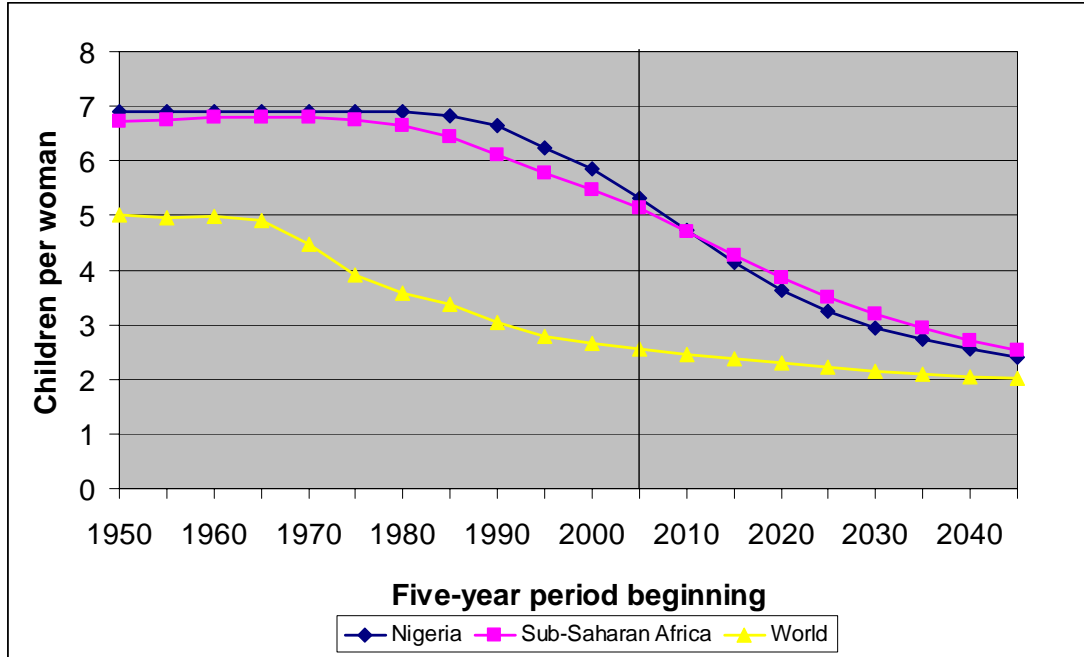
Figure 4: Total fertility rate for Nigeria, Sub-Saharan Africa and the World (Source: United Nations 2007).
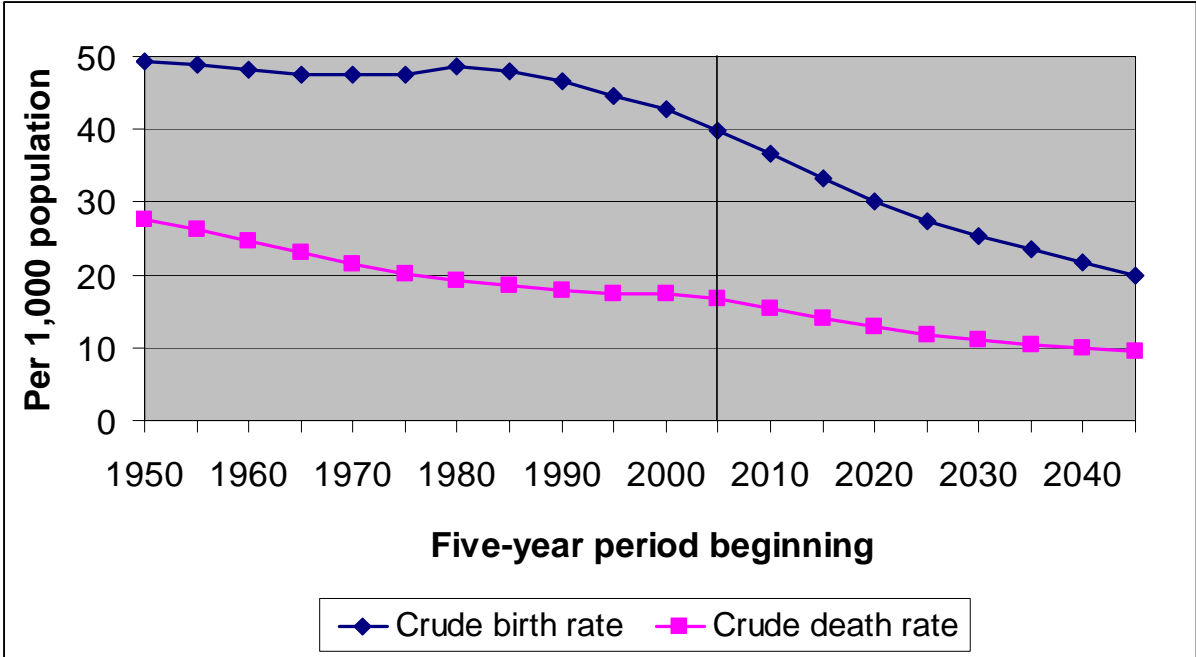
Figure 5: Nigeria's crude birth and death rates (Source: United Nations 2007).
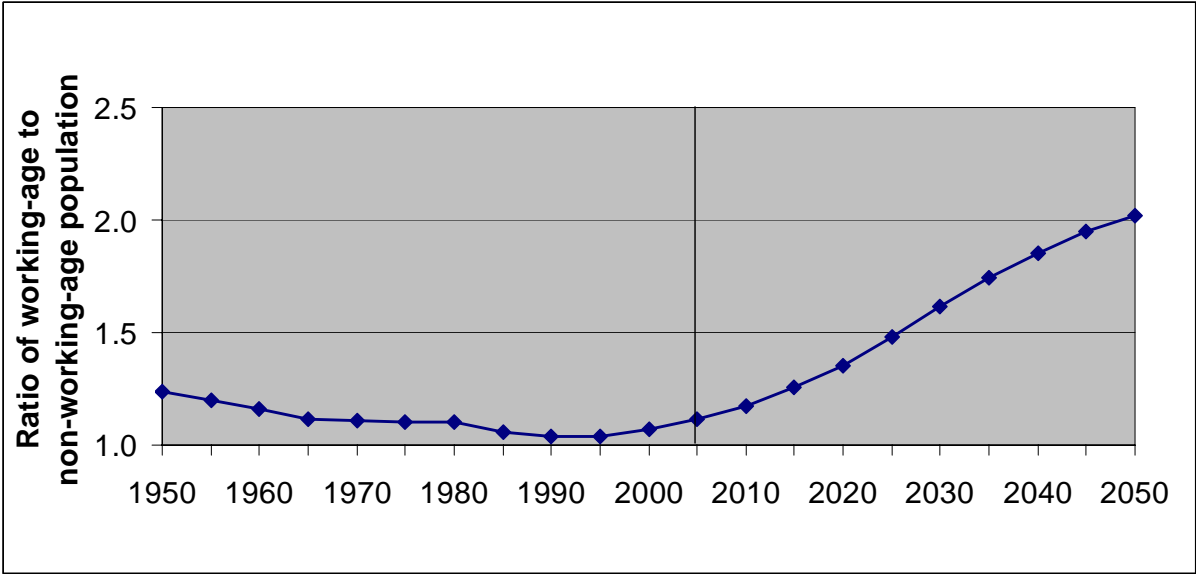
Figure 6: Nigeria's ratio of working-age to non working-age population (Source: United Nations 2007).
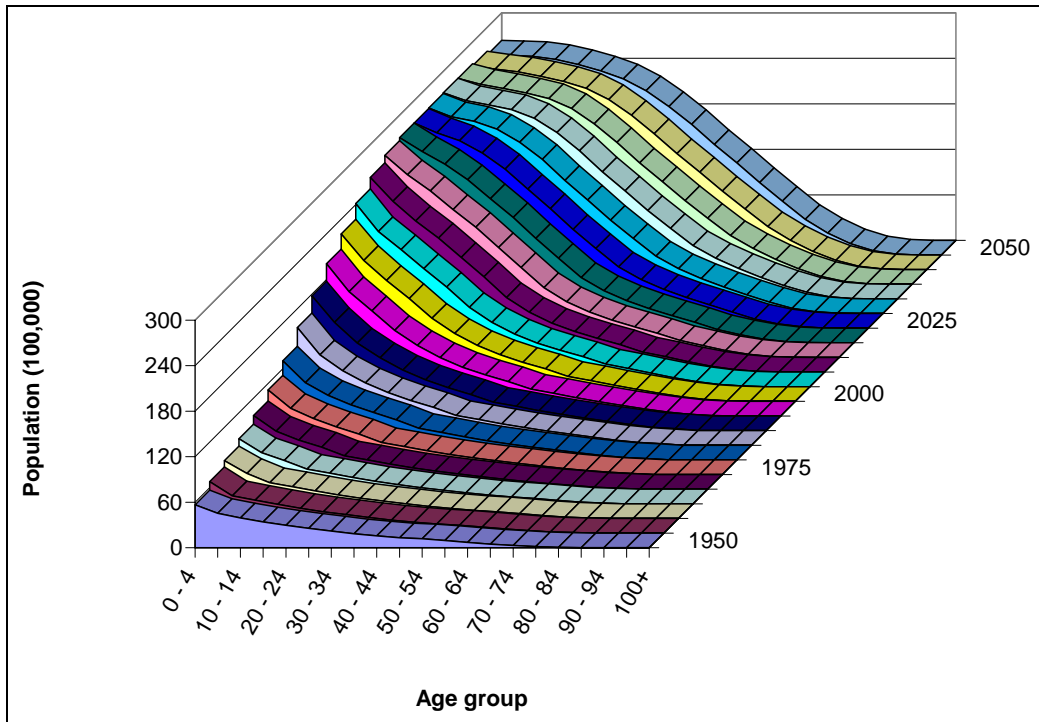
Figure 7: Nigeria's population projections (Source: United Nations 2007).
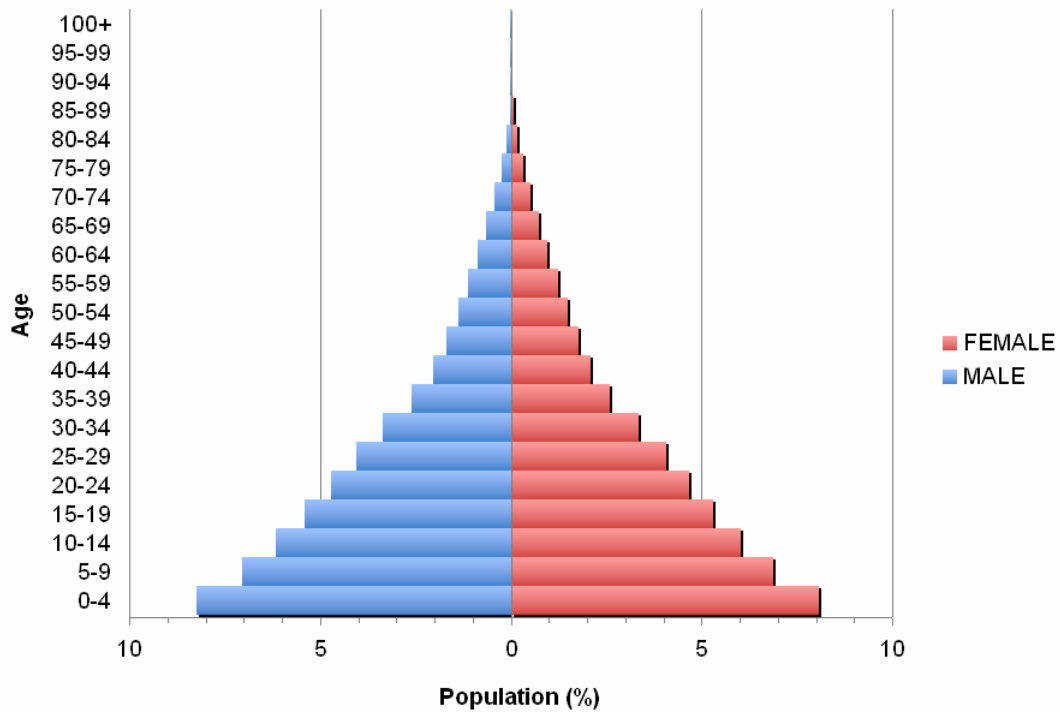
Figure 8: Nigeria's population pyramid in 2010 (Source: UN World Population Prospects 2008).
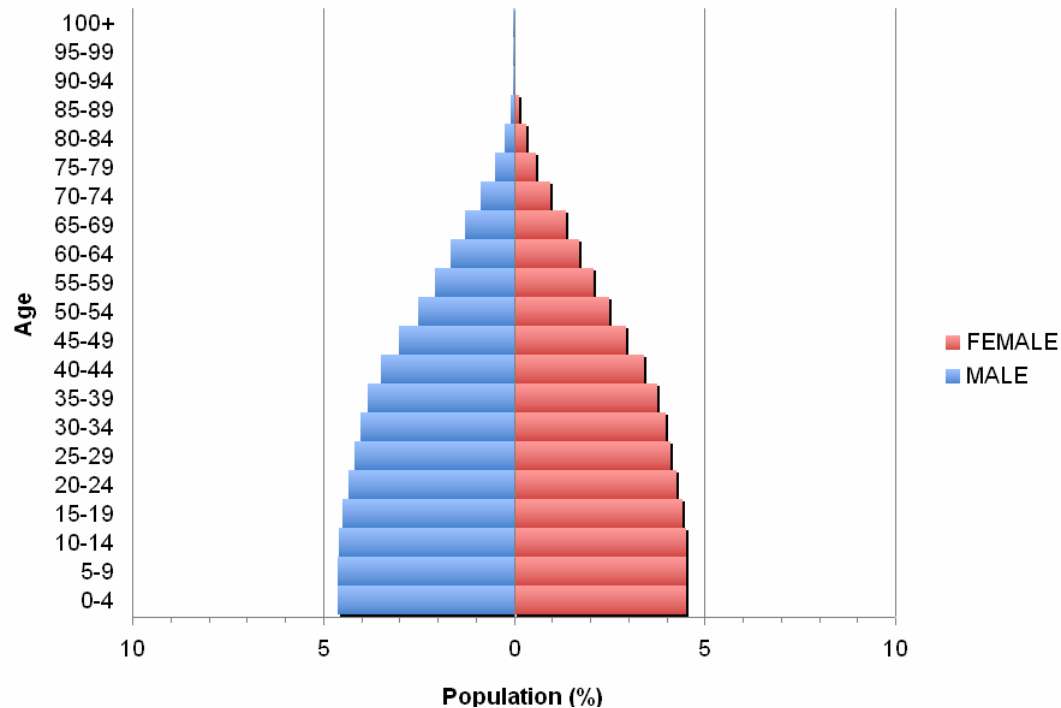
Figure 9: Nigeria's population pyramid in 2050 (Source: UN World Population Prospects 2008)

