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How Expansion of Public Services Affects the Poor: Benefit Incidence Analysis for Gadarif State from Sudan

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Abstract

The study investigates whether the poor benefit more or less than the non-poor from an expansion in public services program in Gedarif State from eastern Sudan; and how government expenditure affects the welfare of different groups of people or individual households at the local level?. Using household survey data carried out in 2009; a sample of 40 clusters from the state was selected with 25 households from each selected cluster. The study followed the recommended standard World Bank methodologies by adopting a benefit incidence analysis techniques and tools to assess the impact of the water, electricity and health program on poverty and income distribution of population to identify the currant beneficiaries and the marginal benefit from increasing government expenditure, based on the geographical variation of localities in the state. A model proposed suggests that, an expansion of water and health programs would be decidedly pro-poor, while an expansion of electricity program would be pro-rich. Water and health programs displayed strong pro-poor and have a greater role for decreasing inequality and poverty in Gadarif State. This maximization appears to occur without policymakers taking into account distributional weights in their implicit social welfare function.

Keywords:: (Public Services Program, Benefit Incidence Analysis, Sudan, Gedarif State)

كيف يؤثر التوسع في الخدمات العامة على الفقراء: تحليل المنافع المتحققة في ولاية القضارف بالسودان

الملخص

تبحث الدراسة فيما إذا كان الفقراء يستفيدون أكثر من الاغنياء من التوسع في برنامج الخدمات الحكومية العامة في ولاية القضارف شرق السودان؛ وكيف يؤثر الإنفاق الحكومي على هذه البرامج على رفاهية السكان على المستوى المحلي؟. أتبعت الدراسةِ منهجيات البنك الدولي المعيارية الموصي بها، وذلك بتبني نموذج تحليل استجابة المنافعِ الحدية كتقنيات وأدوات لتَقييم أثر برنامج الماء، الكهرباء والصحةَ على الفقر وتوزيعِ الدخلَ لتَميز المستفيدين الحاليينِ والذين سيستفيدون من زيادةِ الإنفاق على هذه البرامج مستقبلاً إستناداً على ٱلاختْلَافِ الجغرافي للمحليات بالولاية، وبإستخدام بيانات المسح الأسري الذي نفذته الدراسة عام 2009م، ٱُختيرت عينة من 40 وحدة عد (عناقيد) من الولاية بواقع 25 أسرة من كل وحدة عد مختارة. تشير نتائج الدراسة الي أن التوسع مستقبلاً في برامج المياه والصحة سيفيد الفقراء أكثر من الاغنياء، في حين أن التوسع في برنامج الكهرباء سيفيد الاغنياء أكثر من الفقراء. أظهرت برامج المياه والصحة تحيزاً كبيراً للفقراء ولها دور أكبر في الحد من عدم المساواة والفقر في ولاية القضارف. كما ان تعظيم السكان منافعهم من هذه البرامج لا يحدث ما لم يأخذ صانعو السياسات في حسبانهم الأوزان التوزيعية لدالة الرفاه الاجتماعي بالنسبة لهذه البرامج لتكون أكثر تحيزاً للفقراء.

كلمات مفتاحية: (برامج الخدمات العامة، تحليل استجابة المنافع، السودان، ولاية القضارف)

Introduction

Today, most development agencies and governments finance service provision through large sector programs, providing services to the beneficiary population or individual through water supply, electricity, transport projects from social and economic program sectors, such sector programs typically have little coordination between them. Similarly, even social or economic fund projects, that offer a menu of different services to the beneficiary population, typically only finance one type of service for participating communities. Most of these fund projects follow a menu-approach with local populations choosing the type of service they consider most important for their development.

In general, the problem arises when governments they take on responsibilities to provide public services at the national or local level. When such services are provided by the state (local level), it is much more difficult to measure the benefit obtained by users of the service. As "Younger 2003 says" Policy makers view the providing of public services as rationed, and they think of increased public expenditures that relax the rationing constraint. In this case, the benefits do not go, by definition, to existing beneficiaries, so the standard method, which maps out the concentration of existing beneficiaries in the welfare distribution, is misleading. The question then appears how to decide which services to provide, and to get some idea of which groups in society benefit, and how to measure the impact of those services on welfare distribution of the population, and to assess whether the poor benefit more or less than the non-poor for expansion of these services.

