Provision of Public Goods and Health Outcomes During Political Transition In Nigeria.

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by

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Abstract

This study investigates three issues connected with governance and citizens' welfare in Nigeria. One of the current debates in the political economy literature focuses on the benefits of democracies to ordinary citizens, especially in developing countries, and particularly in sub-Saharan African countries. Most Nigerians have been questioning the benefits of transition from military rule to democratic rule in 1999 to ordinary citizens. This concern relates to the lack of credibility of electoral processes in the country. Politicians in Nigeria have embarked on various unlawful strategies both to win and perpetuate positions of power, with no regard for the principles of free and fair elections. Non-credible elections often lead to capture of political power at both national and sub-national levels in the country by special interest groups headed by political 'godfathers'[1]. This thesis examines whether transition from an autocratic military regime to a relatively competitive democratic regime results in higher provision of public goods and a reduction in health inequality, given the prevalence of political capture due to lack of credible electoral competition in Nigeria. The thesis questions the assumption that transition from a military dictatorship to relatively competitive democratic rule will ensure an increase in the provision of public goods and a reduction in health inequality.

The thesis is divided into three sections, as follows: Chapter 2 considers the effects of political power competition on public expenditure on health, water, education and social services at the national level and households' access to safe

[1] 'Political godfathers' are the professional politicians in Nigeria. These politicians are old but rich enough to sponsor candidates for an elective positions at various levels of governments during elections, with a hidding agreement to be in control of government resources and appointments after the elections.

drinking water at the state level in the country. The paper uses a Bounds testing approach to co-integration and panel analysis to analyze the impacts of transition from military rule to democratic rule on public expenditure including health, education, water services and infrastructure in Nigeria. The thesis shows that political competition is significant and positively related to an increase in public expenditure on health, education and water in the country. However, our dynamic panel analysis shows that access to safe drinking water did not improve in the first ten years of democratic rule across the 37 states in the country, though there was an astronomical increase in public expenditure within the same period in these states. We argued that gap between public expenditure on public goods and access to public goods may be link to diversion of public funds to private pockets due to the high rate of rent seeking in the country.

Chapter 3 looks at the consequences of provision of access to alternative sources of water and sanitation on childhood malnutrition in the country. In this chapter, anthropometric measures of child health are employed to analyze the effect of access to different sources of drinking water and sanitation in households on the health status of children in the country. Our interest in this issue is to empirically identify the health implications of a lack of safe drinking water on the most vulnerable portion of the country's population. Survey regression analysis methods are used to examine the effect of access to different sources of water and sanitation on height z-scores and weight z-scores of children aged 0-59 months in the country. In addition, the chapter uses survey probit regression methods to analyze the probability of a child being stunted and underweight as a result of access to different sources of water and sanitation. The results specifically show that drinking of well water retards the growth rate of children in the country compared to

drinking of piped water. The probability of being stunted and being underweight is significantly higher for children who drink well water. The chapter therefore confirms that it is necessary for policy makers to prioritize the provision of safe drinking water.

The thesis clearly distinguishes between health outcomes and health inputs in chapter 3. The analysis reveals the implication of households' access to safe drinking water and sanitation on children's health outcomes. It specifically shows that households' access to piped and borehole water are both positively related to children's height for-age Z-scores. Importantly, we find that access to borehole water is significant and negatively related to children's weight z-scores and the probability of children being underweight.

In line with our findings, access to proper human waste disposal systems, especially flush toilets, is crucial for the healthy growth of children in the country. Children in households with access to flush toilets are less prone to chronic malnutrition (inadequate growth). Our study also shows that access to flush toilets reduces the probability of a child becoming stunted. Where provision of flush toilets is not immediately feasible, it is necessary to provide, for the short term, pit latrines for households in the country. Government should also propose a policy that will make construction of toilet facilities in new buildings mandatory in the country. Our study shows that drinking well water is harmful to the growth and health of children in Nigeria and has increased the number of children being stunted and underweight. This is a strong signal to the various tiers of government to expedite efforts to provide safe drinking water to every household in the country. Women's education is another area that clearly should be promoted and encouraged by the government because of the positive impact of mothers' education on

the health outcomes of children.

Finally, in chapter 4, the study decomposes health inequality during the political transition between 1999 and 2008 in Nigeria. In this chapter, Oaxaca-blinder decompositions as well as decomposition of concentration indices are used to determine whether inequality in children's health outcomes existed under military rule in the country and to determine the direction of changes in health inequalities ten years into democratic rule in Nigeria. This micro analysis shows that, there was an increase in health inequality subsequent to transition to democratic rule in the country. Inequality in access to basic services such as drinking water, and access to food, as well as maternal and paternal education levels significantly contribute to the severity of health inequality under democratic rule in the country. The thesis therefore concludes that while transition from military to democratic rule in the presence of weak electoral competition and interest group capture may encourage an increase in public expenditure on health, education, water and social services, this may not increase access to public goods nor reduce health inequality without credible elections and a concerted effort by the elected leaders to reduce existing inequality in access to basic services.

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Dedication

Entirely dedicated to God, the source and author of all wisdom and knowledge.

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Chapter 1

Introduction

'Famines kill millions of people in different countries in the world, but they don't kill the rulers... if there are no elections, no opposition parties, no scope for uncensored public criticism, then those in authority don't have to suffer the political consequences of their failure to prevent famines. Democracy, on the other hand, would spread the penalty of famines to the ruling groups and political leaders as well' [**Sen1999, 180**].

'Many scholars claim that democracy tends to improve the material well being of the poor. I argue that previous tests of this claim were flawed, particularly by sample bias. Once these flaws are addressed, there is no evidence that poor people have benefited from living under democratic governments' [**Ross 2006**].

1.0.1 Overview of the Thesis

Since the collapse of the Soviet Union, the general consensus is that competitive democracy is the best form of government to improve the lot of the poor and reduce inequalities. Between 1960 and 2003, more than 100 countries have adopted democratic forms of government (See table 1.1). In a like manner, many developing countries, both in Africa and beyond, have experienced transition from dictatorial regimes to democratic rule. In sub-Saharan Africa alone 43 countries switched from previously autocratic rule to democratically elected governments. However, it is not rare to see democratic governments relapsing back into dictatorial regimes. Between 1960 and 2003, 44 or 38.6 percent democratic governments across the globe underwent this reversal (see table 1.2). 8 of the reversals were in Latin America. Table 1.3. Shows that sub-Saharan Africa led the reversals with 23 (or 53 percent) out of the total 43 democratized governments in the sub-region reverting back to dictatorships between 1960 and 2003.

Table 1.1: Democratization of countries by Region and Decade: 1960-2003

	1960s	1970s	1980s	1990s	2000s	Total	percentage
Central America	2	1	4	4	0	11	9.6
South America	2	2	7	1	1	13	11.4
Western Europe	0	3	0	0	0	3	2.6
Eastern Europe	0	0	0	2	2	20	17.5
N. Africa/M.East	0	1	1	1	1	3	2.6
Asia	4	5	3	8	0	21	18.4
Sub-Saharan Africa	14	6	1	18	4	43	37.7

Source: Centre for Global Development

One of the reasons advanced in the literature by the critics of democracy in developing countries is the failure of these governments to meet the need of the citizens. Therefore, it is becoming clear that political rights may not be enough to

guarantee good governance in democratic regimes without corresponding economic rights, especially in developing countries. The proponents of electoral competition argue that the economic needs of the poor are better met under democratic rule than under any other forms of government. The controversy still persists between these conflicting opinions on the relationship between political power competition and the welfare of the poor in developing countries.

Table 1.2: Global Democratization Reversal and Sustenance: 1960-2003

	1960s	1970s	1980s	1990s	2000s	Total	percentage
Democratizations	22	18	16	50	8	114	100
Sustained	4	6	13	39	8	70	61
No reversal	2	3	8	34	7	54	47.3
Minor reversal	2	3	5	5	1	16	14
Total Reversal	18	12	3	11	0	44	38.6

Source: Centre for Global Development working paper

Nigeria in particular is a good example of a country oscillating between military dictatorships and democratically elected governments. The question is whether electoral competition actually advances the economic interest of the poor majority, as advocated in the literature. One of the main reasons the military always advance for their intervention in politics in the country is the failure of elected leaders to provide for the basic services needed by the poor. Surprisingly, there is no empirical evidence either for or against this claim at national and sub-national level in the country.

To address this issue, one must understand how the welfare of citizens is affected by the activities of the government in power. One of the major ways is via the allocation of public expenditure for the provision of public goods, which are in most cases beyond the ability of ordinary citizens to access. Studies on advanced democracies suggest that public expenditure often increases subsequent to transi-

Table 1.3: Democratization Reversal and Sustenance by Region: 1960-2003

	Latin America	Western Europe	Eastern Europe	Sub-saharan Africa	N.Africa/ M.East	Asia
Democratizations	24	3	20	43	3	21
Sustained	17	3	18	20	2	10
No reversal	10	3	16	15	1	9
Minor reversal	7	0	2	5	1	1
Total Reversal	8	0	2	23	1	11
% per region	33.3	0	10	53.5	33.3	52.4

Source: Centre for Global Development working paper

tion to democratic rule. Increase in welfare related public expenditure is seen as evidence of an increase in elected leaders' commitment to the welfare of ordinary citizens. We are not sure whether this argument can be generalized, particularly in Nigeria, where elections are often non credible due to high rate of rigging and falsification of election results.

Table 1.4: Years of Military and Democratic rules in Nigeria

	Years under Military	Years under democracy
1960-1965	0	6
1966-1979	13	0
1979-1983	0	4
1984-1999	16	0
1999-2011	0	12
Total number of years	29	22

Source: Author's calculation

Does change in political power necessarily encourage an increase in public expenditure on health, education and water in the presence of weak electoral competition in Nigeria? If so, is there evidence of an increase in the provision of public goods subsequent to change in political power in the country? This thesis unravels these arguments from National (macro) and sub-national (micro) perspectives. At the National level, we examine the relationship between allocation of public ex-

penditure to health, education, water and other social services and political power competition under military and democratically elected governments between 1960 and 2009 in Nigeria. At the State level, we used dynamic panel data to analyze the relationship between changes in government and households' access to safe drinking water in the country. State governments in Nigeria are constitutionally required to provide drinking water to the citizens in the country.

If political leaders are not accountable to the electorate, public expenditure can easily be diverted into private pockets. Diversion of public expenditure to private pockets will eventually create gaps between allocation of public expenditure and households' access to public goods in the country. There are basically two levels of embezzlement of public funds. Embezzlement of public funds may occur at the level of collection of public revenue. In this case, the available public revenue will be lower than the actual public revenue. It will then result into availability of fewer resources to be allocated by the political leaders for public goods. In the second case, part of government revenue allocated to public goods can be misappropriated in terms of partial diversion of allocated funds to private pockets or in the form of provision of either lower quality or quantity (both lower quantity and lower quality in some cases) of budgeted public goods to the citizens.

Water is an important basic resource. Though water is a gift of nature, some water sources can be injurious to human health. For governments to really meet the water needs of their citizens, they need to understand the effect of various sources of water on health outcomes in the country. In an attempt to satisfy water needs in the country, the government at all levels has embarked on provision of well-water, borehole or tap water without much consideration of how these sources of water may impact on the health of citizens, especially children. Previous studies on the

quality of well water in the country show that most of the well water contains highly concentrated nitrate. High levels of nitrate intake are inimical (Adelana and Olasehinde 2003; 2008) to good health. Therefore, the focus of this aspect of our research is to use anthropometric measures, specifically height for-age z-scores and weight for-age z-scores to determine how these various sources of water affect the health of children in the country. We shall further employ a probit regression method to analyze how access to these sources of water affects a child's probability of being stunted and being underweight. The thesis capitalizes on the measured weight and heights of children available from the DHS of 2008 in Nigeria for the analysis.

One of the objectives of the Millennium Development Goals (MDG) is to reduce every form of inequality in the world, including health inequality. Therefore, the third issue the thesis addresses is whether childhood health inequality existed under military rule in the country and whether health inequality persists subsequent to transition to democratic rule in 1999. Due to a general increase in total public expenditure as well as an increase in transfers under democratic rule, political economy theories assume that inequality should be inversely related to democratic rule. The argument is further re-enforced by the role of the electorate, who are mostly poor, and their power to vote non-performing leaders out of office. The median voter theory, which is the main argument in this thinking, assumes that the power of the electorate to vote in and out of power will compel leaders to provide more public goods under democratic rule than under other forms of government. Can we generalize this argument or is it conditional on elections being credible?

The general adage that "health is wealth" is instructive to our focus on health in this thesis. Healthier citizens are likely going to be more productive and contribute

positively to economic development of the country, all things being equal. In addition, good health also has a positive effect on the learning attitude and abilities of children and leads to better educational outcomes and increases the efficiency of human capital development by individuals, household and the nation (Strauss and Thomas, 1998; Schultz, 1999). Illness reduces physical, mental and income ability of the populace and their economic usefulness.

Therefore, the most important need of every citizen under either military or democratic rule is health. However, children are the most vulnerable group in the society. One of the most important functions of government is to protect the rights of every child, especially health. When a child's health is guaranteed the future of such a child and the country at large is protected. If citizens health, especially the poor are not protected, all other activities of government in trying to provide for the basic needs of the citizens will be unproductive. Since children cannot protect themselves, their survival depends on both their parents and government in power in the country. It is however assumed that democratic governments will be more committed to policies aimed at improving citizens health and as well reduce health inequality between the rich and the poor in the country.

1.0.2 Distinctions between Military and Democratic Regimes in Nigeria and the general roles of government

Traditionally, the military role in Nigeria is to protect the country against internal and external aggression capable of undermining continual existence of the country. The main distinction between military and democratic rule in Nigeria are summarized below. In the first place, while democratic leaders are elected

by the electorates for a fixed term of four years, successive military governments in the country have assumed power via coups without the input of the general public. Secondly, while democratic governments rule according to the provision of the constitution, the military government always suspend the provisions of the country's constitution, including fundamental human rights. In addition, democratic governments in the country operate by the principle of separation of power between the executives, legislature and the judiciary while the military head of states have combined the duties of both the executive and the legislature under successive military rule in the country. At the state level, the executive governors are directly elected under democratic rule but under military rule, military governors are single handedly appointed by the military head of states without the input of the electorates.

The essence of governance under military and democratic rule is to provide for the needs of the citizens. In recognition of the basic essence of governance, both the military and the democratic governments in Nigeria are similar in terms of their promise to provide basic infrastructures such as, qualitative and affordable education, affordable public health care, safe drinking water and good road network for the citizens. Therefore, differences in the method of operations between military rule and democratic rule in the country not withstanding, the primary functions of every government is to provide for the collective welfare of the citizens and to reduce inequality between the rich and the poor.

1.0.3 Brief History of Political Competition in Nigeria

Nigeria's political history since independence in 1960 has been plagued with ethnic politics, greediness and bitter struggles to gain political power by politicians with the sole aim of controlling government resources for themselves and their associates. Rather than aiming to serve the interests of citizens, politicians aim to enrich themselves and their supporters on assumption of power. Therefore, most of the elections are not credible as various political parties engaged in excessive electoral malpractice and persecution of the opposition (including assassinations) in their main political strongholds. Different tactics, including appeals to religion and ethnicity are often employed to gain political support and blackmail political opponents in the country. In 1960, there were three main political parties in the country, namely: the Northern people's Congress (NPC), the Action Group (AG) and the National Convention of Nigerian Citizens (NCNC). These three political parties dominated political activities in the Northern region, Western region and Eastern region respectively. In addition, these political parties' membership was predominantly Hausa (NPC), Yoruba (AG) and Ibo (NCNC) ethnic groups, which are the main ethnic groups in the country. As observed by Falola and Matthew (2008), the fear of domination of the country by rival ethnic groups was the main concern at independence.

Within the regions, the fear of domination also pervaded the various ethnic groups, so political power was seen as the main source of acquiring power to enrich both selves and associates. Between 1960 and 1965, there were several crises, both within and between the regions, related to politicians with the sole aim of dominating political power for personal benefit (Falola and Matthew, 2008).

In the midst of these political crises in the country, the first military coup took place in the early hours of January 15, 1965. The coup plotters claimed they were motivated by the level of corruption and ethnic politics in the country. The politics of grabbing national resources and bitter rivalry under democratic rule, however, persisted under military leadership. Rivalry among the military officers resulted in a civil war that claimed nearly 3 million lives between 1967 and 1970. The discovery of oil gave much hope of better life to citizens. However, the expansion of the petroleum industry did not benefit ordinary citizens much, contrary to all expectations, as the wealth benefited mainly people with access to political power. The military remained in power between 1966 and 1979 after several coups and counter coups by military officers. In 1979, five political parties, the Unity Party of Nigeria (UPN), National Party of Nigeria (NPN), Nigerian Peoples Party (NPP), Great Nigeria People's Party (GNPP) and People's Redemption Party (PRP) were registered and cleared to contest the general elections. Ironically, most of the parties were dominated by the old politicians responsible for the collapse of the first republic.

The economy of the country had nearly collapsed by the end of 1983 due to the high rate of corruption and total neglect of public services and excessive rigging during elections. There was a general cry in the country for the return of the military to take over governance from the politicians. The cry was heeded by the military when they took over the government and sacked all the politicians in December 31st 1983. There was jubilation in every part of the country, except among the politicians who had nearly milked the citizens to death. A popular Fuji Musician (Kolington Ayinla) echoed the feelings of the citizens as follows:

"Ebawa dupe lowo ologun o to gbawa lowo oselu o, gbogbo Nigeria lapapo adupe o".

This translates into: "help us show appreciation and gratitude to the Military on behalf of all Nigerians for delivering us all from the politicians". Politicians completely lost credibility and they did not taste power again until 1999 when the military again relinquished power due to pressure from the international community and public outcry against the brutal regime of former military dictator, the late General Sani Abacha.

In 1999, politicians returned to power after many years of military dictatorship. It seems however that Nigerian politicians are yet to learn their lessons from their predecessors. Elections in the country have been far from free and fair since then. Joint report of the various transitional monitoring groups during 2007 general elections titled "An Election Programmed to Fail" clearly buttress the general perception of massive electoral malpractices in the country as follows:

> "Our monitors throughout the country noted and documented numerous lapses, massive irregularities and electoral malpractices that characterized the elections in many states. Based on the widespread and far-reaching nature of these lapses, irregularities and electoral malpractices, we have come to the conclusion that on the whole, the election was a charade and did not meet the minimum standards required for democratic elections. We therefore reject it and call for its cancellation. The Federal Government and the Independent National Electoral Commission (INEC) have failed woefully in its responsibility to conduct free, fair and credible elections."(TMG, 2007)

Electoral malpractices in the country are manifest since 1960 but are now at higher magnitudes since 1999. Some of these lapses known to the authority include the following:

•Intimidation of voters and independent election observers

•Partisanship of electoral officers and security agents

• High incidence of violence and assassinations during elections

• High rate of underage voting

• Hoarding of election materials, including ballot papers and result sheets by electoral officials

•Stuffing of ballot papers by dominant parties, often with the connivance of electoral officers and security officials

• Snatching and theft of ballot boxes and papers

•Total absence of voting in many polling stations across the federation, especially in the South East and the North East, and yet results were produced for those states.

•Returning of votes exceeding the total number of registered voters in many polling stations

•Diversion of election materials, especially ballot papers and result sheets, to private homes of powerful politicians from where the ballot papers were thumb printed or the results of elections were written and

• Deliberate refusal to provide adequate voting materials to polling stations (Olukoshi, 2000; TMG, 1999, 2003 and 2007).

Since the inception of the present democratic rule, there has been widespread political assassinations and ruthless suppression of opposition in every part of the country (Edemodu A, 2002; Ivbaze Osazua, 2006; Moghalu G, 2003; Nwokocha

John 2004; Onwuka K 2005 and Offiong and Igbafe 2007)[1]. Corruption has been at its highest level in all tiers of government. There is decay of the country's infrastructure in both rural and urban areas due to lack of maintenance, and failure by the government to provide new infrastructure. Nigeria benefited greatly from the astronomical increase in the international price of crude oil between 1999 and 2008. The rate of growth of real GDP also rose from 2.9 percent in 2000 to about 6 percent in 2007. However, whether ordinary citizens' standard of living is better in the country under democratic rule is difficult to judge, and is the focus of this thesis.

1.0.4 Objectives of the thesis

The objectives of the thesis are:

- To analyze the effects of transition from military dictatorships to democratically elected governments in Nigeria on the allocation of public expenditure on health, education, water and social services[2].
- To use anthropometric measures to evaluate how sources of drinking water and access to sanitation affect children's health outcomes in Nigeria.
- To analyse health inequality under military rule in Nigeria and during political transition in the country.

[1] See Edemodu A (2002); Ivbaze Osazua (2006); Moghalu G (2003); Nwokocha John (2004);Onwuka K (2005) and Offiong and Igbafe (2007) for detailed accounts of political assassination in Nigeria.

[2] Public expenditure on education, water and social services are jointly analyzed and refers to as welfare related public expenditure in chapter 2 due to the limitation of lack of a reliable disaggregated data on education and water

1.0.5 Research Questions of the thesis

The following are the research questions of the thesis:

- Does transition from military rule to democratic rule necessarily increase public expenditure on health, education, water and social services in Nigeria?
- Did household access to safe drinking water improve in the first ten years of democratic rule in Nigeria?
- What is the impact of the varying quality of public goods provision, specifically varying sources of drinking water, on children's health in Nigeria?
- Has health inequality been reduced subsequent to transition from military rule to democratic rule in Nigeria?

1.0.6 Organization of the thesis

In this chapter, the main topics covered in this thesis have been outlined. These include the introduction, objectives, hypothesis and the research questions of the thesis. The research issues shall be divided into three main essays with each of them constituting a separate chapter.

In chapter 2, the thesis examines the effect of electoral competition at the national level on the allocation of public expenditure on health, education, water and social services in Nigeria. It further considers whether access to safe drinking water increased at the state level in the country between 1999 and 2008.

Chapter 3 focuses on the implications of drinking of water from different sources and different sanitation options on the growth of children at the households level in Nigeria. The chapter specifically shows that drinking of well water retards growth of the children in the country. Therefore, it shows why provision of piped water

and hygienic sanitation at the households level by the government should be given priority.

Chapter 4 explores the direction of change in health inequality subsequent to transition to democratic rule in 1999 at the households level. It uses concentration indices and Blinder-Oaxaca decomposition to show that health inequality rose, to the disadvantage of children in poor households, subsequent to transition to democratic rule in the country.

The thesis clearly distinguishes between health outcomes and health inputs in chapter 3 and 4. The analysis reveals the implication of households' access to safe drinking water and sanitation on children's health outcomes. It specifically shows that households' access to piped and borehole water are both positively related to children's height for-age Z-scores. Importantly, we find that access to borehole water is significant and negatively related to children's weight z-scores and the probability of children being underweight.

In line with our findings, access to proper human waste disposal systems, especially flush toilets, is crucial for the healthy growth of children in the country. Children in households with access to flush toilets are less prone to chronic malnutrition (inadequate growth). Our study also shows that access to flush toilets reduces the probability of a child becoming stunted. Where provision of flush toilets is not immediately feasible, it is necessary to provide, for the short term, pit latrines for households in the country. Government should also propose a policy that will make construction of toilet facilities in new buildings mandatory in the country. Our study shows that drinking well water is harmful to the growth and health of children in Nigeria and has increased the number of children being stunted and underweight. This is a strong signal to the various tiers of government

to expedite efforts to provide safe drinking water to every household in the country. Women's education is another area that clearly should be promoted and encouraged by the government because of the positive impact of mothers' education on the health outcomes of children.

Lastly, chapter 5, which is the final chapter, draws conclusions from our findings, presents policy implications and recommends areas of future research arising from the thesis findings.