2 Nigeria's Demographic Dividend

Empirical cross-country growth equations are now well-established for estimation (Bloom, et al., 1998; Bloom, et al., 2000). These models use a Barro and Sala-i-Martin type income per worker growth model (Barro, et al., 2004), and then formulate an estimable equation by relating income per worker growth to income per capita growth and the working-age population growth. We present the model below followed by data sources used for estimation. We then project the results in the future.

2.1 Model

The model notation is as follows.

Overall measures

Y: Aggregate income.

W: Total working-age population.

P: Total population.

Log measures

y: Log of income per capita, $\log(Y/P)$.

z: Log of income per working-age person, $\log(Y/W)$.

w: Log of the working-age population, $\log(W)$.

p:　　Log of the total population, $\log(P)$.

Growth rates

g_y:　Growth rate of per capita income, y.

g_z:　Growth rate of income per working-age person, z.

g_w:　Growth rate of total working-age population, l.

g_p:　Growth rate of total population, p.

The log income per worker growth model expresses growth at a given time 0 as $g_z = \lambda(z^* - z_0)$, where z^* is the steady-state income per worker, z_0 is the income per worker at time 0, and λ is the convergence rate. This equation states that growth of income per worker is proportional to the difference of the current log income per worker and the steady state log income per worker. The farther a country is below its steady state income, the faster it is expected to grow.

The steady state log income per worker is usually expressed as $z^* = X\beta$, where X is a matrix of variables including physical resources, human capital, population growth and institutional strength, and β is the set of coefficients.

To relate the income per worker growth model $g_z = \lambda(X\beta - z_0)$ to income per capita growth which is more readily available, and to demographic factors, one uses the identity

$$\frac{Y}{P} = \frac{Y}{W}\frac{W}{P},$$

to get the relations (where the subscript 0 denotes quantities at start of a period)

$$y_0 = z_0 + \log\left(\frac{W}{P}\right)_0,$$

$$g_y = g_z + g_w - g_p.$$

Then denoting $g_{wp} = g_w - g_p$ gives the following formulation for estimation, where ε is the disturbance term.

$$g_y = \lambda X\beta - \lambda y_0 + \lambda \log\left(\frac{W}{P}\right)_0 + g_{wp} + \varepsilon. \tag{1}$$

2.2 Data

We use 5-year country-level panel data from 1965 to 2005 for a global sample. In addition to income and demographic variables, we follow the general cross-country comparisons literature and consider geographical characteristics (tropical area, landlocked-ness), human development (years of secondary schooling, life expectancy at birth), and institutional measures (explained below) as explanatory variables. The complete description of variables and their data sources are in Table 1.

The use of tropical area is based on the expectation that a larger share of tropical area will be associated with lower steady state per capita income and therefore lower growth. The use of landlocked-ness is related to transport conditions, expecting that countries which do not have a coastline will have fewer opportunities for trade and hence lower opportunity for growth. Average years of secondary schooling is a proxy for the productivity of the workforce, with the expectation that a more educated workforce is likely to be more productive and have higher likelihood of seizing opportunities for growth. Life expectancy is used as a measure of health and is expected to lead to economic benefits through lower morbidity, higher returns to investment in human capital, and increased savings.

Variable	Description	Source
Population growth	Annual average growth rate of the total population over a 5-year period	WDI 2007
Working age population growth	Annual average growth rate of the 15- to 64-year-old population over a 5-year period	WDI 2007
Ratio of working age to total population	Working-age population/population	WDI 2007
Growth GDP per capita	Annual average change in the log of real GDP per capita over 5 years	PWT 6.2
Real GDP per capita	Real GDP per capita (Constant International Prices: Laspeyres)	PWT 6.2
Tropical location	Fraction of a country's land area in the tropics	Sala-i-Martin et al. (2004)
Landlocked	Dummy = 1 if a country is landlocked	Sala-i-Martin et al. (2004)
Trade openness	Exports plus imports divided by real GDP per capita. Constant 2000 prices	PWT 6.2
Average years of secondary schooling	Average years of secondary schooling of individuals >15 years of age	Barro and Lee (2001)
Sachs Warner openness	Sachs Warner classification of a country's economy as open=1 or closed=0	Sachs and Warner (1997)
ICRG score for quality of institutions	Sum of rule of law, bureaucracy efficiency, corruption, government stability, expropriation risk	Knack and Keefer (1995)
Life expectancy	Life expectancy at birth	WDI 2007

PWT 6.2, Penn World Table version 6.2 (Heston et al., 2006); Freedom House: http://www.freedomhouse.org/template.cfm?page=1, degree of democracy less degree of autocracy; Barro and Lee (2001); WDI 2007, World Development Indicators 2007 (World Bank, 2007). GDP, gross domestic product; PPP, purchasing power parity.

Table 1: Variable descriptions and data sources.

Income data is from the Penn World Table version 6.2 data (Heston, et al., 2006), extrapolated to 2005 using the latest available annual growth rate whenever income data are not available for 2005 (for most countries they are available till 2004). Historical demographic data such as working-age share, working-age population growth, and population growth are from World Development Indicators (World Bank, 2007). Future demographic data are from World Population Prospects (United Nations, 2007) which include projections to 2050.

Explanatory variables for geographical characteristics tropical area and landlocked-ness are from Sala-e-Martin (Sala-i-Martin, et al., 2004). Human development variable average years of secondary schooling is from Barro and Lee (Barro, et al., 2001), and life expectancy at birth is from World Development Indicators (World Bank, 2007).

Institutional variable Sachs Warner openness is from Sachs and Warner (Sachs, et al., 1997), trade openness is from the Penn World Table (Heston, et al., 2006), and a composite score for institutional quality (ICRG score for quality of institutions) is from the International Country Risk Guide (Knack, et al., 1995). The ICRG score is the sum of five indices in the guide over the 1982-1997 period: rule of law index, efficiency of the bureaucracy index, corruption index, government stability index and expropriation risk index.

Data for series such as ICRG score which were available only for limited periods (1987-1992 for most countries) was extended backwards taking the earliest available value to apply for all years backwards, and the latest available value to apply for all years forward. We chose to do this instead of trend extension because extrapolation based on the trend value of the first two and the last two points did not work; we get several countries with decreasing ICRG scores in the early years to be extrapolated backwards to having perfect ICRG scores. The extension of data in this manner was done for other variables with missing values prior to 1970 or 2000 and after.

Even after the extrapolation, complete data for several countries were not obtained. Instead of further interpolations, we restricted our regressions to the set of countries where we had complete data. This left 88 countries in the sample, for which descriptive statistics are given in Table 2.

Variable	Mean	Std. Dev.	Min	Max
Population growth	2.0	1.4	-3.4	16.6
Working age population growth	2.3	1.5	-1.2	18.9
Ratio of working age population to total population	58.4	6.6	47.1	73.9
Growth GDP per capita	2.1	5.3	-13.8	68.7
Real GDP per capita	8,321	8,595	171	64,640
Tropical location	0.5	0.5	0	1
Landlocked	0.1	0.3	0	1
Trade openness	63.3	45.1	3.8	462.9
Average years of secondary schooling	1.5	1.1	0	5.2
Sachs warner openness	0.5	0.5	0	1
ICRG score for quality of institutions	24.2	8.7	6	38
Life expectancy	63.7	11.8	34.9	82.1

Table 2: Descriptive statistics averaged over the panel 1965-2005 for 88 countries.

The mean, variation and maximum/minimum numbers are not useful for all variables, but do broadly indicate that the sub-sample of 88 countries retains the diversity of the global sample—in terms of low and high growth rates, low and high population and work-age population growth rates, and low and high income. Some of the maximum values are skewed because of extreme data points. For instance, the annual population growth rates are greater than 10% for United Arab Emirates for the years 1970, 1975 and 1980, mainly because the working-age population growth rates are

above 10%. This could have been caused by a large influx of foreign workers to power the oil economy in the 70s and 80s. Similarly, the real GDP per capita is approximately $64k only for Kuwait in 1970, above $43k for UAE in only 1975 and 1980, again likely because of the oil boom, and otherwise at most in the $30k-$40k range.

For comparison with the global sample, Nigeria's data is presented in Table 3. The most striking number is the average growth which is only 0.6% over the last 40 years. Essentially Nigeria has averaged close to 0% growth over much of the last 40 years, with very high variation, reflecting Nigeria's chaotic economic history. Also striking is the low mean institutional quality score which, even though it is much higher now, has historically been more than a standard deviation below the global mean.

Variable	Mean	Std. Dev.	Min	Max
Population growth	2.6	0.2	2.2	3.0
Working age population growth	2.6	0.2	2.4	3.0
Ratio of working age population to total population	52.0	0.7	51.1	52.7
Growth GDP per capita	0.6	2.5	-3.4	3.1
Real GDP per capita	1,056	100	946	1,210
Tropical location	1	0	1	1
Landlocked	0	0	0	0
Trade openness	48.1	32.5	16.2	92.4
Average years of secondary schooling	-	-	-	-
Sachs warner openness	0	0	0	0
ICRG score for quality of institutions	15.8	4.6	11.7	21.1
Life expectancy	44.6	1.5	42.1	46.4

Table 3: Descriptive statistics for Nigeria over 1965-2005. Data for schooling was not available.

2.3 Estimation

The results of the estimation are presented in Table 5. Our estimation strategy is to start parsimoniously and add sets of variables to see how they affect the explanatory power of the regression. We thus include only geographical, income and working-age share variables in column (1), add the human development measures in column (2), add demographic growth variables in columns (3) and (4), and then add institutional variables incrementally to see which ones are important: ICRG score in columns (5) and (6); Sachs Warner openness in addition to ICRG score in (7) and (8); and replacing Sachs Warner openness by trade openness (keeping the ICRG score) in (9) and (10). For column (3) onwards, we try both an OLS and an instrumental variables version, where the difference of the working-age and total population is instrumented with its lagged counterpart.

Broadly, the results indicate (i) that both human development and demographic growth variables significantly increase the explanatory power of the regression; (ii) that

institutional variables are important; and (iii) ICRG score and PWT trade openness are more significant than ICRG score and Sachs Warner openness in this data set.

In all regressions, the difference in demographic growth rates enters with a positive and highly significant co-efficient. Among human development measures, schooling is unimportant but life expectancy has a positive and very significant coefficient in all columns. In geographical variables, tropical location is sometimes important, but landlocked-ness appears significant–in all but the first regression.

Looking in more detail from column (3) onwards – since the first two columns are for comparison purposes only – we see that when we control for the working-age share life expectancy remains significant but reduces in magnitude (from 8.6 to 5.4). This indicates that age structure dynamics behind increases in life expectancy play a role in explaining cross country differences in economic growth. In column (3) we report the association between the demographic variables and GDP per capita growth. To control for reverse causality, i.e. that GDP per capita growth might affect demographic outcomes, we apply an instrumental variable (IV) approach in column (4). The coefficient on the difference in working-age and population growth declines only slightly indicating a correction of potential omitted variable bias.

In columns (5) and (6) we include a control variable for institutional quality by including the ICRG score in the regression. We find that the robustness of the resulting specification improves. In column (5) we report the OLS coefficients, noting that institutional quality is positive and significant correlated with GDP per capita growth. The explanatory power of the model in column (5) is also improved over the demography model in columns (3) and (4). In column (6) we control for reverse causality using (IV). The decrease in the coefficient of the difference of the working-age and population growth from the OLS in column (5) to the IV in column (6) indicates that the simultaneity bias has been corrected. This means that we can take the results in column (6) to infer causality–institutional quality improvements lead to improvements in GDP per capita growth, so too does an increase in the difference between working-age and population growth.