These statements mentioned above raised that this study can highlight these concerns and attempt to answer some questions, such as who benefits from public services provided by government in Gadarif State at the local level?; do poor people benefit more or less than the non-poor from an expansion in access to public services?; do those benefits depend on type of services or the existing level of access?; how government expenditure affects the welfare of different group of people or individual household. The study answers these questions focusing on average and marginal benefit incidence of local public services in Gadarif State to describe how existing government expenditure affects the income distribution of people or individual household's welfare, with an aim to help policy makers draw effective polices with respect to this issue.

One other aspect to be considered is that the government of Sudan has made substantial movement toward decentralization during the 1990s and it has promoted and modified this through many rules. As a result, expenditures of public services tend to be managed more and more at the local level. Although the flow of financial resources to local authorities has increased considerably in Sudan over the last decade, good accountability mechanisms at the local level are still missing. One remaining challenge, however, is to design appropriate institutional management and control mechanisms to ensure that the funds are well spent. Another important issue with the trend toward decentralization Sudan is whether the funds allocated to local authorities benefit the poor, which would "empower" them.

More precisely, the study examines the impact of water, electricity and health programs on welfare distribution of population accesses to those public service programs. The study shall analyze the inequality in the distribution of these public service programs, and its impact on the income distribution of population accesses, to identify the current beneficiaries (average benefit), and the beneficiaries of an increase in access (marginal benefit) or (new access); using simple cross section data.

In general, the contribution of this study emanates as follows; a key difference between this study and previous studies is that within the context of decentralization, we adopt the benefit incidence analysis methodology and its focus on marginal benefit incidence at the local, rather than at the national level. Another difference is that we analyze marginal benefit incidence in a broader social welfare framework that takes into account relative deprivation, whereby individuals and households assess their level of well-being not only in absolute terms, but also by comparing themselves to others by their geographic neighbors.

Methodology and Data

To achieve the objective of the study, the World Bank method of benefit incidence analysis may be useful to answer the study questions. To measure the distribution of gains from access to public services programs in Gedarif State, panel data or at least repeated cross-sectional data are necessary. In the study area of Gedarif State in eastern Sudan, such data is not available or are not comparable over time. However, the lack of panel data or repeated cross-sectional data in Gedarif State and in Sudan in General has often made it impossible. Thus, the study adopted the World Bank method for answering the study questions using data from only a single cross-section survey, besides secondary and community data using benefit incidence analysis techniques at the local-level as a methodology to discuss the impact of water, electricity and health programs on income distribution of population or individual households in Gedarif State to describe the welfare of current access (average benefit) and increase in access (marginal benefit). To do so, the study discusses the research methodology in to two stages as follows:

(i) Stage one:

The approaches adopted in this study, closely matches the general standard methodology for poverty analysis recommended by the World Bank (W.B, 2003). Given the above arguments, the study adopted various methodological approaches to capture poverty measures firstly, such as poverty line, poverty indices, due to the strong relationship between poverty measures and benefit incidence indicators. Thus, the study seeks to estimate firstly, the poverty line based on the consumption pattern approach following the Cost of Basic Needs (CBN) method, because it is most important and appropriate and most relevant and widely used for low income countries for determining the poverty line. Accordingly, the poverty line was estimated as the food poverty line, the non-food poverty line and total poverty line. Secondly, based on the poverty line, several poverty indicators and its decomposition, incidence, depth and severity of poverty also have been estimated.

(ii) Stage two:

In this stage, we seek to estimate the benefit incidence indicators to evaluate the impact of public services programs on income distribution of population in Gadarif State. Thus, the study used primary data to combine information of Gadarif State from three sources: (i) a household survey we carried out in 2009, which provides information about households, their dwellings, neighborhoods and their opinions on the related issue, (ii) community level survey data of the selected sample, and (iii) consumer prices data survey. Secondary data has been collected from Ministry of Finance and Economy of Gadarif State and Central Bureau of Statistics of Sudan in 2008.

Concerning the sample size, the study followed the method proposed by Sudan Household Health Survey (SHHS, 2006), which conducted in 2009 as a cross section data of the Household Survey; using an old administrative distribution of localities which was four localities (Gedarif, Galabat,

Fashaga and Rahad). Therefore, 40 clusters were allocated in Gadarif State, with the final sample size calculated at 1000 households (i.e., 40 clusters of Gadarif State X 25 households per cluster). In addition to 40 clusters for community level data and 40 clusters for consumer prices i.e. 40 clusters per Gadarif State; where the data was collected in 2009.

(iii) Methodology and Approaches of Benefit Incidence Analysis

The most appropriate tool to assess the direct as well as the indirect channels through which public policies affect the population welfare, the World Bank, 2003 shows that the goal of incidence analysis is to evaluate how particular individuals or households are affected by a change in the accessibility of public services.