Chapter 2

Democracy and provision of public goods in Nigeria: A Bounds Testing and Panel Approach

Abstract

In this paper we examine the effects of transition from military rule to democratic rule on health, education, water and public expenditure on social services at the national level (public expenditure on water, education and social services are jointly referred to as welfare related public expenditure in this study) and access to safe drinking water at the state levels in Nigeria. We use a bound testing approach to cointegration to establish a long run relationship between political power competition and public expenditure on health on one hand and on welfare

related public expenditure on the other hand in the country. Our results show that political power competitions have a positive and significant relationship to health expenditure as a percentage of total expenditure between 1960 and 2007. Our results also indicate that per capita health expenditure was significantly higher under democratic rule in the country compared to the period under military rule. However, there was no significant relationship between political power competition and public expenditure on infrastructure (Capital expenditure), from our findings. This result confirmed previous studies conclusions that politicians prefer to invest in relatively visible and targeted public goods with the purpose of boosting their re-election chances rather than relatively non-targeted and long term capital goods (Vergne, 2009)[1]

For the panel analysis, we use the GMM estimator, as modified by Arrellano and Bover (1995) and Blundell and Bond (1998), to establish the relationship between electoral competitions and provision of safe drinking water across states in the country. Our results show that democracy at the sub-national levels has not improved provision of safe drinking water in the country, despite an increase in government expenditure subsequent to democratic transition in 1999. This, we argue, is due to the problem of political capture by special interest groups at the sub-national level, due to the lack of a credible electoral system in the country. We therefore conclude that an increase in government expenditure subsequent to transition of political power from military rule to democratic rule may not translate to an increase in access to basic services in the presence of interest groups capture and weak electoral competition.

[1]Vergne, (2009) discussed in details, various theories on targeted investment expenditure and manipulation of current expenditure by political office holders with the sole objective of wining the support of swing voters during election periods.

"In a democracy the poor will have more power than the rich, because there are more of them, and the will of the majority is supreme"- **Aristotle**

"People must organize for collective action to influence the circumstances and decisions affecting their lives. To advance their interests, their voices must be heard in the corridors of power ... Ending human poverty requires a democratic space in which people can articulate demands, act collectively and fight for a more equitable distribution of power ... Government that acts in the interest of poor people is easier to achieve in democratic political systems where the poor represent a significant electoral bloc". **(UNDP, 1997, pp. 94, 103, 105)**

2.0.7 Introduction

The effect of democracy (represented by electoral competition in this chapter) on the provision of pro-poor basic services is still an open question, especially in young democracies. There is no agreement yet on whether transitions from dictatorial regimes to democratic regimes actually improve the welfare of citizens, especially in Nigeria. Some scholars have attempted to address this issue at cross-national level, in developed countries in particular(Ross, 2006;Keefer, 2004; Avelino, Brown, and Hunter, 2005; Brown and Hunter, 2004; McGuire, 2006). Most of these studies focus on the effects of democracy on allocations of public expenditure to pro-poor public goods. The general belief is that when budgetary allocation to public utilities such as drinking water, sanitation and electricity increases, access to these basic services will also increase (Keefer, 2004; Avelino, Brown, and Hunter, 2005;

Brown and Hunter, 2004; McGuire, 2006).

The above thinking (assumption) may be appropriate in a transparent society with credible electoral systems. However, in a society where a credible electoral system is lacking, coupled with rent seeking, the connection between democratic rule and an increase in public expenditure and access to public goods becomes less apparent. Therefore, transition from a less inclusive military government to a more inclusive democratic government may not necessarily improve provision of public goods (Keefer, 2004; Ross, 2006; Habyarimana, et al.. 2007). It is imperative to understand the effects of political power competition on the provision of public goods, especially at the national and sub-national levels. Theory suggests that national and sub-national governments in developing countries are prone to the problem of rent seeking and interest-groups capture (political capture), especially when elections are not credible. Recent empirical studies also suggest that young democracies characterized by weak electoral competition and social polarization are prone to reduction in the provision of basic public goods (Keefer, 2004; Ross, 2006; Habyarimana, et al.. 2007)[2].

Therefore, we examine the effect of democratic rule in Nigeria on the allocation of public expenditure to public goods specifically health and welfare related public services (combination of public expenditure on education, water and social services) at the national level and access to safe drinking water (pipe and bore-hole water) at the states level in the country. We depart from previous studies by combining time series analysis of public goods provision with an examination of households' access to drinking water as our measure of provision of public goods,

[2]See Bardhan and Mookherjee (2000) for a detailed theoretical analysis of the effects of interest-groups capture at national and sub-national levels on the provision of public goods.

instead of just cross-national analysis which may not be able to account for heterogeneity in the practice of democracies across countries.

The novelty of this paper lies in three contributions: In the first place, the Bound Testing Approach we used is an improvement over other methods previously discussed in the literature to establish a long run relationship between electoral competition and allocation of public goods. Secondly, as far as we know, this is the first attempt to use actual household access to public goods as a measure of provision of public goods in studying the relationship between electoral competition and public goods provision at sub-national levels in Nigeria. We chose this method to overcome the problem of leakages between allocation of public funds and actual delivery of basic services, created by rent seeking at sub-national levels in most of the states in the country.[3] . This study is an answer to the recent call by the World Bank to depart from the use of public expenditure as measure of service delivery to citizens (World Bank, 2008).

Lastly, this is the first case study, as far as we know that compares service delivery under military rule with delivery under democratic rule in sub-Saharan Africa in general and particularly in Nigeria. Filling this gap is important considering the common occurrence of military interventions in politics in the country due to the perceived failure of the democratic governments to meet the aspirations of the poor majority.We therefore focus on health related public service due to the general adage that "health is wealth". Healthier citizens are likely going to be more productive and contribute positively to economic development of the

[3]For instance, in one of the states in Nigeria, a former Local Government Chairman and the Treasurer converted the sum of N6 million into their personal pockets out of the N7 million mobilisation fees for the construction of a borehole. The contractor was only paid N1 million to execute the project (ICPC, 2009)

country, all things being equal (Strauss and Thomas, 1998; Schultz, 1999). Illness reduces physical, mental and income ability of the populace and their economic usefulness.

2.0.8 Nigerian political structure

Nigeria occupies an important place as the most populous young democratic country in Sub-Saharan Africa. It is also the second-largest economy on the continent, after South Africa. Most of the problems common to developing countries experimenting with democracies are not strange to this country. Nigeria gained independence from British rule in 1960. The first democratic regime in the country lasted for only five years before it was truncated by the military in 1965. The country did not experience democratic rule again until 1979, when another general election was conducted. Once again, the military terminated the democratic government after four years, in 1983, and remained in power until 1999. Since 1999, four general elections have been conducted for the first time at both the state and the federal level. One major reason for military intervention in politics is the perceived failure of the democratically elected leaders to provide basic services for its citizens.

Nigeria's political structure consists of a federal government, 37 states, including the federal capital territory, and 774 local governments. The states are constitutionally independent of the federal government, politically, administratively and financially. These states were previously governed by military governors appointed by the military heads of state without the input of the electorate. Since 1999, governors have been elected directly by the voters for a term of four years. Each state also has a unicameral legislature elected directly by the electorate for a

term of four years. The president, governors and members of the legislative house can all seek re-election after their first term in office (Constitution of the Federal Republic of Nigeria: 1999).

Literature Review

Allocation of public expenditure to public goods and access to basic services such as health care, clean drinking water and electricity affects citizens' health, poverty reduction, growth, and environmental protection. Provision of these basic services is beyond the ability of the poor due to the relatively high cost and their non-excludability in consumption. However, these basic services are not readily available in developing countries, partly due to bad governance. Democracy is therefore in theory a remedy for the problem of bad governance, since elected leaders under democratic rule should be more responsible and accountable to their electorates than non-elected leaders under military rule. Autocratic governments typically under-provide public goods, since they are neither accountable to the electorates nor subject to electoral competition. Some critics argue that autocratic governments are mainly engrossed in rent seeking and provision of targeted public goods needed by special interest groups in order to remain in power (Meltzer and Richard, 1981; Holbrook and Dunk, 1993; McGuire and Olson, 1996).

Less competitive governments such as those under military rule or one- party governments share similarities with monopoly market situations. The welfare of consumers is severely undermined by excessive prices and the rent extraction practices of monopolists, and the welfare of citizens is less a concern for non-elected governments. Democratic rule, on the other hand encourages political competition through elections and party politics (Key, 1949: 307; Gilligan and Matsusaka,

1995: 393; Ashworth, Geys, Heyndels and Wille, 2006).

In addition, the pro-democratic literature further argues that electoral competition affords the electorate the means of holding politicians accountable for their actions. Therefore, the intensity of political competition among politicians and political parties affects the decisions of the incumbent politicians (and parties) with regard to the provision of public goods. The presence of stringent political competition provides a credible threat of removal from office to the incumbent (Zeckhauser et al, 2002; Acemoglu and Robinson, 2005; Boix, 2003; Bueno de Mesquita et al., 2003; Ghorbarah, Huth, and Russet 2004; Deacon, 2003; Meltzer and Richard, 1981; McGuire and Olso, 1996; Shen, 2007). The number of countries undertaking competitive elections increased from 60 to 100 between 1990 and 2000 (Keefer and Khemani, 2004; Acemoglu and Robinson, 2005; Boix, 2003; Bueno de Mesquita et al, 2003; Ghorbarah, Huth, and Russet 2004; Deacon, 2003; Meltzer and Richard, 1981; McGuire and Olso, 1996; Shen, 2007)). Evidence from some studies also confirms an increase in public expenditure with shifts from autocratic regimes to democratic rule (Avelino, Brown, and Hunter 2005; Brown, and Hunter, 2004; Kaufman and Segura-Ubiergo, 2001; McGuire, 2006).

Some scholars have, however, raised doubts over whether there is a positive relationship between electoral competition and provision of public goods in both developing countries and young democracies, since these countries are characterized by non-credible electoral systems, ethnic polarization, low literacy rates, corruption, limited rule of law and special interest politics. The argument is that politicians in young democracies are less credible, under-provide public goods and engage in excessive rent seeking (Keefer and Khemani, 2004; Keefer, 2005 and 2007; Cleary, 2007; Bardhan and Mookherjee, 2000). The implication of these

studies is that the effects of democracy on the provision of pro-poor public goods cannot be generalized because of variations in its practices.

2.0.9 Empirical Model Specification and methods of analysis

We use time series analysis to estimate the relationship between political power competitiveness and public expenditure at the national level and we make use of state panel data to estimate how electoral competition in the 37 states in Nigeria affects the provision of drinking water in these states. Our analysis of access to drinking water at the state level is appropriate due to the fact that provision of drinking water is one of the major responsibility of the state governments in Nigeria.

Time series model and method

Based on the theory above on the provision of public goods and the standard model of public expenditure, we propose the following time series relationship:

$$Exp = f(polity2, rpop, Linaid, Linpgdp, Under14) \qquad (5)$$

Where, Exp is the proportion of different public expenditure of interest as a percentage of total public expenditure or GDP. $polity2$ is our measure of political power competitiveness. $polity2$[4] was developed by the Polity 1V project for 164 countries as a measure of political power competitiveness of each country between 1800 and 2010. The datasets include eight factors ranging from the degree of

[4]Polity2 has been used by many authors in the past as an objective measure of political power competitiveness.Some of the authors that used polity2 are Jaggers et al (1996); Gurr (1989); Gurr et al (1990); Reiter et al (1998); Ward et al (1998) and Lake et al (2001).

political power competitiveness to the degree of constraint on the chief executive. These factors are used to derive two weighted summary indicators of autocracy and democracy. The two indicators are then combined to form a single measure ($polity2$) of political power competitiveness. In the case of Nigeria, political power competitiveness runs from a maximum of 8 to a minimum of -7. $rpop$ is our control for the rural population density to account for the possible bias in rural-urban provision of public goods. $Linaid$, is the log of foreign aid which is expected to have a positive effects on public expenditure. $Linpgdp$,is the log of per capita GDP to account for the effects of the country's economic development on the provision of public goods. $Under14$ is the ratio of total population under the age of 14years. This is the dependency ratio of the population and it is expected to have a negative effect on the availability of funds for public expenditure.

Linear representation of the model takes the following form:

$$Exp = a_0 + a_1 polity2 + a_2 rpop + a_3 Linaid + a_4 Linpgdp + a_5 Under14 \qquad (6)$$

The method used for the analysis of equation (6) is the Auto-Regressive Distributed Lag (ARDL) bounds testing approach developed by Pesaran, et al, (2001). This method has the following advantages over other methods, including Johansen's cointegration technique: In the first place, it yields consistent estimates of the long run coefficients irrespective of whether the regressors of our equation are integrated of order zero I(0), order one I(1), or a mixture of both. Secondly, the ARDL model is suitable for limited sample data of between 30 and 80 observations, as in our case (Narayan, 2004). In addition, it provides a remedy for the problem of endogeneity bias by the inclusion of the variables' dynamics among the regressors, as shown by Harris (2003). The first step in the Bounds testing approach to cointegration is to establish whether a long run relationship exist by

modeling equation (6) as a conditional ARDL error correction model, as given below.

$$\Delta Exp_t = a_0 + \sum \theta_j \Delta polity2_{t-j} + \sum \lambda_j \Delta rpop_{t-j} + \sum \phi_j \Delta Linaid_{t-j} + \sum \psi_j \Delta Linpgdp_{t-j} + \sum \delta_j \Delta Under14_{t-j} + a_1 polity2_{t-1} + a_2 rpop_{t-1} + a_3 Linaid_{t-1} + a_4 Linpgdp_{t-1} + a_5 Under14_{t-1} + a_6 Exp_{t-1} + \epsilon_t \qquad (7)$$

where a_0 is a drift component, Δ is change, while ϵ_t represents a well behaved error term. Other variables are as defined in equation (5). We used the ordinary least square (OLS) method to estimate equation (7). The second step is the use of a F-test of the estimated equation (7) for testing the null hypothesis of no contegration; $H_0 : a_1 = a_2 = a_3 = a_4 = a_5 = a_6 = 0$ against the alternative hypothesis of cointegration; H_1:$\neq a_1 \neq a_2 \neq a_3 \neq a_4 \neq a_5 \neq a_6 \neq 0$. There are two asymptotic critical values generally referred to as lower and upper bounds. While the lower bound assumes that all the regressors are I(0), the upper bound assumes they are I(1). If the computed F-statistics lies below the lower bound, it indicates no cointegration, meaning we must accept the null hypothesis. If the computed F-statistics lies above the upper level of the bound, then we reject the null hypothesis of no cointergration but accept the alternative hypothesis of cointegration. Our inference will be inconclusive if the computed F-statistics lies between the lower and upper bounds.

The next step in our analysis is to derive the long run and short run estimates of our model using either Schartz Bayesian or Akaike information criteria based on the establishment of a long run relationship as explained above.

Panel model and method

For our states panel analysis, we propose the relationship between provision of safe drinking water and democracy to be:

$$W_{i,t} = a + \beta_1 Ex_{i,t} + \beta_2 Lg_{i,t} + \beta_3 Control_{i,t} + U_i + \epsilon_{i,t} \qquad (8)$$

where $W_{i,t}$ is the provision of safe drinking water in state i at time t, $Ex_{i,t}$ represents executive competitions in state i at time t, $Lg_{i,t}$ is the legislative competition in state i at time t, while $Control_{i,t}$ are the control variables (average rain fall, per capita gdp, population density, rural proportion of the state population and opposition (which is a dummy indicating that the party ruling in the state is different from the party ruling at the national level)) in state i at time t, U_i are unobserved state specific effects, while $\epsilon_{i,t}$ is a random disturbance in state i at time t. A dynamic representation of equation (8) is more appropriate considering the fact that provision of safe drinking water in time t will be affected by access to water in time t_{-1}.Therefore, the dynamic specification of the model is given as

$$W_{i,t} = W_{i,t-1} + \beta_1 Ex_{i,t} + \beta_2 Lg_{i,t} + \beta_3 Control_{i,t} + U_i + \epsilon_{i,t} \qquad (9)$$

Here the OLS method will not be appropriate to estimate the above model due to the correlation of $W_{i,t-1}$ with U_i which will lead to the OLS estimator of the above model being biased and inconsistent. Random effects regression is also not appropriate due to a state's specific unobservable characteristics which may be correlated with the error terms. The next alternative is to consider fixed effects regression, which enables us to control for omitted time-invariant state characteristics. However, since our model includes a lagged dependent variable, the use of fixed effects estimators introduces a potential bias. In addition, the lagged dependent variable is correlated with the error term. The Generalized-

Method-of Moment (GMM) estimator developed by Arellano and Bond's (1991) as modified by Arrellano and Bover (1995) and Blundell and Bond (1998), and as used by Vergne (2009) is the main solution to the issue of bias and inconsistency in connection with our model. We therefore used a systematic GMM method which enables us to control for unobservable state-specific-effects and the possible endogeneity of the explanatory variables. We in addition used the two step GMM estimator which is asymptotically more efficient than the one step GMM.

2.0.10 Measurements of other variables and sources of data

We source data for our time series analysis from the World Development Indicators and the Statistical Bulletin of the Central Bank of Nigeria. In our panel analysis, we are interested in the provision of basic services that promote sustainable development of natural resources, but also provide the opportunity for sustainable livelihoods through provision of clean drinking water within households. Lack of this basic service will affect the environment negatively, make life more difficult for the poor, and pose a danger to citizens' health in general. We measure the state's mean access to safe drinking water (piped water within and outside the dwelling as well as borehole water), as our proxy for the provision of public goods. We source this variable from the National Bureau of Statistics Core Welfare Indicators (CWI) survey of 2006 (NBS, 2008) and the National Demographic and Health Survey (DHS) datasets on Nigeria for 1990, 1999, 2003 and 2008. Therefore, the values of variables used for our state panel analysis represent various states n-years averages.

We approach the problem of representing military and democratic rule for our

panel analysis at the sub-national levels by using one of the most objective measures available. This method takes into cognizance the degree of electoral competition at the state level. We calculate the data by using the standard indices from the Database of Political Institutions (DPI) as proposed by Beck, Carke, Groff, Keefer and Walsh (2001) in their paper, "New tools and new tests in comparative political economy".

Table 2.1: Measurement of Executive competitions

EXECUTIVE CRITERIA	SCORE
No executive in the state	1
Unelected executive	2
Elected but one candidate or one party	3
Multiple parties but winner got over 75% votes	4
Multiple parties but winner got between 65.1-75% votes	5
Multiple parties but 1 party got between 55.1-65% votes	6
Multiple parties but winner got less than 55% votes	7
LEGISLATIVE CRITERIA	SCORE
No legislature in the state	1
Unelected legislature	2
Elected but one candidate	3
1 Party, multiple candidates	4
Multiple parties but only one party won seats	5
Multiple parties won seats but 1 party got more than 75% of seats	6
Largest party got less than 75%	7

The indices range from a minimum of 1 for the most autocratic system to a maximum scale of 7 for the most inclusive competitive political system with many parties, where the largest party receives less than 75 percent of the seats. We collect election results from the National Bureau of Statistics in Nigeria and the Independent National Electoral Commission in Nigeria. The results include aggregate votes in favour of all the political parties that participated in the gen-

eral elections in each state. Since public goods provision may not immediately be affected by inclusiveness, that is, within the election year, we measure electoral competition based on the political regimes in the year preceding the year of observation.

The summary of the indices of electoral competitiveness, according to the scale created by Ferree and Singh (1999), as modified by Keefer (2009) are as presented in Table 2.1 for legislative and executive competition respectively.

Stylized Facts By Political Regime in Nigeria

The traditional role of the military in Nigeria is to protect the country teritory against internal and external aggression capable of undermining continual existence of the country. The main distinction between military and democratic rule in Nigeria are summarized below. In the first place, while democratic leaders are elected by the electorates for a fixed term of four years, successive military governments in the country have assumed power via coups without the input of the general public. Secondly, while democratic governments rule according to the provision of the constitution, the military government always suspend the provisions of the country's constitution, including fundamental human rights. In addition, democratic governments in the country operate by the principle of separation of power between the executives, legislature and the judiciary while the military head of states have combined the duties of both the executive and the legislature under successive military rule in the country. At the state level, the executive governors are directly elected under democratic rule but under military rule, military governors are single handedly appointed by the military head of states without the input of the electorates.

2.0.11 Preliminary analysis

Summary statistics of our time series variables are presented in table 2.1. We however focus our discussion of the descriptive analysis on the mean public expenditure on health and mean public expenditure on education as percentage of total expenditure as seen in figure 2.1 and in table 2.2.

In Figure 2.1, we illustrate the relationship between democracy in Nigeria and mean public health expenditure as a percentage of total expenditure between 1960 and 2008. The graph shows that mean public expenditure on health was generally higher in the country under democratic rule than under military rule. While mean health expenditure was 1.9 billions under democratic rule, it was only 0.9 billion naira under military rule. In addition, while mean public expenditure on education as a percentage of total public expenditure was 4.2 billions naira under democratic rule, it was about 2.6 billions naira under the military rule in the country. It is clearly evidence that democratic regimes on average spend more on health and education in the country.

The illustration of the relationship between democracy and mean public expenditure on education and health as percent of total expenditure in Figure 2.1 was further tested in table 2.3 using two sample t test to determine whether mean public expenditure on health and education as percentage of total public expenditure under the two regimes are statistically significantly different from zero. Our results show that public expenditure on public health as percentage of total expenditure was significantly lower under military rule compare to under democratic rule in the country (-4.2771; $p = -0.0001$). the alternative hyphothesis Ha, shows that the means are statistically different from each other at any level greater than

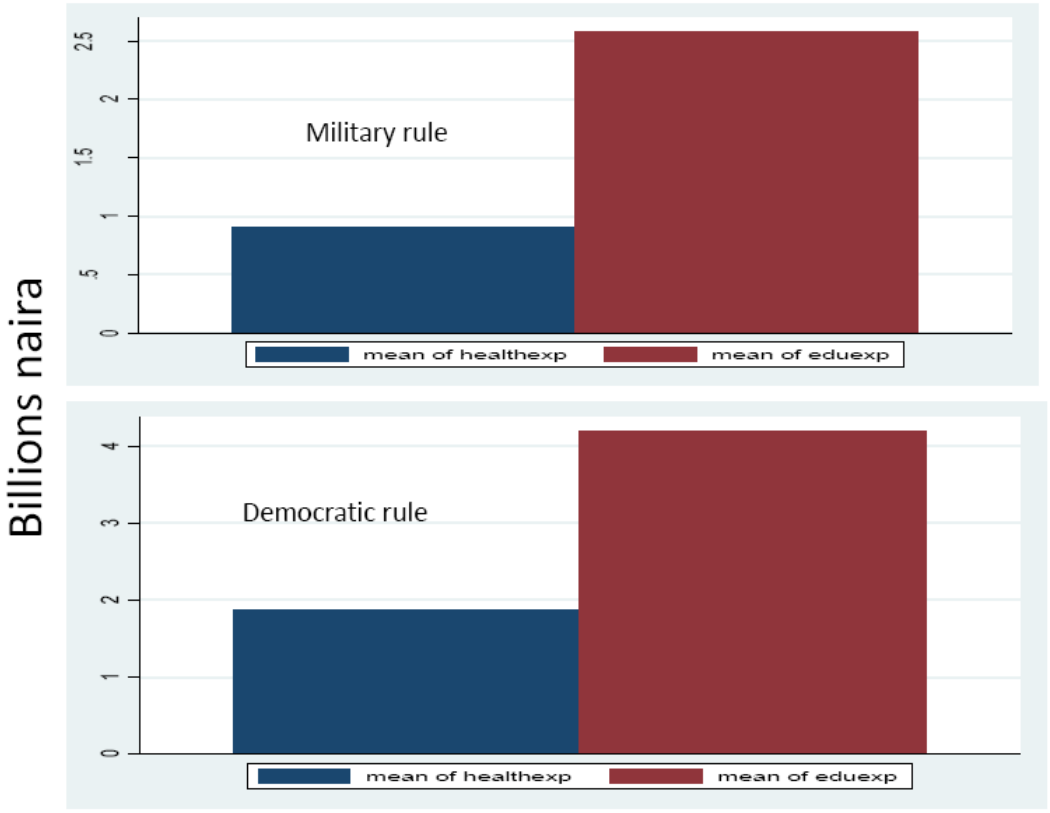


Figure 2.1: Mean public expenditure on health and education as a percentage of total public expenditure under military and under democratic rule in Nigeria

Table 2.2: Summary statistics of variables used for the analysis

Variables	*observations*	*mean*	*std.Dev*	min	max
healthexp	49	1.3018	0.9081	0.09344	3.9897
healthgdp	49	0.0002	0.00001	0	0.00013
under14	49	44.166	1.025	42.5733	45.8741
rgdp	50	204888	205670	2489	716949
aidk	49	7.4141	14.2690	0.9584	89.5142
healthk	49	0.0001	0.0002	6.06e-9	0.0006
pgdp	49	360.805	58.114	236.39	487.26
polity2	49	-1.1224	6.1054	-7	8
aid	49	7.74e+08	2.07e+09	6.93e+07	1.29e+10
rpopdensity	47	189.525	33.659	136.30	243.70
socioecons	49	56688	115328	5.70436	485000
socgdp	48	0.00008	0.00012	4.47e-08	0.00065
lpgdp	49	5.8753	0.1649	5.4655	6.1888
capgdp	49	156000	288901	63.874	1325019
eduexp	49	3.2394	1.9190	0.3139	8.2670

0.01%. In the case of mean public expenditure on education as percentage of total public expenditure, the t statistics indicates that the two means are statistically significantly different from each other (t= -3.1553; $p = -0.0028$).