In column (7) we include the Sachs Warner measure of openness to test whether openness (which is a subset of the ICRG score) is a leading institutional factor driving GDP per capita growth. We find that it is not, but other institutional factors captured by the ICRG score do have a positive and significant effect on GDP per capita growth. Column (8) is the (IV) counterpart of column (7).

In column (9) we remove Sachs Warner openness and include a simple measure of trade openness which enters positively and significantly, and also increases the explanatory power of the regression. All other variables except schooling are significant. This indicates that institutional quality, trade openness, and growth of the working-age

each have a significant and positive effect on GDP per capita growth. Health, proxied by life expectancy, also has a positive and significant effect on GDP per capita growth. Column (10) is the (IV) version of the model is column (9).

2.4 The Dividend

We can use the information in Table 5 to quantify the demographic dividend Nigeria could enjoy if it were to follow international trends. We do this in Table 6 using results from column 10 of Table 5.

Broadly, Nigeria's immediate opportunities exist in three areas: the window of its demographic transition, health improvements, and institutional improvements – the latter two because of very low health indicators and widespread concern about institutional weakness and corruption in the country (Nigeria: The Next Generation, 2010). We can directly quantify the first because the difference of the population growth rates is present in the regressions. For the second and third areas, we use the proxy measures life expectancy and ICRG score for institutional quality to quantify the potential benefits. Life expectancy, while not ideal as a measure of health is nevertheless both available and widely used in the context of cross-country regressions. For Nigeria, life expectancy is doubly important because of a very low value of around 47-48 years (Nigeria: The Next Generation, 2010), implying that it can be easily increased with minor investments in health.

Specifically in Table 6, to compute added growth, we first project Nigeria's demographic growth variables and life expectancy to 2030 using the medium fertility scenarios from the World Population Prospects (United Nations, 2007). We then also project improvements in institutional quality and a more optimistic life expectancy increase, where Nigeria reaches the average world life expectancy (64 years) by 2030, to estimate additional growth Nigeria could enjoy. For institutional quality, since no projections are available, we assume a reasonable target to reach in 2030 of 28.8—by comparing it with similar countries—and assume a linear increase between 2010 and 2030.

We first project the "business-as-usual" scenario in Table 6 using a 4.02% annual growth rate from 2010-2030, which is Nigeria's average annual GDP per capita growth rate from 2000-2008 from World Development Indicators (World Bank, 2009). Given Nigeria's performance in the past 40 years, this could be an optimistic assumption. Only in the last decade has Nigeria enjoyed this high a growth. In fact, the annual growth rate based on a 5-year growth average for 2000-2005 was 3.78%, for 1995-2000 it was 0.31%, for 1990-1995 -0.41%, and more chaotic in the decades prior. We use the 2008 GDP for our projections ($1924 PPP, constant 2005 International $), giving a start GDP of $2070 for 2010, the start year for our projections. Then using coefficients for population growth difference and life expectancy from Table 5 we compute the added annual growth

Nigeria could enjoy due to demographic change, increase in life expectancy and institutional change.

Projections in Table 6 show Nigeria could enjoy almost 12% additional per capita income by 2020 and as much as 29% more per capita income by 2030, just because of the demographic change and expected life expectancy increases (Table 6 column F and Figure 10). With increased institutional quality and by reaching the world average life expectancy by 2030, the additional income could be 13% more by 2020 and 31% more by 2030 (Table 6 column I). Accounting for population growth in Table 7, the economy in 2030 could be more than 3 times larger than today with the demographic dividend and life expectancy increases, compared to around 2 times larger than today under the default growth scenario.

To understand the impact of these numbers, we estimated the effect of the demographic dividend on poverty (< $1.25/day) in Nigeria. Table 9 shows the results. The additional growth due to the demographic dividend and life expectancy increase can lift around 5.8 million people out of poverty by 2020 and around 31.8 million more by 2030, over and above the "business-as-usual" scenario. With institutional improvements and better life expectancy, the number of additional people lifted out by 2030 becomes around 34 million. These substantial numbers were estimated using a proxy income distribution derived from the Nigeria DHS 2008 (DHS, 2009) survey's wealth index (since income distribution data for Nigeria are not available), adjusted to scale for the per capita GDP income. The current poverty level estimates are from WDI 2009 (World Bank, 2009).

Finally, we also know from literature that the effect of institutions on states' ability to capitalize on their demographic transition is important, and can be quantified (Bloom, et al., 2007). In our data, the correlation between ICRG score and demographic change made the effect difficult to isolate. Adding an interaction between ICRG score and population growth difference resulted in counter-intuitive results. However, the interplay between demographics and institutions is particularly important for Nigeria. We comment on this in the discussion section.

2.5 Policy Discussion

The projections above have quantified Nigeria's demographic dividend based on formal econometrics. Quite obviously, this dividend is not realizable unless proper conditions for development are present. It relies critically on Nigeria's ability to create the right jobs to employ its workforce productively. This in turn requires sustained investment in human capital, and strong institutions.

Nigeria needs to create roughly 2-2.5 million new jobs per year each year from 2010 to 2030 to employ its coming workforce. Table 10 projects Nigeria's future job requirement using a labor participation rate of 77%, and a step-wise reduction in unemployment

from 20% currently to 7% by 2030. The labor participation rate and the target unemployment rate in 2030 is chosen to be comparable to peer countries. Without these 24 million jobs in the next decade and almost 50 million more new jobs by 2030, the benefits of the demographic dividend will be very hard to realize.

Job creation will require strong institutions. Nigeria's current institutional quality as measured by its ICRG score of 21.1 is only somewhat less than the global mean of 24.2, but its historical average of 15.8 is well below the global mean. In addition, comparison with the global mean does not give a full picture of Nigeria's institutional situation. In fact, in the unbalanced sample of 208 countries, only 16 countries currently have an ICRG score less than Nigeria. It is therefore more instructive to compare Nigeria's institutional quality to a select peer group. Figure 11 and Table 8 compare Nigeria's ICRG score with Bangladesh, India, Indonesia and Pakistan over the 1980-2005 period, which includes projected data for 2000-2005 as described in Section 2.2. Nigeria currently has the lowest score in this group because of its slower institutional quality improvement in the mid-80s. Over the same period 1980-2005, the GDP per capita of the countries is shown in Figure 12. Even to a first glance, there seems to be a concurrence of the increasing gap of institutional quality between Nigeria and these countries, and the increasing gap of the per capita GDP. The composition of the ICRG score also disguises the fact that Nigeria's ranking in corruption, rule of law and bureaucracy's efficiency is exceptionally low (2, 3, 3 on a scale of 1-6). These factors are particularly important to the country's youth as it affects their sense of inclusion and vulnerability (Alao, 2010).

Institutions, however, are only means to some end. Their goals are to provide continuity of stewardship in delivering services to populations. The primary services essential for Nigeria to capitalize on its demographic potential are health and education, and initiatives to increase gender parity in employment and provide other opportunities to women.

Nigeria's projected life expectancy for 2030 of 56 years by the UN WPP (United Nations, 2007) is still well-short of our global sample average of almost 64. If Nigeria manages to achieve the current global average by 2030, the economic benefits it could enjoy from increased productivity, lower morbidity mortality costs and returns in human capital investment could be well more than we have estimated. Given very low health expenditures and health status in Nigeria, significant improvements can be bought at relatively low investments, with attendant per capita GDP improvements. To give a sense of the investment level, WHO ranked Nigeria's health system at 187 out of 191 countries in 2000, and estimated per capita public spending on health at $10 per year in 2006. This is well below the cost of the "set of essential interventions" of $34 computed by WHO Commission on Macroeconomics and Health in 2000 (Nigeria: The Next Generation, 2010).

Education has not appeared as a significant variable in our regression, but that is an artifact of the data. The strong correlation between average years of secondary schooling in population (15 and older) and life expectancy and population growth difference prevents us from isolating the effect of education in the regression. Table 4 shows the correlations. In fact, as a quick measure, regressing log of schooling with log of life expectancy and population growth difference gives a very highly significant positive coefficient for life expectancy and 'explains' 71% of the variation in the schooling, indicating how strongly they are tied. This hints at the fact that investments in health and education are closely and positively tied together, therefore the benefits of one cannot be realized without the other.

	Log schooling	Log life exp	Pop growth diff
Log schooling	1		
Log life exp	0.8318	1	
Pop growth diff	0.2522	0.2923	1

Table 4: Correlation between log secondary years of schooling, log life expectancy, and population growth difference.

The role of gender is not formally included as a variable in our regression. Rights arguments aside, gender imbalance is clearly very important for growth through its effects on health, education and employment. Average life expectancy and average years of schooling cannot improve significantly when a majority of 50% of the population is marginalized. This is all the more important in Nigeria, where gender inequality is one of the highest in the world. Nigeria ranks 177th out of 194 countries when comparing life expectancy between men and women, high maternal mortality being a chief cause (Nigeria: The Next Generation, 2010). Women's education also significantly lags behind men's in both enrollment and completion rates at both primary and secondary levels. This lack of education also prevents other benefits from being realized, such as reduced fertility (Nigeria: The Next Generation, 2010). Most importantly, it affects the training of the next generation, given the disproportionately large influence of women on their children's development.

In sum, for Nigeria's demographic dividend to be realized, a set of essential investments in education, health, gender parity and institutional development will be required. None of them is likely to be sufficient for growth alone. Absolutely none will be sustainable in the long term without the others.

VARIABLES	(1) Geographical only (OLS)	(2) Geographical and human only (OLS)	(3) Geo, human and dem only (OLS)	(4) Geo, human and dem only (IV)	(5) Column (4) with ICRG Score (OLS)	(6) Column (4) with ICRG Score (IV)	(7) Column (5) with SW Openness (OLS)	(8) Column (5) with SW Openness (IV)	(9) Column (5) with Trd Openness (OLS)	(10) Column (5) with Trd Openness (IV)
Difference working-age and total population growth			2.083*** (0.602)	1.972*** (0.624)	1.896*** (0.684)	1.923*** (0.620)	1.907*** (0.682)	1.951*** (0.618)	1.888*** (0.674)	1.887*** (0.619)
Trade openness									0.00772** (0.00313)	0.00772** (0.00310)
Sachs Warner openness							0.389 (0.479)	0.391 (0.469)		
ICRG score for quality of institutions					0.108** (0.0445)	0.107** (0.0419)	0.105** (0.0466)	0.104** (0.0441)	0.104** (0.0446)	0.104** (0.0420)
Log average years of secondary schooling		-0.172 (0.325)	-0.429 (0.334)	-0.415 (0.332)	-0.447 (0.333)	-0.450 (0.332)	-0.454 (0.328)	-0.459 (0.326)	-0.450 (0.332)	-0.450 (0.331)
Log life expectancy		8.606*** (1.926)	5.434** (2.161)	5.603*** (2.044)	5.357** (2.154)	5.317*** (1.957)	5.146** (2.283)	5.079** (2.081)	5.269** (2.150)	5.271*** (1.958)
Tropical location	-0.699* (0.363)	-0.407 (0.349)	-0.648* (0.344)	-0.635* (0.343)	-0.477 (0.368)	-0.481 (0.361)	-0.533 (0.390)	-0.539 (0.380)	-0.731* (0.392)	-0.731* (0.382)
Landlocked	0.332 (0.367)	0.805** (0.386)	1.008*** (0.382)	0.998*** (0.384)	0.725** (0.358)	0.729** (0.358)	0.699* (0.358)	0.705** (0.358)	0.734** (0.357)	0.734** (0.357)
Log working-age population to total population	14.20*** (2.420)	12.94*** (2.259)	16.68*** (2.650)	16.48*** (2.597)	12.89*** (3.437)	12.95*** (3.118)	12.50*** (3.287)	12.59*** (3.018)	12.91*** (3.403)	12.91*** (3.084)
Log real GDP per capita	-0.902*** (0.280)	-1.844*** (0.337)	-1.617*** (0.350)	-1.630*** (0.342)	-1.828*** (0.369)	-1.825*** (0.354)	-1.852*** (0.370)	-1.846*** (0.356)	-1.897*** (0.368)	-1.897*** (0.353)
Constant	18.85*** (3.441)	-9.351 (8.028)	3.388 (8.945)	-0.490 (8.396)	0.853 (9.759)	-2.463 (8.752)	1.618 (10.27)	-1.619 (9.260)	1.564 (9.762)	-2.027 (8.766)
Observations	610	610	610	610	610	610	610	610	610	610
R-squared	0.146	0.198	0.253	0.253	0.274	0.274	0.276	0.276	0.282	0.282

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Cross-country growth regressions over 1965-2005. All regressions include time fixed effects.