The study focuses on the distribution of the impact public services programs of the current access and new access to identify the current beneficiaries of access and the beneficiaries of an increase in access. Due to the strong relationship between poverty measures and benefit incidence indicators, it is very useful to review firstly, the poverty measures before going to benefit incidence analyses. To do so, the research methodology proceeds on at two stages as follows:

(vii) Measuring Participation Rates

Firstly, in incidence methodology identify the household's participants "uses in access" of a particular program (water, electricity and health). This identification is the amount by which household consumption expenditure would have to increase if it had to pay for a program service used. The data on participation in these programs can be collated with data on total consumption expenditure per person at the household level. Participation in water program is based on government expenditure on taps inside or outside the houses, artesian and surface wells that have a certain value of households or individual. Participation in the electricity program is defined as whether the household received any transfer of government to electricity networks and public local generators of villages or blocks where they live. Participation in the health program is defined as whether the households have any health units in villages or blocks.

Secondly, our methodology computes the unit cost of a program, namely the unit cost of access to water, electricity and health, which is provided by Gadarif government to the households and individuals at the local level. Ultimately, with some exercises it is passable to identify whom benefits from the services provided. The study attempts to account for public in kind benefits and typically assumes that the value of public programs is equal to the expenditure of public programs in Gadarif State.

According to the World Bank, 2003 the benefit incidence analysis technique involves a three-step methodology aimed of identify the transfer of government expenditures received by each income quintile. The first step involves aggregating households into quintiles of the population in order to compare how public expenditures are distributed across such groups, which is shown in the common formula as follows:

$$X(ij) = E(ij)/E(j) * S(j) \qquad (1)$$

Where:

$X(ij)$ is a benefit incidence for (i) quintile in (j) program service.

$E(ij)$ is a number of people in (i) quintile using the (j) public service.

$E(j)$ is a total number of beneficiaries of (j) service.

$S(j)$ is the transfer of the sub-sector expenditures of the (j) service.

In order to calculate the unit cost of public services (water, electricity and health) to estimate the benefit incidence of public expenditure, the World Bank, 2003 outlines these calculations in four steps, which are adopted in our methodology:

Step1: Estimating unit subsidies: The calculation of the cost per unit of output per user cost of these services which is defined as total government spending on a particular service divided by the number of users of that service; the user means a total population is access to a program in 2009 in Gadarif State, or who participated or received a particular program transfer. In other words, it does this by combining information about funding of providing those services, which are obtained from Ministry of Finance and Economy of Gadarif State in 2009 with information on the users of these services programs, which is obtained from the households themselves through the sample survey.

Step2: Identifying users, where information on who uses the service is obtained from a household survey to find out which types of household get the service (rich/poor, quintiles).

Step3: Aggregating users into groups by per adult equivalent consumption, to describe how the benefits from public services programs are distributed across the households. This enables the policy-maker to judge whether the distribution is progressive or regressive.

Step4: Following the experience of the World Bank, which shows that, households contribute substantially to service provision despite the large government subsidies, involved, and that this contribution increases with income. In addition, the burden of these costs (especially to low-income households) can discourage the use of the services, and lead to poor targeting of the government subsidy. The study focuses on the share of households or individuals of the government expenditure and the household's consumption expenditure as a welfare measure of population, rather than income, because data on income is not accurate. Moreover, because access to particular service has a certain value for a household, this value is considered an income source (the means of consumption). However, it discusses the cost that the households or individuals income when the program is absentee. It is also assume that access means usage (because it is usage that typically generates value), such that take-up of the service among those who have access does not need to be considered.

In Gadarif State, localities have acquired important responsibilities and autonomy, which is composed of 4 localities, and 16 administrative units. According to the Sudan decentralization, a policy, which is, adopted in1992, localities and administrative units have political, administrative, and financial autonomy. The functions of the localities include (a) the coordination with the state government of the delivery of public services, such as water, electricity, health, education and others; and (b) the preparation with the state department development plans with budgets. Local governments are responsible for urban and rural development and zoning, public education, health, water, sanitation, and social services, as well as the maintenance of local roads and public infrastructure.