These findings confirm our earlier assumption that public expenditure would be higher under democratic rule than under military rule, irrespective of the problem of electoral malpractice and interest groups capture.

2.0.12 Empirical Results and Analysis of the Bounds Testing Approach

The ARDL method does not require testing for the order of integration of each variable, but we conducted the test to be sure that our variables are not integrated of higher order than I(1) which is a necessary condition for using the method to estimate our models.

Table 2.3: Two-sample t test of mean public health and mean public education expenditure in Nigeria

Public Health expenditure					Public Education expenditure				
Group	*obs*	mean	std.Err	std. Dev.	Group	*obs*	mean	std.Err	std. Dev.
Military	29	0.9067	0.0855	0.4602	Military	29	2.580	0.3104	1.6713
Democracy	20	1.8746	0.2437	1.0897	Democracy	20	4.1956	0.4219	1.887
Combined	49	1.3018	0.1297	0.9081	Combined	49	3.2394	0.2741	1.919
*diff= (M)- (D)		-0.9679	0.2263		*diff= (M)- (D)		-1.6156	0.5120	
t=-4.2771					t=-3.1553				
Ho:diff=0					Ho:diff=0				
Ha: diff!=0 Pr(|T| > | t |) = 0.0001					Ha: diff!=0 Pr(|T| > | t |) = 0.0028				

*where M and D represents mean of public expenditure
under military and under democratic rule respectively

Table 2.4: Augmented Dickey-Fuller (ADF) and Dickey-Fuller GLS (DFGLS) Unit Root Tests

	levels		*first difference*		*Decision*	
Variables	*ADF*	*DFGLS*	*ADF*	*DFGLS*	*ADF*	*DFGLS*
healthexp	-1.358	-1.848	-5.891	-5.474	$I(1)$	$I(1)$
healthgdp	-0.890	-1.496	-5.648	-4.314	$I(1)$	$I(1)$
under14	-4.167	-5.533			$I(0)$	$I(0)$
rgdp	2.110	-0.572	-4.040	-4.500	$I(1)$	$I(1)$
aidk	-4.253	-4.027			$I(0)$	$I(0)$
healthk	3.437	0.007	-4.891	-5.199	$I(1)$	$I(1)$
pgdp	-1.645	-1.363	-4.365	-4.432	$I(1)$	$I(1)$
polity2	-2.618*	-2.162		-3.968	$I(0)$	$I(1)$
aid	-4.112	-4.140			$I(0)$	$I(0)$
rpopdensity	-1.575	-0.934	-4.309	-4.295	$I(1)$	$I(1)$
socioecons	3.710	-0.430	-3.260	-3.939	$I(1)$	$I(1)$
socgdp	3.193	0.138	-3.367	-2.876	$I(1)$	$I(1)$
lpgdp	-2.149	-1.513	-4.760	-4.840	$I(1)$	$I(1)$
capgdp	0.500	-1.271	-9.126	-4.129	$I(1)$	$I(1)$
eduexp	-3.594	-3.770			$I(0)$	$I(0)$

Note: $I(0)$ and $I(1)$ indicate that variables are integrated (stationary) of order zero and one respectively

Table 2.4 presents our results which show that all the variables are integrated of either order one I(1) or other zero I(0). It is then certain that the ARDL method is appropriate for our analysis. We therefore used the method to test for the existence of a long run relationship in each of the following models:

(i) $\%\frac{health\ \exp}{total\ \exp} = f(polity2, rpop, \ln aid, \ln pgdp, Under14)$

(ii) $per\ capita\ health\ \exp = f(polity2, rpop, \ln aid, \ln pgdp, Under14$

(iii) $\%\frac{welfare\ \exp}{gdp} = f((polity2, rpop, \ln aid, \ln gdp, Under14)$

(iv) $per\ capita\ health\ \exp = f(polity2, rpop, aidk, pgdp, Under14)$

(v) $WT\ \exp = f(polity2, rpop, \ln aid, \ln pgdp, Under14)$

(vi) $\%\frac{capital\ \exp}{gdp} = f(polity2, rpop, \ln aid, \ln pgdp, Under14)$

We present in Table 2.5 the results of our Bounds tests for the existence of a long run relationship for six different equations of public expenditure and political competition. The F-statistics used for this were developed by Pesaran, et al. (2001). The critical values are:10% Critical values:Lower- I(0) 2.26;Upper -I(1) 3.35; 5% Critical values:Lower-I(0),2.62; Upper -I(1) 3.79,1% Critical values:Lower-I(0) 3.41; Upper I(1) 4.68;Since all the models except (v) are cointegrated we can proceed in our analysis of the long and short run estimates of each of the cointegrated models below.

Table 2.6 presents the long run relationship between political competitions and public expenditure using our public goods of interest. The table shows in column (ii) that political power competition, measured by polity2, was positive (0.0338) and statistically significant at 5 per cent level. Electoral competition from the result is associated with increase in health expenditure by about 0.03% of total public expenditure. This result confirms political economists' predictions regarding the positive relationship between transition to democratic rule and public

Table 2.5: Bounds Tests for the existence of Cointegration

(i) $Models$	(ii) $F-statistics$	(iii) $probability$
(i)	3.49*	0.0026
(ii)	3.94**	0.0011
(iii)	3.43*	0.0029
(iv)	5.08***	0.0001
(v)	2.77	0.0115
$(vi))$	3.87**	0.0003

while *** p<0.01,** p<0.05, * p<0.1,indicates . cointegration at 1%, 5% and 10% respectively

expenditure on health as a percent of total public expenditure. Rural population density and the log of foreign aid are both positive and statistically significant at 1 per cent level. From our result, an increase in rural population will lead to about 0.01% increase in health expenditure as percentage of total expenditure. On the other hand, increase in foreign aid is associated with an increase of 0.28% in health expenditure as percentage of total expenditure. The proportion of the country population under the age of 14 is negative and significantly related to the three measures of public expenditure. Public expenditure on health as percentage of total expenditure will be lower by about 0.28% with an increase in the proportion of the population belowf 14 years old.

However, per capita GDP, which is a measure of the country's economic development, does not seem to have a statistically significant effect on public expenditure on health. Our result concerning welfare expenditure as a percentage of GDP is consistent with the theories of political economists. Political power competition, population density and the log of foreign aid show a positive and significant relationship at 1 percent level. However, the effect of these variables on welfare expenditure as a percentage of GDP are less than 0.01%. An examination of capital

Table 2.6: Long run relationship between public goods and political competitions in Nigeria

Measures of public goods	*Health expenditure % Total expenditure*	*Welfare expenditure % GDP*	*Capital Expenditure % GDP*
(i)	(ii)	(iii)	(iv)
polity2$_{t-1}$	0.0338**	3.85e-06***	7.58e-07
	(0.0147)	(1.14e-06)	(3.04e-06)
rpopdensity	0.0145***	2.72e-06***	9.24e-06***
	(0.00305)	(2.37e-07)	(6.31e-07)
Linaid	0.281***	2.94e-05***	2.94e-05
	(0.102)	(7.95e-06)	(2.12e-05)
Linpgdp	0.0885	2.87e-05	-0.000141
	(0.597)	(4.64e-05)	(0.000124)
under14	-0.279**	-5.56e-05***	-0.000180***
	(0.122)	(9.51e-06)	(2.53e-05)
Constant	4.834	0.00127**	0.00669***
	(7.713)	(0.000600)	(0.00160)
Observations	45	45	45
R-squared	0.641	0.884	0.888

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

expenditure as a percentage of GDP confirms previous studies that politicians are more willing to spend on current expenditures than on capital, because the former are immediately available and are of more political value during pre-election periods (Rogoff, 1990 and Vergne, 2009).

The results of our Error Correction Models (ECM), as presented in Table 2.7, column (ii) - (iv) show that political competition has no significant effect on the three measures of public goods. However, the log of foreign aid is positively related to health and welfare expenditure at 10 percent level of significant. Our result shows that public expenditure on health as a percentage of total expenditure will rise by about 0.28% with an increase in foreign aid. This is partly due to conditions attached to such aid by international donors which are often aimed

at alleviating poverty. The most important component depicted in table 2.7 is the lagged ECM which was significant at 1 per cent and negative, as expected, and further confirms the existence of a long run relationship in our models. Column (ii) shows that about 70 per cent of deviation from the long run equilibrium path of health expenditure as a percentage of total expenditure is corrected within a year. Correction of any deviation from long run equilibrium path in welfare expenditure as a percentage of GDP, is, however, slower at about 31 percent a year while restoration to long run equilibrium path in capital expenditure as a per cent of GDP will be achieved in one year.

Table 2.8 presents another dimension of public expenditure on public goods, which is health expenditure as a percentage of GDP and per capita health expenditure. Once again, the Table shows that political competitions have a positive long run relationship to both health expenditure as a percentage of GDP and per capita health expenditure at 10 per cent level of significant. Rural population density and per capita foreign aid are both positive and significant at 1 per cent level. However, the effect of an increase in these variables are less than 1% increase in health expenditure as per cent of GDP. Per capita GDP have no statistical significance in relation to both measures of health expenditure. Similar to our results in Table 2.6, the dependency ratio (under14) was negative and significantly related to per capita health expenditure and total health expenditure as a percentage of GDP. As the dependency population ratio increases, public expenditure on health as a percentage of GDP declines.

Table 2.9 presents the ECM results of the two long run models shown in Table 2.8. Similar to our short run result shown in Table 2.7, rural population density was negative and significantly related to both measures of public expenditure at

Table 2.7: Error Correction Models of Public Goods and Political Competitions in Nigeria

Public goods measures	*Health expenditure % Total expenditure*	*Welfare expenditure % GDP*	*Capital Expenditure % GDP*
(i)	(ii)	(iii)	(iv)
dpolity2	0.00341	9.79e-07	6.97e-06
	(0.0197)	(1.00e-06)	(4.85e-06)
drpopdensity	-0.0240	-2.02e-06**	7.10e-06*
	(0.0172)	(8.72e-07)	(4.20e-06)
dLinaid	0.282*	1.37e-05*	2.76e-05
	(0.155)	(8.03e-06)	(3.81e-05)
dLinpgdp	1.723*	-4.43e-05	-0.000310
	(1.007)	(4.92e-05)	(0.000235)
dunder14	0.158	-3.56e-05	-0.000148
	(0.474)	(2.46e-05)	(0.000115)
ECM_{t-1}	-0.699***	-0.307***	-1.020***
	(0.141)	(0.0893)	(0.164)
Constant	0.0415	1.07e-05**	6.00e-06
	(0.0779)	(3.97e-06)	(1.90e-05)
Diagonistic tests			
X^2_{Auto}	0.6382	0.6310	0.5644
X^2_{DW}	1.899447	1.855292	2.018599
F-stat.	6.31	5.77	7.53
Observations	45	45	45
R-squared	0.472	0.477	0.543

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

5 percent level. While per capita foreign aid was positive and significantly related to health expenditure as a percentage of GDP, at 5 per cent level, it was positively and significantly related to per capita expenditure at 1 per cent level. As earlier noted, most of the foreign aid is targeted at welfare related public expenditure in developing countries, such as expenditure on health services. The sign of the ECM was negative as expected and the size of its coefficient suggests a higher speed of adjustment for health expenditure as a percentage of GDP from the short run deviation to the long run equilibrium expenditure compared to per capita

Table 2.8: Political competitions and public health expenditure in Nigeria

VARIABLES	*Health expenditure % GDP*	*Per capita health expenditure*
(i)	(ii)	(iii)
polity2_{t-1}	6.44e-07**	2.69e-06**
	(2.80e-07)	(1.09e-06)
rpopdensity	5.47e-07***	2.11e-06***
	(5.69e-08)	(2.22e-07)
aidk	6.17e-07***	3.13e-06***
	(1.22e-07)	(4.74e-07)
pgdp	1.45e-08	9.50e-08
	(3.47e-08)	(1.35e-07)
under14	-1.23e-05***	-4.60e-05***
	(2.11e-06)	(8.22e-06)
Constant	0.000443***	0.00163***
	(9.20e-05)	(0.000359)
Observations	45	45
R-squared	0.850	0.868

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

expenditure. That is, about 41 per cent deviation from the long run expenditure as a percentage of GDP is corrected each year, compared to about 27 percent for per capita health expenditure.

Table 2.9: Error correction estimates of political competition and public health expenditure in Nigeria

Variables	*Health expenditure* % *GDP*	*per capita Health expenditure*
dpolity2	4.82e-08	7.82e-07
	(3.07e-07)	(1.15e-06)
drpopdensity	-6.77e-07**	-2.53e-06**
	(2.69e-07)	(1.00e-06)
daidk	3.29e-07**	1.57e-06***
	(1.39e-07)	(5.22e-07)
dpgdp	-2.79e-08	-1.36e-07
	(4.61e-08)	(1.70e-07)
dunder14	-7.64e-06	-2.22e-05
	(7.47e-06)	(2.93e-05)
ECM_1	-0.414***	-0.268**
	(0.112)	(0.102)
Constant	2.70e-06**	1.07e-05**
	(1.23e-06)	(4.62e-06)
Diagonistics Tests		
X^2_{Auto}	0.1414	0.1000
X^2_{DW}	2.319719	2.348957
F-stat.	6.43	6.31
Observations	45	45
R-squared	0.485	0.499

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

2.1 Parameter Stability Test

The above long run and short run relationship can be tested further with the aid of cumulative sum (CUSUM), as proposed by Brown, et al. (1995) to determine possibility of a structural break in our models of electoral competitions and the various components of public expenditure. In other words, we are testing for the stability of the parameters of the established long run relationship between our dependent variables and their respective independent variables. The advantage of

the CUSUM method over others is that it is suitable for testing the stability of parameter even if the point of the structural break is unknown, unlike the Chow test. The method uses the cumulative sum of recursive residuals based on the first n observations which is then updated recursively and plotted against the break point. The null hypothesis H_0 for CUSUM test assumes that the parameters are stable while the alternative hypothesis H_1 assume instability of the parameter.

The decision rule is that, if the CUSUM plot falls within the 5 per cent critical bound, the null hypothesis is accepted, if it however falls outside the 5 per cent critical bound, then the null hypothesis of stability is rejected and we accept the alternative hypothesis of instability in the parameters. Figure2.2 presents the results of our analysis, with clear evidence of stability of the parameters in our models. The CUSUM plots of the entire model lie within the 5 per cent critical bound. Therefore, we accept the null hypothesis of stability but reject the alternative hypothesis of instability of the parameters in our models.

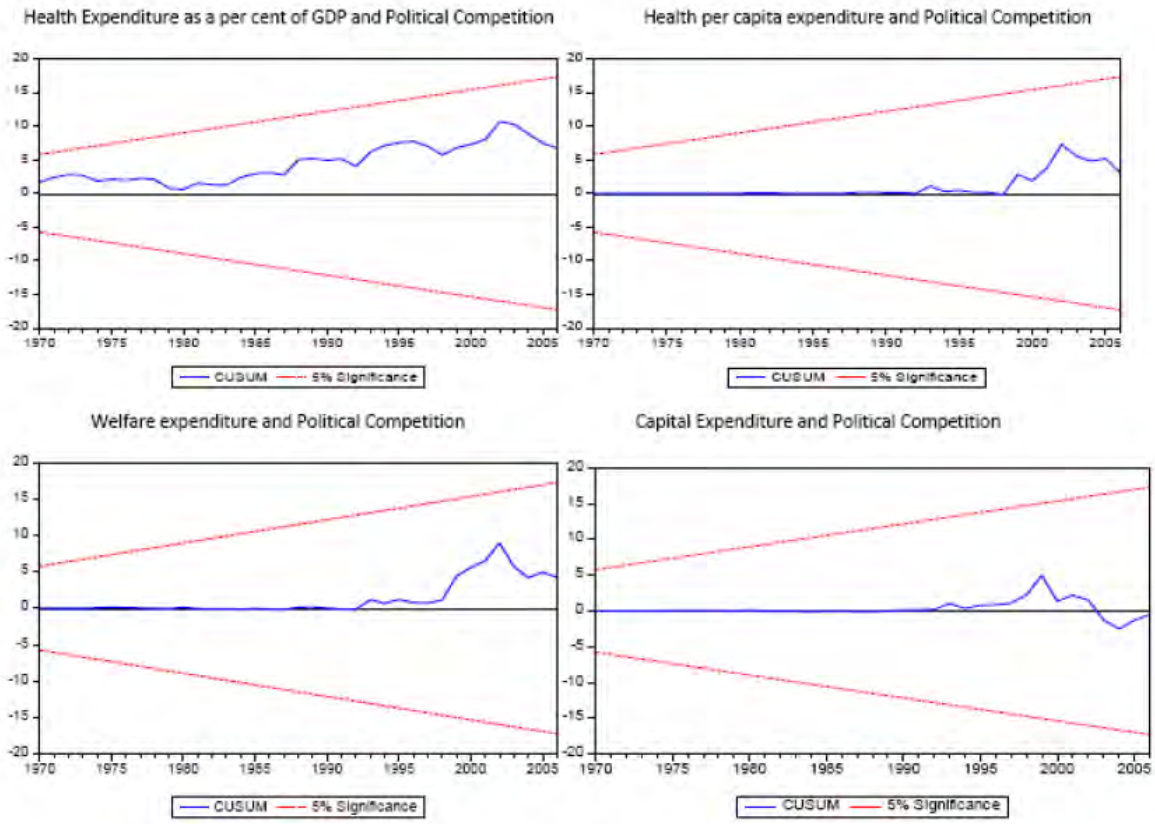


Figure 2.2: Parameters stability tests for models of public expenditures and political competitions

2.2 Sub-national electoral competitions and provision of public goods in Nigeria

In the remaining part of this paper we used panel data to examine the links between electoral competition at sub-national level in Nigeria and the provision of safe drinking water. It is the primary responsibility of the state governments in the country to provide safe drinking water to citizens. We present a graph of the 37 states' public expenditure trends between 1990 and 2010 in Figure2.3

The graph clearly shows evidence of a rapid increase in public expenditure immediately after the transition from military rule to democratic rule in 1999. Annual public expenditure (real) for the states was below N50, 000 billions in the 10 years under military rule but rose to a maximum of N400,000 billions in the first 10 years of democratic rule. However, whether the above increase in the states' real public expenditure translates to an increase in the provision of public goods, especially safe drinking water, is the focus of our next discussion. Figure2.4 is a pictorial illustration of women suffering due to lack of safe drinking water.

Drinking water can easily be provided within one to two years through massive public expenditure on Boreholes . On average, it takes less than a week to complete the drilling of a bore hole in Nigeria (Adekile & O. Olabode, 2009). If the elected leaders of the states are responsive to the need for basic services in the country, we expect access to safe drinking water to have improved in the country within the ten years under consideration.

From our results, shown in Table 2.10, lagged provision of water, as expected, was positively and significantly related to the provision of safe drinking water in the country. It contributed about 0.35% increase to access to drinking water. Sur-

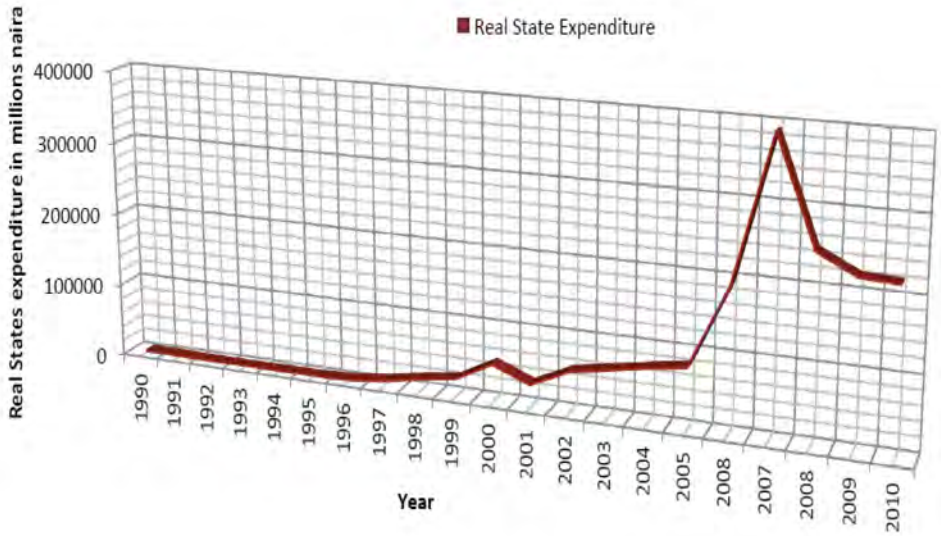


Figure 2.3: Real States Public Expenditure under military and democratic rule in Nigeria

prisingly, our measure of executive competition was not significantly related to access to safe drinking water. This result may be due to the high level of electoral malpractices during the governorship elections since the inception of the present democratic rule in the country. In addition, legislative competition have significant negative effect on the provision of safe drinking water in the country. Legislative competition reduced households access to drinking water in the country by about 3%. This suggests that weak electoral competition in the country due to the problem of special interest group capture has led elected leaders to concentrate on rent seeking rather than the provision of basic services such as safe drinking water. Our result is consistent with our earlier argument that a mere increase in public expenditure may not necessarily increase provision of public goods, particularly when elections are not credible and corruption is endemic. Legislative competition's

Figure 2.4: Women and Children Fetching Water In The Rural Area for Daily Use

Table 2.10: Political competitions and provision of drinking water in Nigeria

Variables	Access to piped and borehole Water			
(i)	(ii)	(iii)	(iv)	(v)
$water_{t-1}$	0.345*	0.324**	0.333*	0.324**
	(0.180)	(0.161)	(0.174)	(0.161)
executive competition	-0.606		-0.586	
	(1.078)		(1.087)	
legislative competition	-2.992**		-2.459*	
	(1.437)		(1.345)	
rural	-0.168	-0.141	-0.162	-0.141
	(0.158)	(0.166)	(0.156)	(0.166)
population	3.08e-06	3.31e-06	3.13e-06	3.31e-06
	(4.32e-06)	(4.26e-06)	(4.42e-06)	(4.26e-06)
pgdp	0.0347***	0.0412***	0.0376***	0.0412***
	(0.0132)	(0.0137)	(0.0143)	(0.0137)
opposition	3.098	2.905		
	(5.080)	(4.963)		
rain	0.0524**	0.0597**	0.0531**	0.0597**
	(0.0260)	(0.0259)	(0.0264)	(0.0259)
democracy dummy		-18.46***		-15.55***
		(5.134)		(3.728)
national party			-3.863	-2.905
			(5.004)	(4.963)
Observations	111	111	111	111
Number of id	37	37	37	37

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

negative effect on the provision of safe drinking water was significant at the 5 per cent level. Per capita GDP as expected was positively and significantly related to the provision of safe drinking water. An increase in the States per capita GDP is associated with about 0.04 increase in households access to drinking water. States with a higher GDP are more capable of providing safe drinking water to their citizens. Average rain fall in the state as expected was positive and significantly related to the provision of safe drinking water from our result. Average rain fall in

the States is associated with about 0.05 increase in households' access to drinking water. It is therefore necessary for the Federal Government to financially support states with lower average rain fall in order to improve provision of safe drinking water in such states. Our dummy for democracy has negative and significant relationship with households access to safe drinking water in the country. It clearly shows that provision of safe drinking water was worse-off in the first ten years of electoral competitions in the country, which was primarily due to the problem of political capture at the state levels. Transition from military to democratic rule was associated with about 18 per cent decrease in access to drinking water.

2.3 Conclusion and policy implication

In this paper, we considered a long run relationship between political power competition and public expenditure on public goods in Nigeria using the recently developed Bounds Testing Approach to cointegration. From our findings, we establish the existence of a long run positive and significant relationship between political power competition and health expenditure per capita, health expenditure as a percentage of total expenditure and welfare expenditure as a percentage of GDP. However, our results show that no significant positive relationship exists between political power competitions and capital expenditure in the country. This, we argue, may be due to the excessive targeted spending of democratic leaders in the country with the aim of satisfying the electorate and winning subsequent elections[5]. This result shows that public expenditure on public goods may still be high

[5]For instance, recurrent expenditure of the 2012 federal government budget was over 72 per cent of the total government estimated total public expenditure. In most cases, government often diverts capital funds into recurrent during implementations purposely to satisfy political

in developing countries despite the presence of non-credible electoral competitions and special interest groups capture.