Year	Growth rate "business-as-usual" (%)	GDP/cap "business-as-usual"	(WA - TP) growth rate (%)	Life exp (years)	GDP/cap with DD & added LE	Improved ICRG Score	Improved life exp (years)	GDP/cap improved ICRG & LE
2010	4.02	$2,070	0.55	48.45	$2,070	21.10	48.45	$2,070
2015	4.02	$2,521	0.66	50.38	$2,653	23.03	52.33	$2,664
2020	4.02	$3,070	0.75	52.35	$3,435	24.95	56.22	$3,461
2025	4.02	$3,738	0.80	54.39	$4,486	26.88	60.11	$4,535
2030	4.02	$4,553	0.76	56.37	$5,882	28.80	64.00	$5,966

WA, working age population; TP, total population; LE, life expectancy at birth; DD demographic dividend. Starting GDP per capita taken as $1924 PPP (Constant 2005$) for 2008 from WDI 2009. Default "business-as-usual" growth rate of 4.02% taken as the average annual growth over 2000-2008 from WDI 2009.

Table 6: Nigeria's GDP per capita projected with and without demographic dividend and life expectancy increases according to UN projections.

Nigeria's future GDP per capita with demographic dividend & health gains

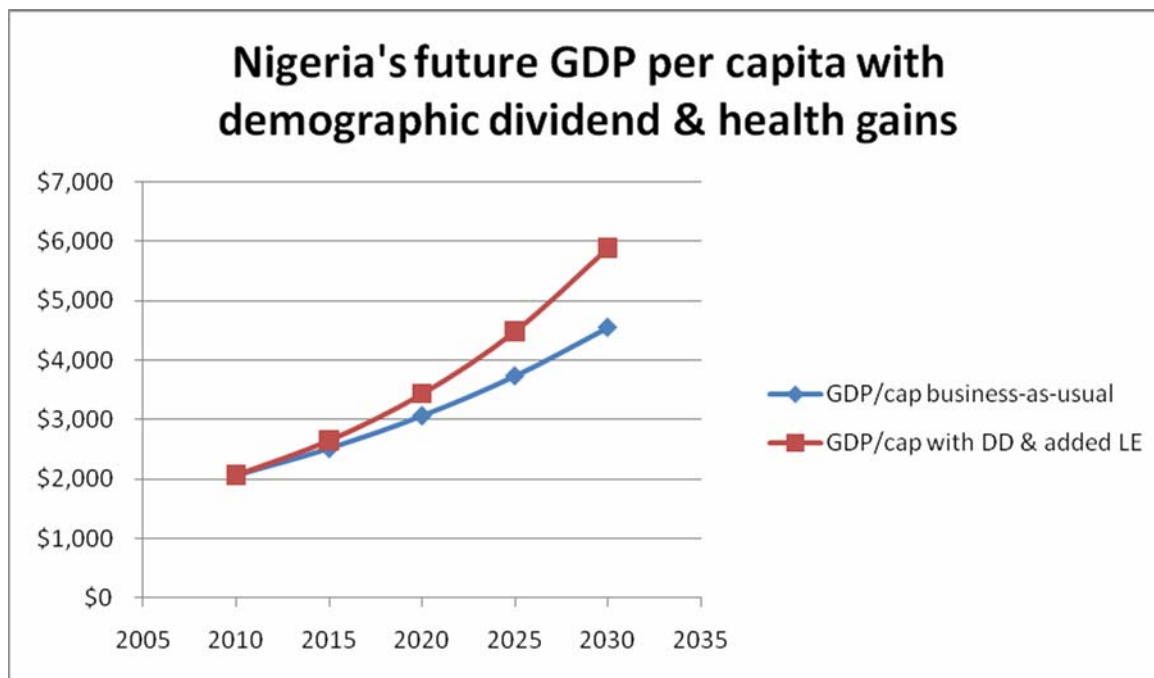- GDP/cap business-as-usual
- GDP/cap with DD & added LE

Figure 10: Nigeria's GDP per capita projected forward with business as usual (using the 2005 growth rate) or with demographic dividend and added life expectancy.

Year	Population projection	GDP "business-as-usual" (billions)	GDP with DD&added LE (billions)	GDP with improved ICRG+LE (billions)
2010	158,313,209	$328	$328	$328
2015	175,715,469	$443	$466	$468
2020	193,099,080	$593	$663	$668
2025	210,128,768	$786	$943	$953
2030	226,854,804	$1,033	$1,334	$1,353

Table 7: Nigeria's GDP projections; the economy due to demographic dividend and life expectancy increases can be more than 3 times larger in 2030 than today, compared to more than 2 times larger under the "business-as-usual" scenario.

Year	Bangladesh	India	Indonesia	Nigeria	Pakistan
1980	9	21	13	11.7	11
1985	9.6	22.5	16.2	12.0	17
1990	9.2	19	17.3	15.8	14.5
1995	21.0	29.6	29.7	20.9	24.5
2000	24.3	30	28.7	21	28.8
2005	24.3	30	28.7	21	28.8

Table 8: ICRG institutional quality score for Nigeria with Bangladesh, India, Indonesia and Pakistan over 1980-2005.
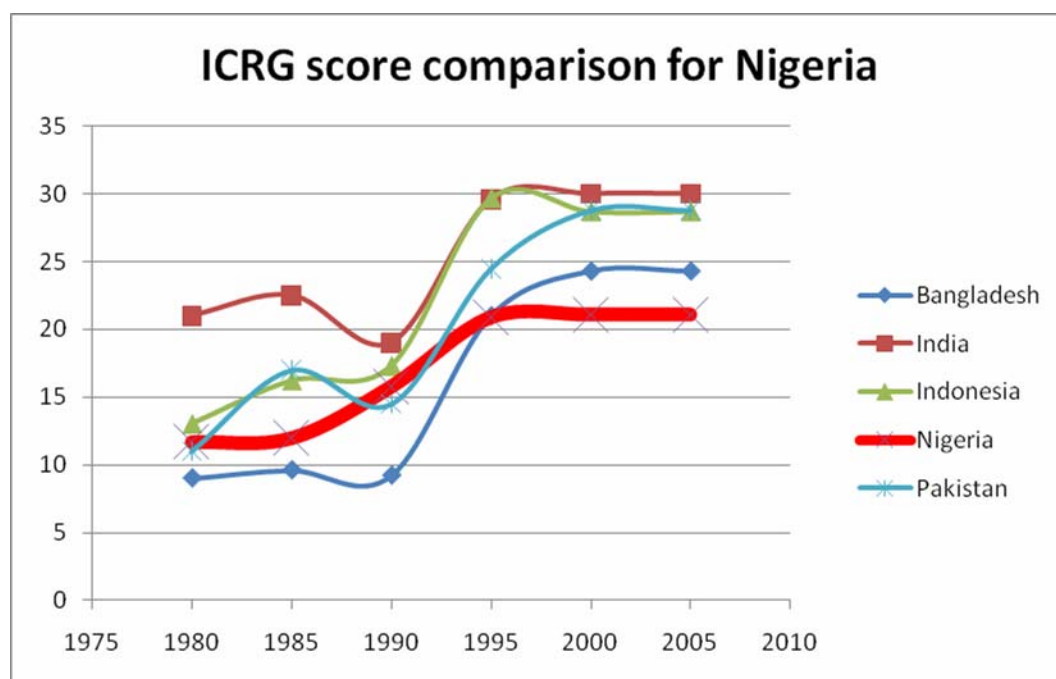

Figure 11: ICRG institutional quality comparison for Nigeria, Bangladesh, India, Indonesia and Pakistan over 1980-2005; Nigeria shown in extra thick red-line.
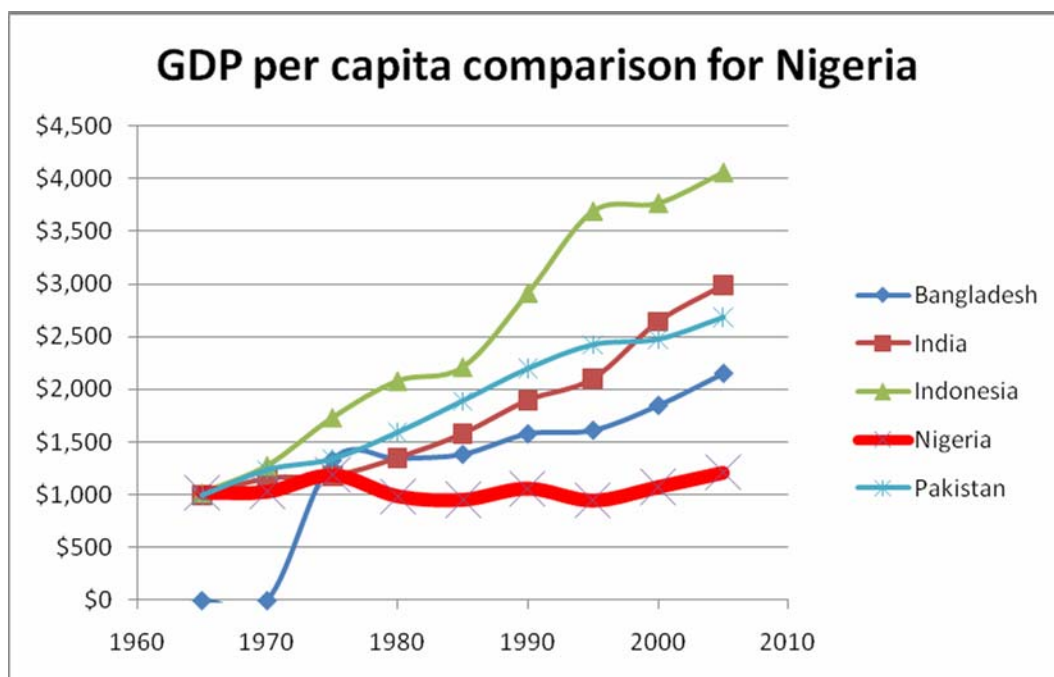
Figure 12: Historical GDP per capita comparison for Nigeria, Bangladesh, India, Indonesia and Pakistan over 1965-2005; real GDP per capita (constant international prices: Laspeyres, PWT 6.2); Nigeria shown in extra thick red-line.

Year	% poor "business-as-usual"	% poor with DD & added LE	Additional # LOP due to DD&LE	% poor improved ICRG & LE	Additional # LOP improved ICRG&LE
2010	64%	64%	-	64%	-
2020	58%	55%	5,792,972	55%	5,792,972
2030	46%	32%	31,759,673	31%	34,028,221

Table 9: Additional people lifted out of poverty through the demographic dividend and increased life expectancy, and through improved institutions and further improvements in life expectancy.

Year	WA pop	Unemployment in year	Jobs needed in year	Jobs to be added	Between years
2010	85,525,401	20%	52,358,719		
2015	97,731,223	15%	63,570,579	11,211,860	2010-15
2020	111,088,850	10%	76,509,768	12,939,189	2015-20
2025	125,325,513	8%	88,233,036	11,723,268	2020-25
2030	140,036,212	7%	99,661,452	11,428,415	2025-30

Table 10: Jobs needed to accommodate the working age population in Nigeria, assuming a labor participation rate of 77%.

3 Realizing the Dividend: Challenges and Opportunities

The regression and simulations presented in the preceding sections provide a benchmark for thinking about Nigeria's development prospects. The key point is that favorable changes in age structure are creating an opportunity for more rapid economic growth than Nigeria has experienced in the past. How Nigeria actually performs, however, will depend on some key features of the Nigerian economy that are not widely understood. Perhaps the most important of these is that Nigeria has an unfavorable economic lifecycle. If successful steps are not taken to improve employment among young adults, the demographic dividend will be delayed and possibly reduced in magnitude.

A second objective of looking in more detail at the Nigerian economy is to identify options created by the demographic dividend. One possibility is to devote all of the demographic dividend to raising current standards of living. This is attractive given the extent of poverty in Nigeria. If this path is pursued, however, standards of living will eventually decline as dividend period comes to an end. Given sound and careful policy, permanently higher standards of living can be realized. One particularly promising approach is to substantially increase investment in human capital as fertility declines.