Conceptual and Analytical Framework

Following Lindert, Skoufias and Shapiro 2006, method (quoted from Emil and Phillippe, 2010) these statistics are presented as follows:

Given the income quintile, an area of residence (g^h), let (dm^h) represent the per capita value of a transfer to household (h), (w^h) represent the number persons in the household multiplied by the household weight in the survey. Also, let (y^h) represent the reported consumption of a household, (α) a parameter for distinguishing poverty indices, and (z) a poverty line. With these definitions, the

average per capita transfer value for the population is simply the transfer average across households, or:

Average transfer per capita for the population = $\frac{\sum dm^h w^h}{\sum w^h}$ (2)

The average per capita for beneficiaries (i.e., unit transfer value) is the transfer averaged across beneficiary households only:

Average transfer per capita for beneficiaries = $\frac{\sum dm^h w^h}{\sum A(dm^h>0)w^h}$ (3)

Where, (A) as an indicator function that takes the value 1 if its households or individuals benefits and 0 otherwise. The coverage is defined as the portion of the population that receives a transfer, or

Program coverage = $\frac{\sum A(dm^h>0)w^h}{\sum w^h}$ (4)

Absolute incidence represents the portion of a transfer's total budget received by a population group:

Absolute incidence = $\frac{\sum dm^h g^h w^h}{\sum dm^h w^h}$ (5)

Relative incidence, a related measure, considers the " importance" of a transfer to a particular croup relative to it is consumption or income. It is the total transfer amount received by a specific group divided by total consumption or income for that group, i.e.:

Relative incidence = $\frac{\sum dm^h g^h w^h}{\sum y^h w^h}$ (6)

The measure by Cody,Grosh, and Hoddinott (2004) compare for a number of transfer programs: the portion of the transfer budget received by a population quintile divided by the portion of the population in that quintile:

Cody, Grosh, and Hoddinott measure = $\frac{\sum dm^h g^h w^h / \sum dm^h w^h}{\sum g^h w^h / \sum w^h}$ (7)

This measure is a multiple of absolute incidence. For the bottom quintile, this measure equal a transfer's absolute incidence for the bottom quintile multiplied by five. To measure the impact of transfers on poverty and inequality, we present poverty and inequality indices before and after the transfer. We use the Foster Greer and Thorbacke (1984) of the poverty headcount (α=0), poverty gap (α=1), and poverty severity (α=2) with all transfer:

$$= \frac{\sum(1-\frac{y^h}{z})^\alpha \, A(y^h \le z)w^h}{\sum w^h} \quad (8)$$

For each transfer, we present the same indices without the transfer:

$$= \frac{\sum(1-\frac{y^h-dm^h}{z})^\alpha \, ((y^h-dm^h)) \le w^h}{\sum w^h} \quad (9)$$

The Impact of Public Services Programs on Poverty and Income Distribution:
A benefit Incidence Analysis

How do economic development policies affect poverty and distribution? In recent years that question has become a major focus of national and international approaches to development policies. To be fair, the debate on economic development policies has more or less continuously intertwined growth and distribution issues, but never before have evaluations of the effects been so systematic or so prominent an element of the debate.

The goal of incidence analysis is to evaluate how particular individuals or households are affected by a change in the tax system or in the accessibility of public services. There are two main

difficulties behind this exercise. First, gainers and losers may not be those who at first sight nominally benefit from the transfer or pay the tax. Behavioral and market responses to taxes and transfers may shift their burden or their benefits to other agents through partial or general equilibrium mechanisms. For example, an indirect tax paid by producers may be partly or fully shifted onto consumers. Second, the identification of the gainers and losers is made difficult by the natural heterogeneity among individual economic agents, even when they belong to some apparently well-defined socio demographic group such as "unskilled urban workers" or "small farmers"(World Bank, 2003).

Poverty incidence analysis may be more or less difficult and more or less detailed depending on the nature of the public expenditure being considered and the way in which policies are actually implemented. For example, evaluating the direct poverty impact of some transfer policy conditional on some individual or household characteristic requires only observing those characteristics as well as knowing the welfare status of households. Nevertheless, an evaluation may also require information on possible differences between the official transfer rules and the actual implementation. Observing or inferring the actual impact of a policy may be more difficult in other instances.

The provision of basic services for the poor is one of the most effective instruments governments have to achieve this objective based on the following premises:

First, public expenditures can only be effective in reducing poverty when the policy setting is right. Second, it is assumed that the public expenditure process (including budget management, accountability, transparency, and so on) is based on outcomes and impacts and not just line items and inputs. The third is that public policy in general, and public expenditure decisions in particular, must be based on a sound understanding of the needs and preferences of the population at large. The provision of public services should be viewed as collaboration between governments, on the one hand, and households on the other. To make this collaboration effective, there must be a two-way flow of information, with governments constantly 'listening' to households, and households, in turn, being informed of government objectives and their rights under explicit contracts or covenants. Our concern here is with one dimension of the information flow: how can governments be informed about the needs and behaviour of their clients, especially the poor, who indeed benefits from public spending. Our concern here is to highlight what benefit incidence analysis tells us, and what it leaves unresolved.