In the State panel analysis, we considered the relationship between sub-national electoral competition in Nigeria and provision of safe drinking water to the citizens. Although real public expenditure rapidly rose between 1999 and 2008, our results clearly show that access to safe drinking water did not improve in the country subsequent to transition to democratic rule in 1999. The problem of political capture and diversion of public funds to private pockets is common at both the sub national level and the national level.

Policy implications of our results are that transition to democratic rule is not enough for improvement in the provision of public goods without credible electoral competitions. Therefore, political leaders, especially in Nigeria, should put emphasis on credible electoral competition rather than on a change in political power from military to civilian rule. In addition, political leaders should go beyond increasing public expenditure to actual delivery of basic services in order to improve the standard of living of the electorates subsequent to transitions..

interests.

Chapter 3

Use of Anthropometric Measures to Analyze How Sources of Drinking Water and Sanitation Affect Children's Health in Nigeria

Abstract

We use 2008 Demographic and Health Survey (DHS) datasets to construct child height- and weight-for-age Z-scores and use regression analysis to analyze the effects of different sources of drinking water and sanitation on child health outcomes in Nigeria. We also calculate the probability of a child being stunted or underweight as our measure of malnutrition among children aged 0-59 months. Our

results show that both child height- and weight Z-scores are positive and significantly related to access to borehole and piped water, and negative and significant for access to well water. The probabilities of a child being stunted or underweight are both significantly lower for children drinking borehole or piped water, whereas well water has a positive and significant effect on these measures of child health.

Children's access to flush toilets is positive and significantly related to child height- and weight-for-age Z-scores, but the same measures are negatively related to children's use of pit latrines. In line with this, the probability of a child being stunted or underweight is negative and significantly related to access to flush toilets, but positively related with pit latrines. Our results suggest that increasing access to safe drinking water and flush toilets for households will significantly reduce the high incidence of malnutrition and water-borne diseases among children in Nigeria and should be a high priority for policy makers.

> *"The safety and accessibility of drinking water are major concerns throughout the world. Health risks may arise from consumption of water contaminated with infectious agents, toxic chemicals, and radiological hazards. Improving access to safe drinking water can result in tangible improvements to health".* - **UN Water Initiative (2010)**
>
> *"Lack of access to safe water and adequate sanitation puts children at high risk of not living beyond his/her fifth birthday, but those who survive serious illness (due to water-related diseases) often do not reach their full physical, intellectual, and social potential due to the effects of poor health care and nutrition".* – **UNICEF (2010)**

3.0.1 Introduction

Access to safe drinking water and improved sanitation is essential for healthy life and can significantly reduce public expenditure on preventable diseases and epidemics (e.g., cholera, diarrhea, typhoid, and dracunculiasis) arising from contaminated drinking water and unhygienic disposal of human waste. According to the World Health Organization (WHO 2007), about 1.7 million deaths annually are related to drinking unsafe water and poor disposal of human waste. Children are the most vulnerable, due to their low natural immunity, and a high percentage of infant mortality and morbidity is linked to contaminated water and lack of hygienic sanitation. Various studies in different countries have shown that the quality of drinking water is positively associated with reductions in diarrhea and mortality (Cutler and Miller 2005; Clasen et al. 2007; Arnold and Colford 2007; Kremer et al. 2009).

Recent research also shows that drinking unsafe water and poor disposal of waste affects the growth rate of children and may eventually determine their intellectual and physical contribution to economic development (Kingdon and Monk 2010; Deaton 2008; WHO,2007). Over 1.1 billion people worldwide, most of them in developing countries, lacked access to safe drinking water in 2007 (UNDP, 2008; WHO, 2007).

In this paper, we look at how access to different sources of drinking water and sanitation affects Nigerian children's height-for-age Z-scores and weight-for-age Z-scores. We focus on the effects of drinking water from different sources on children's health, which is particularly important, given the low quality of well water in Nigeria. A study of six hydrostratigraphic zones in the country shows

that the water in about 84 percent of wells contains highly concentrated nitrate, which has severe adverse effects on human health (Adelana and Olasehinde 2003; 2008).

Nigerian children below the age of 5 years make up 17 percent of the 1.8 million deaths due to poor sanitation globally (UNICEF, Nigeria, 2010). In 2010, 11 states in Nigeria battled an extended cholera epidemic; of the 38,173 cases reported from January–October 2010, some 1,555 were confirmed dead (Paula, 2010). Between 1999 and 2008, over US$6 billion of public funds has been devoted to the provision of safe drinking water and improved sanitation and health related services by the federal government, excluding states and local governments' contributions (CBN, 2009). What is not clear, however, is the quality of water the government has been providing and its effects on the health outcomes of children. In this paper, we specifically try to establish the relationship between households' access to safe drinking water (piped and borehole water) and level of sanitation, and the health outcomes of children in Nigeria. We want to offer some insight into how well the public expenditures for drinking water and sanitation are benefiting Nigerian citizens, especially children. Previous studies on the effects of water and sanitation on children's health outcomes have not been conclusive, and we are not aware of any such study for Nigeria (Christiaensen and Alderman 2004; Strauss and Thomas 1995).

Nigeria is the most populated country in Africa, with an estimated 150 million people. Although the country is rich in both human and natural resources, about 71 percent of the population lives on less than US$ 1 dollar a day and about 92 percent lives on less than $2 dollars a day. Nigeria has the world's second highest maternal mortality rate and mortality for children under five years—about

1 million children annually (191 per 1,000 children). Infant mortality is as high as 86 per 1,000 live births (UNICEF, Nigeria, 2010).

In terms of human development, the United Nation Human Development Index ranked Nigeria 158 out of 177 countries in 2007. The 2010 theme of the UN's annual water day, "Clean Water for a Healthy World," speaks volumes about the importance of safe drinking water across the globe. However, about 42 percent of Nigeria's population has no access to clean drinking water, making up almost 20 percent of those in Africa in this situation (UNICEF, Nigeria, 2010). The implication of this is that Nigerian children are exposed to deadly but preventable water-borne diseases, which affects their growth and health in general (Kingdon and Monk 2010).

Regarding sanitation, none of the successive governments in Nigeria have taken responsibility for the provision of sanitation services to its citizens. Most houses are built without toilet facilities, in both rural and urban areas. It is rare to find rural houses with personal toilets, and urban houses with 50 or more tenants may share one toilet. In 2008, the government, for the first time, promised to construct 1 million public latrines across Nigeria to serve more than 150 million people, but these needed facilities have not yet materialized.

The majority of the poor who struggle to survive do not consider access to a toilet as crucial, yet diarrhea remains the second largest cause of children's deaths in Nigeria (UN Water Initiative, 2010). In the 1980s, during military rule, sanitary workers were responsible for monitoring household sanitation both in rural and urban areas, but due to shifts in government priorities this service, was discontinued by the new regime.

The general adage that "health is wealth" is instructive to our focus on health in

this paper. Healthier citizens are likely going to be more productive and contribute positively to economic development of the country, all things being equal. In addition, good health also has a positive effect on the learning attitude and abilities of children and leads to better educational outcomes and increases the efficiency of human capital development by individuals, household and the nation (Strauss and Thomas, 1998; Schultz, 1999). Illness reduces physical, mental and income ability of the populace and their economic usefulness. However, children are the most vulnerable group in the society. One of the most important functions of government is to protect the rights of every child, especially health. When a child's health is guaranteed the future of such a child and the country at large is protected.

This paper makes four main contributions to the literature. First, to the best of our knowledge, all other studies have used the incidence of diseases to explain child health outcomes in Nigeria: ours is the first to employ anthropometric measures. This non-monetary measure of malnutrition is not affected by the problem of reliable deflators often associated with other methods. Second, our study is the first to examine the effects of different sources of drinking water at the household level on the health outcomes of children below the age of five years in Nigeria. This is significant, considering the high infant mortality associated with contaminated drinking water. Third, this paper also differs from previous studies because we use both height- and weight-for-age Z-scores to determine the probability of stunted growth and of being underweight, respectively, as proxies for malnutrition in the country. While stunted growth is a measure of chronic malnutrition, being underweight is a measure of general malnutrition (Silva 2005). Last, this paper is the first to separately examine the effects of available sanitation (pit latrines and flush

toilets) on the probability of stunted growth and of being underweight in children in Nigeria.

3.0.2 Literature Review

Several studies have attempted to analyze the effects of access to clean water, improved sanitation, and other socioeconomic factors on children's health outcomes using a variety of measures. Most of these studies use either infant mortality or incidence of diarrhea as measures of child health outcomes. These studies do not examine the effects of access to water and sanitation on children's height and weight z-scores. But better the anthropometric measures which are far better are now available through Demographic and Health Survey (DHS) datasets and the WHO Child Growth Standards.

In their review, Esrey et al. (1991) attribute a 17 percent reduction in the incidence of diarrhea to children's access to improved water supply, and a further 22 percent reduction to better sanitation. In another Meta study, Fewtrell et al. (2005) also report a 25 percent reduction in illness as a result of improved access to safe drinking water and a 32 percent reduction to better sanitation. Waddington et al. (2009), on the other hand, shows that improved sanitation led to a reduction of 37 percent in the incidence of diarrhea, but improved water accessibility had no significant effect on the incidence of this disease.

Esrey (1996) used DHS datasets in a cross-country analysis of eight countries. His study established a 13-44 percent reduction in diarrhea could be attained with provision of access to flush toilets and an 8.5 percent reduction with provision of latrines. He concluded that access to good sanitation has a greater effect on

health than access to clean drinking water. However, Gunther and Fink (2010) criticized this study because it included only 8 countries of the 63 countries with available DHS datasets in 1995. In response to this shortcoming in the work of Esrey (1996), and with the availability of new datasets, Gunther and Fink (2010) used 172 datasets from 70 countries to analyze the effects of access to safe drinking water and sanitation on infant mortality and morbidity. Their cross-country analysis showed that access to improved water and sanitation reduced the incidence of diarrhea in children less than five years by 5-17 percent and led to a 5-20 percent reduction in infant mortality.

While empirical studies on the effects of access to sanitation and clean water are rare in developing countries, there are some historical retrospective studies. For instance, Woods, Watterson and Woodward (1988) relate reduced infant mortality in both England and Wales in the 19th century to an increase in access to improved water and sanitation. In a similar study in the United States, a 50 percent reduction in infant mortality in the 20th century is attributed to improved water and 75 percent reduction is attributed to accessibility of sanitation (Cutler and Miller 2005). However, Gunther and Fink (2010) observe that it is very difficult to establish causal relationships in these studies because their historical nature may not account for some unobservable variables at that time.

Dasgupta (2004) analyzes diarrhea morbidity in the slums of Delhi. His results show that access to piped water reduces the probability of the incidence of diarrhea. Surprisingly, however, he concluded that access to sanitation and education of the household head has no significant effect on illness. In another study in India, Jalan and Ravallion (2003) examined the effects of access to clean water on the incidence of diarrhea in children. Their analysis showed that access to piped water

reduced the incidence of diarrhea, but the result is sensitive to families' incomes and education of mothers. Other studies that use diarrhea as a measure of health in relation to access to water include Bozkurt, et al. (2003), Van der Hoek, et al. (2001), Rao et al. (1998) and Alberini, et al. (1996).

However, the above studies do not specifically focus on children's growth rates. Skoufias (1998) uses 1994 cross-sectional data to analyze the effect of environmental and socioeconomic factors on the growth of children between ages 0 and 5 years in Romania. His measures of children's health outcomes are height- and weight-for-age Z-scores. His results are not conclusive, but he found that poor sanitary conditions are negatively related to children's health.

Kabubo-Mariara, et al. (2008), use DHS datasets from Kenya to analyze the determinants of children's nutritional status. Surprisingly, their results show that children's growth is either insignificant or negatively related to access to water, measured by cluster shares of households with piped water. On the other hand, children's height has a negative relationship to the share of cluster households with access to traditional toilets, but stunted growth is positively related to access to traditional toilets. This result contradicts Silva's (2005) findings in Ethiopia, where access to water and sanitation was found to have positive effects on children's height and weight z-scores. The effect may partly depend on the type of access to drinking water that households use. While Kabubo-Mariara et al. (2008) used cluster shares of households with access to piped water and sanitation, Silva (2005) used both individual and community access to water and sanitation. Mangyo (2008) studied the effects of access to water on children's health in China using a dynamic panel model. His results show that access to in-yard water sources only improve children's health when their mothers are educated. He concluded that the

effects of access to water on child health are inconclusive.

3.0.3 Empirical Model Specification

Like previous studies on the relationship between environmental variables and child health outcomes (Skoufias 1998; Kabubo-Mariara et al. 2008; Jalan and Ravallion 2003; Khanna 2008), our model is based on the theories of human capital investment, as well as the household production function as specified by Kabubo-Mariara, et al. (2008). A household is faced with a utility function, U, which depends on the consumption of a vector of commodities, X, and a vector of leisure, L:

(1) $U = u(X, L)$

The household production function for the goods consumed depends on a vector of inputs supplied by the household. A rational household chooses an optimal consumption bundle, given that the production function and the budget constraint do not exceed total income. The assumption of perfect substitution between home production and market goods in the household model is further relaxed to model human capital outcomes because most human capital outcomes cannot be purchased in the market. Other considerations in the household production function are the influence of biological, demographic, and economic factors.

A typical child's health outcome is a product of the biological production function, which is affected by the household's decisions on inputs, such as nutrient intake and general care. The ability of each household to maximize the health of a child depends on available resources and the information constraints facing them. Equation (1) is therefore modified to include a health outcome measure, namely,

the supply of growth Y for each child in order to model child health outcome. It is assumed that good health is desirable in its own right and that other reasons are the basis for household decisions on consumption (Kabubo-Mariara et al. 2008). A modification of equation (1) based on the above assumption is:

(2) $U = u(X, L, Y)$

Thus, our budget constraint is modified to include child health production function inputs. The constrained utility function is then solved for optimal quantities of child health supplies in the market. In this framework, the reduced form function for each child's health supply is:

(3) $Y_{\mathrm{I}} = f(X_i, X_e, X_h, U_i)$

Equation (4) is a linear regression function of equation (3):

(4) $Y_i = a + \beta_1 X_i + \beta_2 X_e + \beta_3 X_h + U_i$

where Yi is the child's health outcomes represented by height- and weight-for-age Z-scores, respectively. X_i is a vector of child-specific characteristics, such as age, age squared (to control for non-linearity between the age of the child and health outcomes), gender (girls grow faster than boys at early age), single birth (an only child), and multiple births (twin children). X_e is a vector of environmental variables, in this case including piped water, borehole water, and sanitation (flush toilets and pit latrines) (Kabubo-Mariara et al. 2008; Jalan and Ravallion 2003; Khanna 2008). X_h is a vector of household-specific characteristics, such as education of parents, household food index, mother's years of education, and whether the household is located in a rural or urban area. Ui is the effect of unobservable variables on the child's health, which is assumed to be uncorrelated with the regressors (Sahn and Stifel 2002a; 2002b; 2003a; 2003b; Kabubo-Mariara, et al. 2008).

3.0.4 Measuring Children's Heights and Weights for-age z-scores

We constructed Z-scores for children's height and weight by using the WHO Child Growth Standards.

Height-for-age$Z$-score:$Z = \frac{H-HM}{\sigma}$

where H is the measured height of the child, MH is the age- and gender-specific median heights of a well-nourished child, and σ is the standard deviation of height of a well-nourished child.

Weight-for-age Z-score: $Z = \frac{Y-X}{\sigma}$

where Y is the child's specific measured weight, X is the age- and gender-specific median weights of a well-nourished child, and σ is the standard deviation of weight of a well-nourished reference child.

3.0.5 Hypotheses

We approached our study with two basic hypotheses. One, there is a positive relationship between the quality of drinking water and sanitation that children are exposed to, and their height- and weight-for-age Z-scores. Access to piped water, borehole water, and flush toilets, which improve hygiene, should have a positive effect on children's health outcomes. Conversely, the effects of access to only well water and pit latrines on these health outcomes should be negative.

Two, in line with the first hypothesis, greater access to safe drinking water and hygienic sanitation facilities will negatively impact the probability of stunted growth and the incidence of being underweight in children.

3.0.6 Data Sources and Method of Estimation

Our main source of data is the 2008 DHS dataset for Nigeria, which has data on households' access to water and sanitation. The dataset contains information about children aged 0–5 years in each household, including their weight and height. It also contains information about the parents and the socioeconomic characteristics of the household. We also used the WHO Child Growth Standards for our analysis, plus the WHO's age- and gender-specific median weight and height measures (and their standard deviations) for a well-nourished child.

We first adjusted for the sampling methods and then used OLS (ordinary least squares) regressions to analyze the effects of access to water and sanitation on children's height- and weight-for-age Z-scores. (See results in tables 3.1 and 3.2 below, columns 1 and 2.) We further analyzed the probability of a child being stunted and underweight, using survey probit regression methods. By adjusting for the sampling methods, we controlled for the effects of sample design in collecting the primary data: sampling weights, clustering, and stratification (Statacorp 2009). Failure to account for sampling weights, according to Kabubo-Mariara, et al. (2008), will affect standard errors and yield-biased estimators; in addition, if clustered observations are not independent, using ordinary least squares may result in small standard errors.

DHS data collection does not involve purely random sampling, because different groups of clusters are separately sampled. The solution to this problem is to apply survey regression techniques to the data in order to produce the correct standard errors (Kabubo-Mariara, et al. 2008), as we do for this research. More simply, we estimate the marginal effects of the independent variables on the dependent

variable for our probit regressions.

We analyze the effects of households' access to safe drinking water and sanitation on the probability of children being stunted and underweight. A child is considered stunted if his or her height-for-age Z-score is less than -2, and underweight if the weight-for-age Z-score is less than -2. Our dummy variable for stunting is 1 if a child's height-for-age Z-score is less than -2, and 0 otherwise. The dummy variable for underweight is 1 if the weight-for-age Z-score is less than -2, and 0 if it is equal or greater than -2. This is the international child growth standard recommended by WHO and used by most studies (Kabubo-Mariara et al. 2008; Khanna 2008; Silva 2005; Skoufias 1998). We use survey probit regressions to estimate the probability of a child being stunted and being underweight.

3.0.7 Regression Results

In table 3.1 and 3.2 we present the results of our analysis of the effects of different sources of water and sanitation on the heights and weights for-age z-scores of children in Nigeria. In columns 3 and 5 in all our tables, we substituted well water for piped and borehole water to test for robustness. In table 3.1, column 2, we examine the effect of household access to drinking water (piped and borehole water) and sanitation (pit latrine and flush toilets) on a child's height-for-age Z-score. The coefficients and the signs of age in months and age squared are both instructive from our results in table 3.1 and 3.2 columns 2 to 4. The significant negative coefficient of age and significant positive coefficient of age squared at 1 percent level respectively shows that HAZ increases at a decreasing slope with age of a child, due to non-linear relationship between age and HAZ. In other words,

age has a statistically negative non-linear relationship with HAZ, while there is negative linear relationship between HAZ and age squared. Our results further suggests that although Nigerian children have a great disadvantage at birth, they tend to catch up somewhat over time.The results show that the male dummy and multiple birth child (twin dummy) are both negatively related to a child's height for-age z-score. This result is consistent with the findings of Kabubo-Mariara, et al. (2008). In other words these variables are inversely related to the height-for-age Z-score of a child; this finding is statistically significant at the 1 percent level. Young children are thus less likely to be stunted if they obtain sufficient breast milk for their feeding when newborn. However, as a child's age increases, weaning from breast milk makes them more vulnerable to malnutrition. Our findings indicate that the height-for-age Z-score of a boy is likely to be 0.22 less than that of a girl.

The heights of twin children are likely to be 0.34 z-scores less than single births (non-twin children). This result is significant at 1 per cent level in all our specifications and consistent with the theory that twin children are generally more disadvantaged than single children, due to insufficient breast feeding (Sahn and Stifel 2002b; 2003a; Kabubo-Mariara et al. 2008). Household's food consumption index was positively related to children's height z-scores and significant at 5 per cent level.

We now turn to the effects of environmental variables on children's height-for-age Z-scores. The effect of access to borehole water is stronger and significant while piped water has no significant effects on children's height-for-age Z-scores, from our results. Access to borehole water is positively related to children's height z-scores and significant at 1 per cent level from our OLS estimate. Similarly, the height of a child drinking borehole water is likely to be 0.11 Z-scores higher than

Table 3.1: Effects of Sources of Water and Sanitation on Children's Height for age z-scores

(1)	(2)	(3)	(4)	(5)
VARIABLES	HAZ-OLS	HAZ-well	HAZ-fixed effects	HAZ-fixed effects-well
age in months	-0.0893***	-0.0894***	-0.0851***	-0.0852***
	(0.00401)	(0.00401)	(0.00444)	(0.00445)
age squared	0.00121***	0.00121***	0.00115***	0.00115***
	(6.82e-05)	(6.82e-05)	(7.13e-05)	(7.14e-05)
gender (male=1)	-0.207***	-0.208***	-0.225***	-0.225***
	(0.0335)	(0.0334)	(0.0384)	(0.0384)
child is twin	-0.338***	-0.341***	-0.287***	-0.290***
	(0.0641)	(0.0641)	(0.0734)	(0.0732)
food index	0.0118**	0.0117**	0.00678	0.00670
	(0.00563)	(0.00563)	(0.00655)	(0.00655)
piped water	0.0724		0.0440	
	(0.0580)		(0.0736)	
borehole	0.112***		0.104*	
	(0.0429)		(0.0624)	
flush toilet	0.396***	0.424***	0.326***	0.347***
	(0.0685)	(0.0671)	(0.0832)	(0.0821)
pit latrine	0.0232	0.0438	0.0213	0.0400
	(0.0398)	(0.0396)	(0.0576)	(0.0574)
had fever	-0.0804*	-0.0811*	-0.0836	-0.0825
	(0.0459)	(0.0459)	(0.0509)	(0.0508)
mother's height	0.0242***	0.0241***	0.0280***	0.0279***
	(0.00241)	(0.00241)	(0.00324)	(0.00324)
mother's education	0.100***	0.0986***	0.0912***	0.0893***
	(0.0233)	(0.0233)	(0.0290)	(0.0292)
urban	0.218***	0.230***	0.256***	0.261***
	(0.0441)	(0.0428)	(0.0682)	(0.0650)
North central	-0.228***	-0.232***	-0.214***	-0.216***
	(0.0636)	(0.0635)	(0.0815)	(0.0813)
North east	-0.183***	-0.179***	-0.165*	-0.156*
	(0.0651)	(0.0651)	(0.0893)	(0.0895)
North west	-0.261***	-0.242***	-0.231***	-0.211**
	(0.0666)	(0.0668)	(0.0862)	(0.0860)
South east	0.392***	0.383***	0.434***	0.424***
	(0.0750)	(0.0747)	(0.0885)	(0.0877)
South south	0.0764	0.0580	0.0759	0.0653
	(0.0692)	(0.0693)	(0.0814)	(0.0817)
well water		-0.123***		-0.129**
		(0.0369)		(0.0538)
Constant	-4.146***	-4.068***	-4.769***	-4.686***
	(0.387)	(0.387)	(0.519)	(0.521)
Observations	16,791	16,791	16,791	16,791
R-squared	0.082	0.083	0.085	0.085

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

a child drinking water from a well.

Regarding sanitation, access to pit latrines and flush toilets are both positive determinants of children's height z-scores in the country. On the other hand, access to a flush toilet is both a significant and positive determinant of children's height-for-age Z-scores. Access to flush toilets is statistically significant at the 1 percent level. The height Z-score of a child with access to a flush toilet will be 0.4 higher than a child with no access to a flush toilet. This finding strongly supports the argument that safe disposal of human waste is essential for the healthy life and adequate growth of children. Our result agrees with that of Silva (2005), but contradicts the findings of Kabubo-Mariara, et al. (2008). Incidence of fever, as expected, is negatively related to a child's height z-score. OLS estimate shows that a child that has fever will be about 0.08 height z-score less than a healthy child at the 10 per cent significance level.

The height of a child's mother is a positive and significant determinant of a child's height-for-age Z-score. The height of the mother captures genetic effects and other family background characteristics (Kabubo-Mariara, et al. 2008). Mothers' levels of education are both positive and significant in determining the nutritional status of children. When mothers are educated, they have better information on children's health care and generally earn higher incomes than mothers who are not educated. This is one of the reasons why investment in human capital, especially that of women, has great importance, given the pivotal role that women play in the upbringing of children. Children in urban areas have higher height z-scores than those in rural areas, from our estimates. This may be due to the fact that better health care infrastructure is available in urban areas which is also attractive to wealthy households.