3.1 Nigeria's Economic Lifecycle

The shape and structure of economic lifecycle, summarized by the amount consumed and by the amount produced through labor at each age, is important understanding the interaction between age structure and the economic development of any country (Lee et al, 2008). There are extended periods at the beginning and end of life during which members of the population on average consume more than they produce through their labor. These periods of "dependency" bracket a period during which labor income substantially exceeds consumption. Nigeria's economic lifecycle incorporating the labor income and consumption profiles by age groups and measured in per capita terms is presented in Figure 13.[e] Labor income is an estimate of all returns to labor normally measured in National Income and Product Accounts including wages, employee benefits, and a portion of self-employment income estimated to be a return to labor before any taxes have been assessed. Labor income of unpaid family workers has been estimated to insure to the extent possible that the contribution of the

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young and the old has not been understated. Household surveys have been used to estimate age profiles of labor income. All values have been adjusted to match NIPA estimates. In 2004, labor income was relatively low for children and young adults, reached a plateau of about 160,000 Naira a year for those in their late forties and fifties, and began to decline fairly rapidly near age 60. There are several important points about this age profile to keep in mind. First, it is average labor income for all members of the population and is determined by variation in labor force participation, hours worked, unemployment, and wages and labor productivity. Second, it is a cross-sectional curve and not the path that any particular cohort will follow.
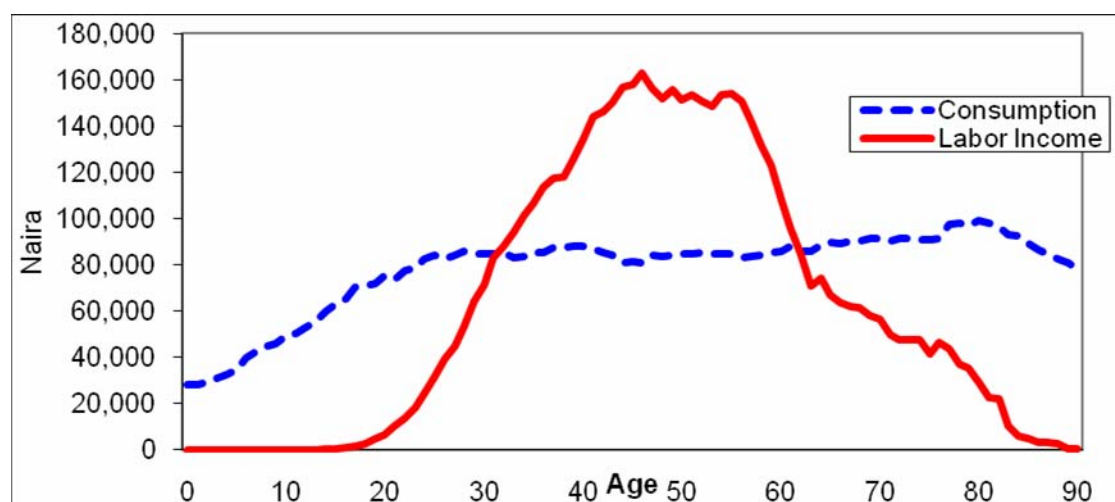

Figure 13: Economic Lifecycle for Nigeria, Per Capita Values, 2004. Source: Soyibo et al. 2009a.

The second curve in Figure 13 is average consumption also measured in a comprehensive fashion. All consumption measured in National Income and Product Accounts, including both public and private consumption, has been allocated by age. Private consumption by age is estimated using the 2004 National Living Standard Survey conducted by the National Bureau of Statistics. Private consumption of education, health, and other consumption are estimated separately. Some public consumption, such as education and health, is assigned to the beneficiaries of those public services based on administrative records and regression methods. Non-assignable public consumption is assumed to flow equally to each member of the population. Per capita consumption in Nigeria increases substantially with age from birth until the mid-twenties. Thereafter, consumption is relatively flat neither rising nor falling substantially with age.

The figure reveals that based on the cross-sectional estimates Nigerians are consuming more than they are producing through their labor during the first 33 years of their lives. For the next 30 years of their lives their labor income exceeds their consumption. After age 63 Nigerians produce less than they consume, on average, over the remainder of their lives. Apart from Mexico with a very short span and Kenya that has the same 30

years span during which labor income exceeds consumption, the span for other developing countries are higher with 35 in India, 34 in Indonesia and Philippines and 37 in China (Mason, 2007).

Combining population data with the per capita profiles of consumption and labor income as shown in Figure 14 provides an important tool for understanding from a generational perspective some of the important macroeconomic issues that Nigeria faces because of its young age structure. The large lifecycle deficit for the young, i.e., the gap between consumption and labor income, is the dominant feature of the aggregate economic lifecycle. The lifecycle deficit for the young is substantial while the deficit for the old is much smaller. The child deficit is almost 80% of total labor income while the old-age deficit is about 3% of total labor income. The lifecycle surplus is only 14% of total labor income and, hence, the combined deficit including the surplus of prime-age adults is almost 70% of total labor income. The deficit at young ages is equal to 4.5 billion Naira or 87% of total labor income. In comparison the old-age deficit is 0.165 billion Naira or 3.2% of total labor income. The lifecycle surplus, the excess of labor income over consumption between the ages of 30 and 65 is 1.3 billion Naira or 26% of total labor income.
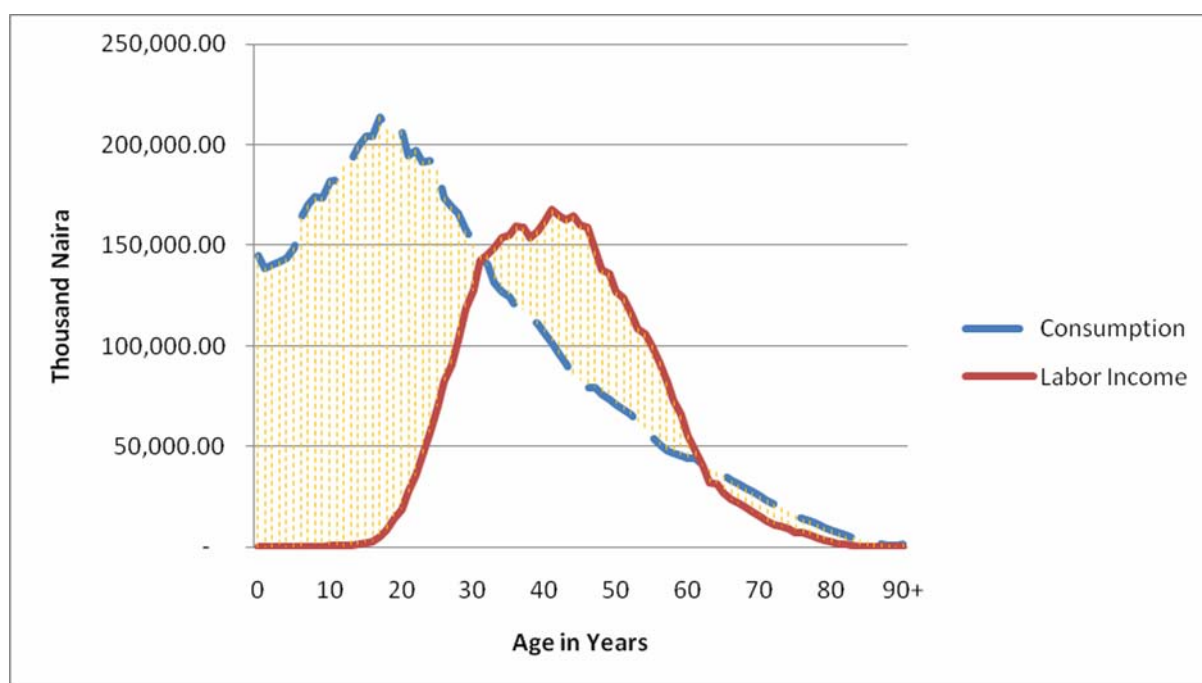

Figure 14: Economic Lifecycle for Nigeria, Aggregate Values, 2004. Source: Soyibo et al, 2009a.

In the absence of comparable estimates from African countries, we draw on estimates for the seven economies with the youngest populations that are currently available for inter country comparison: Chile, China, Costa Rica, Mexico, South Korea, Taiwan, and Thailand. We refer to the average economic lifecycle of these seven countries as the

standard lifecycle. It should be kept in mind that the lifecycle is different in some important ways from the economic lifecycle of the industrialized economies.

Nigeria's age profile of labor income is quite different than the standard profile (Figure 15). Per capita labor income is very low for young adults and relatively high for older adults. The per capita income of a thirty year-old, for example, is only 56% of the average per capita income of those in the 30-49 age group. In the standard profile, a thirty-year-old has an average labor income of 88% of the per capita value for those in the 30-49 age group. The other striking feature of labor income in Nigeria is that it remains at a high level for so long and declines relatively slowly in old-age.
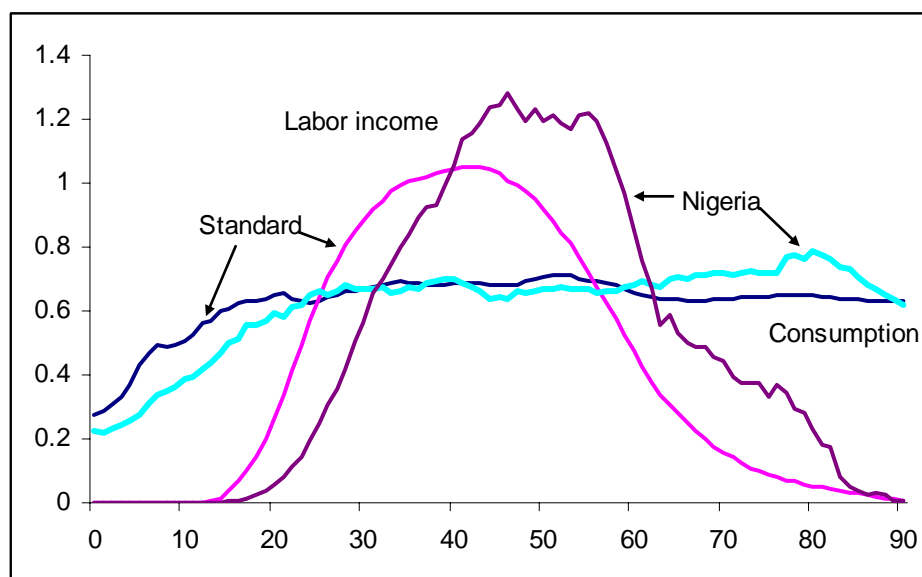

Figure 15: Per capita labor income and consumption by age. Values are relative to average labor income for persons 30-49. Nigeria estimates for 2004. Standard is simple average of normalized values for seven economies: Chile, China, Costa Rica, Mexico, South Korea, Taiwan, and Thailand. Source: www.ntaccounts.org.

The lifecycle deficit (LCD) can be funded in only three ways: net transfers, asset income, and dis-saving. Any economy taken its entirety is governed by a fundamental flow constraint that must hold in every period – the lifecycle deficit plus saving must equal net transfers from the rest of the world plus asset income. The lifecycle deficit of any age group is governed by a similar flow constraint, but net transfers from other age groups represents an important source of funds. The lifecycle deficits of the young are funded almost exclusively by transfers in all countries. Children depend on public transfers,[f] cash or in-kind, to fund education, health, and other public goods and services that children consume. In every country for which estimates are available private transfers, especially intra-household intergenerational transfers, are more important to children than public transfers. Typically, about one-third to forty percent of

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[f] Public transfers are broadly conceived here to include all cash transfers and all public consumption.

the lifecycle deficit of children is funded by public transfers and two-thirds to sixty percent is funded by private (familial) transfers. In this context, the discrepancy between Nigeria's entire lifecycle surplus and the lifecycle deficit of children is important and striking. If the entire lifecycle surplus were transferred to children it would fund only 30% of the child deficit. The remainder is supported almost exclusively by transfers, but these transfers are funded by relying on assets. Hence, Nigeria's large child deficit is primarily funded indirectly by relying on assets. Public transfers to children can be funded by taxing assets or asset income, using income from public assets, e.g., oil revenues, or by increasing public debt or disposing of public assets. Families can rely on private asset income, borrowing, or dis-saving to fund their transfers to children. Thus, Nigeria's large child deficit is thus funded from both the lifecycle surplus of prime-age adults, shown in Figure 14, and by relying on public and private assets.

Assets play a relatively minor direct role in funding the lifecycle deficit for the young. In general, minor children do not own assets and, hence, cannot rely on asset income or dis-saving to fund their consumption. They may rely to a limited extent on public assets to fund their consumption. Royalties from publicly owned natural resources, for example, may fund consumption by children. Moreover, Nigeria is relying on asset income. An important form of public asset income is income from oil exports. In 2005, oil revenue was N4,762.4 billion, which increased to N5,287.6 billion in 2006, and dropped to N4,463billion in 2007 (NBS,2008). Asset income also includes income produced from privately owned capital. Any excess of net transfers from ROW and asset income over the lifecycle deficit is saved. On the other hand, dis-saving must occur if the lifecycle deficit exceeds net transfers from ROW plus asset income.

Young adults may rely to some extent on private assets to fund their lifecycle deficits. They may be able to rely on inheritances or other capital transfers, e.g., dowry. Although in many countries, young adults rely on consumer credit – credit cards, education loans, and other forms of consumer credit – to fund the gap between labor income and consumption, the low level of the financial market development limits this option for Nigeria. As a result, the lifecycle deficit at young ages is funded overwhelmingly through public and private transfers.

In addition, Nigeria is funding its lifecycle deficit, in part, by relying on net transfers from the rest of the world. Nigeria receives remittances from Nigerians living and working abroad and is the largest remittance recipient in Africa, receiving an estimated 65% of the total official remittance inflows within Sub-Saharan Africa.

The implications of changes in age structure depend on whether the per capita lifecycle deficits shift or remain constant. Consider the case when the per capita profiles of consumption and labor income do not change. The aggregate deficits can be calculated directly using Nigeria's projected population. The results are presented in Figure 16. The child deficit is projected to decline immediately. The old age deficit

changes very little. The surplus is relatively constant until 2020 and then begins to increase (the surplus is measured as a negative value, a negative deficit, here). The net lifecycle deficit declines with increasing speed and drops from almost 70% of total labor income in 2005, to 52% of total labor income in 2025, and to 20% of total labor income in 2050.