Our control for geopolitical variation in height z-scores shows that children in the three geopolitical zones in the north have lower height z-scores compared to the children in the South Western zone. Children in the South Eastern geopolitical zone have significantly lower height z-scores compare, to children in the South West.

We substituted well water for piped water and borehole water in columns 3, to check for the robustness of the effects of sources of drinking water on a child's height-for-age Z-score, shown in column 2. Results and significance levels of all the variables remained the same as earlier explained above. However, drinking of well water is negative and significantly related to a child's height Z-score at 1 per cent level from column 3. The result suggests that a child's height Z-score is likely to be lower by 0.12 Z-scores if a child drinks well water. This result shows the urgent need for the government to invest more in substituting well water with safer drinking water options in the country.

We controlled for cluster and state fixed effects in column 4 and 5 respectively to further check for the robustness of our estimates in column 2 and 3. The results and significance levels remained unchanged. All other variables maintained their signs, as in column 2 and 3 but with minor changes in the level of significance of some variables, such as borehole access, fever, and region (North East and North West. Our variable of interest, drinking of well water, remained significant at 5 per cent level and negatively related to height z-scores.

In table 3.2, we present the results of the effects of households' access to different sources of drinking water and sanitation on children's weight-for-age Z-scores. The results here echo the findings on height z-scores above. The significant negative coefficient of age and the significant positive coefficient of age squared at 1

percent level respectively shows that WAZ increases at a decreasing slope with age of a child, due to non-linear relationship between age and WAZ. In other words, age has a statistically negative non-linear relationship with WAZ, while there is positive linear relationship between WAZ and age squared. Our results further show that both, being male and twin, have a negative effect on a child weight z-score. These two variables are negative and statistically significant determinants of children's weight Z-scores at 1 per cent level.

The male dummy variable indicates that boys are 0.19 lower in weight-for-age Z-scores than girls. . Once again, twin children are 0.27 lower in weight Z-scores compare to non-twin children (single births). Our result is consistent with previous studies on children's weight z-scores (Kabubo-Mariara et al. 2008; Khanna 2008; Silva 2005; and Skoufias 1998). The food index is positively and significantly related to weight z-scores at 1 per cent level, from our results shown in column 2 and 3. As expected, food consumption is an important determinant of children's weight z-scores in the country.

Children's access to borehole water is surprisingly negatively related to child's weight Z-score and significant at 10 per cent level. The effects of this source of drinking water is partly due to the fact that borehole water is generally not treated in Nigeria because of the public belief that it is clean and hygienic for drinking.

The significance of improved sanitation on children's health is reflected by the coefficient for flush toilets. Access to flush toilets is positive and statistically significant at the 1 percent level in relation to a child's weight-for-age Z-score, from our results shown in column 2 and 3. Children that live in households with access to flush toilets have 0.13 higher weight z-scores than children with no access to flush toilets. Access to pit latrines are also positively related to children's weight

Table 3.2: Effects of Sources of Water and Sanitation on Children's Weight for age z-scores in Nigeria

(1)	(2)	(3)	(4)	(5)
VARIABLES	WAZ-OLS	WAZ-well	WAZ-fixed effects	WAZ-fixed effects-well
age in months	-0.0547***	-0.0547***	-0.0505***	-0.0504***
	(0.00281)	(0.00281)	(0.00316)	(0.00316)
age squared	0.000730***	0.000730***	0.000677***	0.000676***
	(4.82e-05)	(4.82e-05)	(5.03e-05)	(5.03e-05)
gender (male=1)	-0.191***	-0.191***	-0.180***	-0.180***
	(0.0236)	(0.0236)	(0.0254)	(0.0254)
child is twin	-0.275***	-0.274***	-0.263***	-0.262***
	(0.0462)	(0.0462)	(0.0599)	(0.0599)
food index	0 .0137***	0.0136***	0.0119**	0.0119**
	(0.00397)	(0.00397)	(0.00508)	(0.00506)
piped water	0.0439		0.0276	
	(0.0410)		(0.0543)	
borehole	-0.0666**		-0.0599	
	(0.0304)		(0.0468)	
flush toilet	0.133***	0.130***	0.140**	0.134**
	(0.0489)	(0.0480)	(0.0626)	(0.0630)
pit latrine	0.0866***	0.0897***	0.0613	0.0617
	(0.0280)	(0.0279)	(0.0460)	(0.0450)
had fever	-0.261***	-0.262***	-0.265***	-0.266***
	(0.0326)	(0.0326)	(0.0362)	(0.0363)
mother's weight	0.0191***	0.0190***	0.0187***	0.0185***
	(0.00105)	(0.00105)	(0.00142)	(0.00142)
mother's education	0.212***	0.207***	0.206***	0.201***
	(0.0167)	(0.0167)	(0.0223)	(0.0224)
urban	0.0667**	0.0602**	0.0936*	0.0829
	(0.0315)	(0.0306)	(0.0527)	(0.0507)
North central	-0.0459	-0.0343	-0.0548	-0.0378
	(0.0455)	(0.0454)	(0.0585)	(0.0583)
North east	-0.428***	-0.419***	-0.472***	-0.456***
	(0.0465)	(0.0465)	(0.0632)	(0.0626)
North west	-0.524***	-0.504***	-0.478***	-0.453***
	(0.0474)	(0.0476)	(0.0665)	(0.0676)
South east	0.196***	0.157***	0.216***	0.180***
	(0.0537)	(0.0536)	(0.0630)	(0.0617)
South south	0.167***	0.145***	0.132**	0.114**
	(0.0492)	(0.0493)	(0.0564)	(0.0559)
well water		-0.110***		-0.111***
		(0.0261)		(0.0419)
Constant	-1.394***	-1.352***	-1.415***	-1.373***
	(0.0762)	(0.0771)	(0.0989)	(0.102)
Observations	18,779	18,779	18,779	18,779
R-squared	0.141	0.142	0.144	0.144

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Z-scores and significant at 1 per cent level. It is clearly necessary to encourage households to invest in flush toilets to prevent outbreaks of disease and improve children's heath, especially given children's low immunity. Incidence of fever is negatively related to child's weight z-score and significant at 1 per cent level. A clean environment normally facilitated by proper disposal of waste and access to hygienic drinking water will reduce the incidence of fever commonly associated with mosquito bites in the country.

The weight of the mother is a positive and significant determinant of a child's weight-for-age Z-scores. The variable is significant at the 1 percent level of significance. The levels of education of a child's mother are also a positive and significant determinant of children's weight Z-score, which is 0.2 higher if the mother is educated. Children in urban areas have 0.07 weight z-scores than children in the rural areas. We also noticed differences based on region, that is, in which country geopolitical zone the household is located. Children in two Northern geopolitical zones (North east and North west) have lower weight z-scores compared to their counterparts in the South West. However, children in South East and South-South zones have higher weight z-scores than children in the South West zone.

Lastly, when we substituted piped and borehole water with well water, shown in column 3, we found that a child who drinks water from a well has 0.11 weight-for-age Z-score lower than a child who obtains water from a borehole. The signs and the level of our variables are consistent even when we make adjustments for state and clusters fixed effects in column 4 and 5.

Though our analysis on the relationship between sources of drinking water and sanitation and the z-scores of children are instructive, we carried out further analysis by examining the probability of chronic malnutrition (stunting) and the

probability of wasting (being underweight) to fully understand the effects of these variables on children's health outcomes.

As noted earlier, a child is considered to be stunted if his or her height for age z-score is less than -2. As shown in Table 3.3, the significant positive coefficient of age and significant negative coefficient of age squared at 1 percent level respectively shows that probability of stunting increases at a decreasing slope with age of a child, due to non-linear relationship between age and HAZ. In other words, age has a statistically positive non-linear relationship with stunting partly due to weaning, while there is negative linear relationship between HAZ and age squared. Male dummy marginal effects suggest that the probability of a child being stunted is 0.05 higher for boys than for girls at 1 per cent significance level. Multiple birth children are more likely to be stunted than single birth children. The marginal effect shows that for twin children the probability of being stunted is 0.08 higher than that of single birth children.

Access to borehole water is both negatively and significantly related to probability of being stunted at the 1 percent statistical level, as depicted in column 2. In line with this finding, the marginal effect shows that the probability of being stunted is 0.008 lower for a child with access to piped water than for a child with access to well water. For a child who has access to borehole water, the probability of being stunted is about 0.03 Z-scores lower than for a child who has access to well water.

Children in households with access to flush toilets and pit latrines have a lower probability of being stunted, as indicated from our results in column 2 to 4. Even after controlling for state and cluster fixed effects, the marginal effects in column 3 and 4 suggest that children in households with access to flush toilets have 0.2 point

Table 3.3: Determinants of Probability of Stunting in Nigeria

(i)	(ii)	(iii)	(iv)	(v)
VARIABLES	stunting probability		Stunting probability (fixed effect)	
	piped	well	piped	well
age in month	0.0174***	0.0174***	0.0419***	0.0420***
	(0.000942)	(0.000942)	(0.00272)	(0.00273)
age squared	-0.000258***	-0.000258***	-0.000626***	-0.000626***
	(1.60e-05)	(1.60e-05)	(4.51e-05)	(4.51e-05)
gender (male=1)^	0.0538***	0.0538***	0.142***	0.143***
	(0.00776)	(0.00776)	(0.0220)	(0.0220)
child is twin^	0.0770***	0.0777***	0.185***	0.188***
	(0.0148)	(0.0148)	(0.0465)	(0.0464)
food index	-0.00167	-0.00165	-0.00202	-0.00199
	(0.00131)	(0.00131)	(0.00386)	(0.00386)
piped water^	-0.00822		-0.00116	
	(0.0135)		(0.0445)	
borehole^	-0.0293***		-0.0833**	
	(0.00992)		(0.0350)	
flush toilet^	-0.0859***	-0.0911***	-0.200***	-0.211***
	(0.0156)	(0.0153)	(0.0522)	(0.0512)
pit latrine^	-0.00757	-0.0121	-0.0200	-0.0316
	(0.00920)	(0.00917)	(0.0328)	(0.0329)
had fever^	0.0134	0.0136	0.0411	0.0402
	(0.0107)	(0.0107)	(0.0300)	(0.0299)
mother's height	-0.00595***	-0.00593***	-0.0166***	-0.0166***
	(0.000560)	(0.000561)	(0.00191)	(0.00191)
mother's education	-0.0372***	-0.0368***	-0.0937***	-0.0930***
	(0.00545)	(0.00545)	(0.0168)	(0.0169)
urban^	-0.0423***	-0.0440***	-0.129***	-0.131***
	(0.0102)	(0.00989)	(0.0365)	(0.0353)
North central	0.0492***	0.0505***	0.123***	0.127***
	(0.0151)	(0.0151)	(0.0475)	(0.0474)
North east	0.0632***	0.0623***	0.171***	0.168***
	(0.0154)	(0.0154)	(0.0506)	(0.0508)
North west	0.103***	0.0989***	0.254***	0.246***
	(0.0158)	(0.0158)	(0.0463)	(0.0461)
South east	-0.0969***	-0.0970***	-0.271***	-0.274***
	(0.0171)	(0.0170)	(0.0543)	(0.0541)
South south	-0.0219	-0.0185	-0.0454	-0.0423
	(0.0162)	(0.0163)	(0.0511)	(0.0514)
well water^		0.0255***		0.0627**
		(0.00852)		(0.0296)
Constant			1.891***	1.848***
			(0.304)	(0.305)
Observations	16,791	16,791	16,791	16,791

For discrete variables(marked by ^),the coefficients represent the change in probability for a change of the dummy variable from 0 to 1. Standard errors in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

lower probability of being stunted compared to children with no access to flush toilets. The probability of a child being stunted is between 0.03 and 0.09 points lower when a child's mother is educated than when she is not educated, from our OLS and fixed effects estimates shown in column 2 to 4. Children resident in urban areas have a significant lower probability of being stunted or suffering from chronic malnutrition, compared to their rural counterparts.

Similar to our results in table 3.1 and 3.2, children in the three geopolitical zones in the North have a significantly higher probability of suffering chronic malnutrition than children in the South-West zone, while the probability of stunting is lower in the South East zone compared to the South-West. Finally, our results depicted in column 3 and 5 also show that the probability of being stunted is about 0.05 points higher for children who drink well water than those who drink piped or borehole water. This confirms the negative effects of drinking well water on children's health in Nigeria and that provision of alternative drinking water should be one of the main priorities of the government.

We present the relationship between households' sources of drinking water and sanitation and a child's probability of being underweight in Table 3.4. We substituted well water for piped and borehole water shown in column 2 and 4, while we control for state and cluster fixed effects in column 3 and 4 for robustness check. Most of the results in Table 3.4 are similar to our findings on the probability of stunting (shown in Table 3.3). We shall therefore limit our discussion here to the effects of sources of water and sanitation on children's probability of being underweight and any other variables with considerable different estimates from our results in Table 3.3. The significance of improve sanitation on children health is further confirmed by the negative effects of access to flush toilets and pit latrines

Table 3.4: Determinants of Probability of Being Underweight in Nigeria

(1)	(2)	(3)	(4)	(5)
	underweight probability		underweight probability (fixed effect)	
VARIABLES	piped water	well	piped water	well
age in months	0.00905***	0.00905***	0.0258***	0.0258***
	(0.000797)	(0.000797)	(0.00255)	(0.00255)
age squared	-0.000132***	-0.000132***	-0.000387***	-0.000387***
	(1.36e-05)	(1.36e-05)	(4.25e-05)	(4.25e-05)
gender (male=1)^	0.0469***	0.0469***	0.144***	0.144***
	(0.00658)	(0.00658)	(0.0217)	(0.0217)
child is twin^	0.0643***	0.0643***	0.218***	0.218***
	(0.0124)	(0.0124)	(0.0501)	(0.0499)
food index	-0.00342***	-0.00340***	-0.0103**	-0.0103**
	(0.00113)	(0.00113)	(0.00450)	(0.00450)
piped water^	-0.0192		-0.0342	
	(0.0117)		(0.0442)	
borehole^	0.00900		0.0232	
	(0.00861)		(0.0375)	
flush toilet^	-0.0247*	-0.0267*	-0.0657	-0.0676
	(0.0148)	(0.0145)	(0.0594)	(0.0593)
pit latrine^	-0.0272***	-0.0292***	-0.0732**	-0.0759**
	(0.00777)	(0.00776)	(0.0366)	(0.0359)
had fever^	0.0533***	0.0536***	0.155***	0.156***
	(0.00948)	(0.00949)	(0.0310)	(0.0311)
mother's weight	-0.00449***	-0.00447***	-0.0134***	-0.0133***
	(0.000322)	(0.000322)	(0.00147)	(0.00146)
mother's education	-0.0574***	-0.0562***	-0.172***	-0.169***
	(0.00483)	(0.00483)	(0.0190)	(0.0191)
urban^	-0.00862	-0.00878	-0.0506	-0.0487
	(0.00902)	(0.00874)	(0.0445)	(0.0426)
North central	0.0614***	0.0591***	0.191***	0.183***
	(0.0148)	(0.0148)	(0.0524)	(0.0527)
North east	0.172***	0.170***	0.536***	0.529***
	(0.0155)	(0.0155)	(0.0516)	(0.0513)
North west	0.201***	0.195***	0.545***	0.532***
	(0.0156)	(0.0156)	(0.0517)	(0.0523)
South east	-0.0184	-0.0102	-0.0610	-0.0420
	(0.0167)	(0.0170)	(0.0582)	(0.0572)
South south	-0.00386	0.00123	-0.0142	-0.00570
	(0.0156)	(0.0157)	(0.0530)	(0.0532)
well water^		0.0268***		0.0599*
		(0.00718)		(0.0321)
Constant			-0.358***	-0.380***
			(0.0938)	(0.0953)
Observations	18,779	18,779	18,779	18,779

For discrete variables(marked by ^),the coefficients represent the change in probability for a changeof thedummy variable from 0 to 1. Standard errors in parentheses ,*** p<0.01, ** p<0.05, * p<0.1

on the probability of being underweight. The probability of being underweight for children with access to flush toilets is between 0.24 and 0.7 lower than for children with no access to flush toilets, as depicted in columns 1 to 4. However, the probability of children being underweight is between 0.03 to 0.6 higher when children drink well water, compared to drinking piped or borehole water.

3.0.8 Conclusion and Policy Implications

In this chapter, we discussed the use of health z-scores of children aged 0-59 months to analyze how sources of drinking water and types of sanitation in the country affect children's growth. We in addition used probit regression analysis to analyze the contribution of the various sources of water and sanitation to probability of stunting (chronic malnutrition) and the probability of being underweight for children in the country. Looking at the implications of households' access to safe drinking water and sanitation on children's health outcomes in this study, reveals that households' access to piped and borehole water are both positively related to children's height for-age Z-scores. Importantly, we find that access to borehole water is significant and negatively related to children's weight z-scores and the probability of children being underweight. We argue that the quality of borehole water in the country needs to be assessed to determine the main reason for the negative relationship access to this water source has on children's health outcomes. In the short term, however, policy makers should consider funding more piped water throughout Nigeria for household use and at the same time improve the quality of the existing piped water to improve the health of millions of children in the country.

In line with our findings, access to proper human waste disposal systems, especially flush toilets, is crucial for the healthy growth of children in the country. Children in households with access to flush toilets are less prone to chronic malnutrition (inadequate growth). Our study also shows that access to flush toilets reduces the probability of a child becoming stunted. The Nigerian government should encourage both private and public investment in the provision of flush toilets for households to reduce the problem of stunting and being underweight and the frequent occurrences of cholera and other water-borne diseases that presently ravage the country. Where provision of flush toilets is not immediately feasible, it is necessary to provide, for the short term, pit latrines for households in the country. Government should also propose a policy that will make construction of toilet facilities in new buildings mandatory in the country.

Our study shows that drinking well water is harmful to the growth and health of children in Nigeria and has increased the number of children being stunted and underweight. This is a strong signal to the various tiers of government to expedite efforts to provide safe drinking water to every household in the country. Women's education is another area that clearly should be promoted and encouraged by the government because of the positive impact of mothers' education on the health outcomes of children.

If Nigeria and the other national governments of sub-Saharan Africa can provide improved drinking water and sanitation in the sub-region, the lives of millions of children will be saved. Providing safe drinking water and better sanitation will also increase both the physical and mental growth of children. Multiplier effects of adequate access to safe drinking water and sanitation include a healthier environment, reduction in public expenditure for water-borne diseases, and greater

economic growth due to the positive effects of a healthy population.

Finally, we recommend further studies on the quality of borehole water in Nigeria, for example, inquiries into ways to reduce the average cost of borehole drilling, in addition to research to find solutions to the persistence of water borne diseases in the country.

Chapter 4

Decomposing Health Inequality During Political Transition in Nigeria

Abstract

In this paper, we compare health inequalities in Nigeria under two forms of governments. The country was under military rule for several years prior to the general elections in April 1999. Using the DHS data sets of 1999 and 2008, our results show that childhood malnutrition measured by negative height for-age z-scores and negative weight-for age z-scores persisted and even deteriorated, after 1999 to the disadvantage of children in poor households after 1999. While inequality in stunting rose by 13.6 percent between 1999 and 2008 in the country, inequality in being underweight increased by 20.9 percent within the same period. The result of our decomposition of changes in the concentration indices and Blinder-Oaxaca

decomposition of group differences suggest that socioeconomic gaps in asset ownership, maternal and paternal level of education, food index, access to water and sanitation are the main causes of the prevalence of stunting and being underweight amongst poor children in Nigeria. We therefore argue that transition to democratic rule without concerted efforts to reduce existing gaps in the determinants of health outcomes does not benefit the poor.

4.0.9 Introduction

Malnutrition is one of the major causes of infant mortality in developing countries. It accounted for over 3.7 million deaths among young children across the globe in 2000 (WHO).The effects of childhood malnutrition includes inadequate mental development, poorer performance in schools, and subsequent inability of malnourished children to reach their full potential later in life (Fujii, T. 2005, de Onis et al, 2000, Galler and Barrett 2001, Glewwe et al. 2001, Shariff et al. 2000). In most cases, children in poor households are more vulnerable to malnutrition, compared to their counterparts in rich households. Health inequality has been a great concern in developing countries in general and those in Sub-Saharan Africa in particular. In general, socioeconomic health inequality often takes the form of differences in health outcomes such as malnutrition and incidences of diarrhea, differences in health services utilization or in utilization of benefits received from public expenditure on health services. Childhood malnutrition manifests either in low weight for age z-scores (stunting), low height for age z-scores (wasting) or in low weight for height z-scores. In Nigeria like in many other countries, one of the stated goals of the current democratic government is to reduce socioeconomic

inequalities in health. International organizations such as the World Bank, World Health Organization (WHO), UNICEF and other international donors organizations are concerned with reducing health inequality across the globe, Wagstaff (2000). Several policy statements and papers by these organizations stress the need to reduce variations in health status between countries and within socioeconomic groups in every country (Pradhan, et al. 2003, de Onis and Habicht 1996 and de Onis et al. 2000).

The general belief is that the objective of closing the gap between the poor and the better-off is easily achievable under a democratically elected government (Meltzer and Richard 1981, Acemoglu and Robinson 2001, Boix 2003, Bueno et al. 2005, Deacon 2009)[1] . However, recent studies propose that when elections are not credible, political leaders' preferences might be at variance with the general needs of the citizens (Polterovich and Popov 2005, Keefer 2004, Ross 2006, Gottlieb 2009). Many studies have attempted to compare inequality under democracy with other forms of government, especially in developed countries, from both an historical perspective and also based on more recent experiences (Nikoloski 2010, Gradstein and Milanovic 2004). Most of these studies, however, concentrate on one aspect of inequality, that is, income inequality while other aspects of inequality such as health disparites are yet to be explored. However, nutritional well-being and health equity are important fundamental human rights which are expected to be better protected under democratic rule.

In this paper, we examine the extent of health inequality under military rule in Nigeria and compare this with the subsequent ten years of transition to democratic

[1] These studies are based on credible, competitive elections in the advanced democracies unlike many developing countries especially in sub-Saharan Africa where political capture by the elites often prevails.

rule in 1999. In addition, we seek to analyse the determinants of changes in health inequalities in the country between the two periods. Growing interest in health inequality in recent times, as opposed to income inequality measures used in the past, is due to limitations in research using the latter: Poverty which includes the deprivation of capabilities, or the failure of certain basic functioning, is not adequately captured by either income or expenditure data as noted by Sen and Hawthorn (1989) and Pradhan et al. (2003). Although incomes are indisputably significant, health is also an intrinsically important aspect of well-being (Sen 1980, Sen and Hawthorn 1989, Sen 2003, Pradhan et al. 2003). Secondly, health inequality is a non-metric measure without the problem of comparison over time and location. Health inequality is therefore not subject to the challenge of deflation. Thirdly, the effects of health inequality are detrimental to the human capital development of children and to the future growth of the economy. Therefore if these are not addressed in time, health inequality may result in the permanent incapability of children, Deaton (2003). Lastly, health inequalities capture the effects of variations in the distribution of public services which are not easily captured by any measure of income inequality.

Furthermore, the general adage that "health is wealth" is instructive to our focus on health in this paper. Healthier citizens are likely going to be more productive and contribute positively to economic development of the country, all things being equal. In addition, good health also has a positive effect on the learning attitude and abilities of children and leads to better educational outcomes and increases the efficiency of human capital development by individuals, household and the nation (Strauss and Thomas, 1998; Schultz, 1999). Illness reduces physical, mental and income ability of the populace and their economic usefulness.

Therefore, the most important need of every citizen under either military or democratic rule is health. However, children are the most vulnerable group in the society. One of the most important functions of government is to protect the rights of every child, especially health. When a child's health is guaranteed the future of such a child and the country at large is protected. If citizens health, especially the poor are not protected, all other activities of government in trying to provide for the basic needs of the citizens will be unproductive. Since children cannot protect themselves, their survival depends on both their parents and government in power in the country. It is however assumed that democratic governments will be more committed to policies aimed at improving citizens health and as well reduce health inequality between the rich and the poor in the country.

For the reasons enumerated above, it is therefore necessary to give priority to analysis and reduction of health inequality across nations and within socioeconomic groups in a country. The contributions of this paper to this research field are as follows: As far as we know, this is the first paper to compare health inequality under two different forms of government in sub-Saharan Africa in general and in Nigeria in particular. The second contribution of this paper is in our decomposition of changes in inequalities between two periods using anthropometric measures as our indicator of child health outcomes. This is an objective measure of child health outcomes recently made possible by the availability of anthropometric data on children from the Demographic and Health Survey (DHS) data sets.

4.0.10 Review of the Literature

There are two strands of argument in studies on the relationship between democracy and inequality. The first group of researchers proposing the existence of a negative relationship between democracy and inequality argue that there is more redistribution under democracy than under other forms of governments, such as military rule. One of the most celebrated works on democracy and inequality is the median voter model proposed by Meltzer and Richard (1981), in their work "A rational theory of the size of government". The model is based on two assumptions. The first assumption states that redistribution decisions are based on the rational choice of utility maximising individuals, while the second states that the link between market-generated inequality and redistribution is lower in autocracies than in democracies. Analysis of the link between democracy and income inequality has attracted many economists in the past. Analysts argue that if inequality in access to political participation is reduced through competitive elections, inequality in other areas of life will also be reduced. They further argue that democracy redistributes political power in favour of the majority, and thereby enhances equal distribution of socioeconomic benefits (Sirowy and Inkeles 1990; and Lipset 1994).

According to Reuveny and Li (2003), redistribution policies under democratic rule are designed in favour of the poorer and middle classes in society, which will eventually lower the level of inequality. Drawing from Pommerehne and Frey (1978), it can be stated that a non-democratic regime will not provide political outcomes that are as close to the preferences of the median voters as a democratic regime. Bollen and Jackman (1986) and Rodrik (1999), also, propose that greater redistribution under democratic rule results in a reduction in income inequality.

Commander and Nikoloski (2010), examined both the long term and short term effects of democracy on income inequality. They conclude that a reduction in inequality is due to other factors such as availability of natural resources and the sectorial composition of the economy, rather than to democracy. Critics of this view, including Mulligan and Sala-i Martin (1999) and Benabou (1996), argue that a reduction in inequality under different regimes is mainly determined by efficiency rather than politics. In addition, Chong's (2004), argues that democracy is not good at protecting the poor, while Chong and Calderon (2000), propose that the high transaction costs associated with institutional reforms under democracy may increase inequality.

There are empirical works that examine the relationship between democracy and inequality. Milanovic (1999) study shows that there has been an increase in the redistribution of income in favour of the poorer classes under democratic rule. Chong (2004) study however provides comprehensive empirical cross country evidence on the relationship between democracy and income inequality in 51 countries between 1960 and 1997. His conclusions show evidence of a lack of consensus on whether inequality is reduced under democratic rule. For rich and highly equal countries his result shows that income inequality is negatively related to democracy but for poor and highly unequal countries democracy has positive effects on income inequality. His findings are consistent with the studies of Justman and Gradstein (1999), Acemoglu and Robinson (2001), Acemoglu, Johnson and Robinson (2005) and Bourguignon and Verdier (2000)[2].

In a review of 12 studies, Sirowy and Inkeles (1990) concluded that political

[2] Although, these studies provide useful information on the macroeconomic effect of democracies, they do not account for micro effects of democracy on the standard of livings of ordinary citizens including their health outcomes

democracy reduces inequality in general. In another survey of literature on the relationship between democracy and inequality, Gradstein and Milanovic (2004) further concluded, based on recent evidence, that democracy is inversely related to income inequality. Gradstein, et al. (2001) examined the effects of democracy on inequality in 126 countries, between 1960 and 1998. Their result shows that in Judeo-Christian societies, inequality is reduced with an increase in democratizations while democracy had no significant effect on inequality in Muslim and Confucian societies. They concluded that the effect of democracy might therefore depend on the society's ideology on inequality. Feld and Kirchgassner (2006), considers the effects of different forms of democracies on inequality. Their findings show that representative democracy is more effective than direct democracy in reducing inequality.

Bicego and Ahmad (1996), used DHS data from 20 developing countries to analyses socioeconomics related health inequality, using mortality rates as their measure of health outcomes. Their result shows that mortality of children under 5 years old born to women with secondary education was 50% lower than that of those born to women with no education. In another study, Woelk and Chikuse (2000), focused their study on inequalities in stunting, the number of underweight children and the incidence of diarrhoea in Zimbabwe. From their study, they concluded that children in poor households in the country are prone to being underweight three times more than children in non-poor households. Hadad et al, (1999), used DHS data for countries in Africa, Asia and Latin America to analyze variations in the prevalence of stunting in rural and urban areas. Their results show that levels of stunting were greater in urban areas than in rural areas. In a similar study, the findings of Menon et al. (2000), confirmed that inequality in

stunting in Africa, Asia and Latin America are larger in urban than in rural areas.

Wagstaff et al. (2003), decompose inequality in stunting in Vietnam, using concentration indices for the years 1993 and 1998. Their findings show that inequalities in consumption and commune-level effect are the main causes of the prevalence of stunting amongst lowest income quintile in the country. In addition, they find that both the increase in average consumption inequality and general improvements at the commune level accounted for the change in stunting inequality between 1993 and 1998. William et al.(2009), argue that the distribution of endowment and positive maternal characteristics accounted for the widening gap in child malnutrition between poor and the non-poor households in India. Ellen et al. (2009), used Blinder-Oaxaca decomposition to decompose the differences in child malnutrition between Scheduled Castes and the remaining Indian population. Their results show that inequality in stunting between the Scheduled Castes and the remaining population was caused by inequalities in wealth, education and use of health care services. In another study on health inequalities in 42 developing countries, Wagstaff (2002), enumerated four approaches to a better understanding of the impact of anti-inequality policies on health inequalities. These approaches are: cross country comparative studies, before-and-after country based studies with controls, benefit-incidence analysis, and decomposition analysis. His results show that health inequality has been rising in both developed and developing countries in recent times.

All the studies above, with the exception of the research of Wagstaff et al. (2003) focused on comparisons of income inequality under two regimes while some examined health inequality at a point in time. We are not aware of any study which compares health inequality in one country under different regimes in sub-Saharan

Africa in general and particularly in Nigeria.

4.0.11 Research Questions

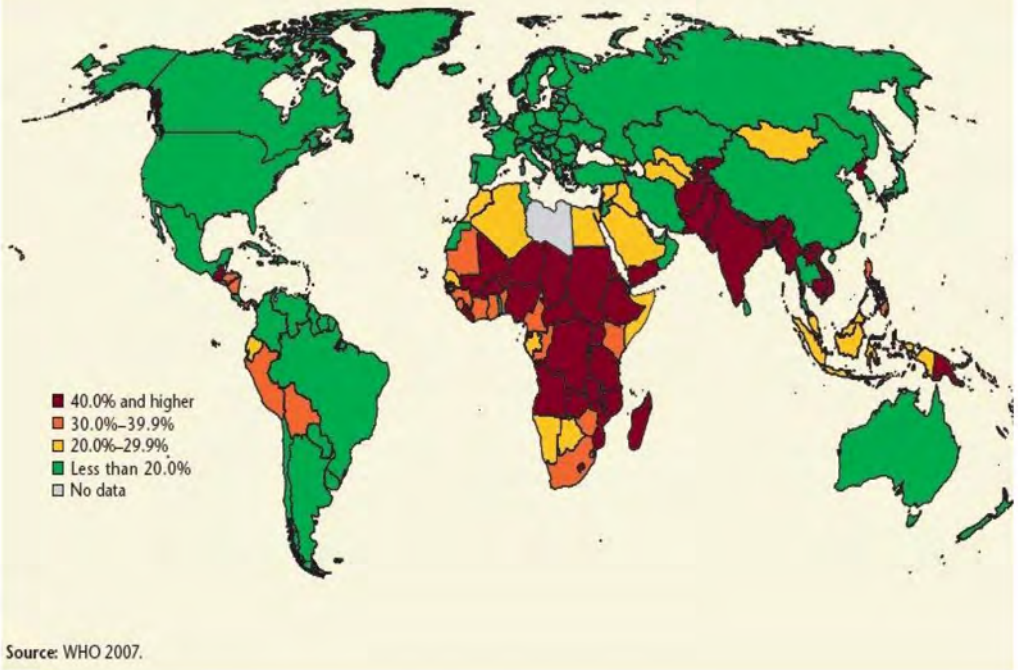
The questions we seek to answer in this paper are: (1) Does the health inequality evident under military rule persists under democratic rule in Nigeria; (2) What are the causes of and changes in health inequality in Nigeria over this period?

4.0.12 Definition, Methods and measurement of health indicators

Various indicators to measure and analyze socioeconomic inequality in health outcomes have been discussed in the literature. Some of these are infant mortality, incidence of diseases such as diarrhoea, life expectancy, morbidity and the recently anthropometric measures of underweight scores (low weights for age z-scores (WAZ)) and stunting (low heights for age z-scores (HAZ)) of children. We are using this last method which has been judged in the literature as the most objective measure of health outcomes especially as measures of child health (Kabubo-Mariara et al.2009, WHO Anthro 2009, and Wagstaff 2002). This indicator is also suitable for health comparisons across time and location. Data from the Demographic and Health Survey (DHS) on Nigeria also enables us to have access to much needed anthropometric measures of children in pre and post democratic transitions in the country.

In this paper, we measure both WAZ and HAZ of children aged 0-36 months in Nigeria in 1999 and 2008 respectively. The 1999 DHS contains information about children born under the military era while the 2008 dataset provides information

Map 6.2 **Geographical pattern of stunting in children under age five on a country basis**



Source: WHO 2007.

about children who were born under democratic rule. Thus we are able to carry out a comparison of child health inequality under these two regimes. We focus on the problem of stunting and being underweight, which we measure by using negative weight-for-age z-scores and negative height-for-age z-scores of children between age 0-35 months. Negative z-scores convey important information on the severity of stunting and being underweight rather than the probability of whether a child will be stunted or underweight. We then multiply the negative z-scores by -1 for the purpose of our analysis, following trends in the literature (O'Donnell, et al. 2008, Wagstaff, et al. 2003, and Skoufias 1998). Based on the WHO recommendation, children with z-scores lower than -6 are excluded from our analysis method (Meng et al. 2005, Goesling and Firebaugh 2004, Pradhan et al. 2003).

For us to be able to measure inequality in health outcomes between the rich and poor under the two regimes, we first use principal component analysis (PCA) to measure households' asset indices, due to the non-availability of income and expenditure information in the DHS dataset. Recent studies show that asset indices derived from PCA are good predictors of health outcomes as well as a good alternative to income and expenditure data (Sahn and Stifel 2003, Filmer and Pritchett 2001). The asset index is also used here to group households into five asset quintiles, from the poorest group to the richest group.

4.0.13 Measurement of health inequality using the concentration index

As earlier indicated, inequality in health between the poor and the rich may be in the form of unequal access to health services and to benefits from health ex-

penditure or subsidies or in the form of inequality in health outcomes. The latter, which is our main focus is the most comprehensive measure of health inequality. We used concentration indices to determine whether inequality exists in stunting and being underweight among children aged 0-36 months in Nigeria. This is the first step in our analysis of health inequality. The Concentration index is twice the area between the concentration curve and the line of equality (O'Donnell et al; 2008). For instance, if yi is the negative of the height-for-age z-score of child i. The concentration index (CI) of y results from a concentration curve, which plots the cumulative proportion of children, ranked by socioeconomic status, against the cumulative proportion of y. The concentration curve lies above the diagonal if y is larger among the poorer children and vice versa. The further the curve lies from the diagonal, the higher the socioeconomic inequality in nutritional status. Therefore, a concentration index is a measure of this inequality and is defined as twice the area between the concentration curve and the diagonal. If children with low socioeconomic status suffer more malnutrition than their better off peers the concentration index will be negative (Wagstaff et al 1991).In the illustrated graph in Figure4.1 below, the 45^0 line is the line of equity between the poor and the rich.

The concentration index is equal to zero at any point along this line, meaning that there is no inequality between the poor and the rich in the distribution of the variable under consideration. If the curve lies above the line, the variable is concentrated amongst the poor and the value of the index will be negative. On the other hand, if the curve lies below the line, then the variable is concentrated amongst the rich and the value of the concentration index in this case will be positive. Households are ranked based on their socioeconomic status, and the concentration index is then computed to determine the group where the health

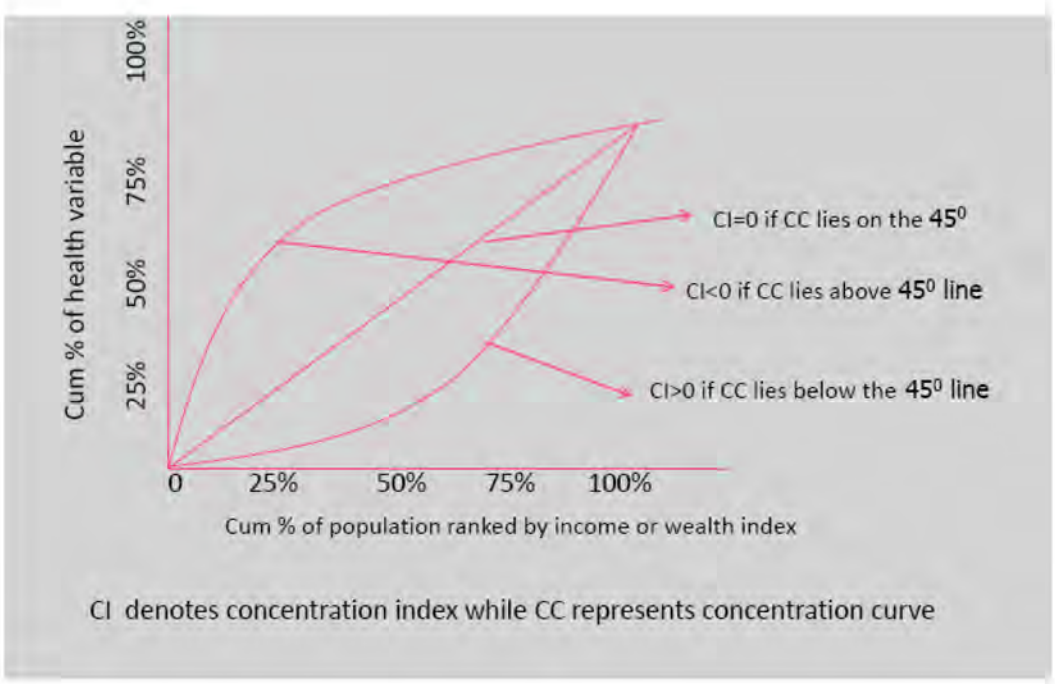


Figure 4.1: Graphical illustration of the concentration index

variable of interest is severe, the variable in our case being incidences of stunting and being underweight. If stunting or being underweight is severe amongst the poor, the index takes a negative value but if stunting and being underweight is severe amongst the rich, the index value is positive. Because stunting and being underweight are indicators of ill health, a negative value of the concentration index means that ill health is severe or intense amongst the poor. If there is no inequality in the health variable under consideration, the index will be equal to zero. If the index is positive, then the variable under consideration is prevalent amongst the rich. A comparison of the concentration index between the two regimes will show whether inequality in ill health between the poor and the rich has been reduced or become worse. Therefore, if government policies after transition from military rule to democratic rule in Nigeria favour the poor, it is expected that inequality

in stunting and being underweight will be lower under democratic rule. We used the well known Kakwani, et al. (1997) method to compute inequality in stunting and being underweight, in 1999, 2003 and 2008 respectively. The index is given as

$$C = \frac{2}{\mu} \sum y_i R_i - 1 \tag{1}$$

where; C is the concentration index, which is a measure of relative inequality, like the Gini coefficient. μ is the mean of y, y is the health variable. R is the fractional rank of the ith person in the income distribution. Therefore, doubling of the score for every individual's health does not affect the concentration index but rather leaves the index unchanged. The concentration index value is bounded between -1 and 1.

4.0.14 Decomposition of changes in health inequality in Nigeria

The next step in our analysis of health inequality in Nigeria is to find a way of explaining differences in health outcomes between the poor and the rich in the country. We used decomposition methods to explain differences in the severity of stunting and being underweight between the poor and the rich in the country. The decomposition method enables us to show how inequality in the two health outcomes can be explained by inequality in other factors that affect stunting and being underweight. Therefore, if inequality in other factors that affect stunting and being underweight are responsible for inequality in child health, then, it will be easier to reduce inequality in stunting and being underweight by reducing inequality in their determinants. This is the main benefit of decomposing health inequality into its contributing factors.

Decomposition of the concentration index as proposed by Wagstaff et al. (2003) in equation (2) to (3) explained inequality in stunting and being underweight across the entire distribution of socioeconomic status. This method decomposed the concentration index of health outcome into the contributions of individual factors to income-related health inequality. Accordingly, each of these contributions is determined by both the elasticity and the income-related inequality in those factors. Based on the work of Wagstaff et al. (2003), O'Donnell et al. (2008) decomposed height-for-Age z-score concentration indices of children in Vietnam for 1993 and 1998. Their work shows that the concentration index can be decomposed into the contributions of individual variables to asset or income-related health inequality. Assuming a reduced linear additive regression model of health, as proposed by Wagstaff et al. (2003) to be,

(2) $y = \alpha + \sum_k \beta_k \wedge_k + \varepsilon_i$,

where y is the health outcome of interest and $\wedge$ is a vector of the determinants of y. The concentration index of health variable y, for the above equation can be decomposed as:

(3) $C = \sum_k (\beta_k \overline{\wedge}_k / \mu) C_k + GC_\varepsilon / \mu$

where μ is the mean of y , $\overline{\wedge}_k$is the mean of $\wedge_k$, C_k is the concentration index for $\wedge_k$(defined analogously to C), and GC_ε is the generalized concentration index for the error term (ε) defined as,

(4) $GC_\varepsilon = \frac{2}{n} \sum \varepsilon_i R_i$,

Eq. (4) is equivalent to the Gini coefficient corresponding to the generalized Lorenz curve (Wagstaff et al; 2003).

Changes in health inequality over time can be decomposed into changes in the determinants of health outcomes, with the aim of identifying the contribution

of changes in these factors to the overall change in inequality. There are two approaches to decomposition of changes in inequality. The first approach, which is the most common calculates differences by assuming that all the components of the decomposition, as specified in equation (3), have changed. This approach is specified as follows:

(5) $\Delta C = \sum_k \left(\beta_{kt}\, \overline{\wedge}_{kt} \,/\, \mu_t\right) C_{kt} - \sum_k \left(\beta_{kt-1}\, \overline{\wedge}_{kt-1} \,/\, \mu_{t-1}\right) C_{kt-1} + \Delta(GC_{\varepsilon t} \,/\mu_t)$

However, (5) is not intuitive enough as it does not differentiate between effects due to changes in the elasticities of the variables and the effects due to changes in the inequality of the variables. To overcome the weakness associated with (5), we use an Oaxaca-type decomposition (Wagstaff et al. 2003; Oaxaca 1973; O'Donnell et al. 2008), to explain changes in health inequality subsequent to transition in 1999 to democratic rule in Nigeria. The Oaxaca-type decomposition of changes in inequality of equation (3) differentiates the effects of changes in the variable's elasticities from the effects of changes in the socioeconomic distribution of the variables on the overall change in inequality in the specific health outcomes which are stunting and being underweight in our case. Based on O'Donnell et al. (2008) and Wagstaff et al. (2003), the Oaxaca-type decomposition of change in equation (3) is as follows:

(6) $\Delta C = \sum_k \eta_{kt} \left(C_{kt} - C_{kt-1}\right) + \sum_k C_{kt-1}(\eta_{kt} - \eta_{kt-1}) + \Delta(GC_{\varepsilon t} \,/\mu_t)$

where Δ represents change, η_{kt} stands for the elasticity of y with respect to variable x_k at time t, C_{kt} is the concentration index of variable x_k at time t, while the remaining part of the equation is as defined in (3). With the above method, we can explain, for each variable, and for all the variables combined, the extent to which changes in health inequalities are due to either changes in inequality in the determinants of health or changes in the elasticities of these determinants.

4.0.15 Measurement of other variables

We measured all our variables using the DHS datasets on Nigeria for 1999 and 2008. Age of the child was measured in months from 0-35 months old. We limit our analysis to 36 months for easy comparison, because the 1999 survey only measured children aged 0-35 months. We include Child's age square to account for nonlinearity in the relationship between child's health outcomes and age in months, as specified in the literature (Wagstaff et al. 2003, Glewwe, Gragnolati and Zaman 2000). Other child related variables included are the gender and twin variables to control for the effect of multiple births, and the variable indicating whether a child had a fever within the two weeks preceding the survey[3]. Household variables included are the asset index[4], a dummy for safe drinking water (piped and borehole water), sanitation (access to flush toilets), weight and height of the mother, Mothers' and Fathers' levels of education, and number of children in the household. We also control for the effects of unobservable characteristics of the six geopolitical zones by including regional fixed effects and a dummy specifying if the individual lives in an urban or rural community. All these variables are theoretically and empirically confirmed to relate to child health outcomes .

[3]Generally, multiple birth children are smaller in weight and height early in life compared to children of single births, due to their sharing of breast milk that would have been available to a single child. Diarrhea is omitted due to its correlation with access to safe drinking water.

[4]We understand that asset index may be endogenous and that our use of OLS may be inappropriate. The asset index may be endogenous if households' acquisition of assets is affected by long term illness of children. The alternative is to use instrumental variables. But as noted by Wagstaff et al, (2003), using instrumental variables will change the interpretation of the concentration index being explained from actual health inequality which is our main interest. Therefore, inclusion of either income or asset index is a pre-requisite for the decomposition and interpretation of the concentration index. However, we followed the general alternative in the literature by using the reduced form equations of health outcomes for our analysis which is a means of reducing the problem of endogeneity(Wagstaff A. 2002). We however exclude asset index from our analysis of Oaxaca-Blinder group differences in malnutrition.

4.0.16 Presentation and analysis of results

Table 4.1: Percentage Distribution of Assets by Quintile for 1999 and 2008 in Nigeria

	1999					2008				
Assets	poorest	poor	middle	rich	richest	poorest	poor	middle	rich	richest
Electricity	0.0	0.0	44.7	90.2	97.2	7.0	4.8	41.4	73.8	90.9
Radio	0.0	95.5	52.9	94.4	99.1	40.6	86.3	95.1	93.6	97.4
Tv	0.0	0.0	0.0	38.8	99.3	0.0	0.0	0.72	90	95.5
Fridge	0.0	0.0	0.0	5.5	79.3	0.0	0.3	0.6	3.32	69.8
Bike	23.4	44.2	32.2	23	23.8	11.4	99.8	33.6	22.1	31.3
Motor bike	0.0	4.5	47.1	15.8	43.6	5.4	8.5	67.8	47.8	50.3
Car	0.0	0.0	8.2	6.9	32.1	0.3	0.13	3.9	4.6	34.5
Sand floor	69.7	50.7	26.1	13.7	3.4	67.0	68.8	50.0	16.3	9.4
Cement floor	22.8	40.2	69.0	75.6	64.6	23.6	22.9	42.4	60.0	55.3
Carpet floor	0.4	0.8	1.2	7.9	29.4	2.8	1.5	4.4	21.6	30.0

Table 4.1 presents percentage distribution of assets across the five quintiles in the country in 1999 and 2008. The table shows that ownership of assets was greatest among the richest quintiles while the poorest quintile was most deprived. We present in table 4.2, summary statistics of stunting and being underweight by quintile in 1999 and 2008 under military and democratic rule respectively. The figures indicate that in the poorest quintile mean stunting and being underweight was higher than in the richest quintiles.

While mean stunting in 1999 was 3.09 in the poorest quintile, it was only 2.51 in the richest households. In 2008 however, there was a general reduction in stunting across the quintiles. Mean stunting in the poorest and the richest quintiles is reduced to 2.67 and 2.08 respectively although stunting was still prevalent in the poorest households. The percentage reduction in stunting of children between 1999 and 2008 for the poorest and the richest quintiles was 13.6 and 17.1 respectively. This indicates that children in the richest households have benefited more than

Table 4.2: Summary statistics of Stunting and Being Underweight of children in Nigeria

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
Poorest	3.09	1.58	2.67	1.6	-13.6
Poor	3.1	1.54	2.59	1.52	-16.5
Middle	2.85	1.61	2.47	1.48	-13.3
Rich	2.68	1.48	2.24	1.45	-16.4
Richest	2.51	1.52	2.08	1.45	-17.1
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
Poorest	2.32	1.63	2.19	1.39	-5.6
Poor	2.06	1.43	2.05	1.41	-0.5
Middle	1.86	1.39	1.86	1.33	0
Rich	1.79	1.27	1.57	1.16	-12.3
Richest	1.67	1.37	1.39	1.13	-16.8

%Δ is the percentage quintiles's change in stunting and being underweight between 1999 and 2008 in Nigeria

those in the poorest households from transition in the country.