We have attempted to delineate the possible options for economic progress in order to fully understand the economic implications of the change in age structure given the macroeconomic flow constraint.[g] First, the lifecycle deficit may not decline in response to favorable changes in age structure because the consumption profile shifts upward or the labor income profile shifts downward. To the extent that consumption increases current standards of living will be higher and current welfare enhanced. A downward shift in the labor income profile due, for example, to a reduction in work and increase in leisure seems like a relatively unlikely possibility. Second, saving could increase. Current standards of living would not be enhanced, but economic growth and future standards of living will be higher. Higher saving will lead to greater assets and asset income in the future. If the additional saving is invested domestically, wages and labor income will be higher. Third, the decline in the lifecycle deficit could lead to a decline in net transfers from abroad. As economic conditions improved foreign aid might decline or Nigerians working abroad may reduce their remittances to family members who are better off. Asset income, the fourth component of the macro constraint, is only influenced indirectly through changes in the saving rate.[h]

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[g] See Mason et al, (2010) for detailed exposition of the macroeconomic flow constraint.
[h] Population change could influence rates of return to capital in a closed economy but is unlikely to have much effect in Nigeria.
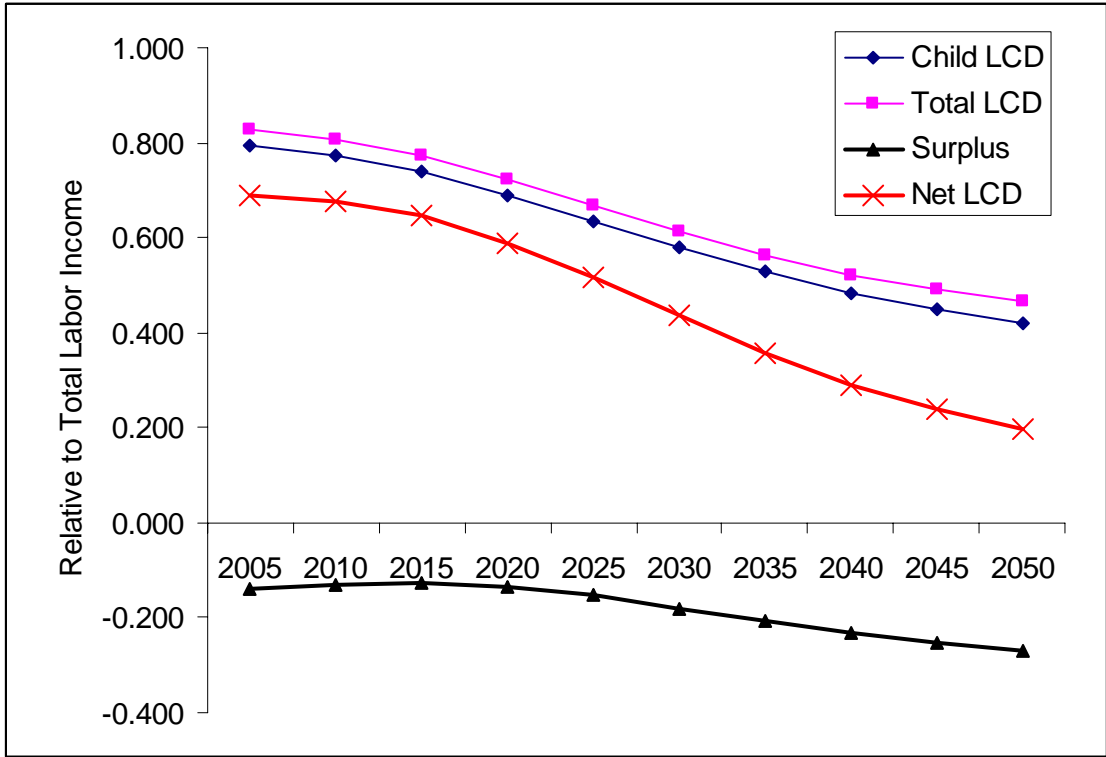
Figure 16: Projected aggregate lifecycle deficits and surpluses holding per capita lifecycle deficit at 2004 level.

Whether Nigeria follows one of these paths, or some intermediate path, will have profound implications for the development consequences of changing population age structure. This will depend, in turn, on a combination of public policy and private behavior. The issues are explored further in the following section.

3.2   Nigeria's Economic Support Ratio

The demographic window for development can be quantified by the economic support ratio. The economic support ratio is similar to the measure of age structure WA/N used in the regression analysis above. The difference is that the numerator, the effective number of producers, incorporates age-specific variation in labor productivity. The denominator, the effective number of consumers, incorporates age-specific variation in "consumer needs". The per capita labor income profile and consumption profiles (Figure 13) are used as weights. The UN Population Projections anticipates that fertility will decline in the country in the next 50 years. If fertility declines as anticipated, then the number of children and the number of children and elderly will decline relative to the number of working-age adults. Given the economic lifecycle that characterizes all societies, the economic support ratio will inevitably rise with favorable economic effects. The magnitude by which the economic support ratio rises, will depend on the particular features of Nigeria's economic lifecycle. The most likely outcomes are that

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current standards of living will increase or investment in physical or human capital will increase or some combination of the two.

The support ratio for Nigeria from 1950 to 2050 is displayed in Figure 17. The ratio is expressed as an index with the value for 2003 set to 100. This year was selected because Nigeria's support ratio reached a low point in this year. Starting from 1950 the support ratio declined very gradually as a consequence of the increase in the share of children in the population. The cumulative effect was to reduce the support ratio by about 10 percent. After 2003, however, the support ratio is expected to increase quite steeply as birth rates decline and the share of the working-age population increases. The cumulative effect is very substantial producing an increase in the support ratio of 40 percent by 2050.
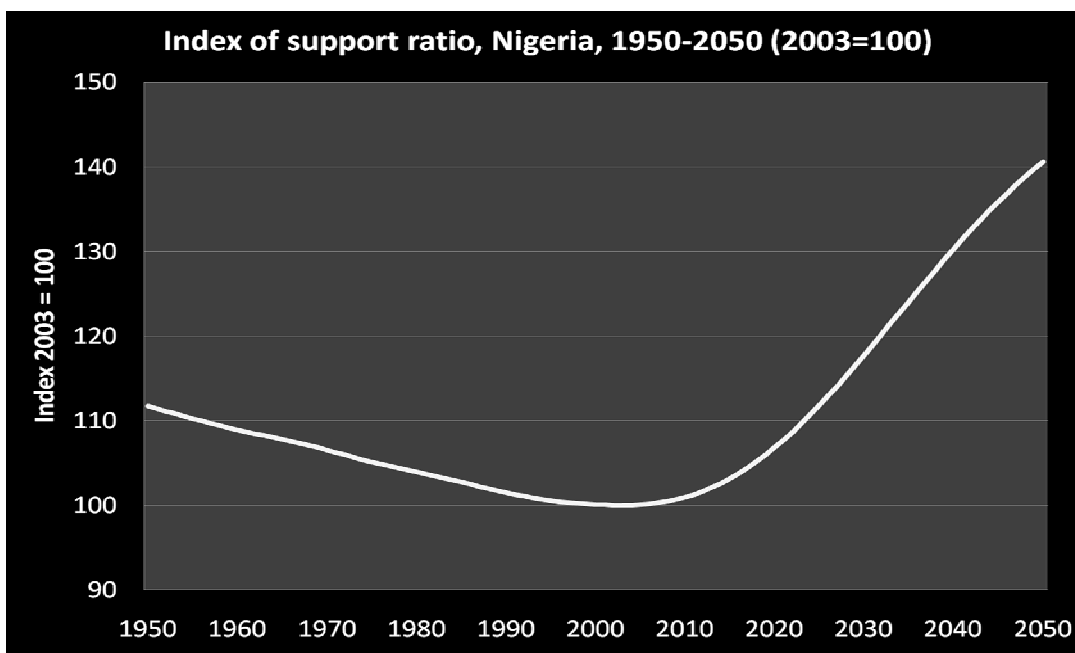

Figure 17: Nigeria's Support Ratio, 1950-2050. Scaled so that 2003 equals 100. Source: Soyibo et al, (2009a).

Between 1950 and the end of the 20th Century, the rate of growth of the effective number of consumers and the effective number of workers increased, but the gap between the two was relatively constant. This produced a very stable decline in the support ratio of well below 1 percent per year. In 2003 as the rate of growth of the effective number of consumers declined while that of the effective number of producers continued to increase ushering in the period for the first demographic dividend. This effect is just beginning to be felt in Nigeria, but it is expected to increase and reach close to 1 percent per year for about two decades. In 2040 the annual effect will begin to decline, but it will remain positive through 2050.

The changes in Nigeria's support ratio are similar to those in many LDCs. Figure 18 shows the support ratio for six developing countries from 1950 to 2100 for Brazil, China, India, Niger, Nigeria, and South Korea. Average developing country age profiles of consumption and labor income have been used to construct the values, including those for Nigeria, so that the differences across countries is due entirely to differences in population age structure. The timing obviously differs among these countries because the demographic transition occurred earlier in Asia and Latin America than in Africa. Moreover, there are differences in the amplitude of the swings in the support ratio. The change from trough to peak in China and South Korea is greater than in India. The change in Niger is even greater (in percentage terms) than those in China and South Korea primarily because the support ratio in Niger reached such low levels due to its very young population. Nigeria is following an intermediate course between Niger and the other developing countries shown in Figure 18.

There is one other important feature of the economic support ratio that should be noted. Consider the case of China – its support ratio in 2100 is actually below its value of 1950 although somewhat above the minimum value of the early 1970s. The support ratio effect is not permanent. By the time that the age transition is completed it largely disappears. This is not apparent for Nigeria because the projection of population change extends "only" to 2100. If we followed Nigeria through to the end of its age transition we would see that its support ratio would also decline until it was very near the level of 1950. This naturally leads to important questions that are addressed below. Are the gains from the favorable support ratio sustainable or do they inevitably dissipate over time? If the gains are sustainable, how can this be accomplished?
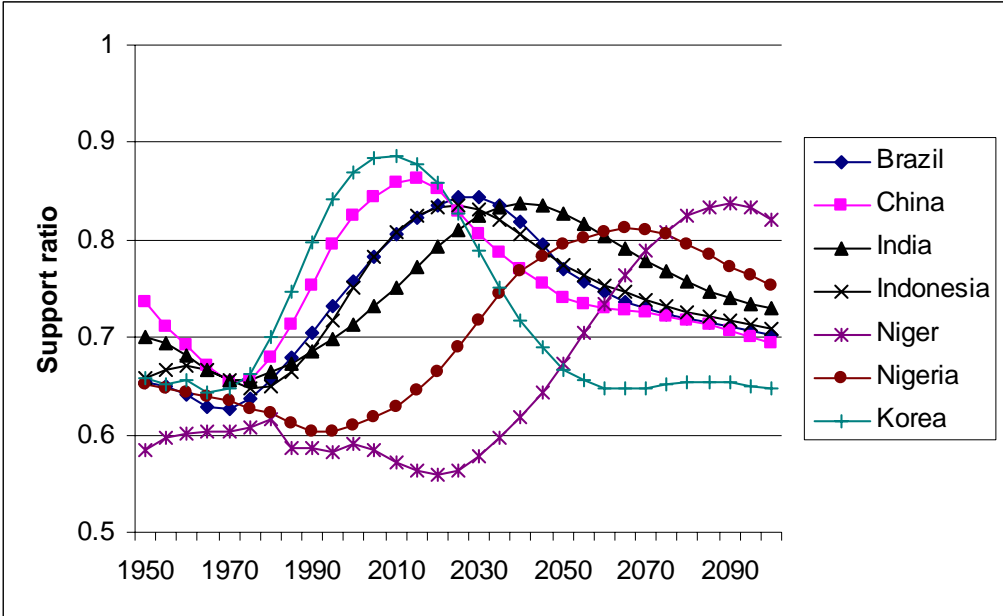
A feature of Nigeria's support ratio is that the take-off is very slow. Part of the slow take-off is a consequence of the relatively slow speed of fertility decline and, hence, the gradual changes in population age structure. This point can be seen by comparing the speed of the rise the support ratios in Nigeria, China, and Korea in Figure 18. In those calculations, the standard profile was used for all countries. Fertility decline was much more rapid in China and Korea than projected for Nigeria. But another reason for the slow takeoff is the very low levels of labor income for young adults in Nigeria. If an enhanced economic lifecycle could be realized, the support ratio would grow much more rapidly over the next ten years and remain at a much higher level over the following decades. Although, the support ratio effect may seem modest at first, further examinations of the context reveal that it is not. Technological progress in advanced industrialized countries, for example, is typically believed to yield growth of 1 to 2 percent per year. Real per capita income growth in Nigeria between 2003 and 2007 has averaged 7.5 percent per year (NBS 2007). And the cumulative effect of the increase in the support ratio, a 40 percent increase in consumption per equivalent consumer, is obviously substantial.

However, a host of factors can account for the depressed levels of labor income at young ages. These include poor employment opportunities particularly for educated, highly-skilled workers, low female labor force participation and low investment in human capital. Others include emigration of educated workers as well as poor health amongst young adult. Interestingly, many of these factors are inter-related and self-reinforcing. The lack of employment opportunities leads to emigration of skilled workers and undermines incentives to invest more in human capital. In fact 36.%1 of tertiary educated Nigerians emigrated out of the country in 2005 (Mason, et al, 2010). The lack of highly skilled workers undermines opportunities to foster economic growth and create jobs for highly-skilled workers. High rates of childbearing increase the opportunity cost of employment for women and reduce their labor force participation. Moreover, high rates of childbearing increase the cost of raising the average educational attainment of the next generation of workers.