Graphical illustration in Figure4.2 also indicates that the rich are better off under democratic rule in the country. In the case of being underweight as presented in Table 4.1 and Figure4.3, in 1999, that is, when the country was under military rule, the poorest and the poor quintiles had the highest mean underweight scores of 2.32 and 2.06 respectively.

In the same year, mean underweight scores for the middle, rich and the richest quintiles were 1.86, 1.76 and 1.67 respectively. In 2008, mean underweight scores for children ages 0-35 months was reduced in all the quintiles, but the rich and the richest benefited the most in this regard. Mean underweight scores for the rich and the richest quintiles, was reduced by 12.3 and 16.8 respectively, compared to a 0.5 and 5.6 reduction in mean underweight scores for children in the poor and poorest quintiles. The mean underweight scores remained unchanged between 1999 and

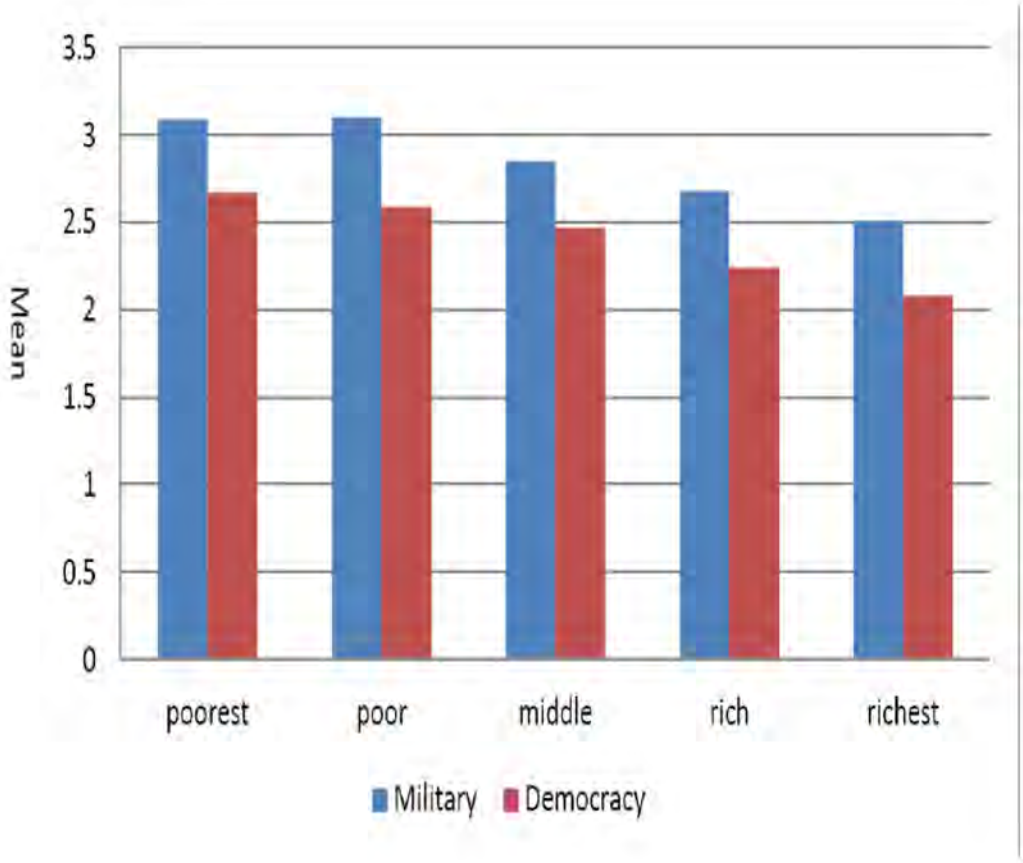


Figure 4.2: National Stunted Children by Asset Quintiles

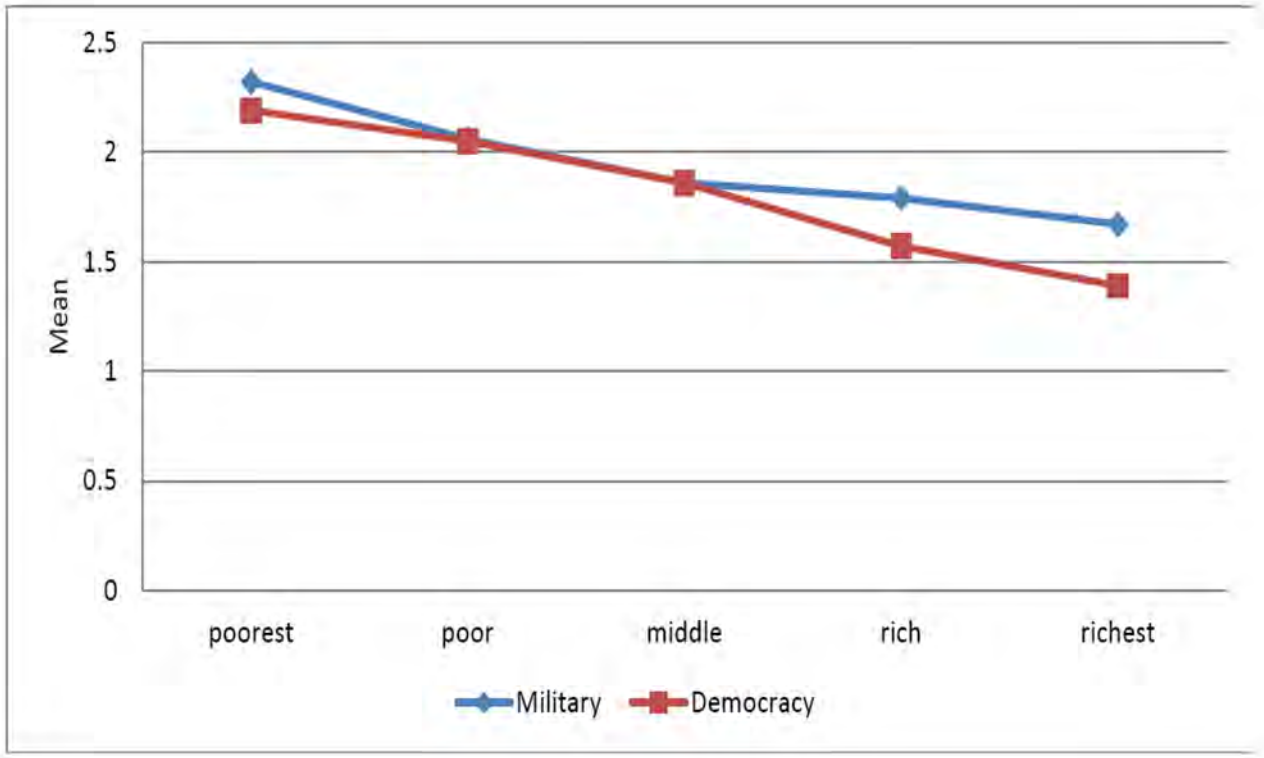


Figure 4.3: National Underweight Children by Asset Quintiles

2008 for the middle quintile. Our summary statistics in Table 4.1 clearly show that the problem of stunting and being underweight are severe amongst the poor in 1999 and in 2008.

The use of a concentration index is more appropriate for a better understanding of socioeconomic health inequality between two periods. In this section we present our analysis and comparison of health inequality for children below the age of 36 months in Nigeria for the years 1999 and 2008. As earlier explained, when the value of the concentration index is positive, stunting or being underweight is severe or prevalent amongst the rich but when it is negative it is more severe amongst the poor. Note also that the value of the index lies between 1 and -1.The closer the concentration index is to zero, the lower the inequality in the variable under consideration. Understanding this relationship is crucial to an understanding of our analysis of health inequality as presented in the rest of this paper.

Table 4.3: Concentration Indices of Stunting and Being Underweight of children in Nigeria

Measures of Health outcomes	1999	2008	Change between 1999 and 2008
	Military rule	Democratic rule	$\%\Delta$
Stunting Concentration indices	-0.044	-0.050	13.6
	(0.008)	(0.004))	
Underweight Concentration indices	-0.067	-0.081	20.9
	(0.011)	(0.004)	
Note: standard errors are in parentheses			

There was considerable variation in the prevalence and changes in the two measures of malnutrition among children in Nigeria. From our analysis of the concentration index shown in table 4.3, childhood malnutrition in the country was disproportionately concentrated amongst children living in poor households in 1999 and 2008. In the first place, inequality in stunting increased by 13.6 percent or

from -0.044 in 1999 to -0.050 in 2008. The results indicate that children in poor households were worse-off in the first ten years of democratic rule in the country. Inequality in children being underweight rose by 20.9 percent or from -0.067 in 1999 to a peak of -0.081 in 2008. Our two measures of malnutrition show that the gap between rich and poor still persists in the country, as indicated by the increase in the severity of childhood malnutrition amongst the poor households. However, we cannot fully explain the causes of the rise in inequalities in stunting and being underweight without a decomposition of the concentration indices into the determinants of health inequality. Therefore, the next step in our analysis is to decompose each index into the contribution of inequality in the distribution of the determinants of stunting and being underweight between the two periods.

4.0.17 Changes in variables determining health inequalities between 1999 and 2008

We present, in table 4.4, the mean, concentration indices and change in the indices between 1999 and 2008 for children below 36 months in Nigeria. There are three columns for each year, which are the mean, the concentration index (CI) of each variable and the standard error of the concentration index (std). When the concentration index (measure of inequality) of a variable is positive, such variable is advantageous to rich people if it is a good outcome, such as a health subsidy. On the other hand, when the concentration index of a variable such as infant mortality is positive, infant mortality is disadvantageous to the rich compared to the poor. The value of the concentration index is bounded between a minimum of -1 and a maximum of 1. Inequality is zero if the value of the concentration index is 0

(zero). The closer the concentration index of a given variable is to -1 the more that variable is prevalent amongst the poor.

Our results for the two years under consideration show that the concentration indices (CI) of most of the variables are positive, which indicates that the distribution of these variables is advantageous to the rich group. The incidence of fever, as expected was concentrated in the poor households, as indicated by the negative sign of CI. In 1999, when Nigeria was under military rule, ownership of assets favoured the rich, with a CI of 0.256 point. Inequality in asset indices increased to 0.276 in favour of the rich by 2008. The food consumption index was also concentrated among the rich in the two years of our analysis. It should be noted that there was a significant increase in food index inequality to the advantage of the rich, from 0.016 in 1999 to 0.071 in 2008. This is an indication that the gap in food security between the poor and the rich had widened, to the disadvantage of the poor.

Access to safe drinking water and sanitation was also more prevalent among the rich, with inequality in access to sanitation nearly doubling between 1999 and 2008 to the detriment of the poor. There was no significant inequality in breast feeding between the rich and the poor, since every child have access to being breast fed except if the child is an orphan. Inequality in maternal and paternal education consistently disfavoured the poor and inequalities over the years widened. While inequality in mothers' education rose from 0.283 in 1999 to a peak of 0.311 in 2008, that of fathers' education rose from 0.221 in 1999 to 0.258 in 2008.

Table 4.4: Selected Variables Mean and Concentration indices

	1999			2008			
Variables	mean	CI*	std**	mean	CI*	std**	ΔCI^{***}
(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Age in months	16.26	0.032	0.008	16.025	0.014	0.003	-0.018
Age squared	362.54	0.054	0.013	356.79	0.024	0.004	-0.03
Child=male	0.508	0.003	0.014	0.503	0.002	0.006	-0.001
Twin dummy	0.049	0.06	0.083	0.041	0.053	0.033	-0.007
Asset index	2.934	0.256	0.004	2.88	0.276	0.002	0.02
Food index	0.752	0.018	0.026	2.20	0.071	0.006	0.053
safe Water	0.367	0.277	0.018	0.354	0.276	0.008	-0.001
Sanitation	0.737	0.085	0.009	0.637	0.134	0.005	0.049
Breast feeding	0.912	0.003	0.004	0.974	0.000	0.000	-0.003
Maternal education	0.846	0.282	0.013	0.840	0.31	0.006	0.028
Maternal height	155.6	-0.000	0.002	158.5	0.002	0.000	0.002
Urban	0.295	0.375	0.019	0.269	0.457	0.008	0.082
Number of children	2.158	-0.013	0.008	2.285	-0.009	0.003	0.004
Head age	40.86	0.008	0.005	40.48	-0.004	0.002	-0.012
Hageˆ2	1823.1	0.015	0.010	1793.4	-0.013	0.004	-0.028
Paternal education	1.1	0.221	0.011	1.07	0.258	0.005	0.037
Fever	0.311	-0.056	0.021	0.176	-0.035	0.012	-0.021
Maternal weight	57.81	0.022	0.004	58.73	0.029	0.002	0.007

Note: *and ** represent concentration indicies and the standard errors of the indices respectively.*** denotes ,change in the concentration index of each variable

4.0.18 Decomposing Changes in Inequalities in Stunting and being Underweight

Inequality in being stunted and being underweight changed from one period to another. As shown in table 4.3, we note that there were changes in both inequalities in being stunted and being underweight between 1999 and 2008. Inequality in being stunted rose from -0.044 in 1999 to -0.050 in 2008. On the other hand, inequality in being underweight changed from -0.067 in 1999 to -0.083 in 2008. These changes, which are disadvantageous to the poor households, are due to changes in the determinants of a child being underweight and being stunted. We therefore decomposed these changes for a better understanding of the contribution of change in each variable to total change in health inequality. The results of the decomposition are shown in Table 4.5 and 4.6 respectively.

We divide the effect of change in each variable into change in the inequality (concentration index) of each variable, weighted by the elasticity of the variable ($\Delta C\eta$) and the change in the elasticity of each variable, weighted by the concentration index of the variable ($\Delta \eta C$) . Summation of these two effects is the total effect of change in the variable on the total change ($T\Delta$) in inequality in being stunted and being underweight. A negative sign of the change in any of the variables in column 1 and 3 indicates that change in such variable between 1999 and 2008 has been disadvantageous to the poor households. The last column in table 4.5 and 4.6 represent the effect of total change in each variable on the total change in inequalities in stunting and being underweight between 1999 and 2008. We shall focus our analysis on the first ($\Delta C\eta$) and second ($\%\frac{\Delta C\eta}{T\Delta C}$) columns which present how changes in the distribution of these variables affect total change in inequality in be-

ing stunted. In table 4.5, changes in most of the variables between 1999 and 2008 disadvantaged the poor, as shown by the negative signs of the coefficient of these variables. Changes in inequality in asset indices accounted for about -0.00092 or 16.5 percent of the increase in inequality in being stunted between 1999 and 2008. The food consumption index contributed -0.000115 or 2.1 percent while change in inequality in sanitation contributed -0.000237 or 4.3 percent of the increase in inequality in being stunted. Differences in access to drinking water marginally reduced inequality in being stunted by -0.1 percent. Changes in inequality in maternal and paternal levels of education contributed -0.0007447 or 13.4 percent and -0.000739 or 13.3 percent respectively, to increase inequality in being stunted between 1999 and 2008 to the disadvantage of children in poor households. Children of malnourished mothers are shown to be more disadvantaged between 1999 and 2008, related to an increase in inequality in mothers' height, which further increase inequality in being stunted by -0.001945 or 35 percent of the total increase in the incidence of stunting amongst children in poor households. The combination of the effect of changes in the concentration indices of the determinants in column 1 and the changes in the elasticities of these variables finally resulted in an increase of -0.005569 or 13.9 percent in inequality in stunting between 1999 and 2008. This result confirmed the worsening conditions of the poor in the first ten years under democratic rule in Nigeria and the findings stress the need for democratically elected leaders to be more committed to the welfare of their citizens, especially the poor.

Changes in the inequality in the food consumption index contributed to the observed prevalence of stunting in poor households. As noted earlier, inequality in the food consumption index increased from 0.037 to 0.074 between 1999 and 2008,

Table 4.5: Oaxaca-type Decomposition of Change in inequality in stunting in Nigeria

	1999-2008			
Variables	$\Delta C\eta^*$	$\%\frac{\Delta C\eta}{T\Delta C}$	$\Delta\eta C^{**}$	$T\ \Delta_k^{***}$
(i)	(ii)	(iii)	(iv)	(v)
Age in months	-0.00742	133.2	0.005825	-0.0016
Age squared	0.005189	-93.3	-0.00509	0.000101
Child=male	-0.00004	0.7	0.00006	0.00001
Twin dummy	-0.00002	00.4	-0.00023	-0.00025
Asset index	-0.00092	16.5	0.016957	0.016038
Food index	-0.000115	2.1	2.75E-05	-8.8E-05
Safe water	3.93004E-06	-0.1	-0.00629	-0.00628
Sanitation	-0.000237	4.3	-0.00481	-0.00504
Breast Feeding	0.000283	-5.1	-0.00027	-8.8E-06
Maternal education	-0.0007447	13.4	0.001552	0.000807
Maternal height	-0.001945	35.0	5.89E-05	-0.00189
Urban	-0.000633	11.4	-0.00969	-0.01033
Number of children	-3.33661E-05	0.6	0.000588	0.000555
Head age	-0.001215	21.8	0.002028	0.000812
Hage^2	0.001714	-30.8	-0.00126	0.000455
Paternal education	-0.000739	13.3	0.011633	0.010894
Fever	-2.42711E-05	0.4	-7.2E-05	-9.6E-05
Regional fixed effects	-0.0003086	5.5	0.007157	0.006849
Residual				0.005394
Total	-0.00721252	129.5	0.018177	-0.005569

Note:* denotes change in the concentration index weighted by the elasticity of the index, ** is the change in the elasticity of each variable weighted by the concentration index, while ***denotes total change in each variable between 1999 and 2008

to the disadvantage of the poor households. The effect of the increase in inequality in the food consumption index on inequality in being stunted was however marginal due to the age of the children included in our analysis who may be depending on breast feeding rather than the alternative of food suplements. Changes in access to drinking water and sanitation increased inequality in being stunted by -0.00628 and -0.00504 or about 14.3 and 11.5 percent of the level of inequality in stunting in 1999. This result confirmed the importance of equal access to basic services such as safe water and sanitation.

Table 4.6 presents the findings that, inequality in being underweight increased by 20.9 percent that is, from -0.067 in 1999 to -0.081 in 2008, to the disadvantage of poor households. The result of our decomposition of change in being underweight was similar to our explanation on the change in being stunted. Most of the policy related variables including the asset index, food consumption index, and access to sanitation and water contributed to the increase in children's being underweight between 1999 and 2008 to the disadvantage of children in poor households. Surprisingly, changes in inequality in the food index as a percentage of the total change in inequality in being underweight was the highest, at -0.0014 or 10.3 percent. We observe, also, that the effect of change in age in months was almost offset by the effect of change in age squared. Two issues require further analysis in the result of our decomposition above. In the first place, although our decomposition of inequality using a concentration index is revealing, the inclusion of an asset index may lead to the problem of endogeneity bias if malnutrition affect household acquisition of assets. Since the inclusion of an asset index is a pre-requisite to our analysis and we are not sure whether incidence of malnutrition have a negative effect on household acquisition of assets, we carried out further

Table 4.6: Oaxaca-type Decomposition of change in inequality in underweight in Nigeria

	1999 - 2008			
Variables	$\Delta C\eta^*$	$\%\frac{\Delta C\eta}{T\Delta C}$	$\Delta\eta C^{**}$	$T\ \Delta_k^{***}$
(i)	(ii)	(iii)	(iv)	(v)
Age in months	-0.00377	27.7	0.011783	0.008009
Age squared	0.003673	-27.0	-0.00971	-0.00604
Child=male	0.000282	-2.1	-0.00015	0.000133
Twin dummy	-0.0005	3.7	-1.13E-05	-0.00049
Asset index	-0.0007	5.2	-0.0016	-0.0023
food index	-0.0014	10.3	-0.00134	-0.00274
Safe water	-0.00011	0.8	0.009377	0.009264
Sanitation	-0.00126	9.3	0.001757	0.00499
Breast feeding	-0.00056	4.1	-0.00026	-0.00082
Maternal education	-0.00095	7.0	-0.01366	-0.01462
Maternal Weight	-0.00077	5.7	0.003055	0.002283
Urban	-7.8E-05	0.6	-0.01354	-0.01362
Number of children	3.74E-05	-0.3	-0.00035	-0.00031
Head age	-0.00057	4.2	-0.00758	-0.00814
Headage^2	0.001558	-11.5	0.005721	0.007279
Paternal education	-0.00055	4.0	-0.00107	-0.00162
Fever	0.000203	-1.5	0.000384	0.000587
Regional fixed effects	-0.00125	9.2	0.026081	0.024835
Residual				-0.0114
Total	-0.00672	49.4	0.008904	-0.01359

Note:* denotes change in the concentration index weighted by the elasticity of the index, ** is the change in the elasticity of each variable weighted by the concentration index,while ***denotes total change in each variable between 1999 and 2008

analyses using group differences of malnutrition, which is devoid of the possible bias of endogeneity (Wagstaff,2002 and William et al.2009)[5], and more appropriate for policy intervention recommendations. In addition, the result of our decomposition of changes in health inequality suggest that there may be regional variation in the incidence and change in health inequality in the country.

4.0.19 Regional dimension of health inequality in Nigeria

We noticed from our decomposition of the concentration index that there may be significant regional variation in the changes reflected in our two measures of health inequality in the country. Therefore, it is necessary to explore this possibility through further analysis of the six geopolitical zones in the country. The six regions vary in terms of pre-colonial traditions, post colonial political ideologies, religion and in natural resources endownment.

As shown in Table 4.7, inequality in stunting is concentrated amongst poor households both in 1999 and 2008 in the North Central (NC) geopolitical zone. Inequality in stunting in the NC region increased by 66.7 percent from -0.03 in 1999 under military rule to -0.05 under democratic rule, in 2008. In the same NC geopolitical zone, socioeconomic inequality in being underweight rose by 250 percent in poor households from -0.02 in 1999 to -0.07 in 2008. Therefore, the poor are worse-off in the NC zone after 9 years of democratic rule in the country. Stunting was concentrated in poor households under military rule in the North East (NE) geopolitical zone in 1999, however, there was an increase in the prevalence of

[5] Oaxaca-blinder decomposition of group differences in malnutrition does not require the inclusion of income related variable such as asset index and consumption expenditure. The inclusion of income related variables in the decomposition of the concentration index is the main possible source of endogeneity as noted earlier

Table 4.7: Concentration Indices of Stunting and Being Underweight by regions in Nigeria

	stunting inequality			underweight inequality		
	1999	2008		1999	2008	
Regions	military rule	democratic rule	%Δ	Military rule	Democratic rule	%Δ
Pooled CI	-0.044	-0.05	13.6	-0.067	-0.081	20.9
	(0.008)	(0.004)		(0.011)	(0.004)	
North central CI	-0.03	-0.05	66.7	-0.02	-0.07	250
	(0.018)	(0.008)		(0.026)	(0.01)	
North east CI	-0.01	-0.02	100	-0.04	-0.02	-50
	(0.013)	(0.007)		(0.017)	(0.007)	
North west CI	-0.05	-0.02	-60	-0.03	-0.05	66.7
	(0.02)	(0.006)		(0.024)	(0.006)	
South east CI	-0.01	-0.04	300	0.05	-0.05	200
	(0.032)	(0.015)		(0.045)	(0.017)	
South south CI	0.02	-0.02	200	0.00	-0.05	5
	(0.021)	(0.01)		(0.035)	(0.014)	
South west CI	-0.08	-0.03	-62.5	-0.05	-0.07	40
	(0.020)	(0.01)		(0.026)	(0.01)	
%Δ is the percentage change in inequality while the standard errors						
of the concentration indices are in parentheses						

stunting between 1999 and 2008 which disadvantaged poor households. Between 1999 and 2008, incidence of stunting was 100 percent higher in the poor households than in rich households. In addition, incidence of being underweight was 250 percent higher in the poor households in 2008 than rich households in comparison with 1999 figures. The situation in the North West (NW) geopolitical zone was mixed for the poor. While inequality in the concentration of stunting was reduced by 60 percent between 1999 and 2008, to the advantage of the poor, inequality in the concentration of being underweight was higher among the poor by 66.7 percent from -0.03 in 1999 to -0.05 in 2008. It is very important to emphasise that both measures of malnutrition are still concentrated amongst poor households in the NW zone in 2008. In the South East (SE) geopolitical zone, inequality in the distribution of stunting and being underweight rose by 300 percent and 200 percent respectively between 1999 and 2008, to the disadvantage of poor households. In the South South (SS) geopolitical zone, the concentration of stunting in poor households increased by 200 percent between 1999 and 2008, while inequality in the incidence of being underweight rose by 5 percent, to the disadvantage of poor children. Lastly, in the South West (SW) geopolitical zone, inequality in the concentration of stunting for poor households declined by 62.5 percent from, -0.08 in 1999 to -0.03 in 2008, but inequality in the incidence of being underweight rose by 40 percent, from -0.05 in 199 to -0.07 in 2008, to the disadvantage of poor children. As at 2008, inequalities in stunting and being underweight were therefore, concentrated in poor households in all six geopolitical zones in the country. While inequality in stunting to the disadvantage of poor children was highest in the North Central zone in 2008, the highest inequality in being underweight was jointly shared by the North Central and South West geopolitical zones.