As changes in age structure continue and the 40-plus population increases its share, the Nigerian economic lifecycle (and the enhanced profile) is preferable to the standard profile because labor income of those 40 and older have such high labor income. If this feature of labor income in Nigeria persists the economic support ratio will remain at a substantially higher level than produced by the standard labor income profile, because a population concentrated in the 40s and 50s is highly beneficial as compared with the standard result.

Whether this feature of Nigeria's labor income profile will persist into the distant future is very difficult to say. High levels of work activity at old ages tend to characterize countries with low per capita income, small formal sector employment, and limited public systems of support for the elderly. If Nigeria is successful in its development efforts, it is quite possible that labor income at older ages will decline relative to labor income among prime age adults. A second and important explanation for relatively low labor income at younger ages in the standard lifecycle is that the human capital of young workers is much greater than that of older workers. If human capital investment is increasing rapidly, wages of younger, more highly-skilled workers will be higher relative to older, less highly-skilled workers. Thus, rapidly expansion of education systems increases the gains from a young work force and reduces the gains from an older work force. Some decline in the relative labor income of older workers may, thus, be inevitable. At the same time policies that discriminate against older workers or create incentives to withdraw from the workforce can be avoided. Moreover, investing in the human capital of older workers may also help to maintain relatively high productivity among these important contributors to economic success.

3.3 Sustaining Nigeria's Growth: Human Capital Investment

Although all spending on children is counted as consumption in national accounts, there is widespread appreciation that a portion of consumption is actually human capital investment. In this paper we use the term human capital spending to comprise public and private spending on health and education for the young. Per capita estimates of these four components broken down by single year of age are shown in Figure 19. These are National Transfer Account estimates constructed by Soyibo et al, 2009a. At very young ages, almost all human capital investment is privately funded. Education begins to play a more important role at age 7, again with privately funded spending dominant. Private education continues to increase in importance peaking in the late teens at a relatively high plateau and then declining slowly.
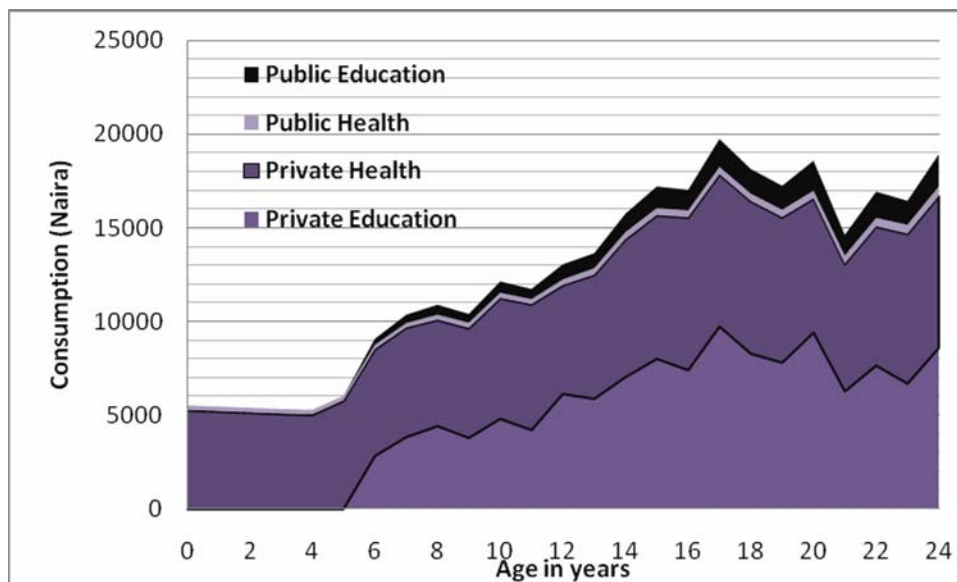
Figure 19: Per Capita Human Capital Spending, Single Years of Age (0-24), Nigeria 2004. Source: Soyibo et al. 2009a.

These data are cross-sectional data for 2004 and do not represent the human capital investment that any birth cohort will receive during its youth. Those who were in their early 20s in 2004 likely received less investment than shown in the figure, and those who were very young will hopefully receive more than shown in the figure. None the less, we can cumulate spending across these ages as a convenient and intuitive way of describing the amount invested in children in 2004. In calculating this total, education spending includes all spending up to and including age 24. Only health spending up to age 17 is included in the total, however, because it is preferable to not include spending on childbearing given the ambiguity as to whether this should be considered human capital investment in the mother or the child. Following this approach per capita lifetime human capital investment in Nigeria in 2004 for a synthetic cohort was approximately 258,000 Naira. Education and health were of similar importance. Public and private education combined comprised 55% of human capital investment, but it should be kept in mind that no health spending after age 17 is included in the calculation.

Table 11 reports values normalized by dividing by the average labor income earned by all members of the population, employed or not, between the ages of 30 and 49. This normalization serves two purposes. First, it provides a useful metric for comparing countries with greatly different standards of living. Second, it controls in a crude fashion for variation across development level in the cost of labor, a dominant input in human capital investment. The total normalized human capital investment in Nigeria was essentially 2.0. Given current spending levels, the lifetime human capital investment per child was two years worth of labor income. If we take the net reproduction rate, estimated at 1.91 for Nigeria for 2000-05 (UN 2008), as a measure of the number of

children raised per parent, then the typical couple could expect to invest 3.8 years of their labor in the human capital of their children given current rates of childbearing, child survival, and human capital spending.

	Actual	Distribution (%)	Normalized
Education, Public	18,931	7.33	0.149
Education, Private	123,091	47.63	0.971
Health, public	5,189	2.01	0.041
Health, private	111,228	43.04	0.877
Total	258,439	100.00	2.039
Total Public	24,121	9.33	0.190
Total Private	234,318	90.67	1.848

Table 11: Human capital spending, Nigeria, 2004, synthetic cohort measures. Source: Soyibo et al. 2009a.

3.3.1 Future of Human Capital Investment

There are conceptual arguments on whether spending per child as a normal consumer good or should be treated as an investment. The demand for and returns to human capital increase with development because of structural changes in the economy that increase the returns to mental ability relative to physical ability, and because of reductions in mortality that reduce the probability that investment in a child will be lost through premature death. An influential idea advanced by Becker, Willis and others is that there is a quality – quantity tradeoff for children (Becker and Lewis, 1973, Willis, 1973). As the number of children declines, the price of achieving a desired quality per child also declines. (Montgomery et al., 2000, Montgomery and Lloyd, 1996, Ahlburg and Jensen, 2001, Jensen and Ahlburg, 2001, Willis, 1973, Becker and Lewis, 1973)

The quantity – quality tradeoff underlies Figure 20 which shows the Total Fertility Rate plotted against normalized lifetime human capital investment for 24 economies including Nigeria. These values were constructed in a fashion identical to the synthetic measure of Nigeria reported above (Lee and Mason, 2009a).   Both total and public human capital investment are plotted on the figure with the vertical distance between the two points equal to private human capital spending. There is a strong relationship between the TFR and human capital investment evident for these 24 economies. Normalized investment in low fertility countries is substantially higher than in high fertility countries. The highest rates of investment are in Sweden, Japan, and Taiwan which are among a group investing more than 5 years worth of labor income per child. Kenya and India have the lowest rates of investment followed by China, Indonesia, and Nigeria. When it comes to public investment in human capital, Nigeria is ranked last among the 24 economies. Indeed Nigeria is investing less than one-third of the normalized public human capital investment found in Kenya (0.61), China (0.67), and India (0.88). It is important to understand that because these values are normalized on

mean labor income of those 30-49, they indirectly control for the level of development. Thus, the low levels of investment do not arise as a more or less automatic feature of low income.

Also shown on Figure 20 are two fitted lines that show the relationship between the TFR and human capital investment. These are iso-elastictic curves - along these lines the percentage change in the TFR is a constant proportion of the percentage change in human capital investment. A special case of interest is an elasticity of -1 which would imply that the human capital investment in all children combined does not decline with the number of children. The same investment would simply be spread over fewer children. The estimated elasticity for total human capital investment is -0.81 and for public human capital investment -1.42. Thus, these estimates imply that human capital investment rises sharply as the Total Fertility Rate declines. This is entirely a consequence of public human capital investment. The estimated elasticity for private human capital investment is positive, small, and not significantly different from zero.

It is important to understand that the fertility – human capital tradeoff portrayed in Figure 20 does not represent any particular causal relationship. The two variables are inter-dependent and mutually determined by a host of factors. The key point here is that they have a strong tendency to move together. In high fertility countries investment in human capital tends to be low while in low fertility countries investment in human capital tends to be high. The relationship reported here is based on cross-sectional data but it holds, with high negative elasticities, for the few time series data that have been analyzed, Japan 1984-2004 and Taiwan, 1978-2004 (Ogawa et al., 2009) and the United States, 1960-2004 (Lee and Mason, 2009b). Also it is important to understand that after controlling for TFR and indirectly for development through the normalization process, a considerable amount of the variation in human capital investment is unexplained. The TFR "explains" 57% of the variation in total human capital investment and 64% of the variation in public human capital investment. Other factors not analyzed here, including public policy decisions, must have a very important impact on human capital investment as well.

Fertility - Human Capital Tradeoff

Sweden

Philippines

Nigeria

Kenya

China   Indonesia

Human Capital Spending
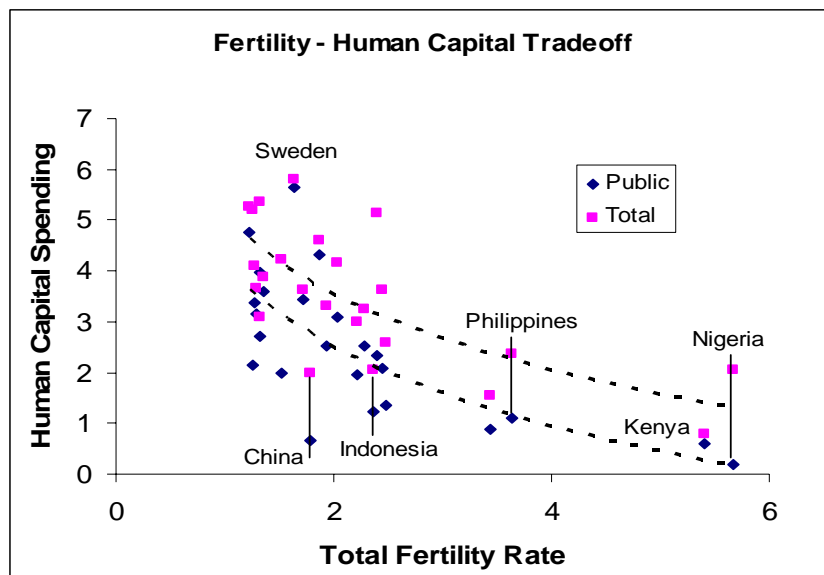
Total Fertility Rate

- ◆ Public
- ■ Total

Figure 20: Tradeoff between human capital investment (synthetic measure) and the Total Fertility Rate, estimates for 24 economies, recent year. Updated from Lee and Mason 2009.

3.3.2   Human Capital Investment as a Means for Sustaining Economic Growth

As fertility continues its decline in Nigeria, the economic support ratio will increase and current per capita consumption can rise for an extended period, but eventually the support ratio will decline. Holding all else constant, a few fortunate generations will have enjoyed higher standards of living during their lives, but no benefits will remain for the generations that follow. Alternative outcomes are possible, however. The first we want to explore is that favorable demographics may be accompanied by greater investment in human capital. Using a highly stylized model, we show that standards of living can be permanently raised if the fertility – human capital tradeoff operates with sufficient force.

The analysis presented here is based on a model of human capital investment recently developed by Lee and Mason (2009). The results presented here are based on the same theoretical framework, but model parameters have been updated and fine-tuned to fit the circumstances in Nigeria. In this case we follow Lee and Mason who assume that the elasticity of output with respect to human capital is 0.33. The second key parameter is the effect of fertility on human capital. Here we rely on the updated estimate of the elasticity of the quantity – quality tradeoff (-0.81) (Table 12) discussed above and based on cross-sectional estimates for 24 countries presented in Figure 20.

Total Human Capital Spending	-0.81
Public Human Capital Spending	-1.42
Private Human Capital Spending	0.14

Based on regression of ln HK on ln TFR, 24 countries, update of Lee and Mason 2009. Private coefficient is not statistically significant.

Demographic variables are exogenously specified in the model: the net reproduction rate (NRR) and the proportion of the population surviving from the working ages to old age. The demographic variables were selected to conform closely to Nigeria's demographic experience where period 0 is matched to 1980, period 1 is matched to 2010, and period 2 is matched to 2040. Thereafter, the NRR is assumed to stabilize at 1.0 (replacement rate) and the old-age survival rate at 0.8. No immigration is incorporated into this model, although the more general implications of immigration are considered below. Several other demographic variables generated by the model, the population growth rate, the age distribution of the population, and the support ratio, are reported in Table 13.