4.0.20 Blinder-Oaxaca Analysis of Group Differences in Malnutrition

As shown in table 4.8, we use Blinder-Oaxaca group mean differences in stunting and being underweight to check the robustness of our concentration indices. The mean differences between poor and non-poor children confirmed the persistency and severity of malnutrition subsequent to transition to democratic rule in Nigeria. In addition, the Blinder-Oaxaca group mean differeces in stunting and being underweight show that there was a significant increase in inequality between poor and non-poor children at the one percent level. Similar to the change in the concentration indices, we observed that there was a slight but significant increase in inequality in stunting, from 0.422 to 0.424, between 1999 and 2008. On the other hand, inequality in being underweight was very large and significant at the one percent level, from 0.363 to 0.540 between 1999 and 2008.

Table 4.8: Blinder-Oaxaca group differences inStunting and Being Underweight

Measures of Health outcomes	1999	2008
	Military rule	Democratic rule
Blinder-Oaxaca inequality in stunting	0.422***	0.424***
	(0.083)	(0.033)
Blinder-Oaxaca inequality in being underweight	0.363***	0.540***
	(0.073)	(0.026)
Note: standard errors of inequality are in parentheses		
and *** indicates significant at 1 percent level		

In the following analysis, as shown in table 4.9, we use Blinder-Oaxaca decomposition to explain inequality due to differences in the magnitudes of the determinants (otherwise known as endownment effect) of health outcomes and those due to the effects of these determinants (also known as coefficients effect) in 2008.

With this method we are able to decompose inequality in malnutrition without the inclusion of an asset index and we are able to explain the relationship between malnutrition and each determinant. An additional advantage of this method is that we are able to adjust for possible selection bias that may arise from grouping households into a poor or non-poor groups. A negative sign of the variable indicates that the gap in the distribution of malnutrition between poor and non-poor children is narrowing, while a positive sign indicates increasing inequality in malnutrition levels between poor and non-poor children. The result of the Blinder-Oaxaca decomposition of group differences in stunting shows that the endowment effect between poor and non-poor contributed a total of 0.275 or 64.9 percent of the total gap in stunting between poor and non-poor children in 2008. The endowment effect's total contribution to inequality in stunting is significant at the one percent level to the disadvantage of poor children, as shown in Table 4.9. Column (ii) in Table 4.9, shows that characteristics of children such as gender and being a twin both influence the levels of inequality in stunting.

Inequalities in access to safe drinking water, maternal education levels and mother's height, also determine differences in stuntingg between poor and non-poor children. Regional fixed effects also play a role in unequal levels of malnutrition between rich and poor children. It should be noted that the contribution of these variables to the recorded differences confirms our earlier analysis of inequality in stunting using concentration indices. While unequal access to safe drinking water was significant at the five percent level, differences in maternal education levels was significant at the one percent level. Unequal access to sanitation, however, favour the poor because most buildings with water closet (WC) toilets lack the regular supply of water which is necessary for hygienic usage. Due to the lack of

Table 4.9: Blinder-Oaxaca decomposition of inequality in stunting in Nigeria, 2008

VARIABLES	Endowments effect		Coefficients effect		Interaction effect	
(i)	(ii)		(iii)		(iv)	
Age in months	-0.0333**	(0.013)	0.575**	(0.263)	-0.0267*	(0.0140)
Age^2	0.0300**	(0.013)	-0.172	(0.165)	0.0144	(0.0142)
Child-male	-0.00132	(0.0025)	-0.0330	(0.033)	0.000372	(0.0008)
Twin dummy	-0.00297*	(0.0018)	-0.00697	(0.0066)	0.00171	(0.0018)
Food index	0.00233	(0.0067)	0.00427	(0.0426)	-0.000883	(0.0088)
Safe water	0.0481**	(0.0188)	0.102**	(0.0411)	-0.0629**	(0.0253)
Sanitation	-0.0361*	(0.0187)	-0.0578	(0.063)	0.0202	(0.0219)
Breast feeding	-1.86e-05	(0.00046)	-0.205	(0.244)	-2.43e-05	(0.0006)
Maternal ducation	0.127***	(0.0295)	-0.0894	(0.0657)	0.0575	(0.0422)
Maternal height	0.0200***	(0.0048)	0.872	(0.638)	-0.00629	(0.0047)
Urban	0.0363	(0.0235)	-0.0248	(0.0460)	0.0201	(0.037)
Number of children	0.00197	(0.0025)	-0.0685	(0.063)	-0.00325	(0.0031)
Headage	6.89e-06	(0.0073)	0.190	(0.531)	0.00305	(0.0086)
Headage^2	-0.00240	(0.0107)	-0.0789	(0.232)	-0.00421	(0.0124)
Paternal education	0.0423	(0.0289)	-0.0136	(0.068)	0.00759	(0.0382)
Regional fixed effect	0.0470***	(0.0148)	-0.108	(0.077)	0.0286	(0.0206)
Fever	-0.00365	(0.0023)	0.0220	(0.014)	0.00405	(0.0028)
Total	0.275***	(0.0397)	0.0954*	(0.0521)	0.0532	(0.0570)
Constant			-0.812	(0.733)		
Observations	8,955		8,955		8,955	

Standard errors in parentheses,*** p<0.01, ** p<0.05, * p<0.1

regular water supply in the country, houses with these toilets pose a greater danger to the health of children.

The total contribution of coefficient effects (effects of the determinants) to total inequality in stunting between the poor and non-poor was 0.0954 or 22.5 percent in 2008 (shown in column (iii)). Most of the variables are not significant at the individual level but unequal access to safe drinking water contributed significantly to unequal levels of malnutrition. Even the interaction of the contribution of endowment and coefficient effects of access to safe drinking water widened inequality in stunting between poor and non-poor children by 2008. Therefore, our results further stress the importance of focus on these policy related variables in order to narrow the gap between rich and poor households in the incidence of stunting in the country.

The results of the decomposition of group differences in being underweight, shown in Table 4.10 were similar to findings with regard to stunting. Column (ii), shows that endownment effects contributed significantly to inequality in being underweight, at 0.231 or 42.8 percent of the total inequality in being underweight between poor and non-poor children in the country. At individual variable level, the contribution of differences in food consumption was positive and now significant, at the10 percent level, while the influence of differences in maternal education and mother's weight, and regional fixed effects are all positive and significant, at 1 percent level. The number of children in the household contributed significantly to widening the gap between children from rich and poor households with regard to being underweight and this is significant at the 5 percent level. The total coefficient effect was not significant, although some of the variables are significant at an individual level. Coefficient effects only contributed 0.2 percent to inequality

Table 4.10: Blinder-Oaxaca decomposition of inequality in being underweight in Nigeria, 2008

Variables	Endowments effect		Coefficients effect		Interaction effect	
(i)	(ii)		(iii)		(iv)	
Age in months	-0.00427	(0.0056)	1.381***	(0.203)	-0.0480***	(0.0179)
Age^2	0.00402	(0.0060)	-0.734***	(0.125)	0.0449***	(0.0158)
Child male	0.000197	(0.0014)	0.0406	(0.026)	0.000118	(0.0008)
Twin dummy	-0.00316**	(0.0016)	0.00106	(0.0054)	-0.000350	(0.0018)
Food index	0.00882*	(0.0054)	-0.0969***	(0.033)	0.0210***	(0.0074)
Safe water	0.00599	(0.014)	0.0430	(0.033)	-0.0258	(0.0196)
Sanitation	-0.0342**	(0.015)	-0.105**	(0.052)	0.0352**	(0.0173)
Breast dummy	0.00130	(0.0013)	-0.340*	(0.20)	-0.000986	(0.0011)
Maternal edulevel	0.125***	(0.023)	-0.275***	(0.053)	0.187***	(0.036)
Maternal weight	0.0366***	(0.0073)	0.148	(0.091)	-0.0145	(0.0089)
Urban	0.00697	(0.018)	-0.0548	(0.038)	0.0445	(0.0307)
Children number	0.00588**	(0.0023)	-0.124**	(0.051)	-0.00509**	(0.0025)
Headage	0.000604	(0.0023)	-0.508	(0.413)	-0.000851	(0.0033)
Headage2	-0.00302	(0.0036)	0.141	(0.180)	0.00261	(0.0039)
Paternal edulevel	0.0294	(0.023)	-0.161***	(0.054)	0.0963***	(0.032)
Regional fixed effect	0.0490***	(0.012)	0.111*	(0.064)	-0.0294*	(0.017)
Fever	0.00143	(0.0012)	0.0134	(0.012)	0.00149	(0.0014)
Total	0.231***	(0.031)	0.000974	(0.043)	0.308***	(0.047)
Constant			0.520	(0.324)		
Observations	10,016		10,016		10,016	

Standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

in being underweight. On the other hand, the interaction between the differences in the endowment and coefficient effects contributed significantly to inequalities in being underweight. The total contribution was 0.308, or 50 percent of the total inequality in being underweight and was significant at the 1 percent level. Some of the variables that contribute positively and significantly to inequality in being underweight when interaction effects are taken into account include unequal access to sanitation, food, and differences in maternal and paternal education levels. Interaction effect of unequal access to water and regional fixed effects are widens the gap in inequality in being underweight.

4.0.21 Summary, policy implications and conclusion

In this paper we have considered the problem of childhood health inequality in Nigeria between 1999 and 2008, in particular, we investigate the problem of childhood malnutrition. Our main aim has been to present empirical evidence on whether health inequality between poor and non-poor children has declined after transition to democratic rule in the country in 1999. Secondly, we also seek to identify the main determinants of health inequality in the country and the effects of changes in these determinants on the change in inequality in childhood malnutrition between 1999 and 2008. From our findings, we establish that inequality in stunting and being underweight has persisted and worsened under democratic rule in the country. Inequality in being stunted rose by 13.6 percent between 1999 and 2008, and inequality in being underweight increased by 20.9 percent within the same period, to the disadvantage of poor children. We show strong evidence of within-country variation in inequality with regard to malnutrition in our de-

scriptive analysis and our regression analysis. Our decompositions show that the main causes of inequality in the two health outcomes of interest are due to differences in maternal and paternal levels of education, and unequal access to safe drinking water and sanitation. Household location was also a major factor in unequal childrenhood malnutrition outcomes. We argue that this may be due to lack of access to basic services such as safe drinking water and sanitation and health care services, in rural areas. We also show that socioeconomic differences in the determinants of health inequality rather than their elasticities are the main causes of the increase in health inequality subsequent to the transition to democratic rule in the country.

Policy implications of our findings are that: (i) mere transition from military rule to democratic rule, without concerted efforts to reduce existing health inequality may worsen the health situation for the poor, (ii) the democratic government in Nigeria should concentrate on reducing inequality in access to education in order to reduce health inequality in the country, (iii) reducing regional variations in health inequality in the country should be given high priority by the various tiers of government (iv) equitable provision of basic services such as access to safe drinking water and sanitation, must be a priority if the government wishes to reduce existing health disparities.

In conclusion, it may be interesting for future research to focus on ethnic dimensions of health inequality in the country, as well as on analysis of the influence of variations in access to environmental goods on regional disparities in health in the country.

Chapter 5

Conclusion

5.0.22 Introduction

To date, competitive democracy remains the most attractive and acceptable form of government across the globe. Therefore, most previous autocratic governments are either now democratic or are in the process of democratization. Pressure from the international community and fear of isolation have contributed to ensuring democracy has become the most popular form of government. In line with general trends, many African countries, including Nigeria, have also made a transition from autocratic rule to relatively democratic governments. However, recent literature focuses on how beneficial the change in government has been for ordinary citizens in term of provision of public goods and improvement in the general well-being of the electorate. This concern emanates from the non-competitive nature of the democratic process in developing countries, as well as the problem of political capture, which is a result of weak electoral competition. This thesis focuses on three issues related to the welfare of citizens in Nigeria as a model of a country

under political transition. The three issues of concern are as follows:

1. To establish the relationship between political power competition and public expenditure on welfare related public goods and on households' access to safe drinking water in Nigeria. Considering the problem of weak electoral competition in the country and political capture by special interest groups, we question the generalization that transition from autocratic rule to democratic rule will improve the welfare of citizens.

2. Due to the lack of of piped water, most households resort to drinking alternative sources of water with little or no consideration for the health implications of these sources of water. What actually is the effect of different sources of water and sanitation on the health outcomes of children in the country, who are the most vulnerable of the country's inhabitants? This is the focus of our second research issue.

3. Based on median voters' theory, inequality should be reduced subsequent to transition from autocratic rule to democratic rule. Previous studies focused on one aspect of inequality, which is income inequality, while health inequality studies have not been undertaken in the past due to the lack of anthropometric measures. However due to the importance of healthy living for children's survival and for human capital development, we fill this gap in the literature by considering the issue of changes in health inequality during political transition in Nigeria.

Answers to the above questions are provided in chapters 2 to 4. In chapter 2, the first issue is addressed while the second issue is investigated in chapter 3. The last issue is analyzed in chapter 4 while a summary of the findings of the three issues are presented below.

5.0.23 Summary of findings

Chapter 2 of this study investigates the relationship between political competition and the allocation of public expenditure on health and welfare related basic services. It applies the recently developed Bounds testing approach to cointegration (ARDL method) to establish a long run relationship between polity2 (measure of political power competition) and public expenditure of interest between 1960 and 2008. The results show that political competition is positive and significantly related to public expenditure on health and welfare related basic services, despite the problem of weak electoral competition and special interest group capture in the country. On the other hand, political competition has no significant relationship to capital expenditure, from our analysis. This is an indication that politicians are less committed to the development of infrastructure in the country.

At the micro level, the chapter uses dynamic panel analysis to investigate the effect of political competition at the sub-national level on the provision of safe drinking water. The results show that political competition is negatively related to access to safe drinking water in the country between 1999 and 2008. This indicates that while public expenditure on basic services may increase under weak electoral competition, actual provision of basic services may be poorer in the presence of corruption and interest group capture, as in the case of Nigeria. Corruption, bitter rivalry and political capture encourage leakages in the economy which may be responsible for the lack of maintenance of dams and pipes constructed under the military rule by politicians subsequent to the change in government.

In chapter 3, the effect of access to different sources of drinking water on the growth of children was considered. The chapter brings the importance of access to

safe drinking water into focus. The chapter shows that drinking of well water in particular is harmful to the health of children in the country. It also shows that access to improved sanitation enhances proper growth of children in the country. To be able to accomplish the objective of this chapter, height z-scores and weight z-scores of children aged 0-59 months were constructed for the analysis of the DHS dataset of 2008 in Nigeria. The results show that children who drink well water grow slower than children who drink piped and borehole water. In addition, children in households with improved sanitation (flush toilets) grow faster than children in households with pit latrines or no toilet facility. Drinking of well water by children significantly increases their probability of being stunted and being underweight, as shown in the results of the analysis in chapter 3. This is the reason why provision of safe drinking water should be given high priority in the country.

Chapter 4 considered changes in health inequality between 1999 during the military regime and 2008 under democratic rule to test the hypothesis on the relationship between inequality and transition to democratic rule. The chapter used the DHS data of 1999 and 2008 under military and democratic rule respectively to evaluate the standard of living of children in poor households in comparison to children in rich households for the two periods. Based on Kakwani concentration index, the analysis shows that inequality in stunting and being underweight increased between 1999 and 2008 among children ages 0-36 months in the country. In addition, inequality in access to safe drinking water, food consumption, access to sanitation, parent's educational levels and wealth increased during the period under consideration. The results also indicate that the severity of increase in inequality varies across the six geopolitical zones in the country. A substantial

increase in health inequalities between the two periods was contributed to by inequalities in basic services such as water, sanitation, food consumption and parent's educational level based on the decomposition of changes in inequality. Children in poor households are disproportionately disadvantaged in all the measures of health inequality used for our analysis. The result is similar to our findings in chapter 2 on the provision of safe drinking water. This later finding further confirms that transition from a military regime to democratic rule may be worse for the poor, especially when elections are not credible and corruption is endemic such as in the case of Nigeria.

5.0.24 Policy implications of the thesis findings

This thesis focused on the welfare implications of transition from a military regime to democratically elected government in the presence of weak electoral competition and interest group capture. While the thesis confirmed that political power competition encourages an increase in the allocation of public expenditure to health and welfare services, it however shows that such an increase in public expenditure may not necessarily lead to an increase in the actual provision of public goods. Therefore, for citizens to enjoy better provision of public goods under democratic rule, the electoral process must be credible so that politicians can be held accountable for their performance in office during future elections.

When elections are not credible, the welfare of the ordinary citizens may suffer under democratic rule. It is therefore misleading to assume that the poor are better off once leaders are elected, especially in the developing countries where rent seeking and electoral malpractices are prevalent. Assessment of governments'

performance subsequent to changes in political power should be based on actual provision of public goods instead of the normal reliance on allocation of public expenditure, due to the problem of leakages in most developing countries, including Nigeria. Once elections are not credible, the power of the electorate to hold office holders accountable for their performance has been completely eroded. Electoral competition in the presence of massive rigging thus becomes mere window dressing with little or no multiplier benefits to citizens.

Chapter 3 shows that drinking of well water is harmful to the growth of children in the country. This calls for serious concern on the part of policy makers, as many households depend on well water as their main source of drinking water. Piped water should be available for all and the negative future implications of childhood stunted growth and being underweight should propel the government to accelerate the rate of provision of safe drinking water in the country for domestic use. Provision of safe drinking water should surpass the rate of growth of the population, if elected leaders in developing countries really have the interests of poor citizens at heart. In addition, it may be necessary to consider treating well water in the country to make it safer for drinking, until piped water is available for all, which is one of the objectives of the MDGs.

Health inequality increased under democratic rule in the country, which is an indication of a worsening standard of living for the poor, as discussed in chapter 4. To reduce poverty in the country, democratic leaders in developing countries, including Nigeria, should consider policies such as the provision of child allowances, which has never been deemed necessary in many of these countries. This policy will help the government to prevent vicious circles of poverty in the sub-region. It will also help in the attainment of rapid economic growth in the near future.

Investment in affordable public education for the benefit of the poor is necessary, especially for women due to their crucial role in the upbringing of children and the multiplier effect of women's education on children's health inequality in the country.

5.0.25 Areas for future research

In the presence of weak electoral competition and ethnic politics, such as in Nigeria and many other countries in sub-Saharan Africa, politicians often depend on ethnic loyalty rather than performance to win positions and remain in office. The presence of ethnic politics may have either a positive or negative effect on the provision of public goods. In the first place, politicians may target provision of public goods in favour of loyal ethnic groups and discriminate against rival or hostile ethnic groups. Another scenario is for politicians to target rival or hostile ethnic groups with the aim of winning their support in subsequent elections. The last option is for politicians to neglect provision of public goods in both loyal and rival or hostile ethnic groups and rely on electoral manipulation rather than ethnic loyalty. The first two cases will lead to increase in ethnic dimensions of inequality in access to public goods and health while the third option will leave the inequality prior to change in regimes unchanged. It is therefore worth exploring the ethnic dimension of inequality in provision of public goods and health in Sub-Saharan Africa, and particularly in a country such as Nigeria, which consists of over 150 ethnic groups.

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5.0.26 Appendix A

Table 5.1: Summary statistics of Stunting and Being Underweight of children in North Central for 1999 and 2008 by quintiles

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
poorest	3.19	1.40	2.54	1.5	-20.4
poor	2.76	1.42	2.60	1.5	-5.8
middle	3.02	1.59	2.56	1.5	-15.2
rich	3.13	1.47	2.06	1.4	-34.2
richest	2.56	1.31	2.12	1.4	17.2
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
poorest	1.80	1.17	1.93	1.5	7.2
poor	1.60	1.22	1.80	1.4	12.5
middle	1.56	1.17	1.65	1.3	5.8
rich	1.69	1.30	1.44	1.2	-14.8
richest	1.39	1.05	1.33	1.16	-4.3
%Δ is the percentage quintiles's change in stunting and underweight between 1999 and 2008					

Table 5.2: Summary statistics of Stunting and Being Underweight of children in North East for 1999 and 2008 by quintiles

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
poorest	3.12	1.66	2.69	1.55	-13.8
poor	3.24	1.55	2.62	1.54	-19.1
middle	3.42	1.56	2.54	1.54	-25.7
rich	3.06	1.46	2.63	1.56	-14.1
richest	2.79	1.53	2.19	1.39	-21.5
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
poorest	2.50	1.60	2.07	1.29	-17.2
poor	2.51	1.64	2.09	1.32	-16.7
middle	2.01	1.50	2.10	1.32	4.5
rich	2.27	1.48	1.89	1.14	-16.7
richest	2.04	1.52	1.69	1.17	-17.2
%Δ is the percentage quintiles's change in stunting and underweight between 1999 and 2008					

Table 5.3: Summary statistics of Stunting and Being Underweight of children in North West for 1999 and 2008 by quintiles

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
poorest	3.71	1.54	3.01	1.62	-18.9
poor	3.53	1.56	2.82	1.5	-20.1
middle	3.09	1.46	2.76	1.47	-10.7
rich	3.30	1.61	2.78	1.51	-15.8
richest	2.57	1.83	2.81	1.52	9.3
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
poorest	2.55	1.80	2.49	1.48	-2.4
poor	2.19	1.31	2.40	1.5	9.6
middle	2.36	1.57	2.26	1.43	-4.2
rich	2.25	1.47	1.98	1.27	-12
richest	1.98	1.81	1.88	1.30	-5.1
%Δ is the percentage quintiles's change in stunting and underweight between 1999 and 2008					

Table 5.4: Summary statistics of Stunting and Being Underweight of children in South East for 1999 and 2008 by quintiles

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
poorest	2.43	1.53	1.96	1.26	-19.3
poor	2.46	1.57	1.92	1.31	-22
middle	1.86	1.46	1.95	1.33	4.8
rich	2.37	1.28	1.91	1.40	-19.4
richest	2.32	1.47	1.61	1.36	-30.6
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
poorest	1.39	1.13	1.60	1.18	15.1
poor	1.52	1.29	1.28	1.09	-15.8
middle	1.45	1.11	1.37	1.09	-5.5
rich	1.86	1.01	1.31	1.09	-29.6
richest	1.64	1.63	1.16	1.01	-29.3
%Δ is the percentage quintiles's change in stunting and underweight between 1999 and 2008					

Table 5.5: Summary statistics of Stunting and Being Underweight of children in South South for 1999 and 2008 by quintiles

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
poorest	2.48	1.29	2.27	1.45	-8.5
poor	2.71	1.30	2.08	1.46	-23.2
middle	2.57	1.41	2.09	1.36	-18.7
rich	2.33	1.31	2.13	1.35	-8.6
richest	2.95	1.68	1.88	1.40	-36.3
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
poorest	1.60	1.37	1.65	1.19	-3.1
poor	1.82	1.37	1.47	1.18	-19.2
middle	1.46	1.01	1.28	1.05	-12.3
rich	1.69	1.31	1.41	1.04	-16.6
richest	1.65	1.47	1.17	0.98	-29.1
%Δ is the percentage quintiles's change in stunting and underweight between 1999 and 2008					

Table 5.6: Summary statistics of Stunting and Being Underweight of children in South West for 1999 and 2008 by quintiles

	MILITARY		DEMOCRACY		
Quintiles	mean stunting	standard deviation	mean stunting	standard deviation	%Δ
poorest	3.14	1.44	2.10	1.24	-33.1
poor	3.43	1.5	2.33	1.41	-32.1
middle	2.46	1.67	1.18	1.19	-52
rich	2.30	1.47	1.95	1.30	-15.2
richest	2.10	1.40	1.92	1.33	-8.6
Quintiles	mean underweight	standard deviation	mean underweight	standard deviation	%Δ
poorest	2.21	1.73	1.44	0.97	-34.8
poor	1.65	1.08	1.58	1.15	-4.2
middle	1.93	1.43	1.47	0.97	-23.8
rich	1.50	0.94	1.32	0.02	-12
richest	1.56	1.14	1.15	0.94	-26.3
%Δ is the percentage quintiles's change in stunting and underweight between 1999 and 2008					