Period	NRR	Survival to old age	Population growth rate	Percent of population			Support ratio
				Children	Workers	Elderly	
0	2.3	0.3	2.51	66.3	28.8	4.8	0.432
1	1.7	0.5	2.20	58.3	34.3	4.8	0.484
2	1.1	0.8	1.35	42.8	38.9	7.5	0.495
3	1.0	0.8	0.51	36.7	36.7	18.3	0.449
4	1.0	0.8	0.09	35.7	35.7	26.7	0.435
5	1.0	0.8	0.00	35.7	35.7	28.6	0.435
6	1.0	0.8	0.00	35.7	35.7	28.6	0.435

Table 13: Demographic Variables, Baseline Simulation.

The basic features of Nigeria's demographic transition are represented in the baseline simulation. A selection of the corresponding demographic data for Nigeria is reported in Table 14. The NRR in the baseline simulation was selected based on the corresponding estimates and projections from the UN and, thus, the baseline values and the corresponding estimates are identical. The population growth rates for the baseline simulation and the estimates are similar as are the age distributions. The matches are by no means exact and an inevitable consequence of the stylized nature of the simulation model and that period in the simulation model refers to a generation, whereas the period demographic variables for Nigeria are for five-year periods.

Period	NRR*	Growth rate	% <30	30-59	% 60+
1980	2.3	2.67	70.6	24.6	4.8
2010	1.7	2.12	70.5	24.6	4.9
2040	1.1	1.16	58.3	34.4	7.4

*NRR and growth rates are for the subsequent five-year interval, medium scenario, UN 2008.

The key results for the baseline simulation are reported in Figure 21. Fertility decline produced an increase in the support ratio that was concentrated between period 0 and 1, but increased modestly until period 2. After period 2 the support ratio declined and stabilized at a level essentially equal to the support ratio in period 0. In the absence of a response in human capital investment, consumption per equivalent adult would exactly track the support ratio. Those who were alive in periods 1 and 2 would enjoy higher consumption, but there would be no lasting demographic effects. If, on the other hand, fertility decline produced a response in human capital investment along the lines assumed in the baseline model, consumption per equivalent adult would have increased between periods 0 and 1 and, again, between periods 1 and 2. Consumption would be lower under these conditions, because resources previously used to fund consumption are being diverted to human capital investment. (Recall that human capital investment is not included in consumption in the model.) The benefits of this response become evident period 2. In period 3 and all subsequent periods, those shown but also future periods not shown, consumption is higher by more than 20 percent. Again this is a permanent increase not a transitory gain.
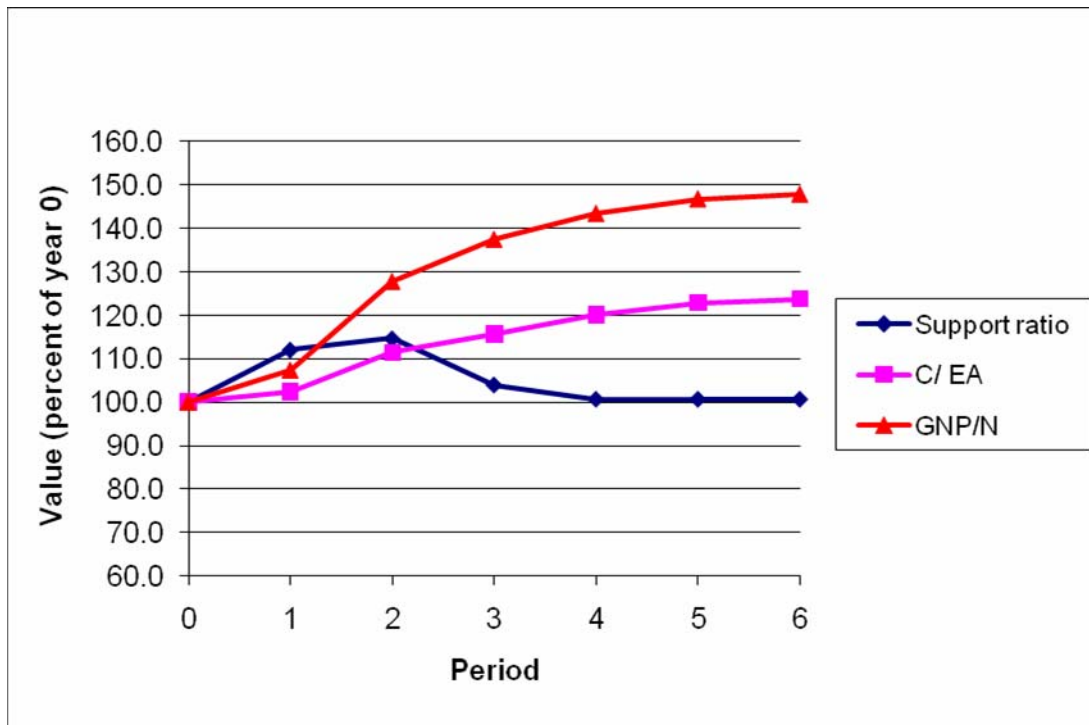

Figure 21: Macro Indicators: Baseline Results (Impact of Demographic Transition on Consumption per Equivalent Adult and GNP/N from Human Capital – Fertility Tradeoff).

The gain in GNP per capita is even greater – stabilizing at about 50 percent more after the demographic transition than before. This overstates the gains in welfare associated with greater human capital investment because the gain in per capita GNP is realized,

in part, by diverting economic resources away from consumption to investment in human capital. The importance of using consumption to measure the economic gains is clearly evident. To the extent that there are benefits of human capital investment beyond its pure productivity effects, however, average consumption understates the welfare gains from increased human capital investment.

Information about human capital spending and its impact on wages is provided in Table 15. Human capital spending per child as a share of wages nearly doubles over the demographic transition – increasing from about 7% of wages in period 0 to 14% of wages in period 3 and thereafter. Human capital spending per child more than doubles because wages are also increasing during this period. A virtuous circle is created because greater human capital spending leads to greater human capital, greater wages, and still more human capital spending. Human capital spending as a share of GDP declines slightly during the period. The human capital investment rate drops because the elasticity of the quantity-quality tradeoff is -0.81. If it were constant, the human capital investment rate would have remained constant.

Period	Human capital spending per child/Wage	Wage	Human capital spending per child	Average human capital ofworkers	Human capital spending/GDP
0	0.072	0.319	0.023	0.031	0.166
1	0.092	0.288	0.027	0.023	0.157
2	0.131	0.302	0.040	0.027	0.144
3	0.142	0.345	0.049	0.040	0.142
4	0.142	0.369	0.052	0.049	0.142
5	0.142	0.378	0.054	0.052	0.142
6	0.142	0.381	0.054	0.054	0.142

Table 15: Human Capital Variables.

3.4 Policy Discussion

Nigeria, like most other countries in Sub-Saharan Africa is just beginning the transition to low fertility but the economic support ratio for the country is not expected to peak for another 40 years or more. Although experiences of countries that have already enjoyed a demographic dividend may be instructive for Nigeria, it is important to understand the general lessons that can be drawn from the experience of other countries.

First, the transition to low fertility throughout the developing world is leading to a decline in the relative number of children in the population and an increase in the share of the population in the working ages. As a consequence, per capita income can be expected to grow more rapidly over an extended period of time, four or more

decades. The boost to income growth will rarely exceed 1 percent per year and will typically be much less. But over the entire dividend period, changes in age structure produce an increase in per capita income of perhaps 40 percent.

Nigeria is just beginning to experience the demographic dividend, because like other SSA countries fertility rates have only recently begun to decline. The total impact on per capita income should be similar to that experienced in other developing countries. However, Nigeria's take-off is relatively slow. This is true because fertility rates are declining more slowly in Nigeria than in many other developing countries and because Nigeria's economic lifecycle cycle is not conducive to a fast take off. In particular, low labor income among young adults is a serious problem. If fertility decline is more rapid than anticipated and if labor conditions improve for young adults, then the economic support ratio will rise more rapidly and Nigeria will enjoy a larger demographic dividend over the next decade or two.

One policy option is to increase investment in human capital per child as birth rates decline. Whether we compare across countries with different levels of fertility or track the experience of individual countries, there is a strong tradeoff between the total fertility rate and human capital spending per child. For this policy to be successful, it is essential that two conditions be met. The first is that spending on education and health be effective in raising the human capital of children. The second is that economic opportunities allow more highly skilled adults to find highly productive and highly paid employment. The general experience is that these conditions are met on average and that investment in human capital is an effective tool for achieving higher standards of living that are sustainable. But this cannot be taken for granted.

Two features of Nigeria seem to be particularly relevant to these issues. The first is the lack of economic opportunities in Nigeria for highly skilled workers. This must account for the long child dependency period in Nigeria compared to other countries. In the absence of those opportunities, therefore, emigration combined with remittances offer a means by which education can be used to raise standards of living of Nigerians living at home and abroad. But the lack of job opportunities in Nigeria is an obvious source of concern. The benefits of emigration have their costs with the attendant loss of experts who could have improved the quality of life of the Nigerian population in many sectors, particularly in health and education, resulting in low quality of life. The second feature is the very low level of public human capital spending in Nigeria. Although private spending is quite high, the international experience is that public spending plays a critical role; particularly in the area of tertiary education.

The twin problem of lack of employment opportunities and loss of highly qualified Nigerians to emigration combine to inhibit the raising of wholesome and creative Nigerians for the next generation. Apart from losses in monetary terms, there are other areas of concern which have monetary outcomes in the final analysis.

Related to the foregoing is the need to improve the quality of Nigerian human capital by improving the employability of graduates of Nigeria's educational system. Employers have alleged in the popular press in Nigeria that graduates of Nigerian universities lack employable skills, including life and leadership skills. Related to this is the very weak link between the universities and other tertiary institutions and society represented by the private sector. However, efforts are already in place to promote university-private sector collaboration and introduce university students to concepts of entrepreneurship and innovation with the twin objective of making all students imbibe entrepreneurial and enterprising attitudes and making some of them who have characteristics of entrepreneurs become entrepreneurs. With this, creation of an enabling environment will not be left to government alone because entrepreneurs as people of passion create markets where they do not exist and thus can create the enabling environment for their activities. In addition staff and students of universities and other tertiary institutions are now being introduced to the concept of commercializing their research through exposure to the concept and use of intellectual property (IP) to improve the quality of life in the society. Indeed, the National Office for Technological Acquisition and Promotion (NOTAP), in conjunction with the World Intellectual Property Organization (WIPO), has established Intellectual Property and Technology Transfer Offices in 13 Nigerian tertiary institutions and research centers as a way of enhancing university-private sector collaboration and promoting entrepreneurship (Soyibo, 2009). Though a good start, it will need to broadened and deepened.

Another complementary approach to achieving sustainably higher standards of living is to channel some of the gains from the demographic dividend into saving and investment. The age transition itself will lead to an increased demand for assets as Nigerians live longer and the expected duration of their retirement increases. Although labor income is relatively high at older ages at the current time, this may well decrease as standard of living improve and the demand for leisure increases and as more are employed in the formal sector. Nigeria launched its Public Pension System in 2005 with the passage of the National Pension Commission (PENCOM) Act of 2004. However, it needs to be deepened and enhanced to involve more participants. Presently only a federal government employed workers and some private sector workers are involved. Most Nigerian workers are yet to be covered.

We have also found that Nigeria can do a lot concerning promoting savings by people in the working age so that they can have assets rely upon during old age dependency period. From the study we learn that enhanced low transfer option in which the old age dependency is financed by two-thirds of asset reallocation and one-third of familial transfer has higher return and per capita consumption and so is preferred. The turning point for these variables, is the year 2020. It is instructive that this coincides with the year Nigeria plans to be in the league of the top 20 industrial economies. To ensure that this preferred alternative materializes, a lot of complementary policy initiatives will need to

be in place well before this time. Among these are the deepening and widening of the Nigerian financial markets to allow for more creative instruments for investment and providing adequate legal institutional framework for dispute resolution, among others.

Whether Nigeria should begin to concern itself with the social security of the elderly is open to question and there may be more pressing issues. However, those who are just entering the workforce will not reach retirement age until mid-century. They may face an extended retirement at that time with a support system that is not up to the task. Thus, Nigeria must consider how its financial system can be improved and retirement saving encouraged among today's workers.

4 Conclusions

We have visited prospects for economic growth in Nigeria from a demographic change and human capital perspective. Our principal conclusions are that Nigeria has a substantial demographic opportunity on the horizon, and even though features of Nigeria's economy make capitalizing on this opportunity challenging, Nigeria does have policy options available that can allow it to harness its demographic transition into indefinite sustained growth.

In particular, we have estimated that Nigeria's potential demographic dividend could raise per capita incomes 30% or more by 2030, increase the size of the economy to 3 times today's size instead of only 2 times, and lift around 32 million additional people out of poverty by 2030. Using a new analysis that highlights previously neglected features of Nigeria's economy, we have determined that some principal challenges in achieving these benefits are unemployment, low job productivity, and low levels of human capital. Using our estimates and analysis, we have identified channels of savings and investment that can translate Nigeria's demographic opportunity into permanent gains.

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