The World Bank (2003) shows that a benefit incidence tells us who is benefiting from public services, and describes the welfare effect of different groups of people or individual households of government spending. It does this by combining information about the unit costs of providing those services (obtained usually from government or service-provider data) with information on the use of these services (usually obtained from the households themselves through a sample survey). In effect, the analysis imputes to those households using a particular service the cost of providing that service. This imputation is the amount by which household income would have to increase if it had to pay for the service used. Benefit incidence estimates can also be obtained for other items of government spending, including social assistance and other transfers, subsidies for other services (such as agricultural extension), and subsidies of private goods (such food or fuel subsidies). The decision of how comprehensive a benefit incidence study should be clearly depends on the objectives of the analysis and on the available data.

Previous Studies:

Uzochukwu Amakom (2013): Public Spending and Poverty Reduction in Nigeria: A Benefit Incidence Analysis in Education and Health

The study evaluated public spending efforts in reducing inequality and poverty at all levels of these two sectors using the Benefit Incidence Analysis (BIA) in Nigeria. Findings from the study suggest that primary education and healthcare were more pro-poor in absolute terms than tertiary education and healthcare. Secondary education and healthcare reveal mixed results, while the findings suggests state, regional (geopolitical), location and gender biases in benefits from public spending for both education and healthcare.

Rolf Aaberge, Audun Langørgen, Magne Mogstad, Marit Østensen(2008): The Impact of Local Public Services and Geographical Cost of Living Differences on Poverty Estimates.

Unlike the standard approach in studies of the distribution of public services, this study employs a method for valuing sector-specific local public services that allows for differences between municipalities in unit costs for providing public services in Norwegian for the period 1993-2001. Furthermore, recipient frequencies in various demographic groups are used as the basis for determining the allocation of the value of these services on citizens of the municipalities. Geographical differences in living costs are taken into account by using municipal housing price indices or by replacing the country-specific poverty line with municipal-specific poverty lines.

Hamid R. Davoodi, Erwin R. Tiongson, and Sawitree S. Asawanuchit (2003): How Useful Are Benefit Incidence Analyses of Public Education and Health Spending?

This study provides a primer on benefit incidence analysis (BIA) for macroeconomists and a new data set on the benefit incidence of education and health spending covering 56 countries over 1960-2000, representing a significant improvement in quality and coverage over existing compilations. The study demonstrates the usefulness of BIA in two dimensions. First, the study finds, among other things, that overall education and health spending are poorly targeted; benefits from primary education and primary health care go disproportionately to the middle class, particularly in sub-Saharan Africa, HIPCs and transition economies; but targeting has improved in the 1990s. Second, simple measures of association show that countries with a more pro-poor incidence of education and health spending tend to have better education and health outcomes, good governance, high per capita income, and wider accessibility to information.

Mohamed Ihsan AJWAD and Quentin WODON (2002): Do Local Governments Maximize Access Rates to Public Services Across Areas? A Test Based on Marginal Benefit Incidence Analysis.

This study investigates whether the poor benefit more or less than the non-poor from an expansion in public services and whether this depends on the type of service provided. Using data from Bolivia, this study investigates the allocation of education and basic infrastructure services across jurisdictions. Results indicate that the marginal benefit incidence is higher for the poor than for the non-poor in education, but lower in the case of access to infrastructure services. A model is proposed to suggest that the distribution of the observed marginal benefits from an expansion in the public provision of services is consistent with local Governments maximizing average access rates.

This maximization appears to occur without policymakers taking into account distributional weights in their implicit social welfare function.

Mohamed Ihsan Ajwad and Quentin Wodon (2002): Who Benefits from Increased Access to Public Services at the Local Level? A Marginal Benefit Incidence Analysis for Education and Basic Infrastructure.

Do poor people benefit more or less than the non-poor from an expansion in access to public services? And do those benefits depend on the existing level of access? Answering these questions is essential to strategies for empowering (or "investing in") poor people, but the lack of panel data or repeated cross-sectional data in poor countries has often made it impossible. This study proposes a methodology for answering these questions using data from only a single cross-section survey. We argue that the methodology may be useful for monitoring the allocation of public expenditures in a context of decentralization, and we demonstrate this by applying it to local-level data from Bolivia and Paraguay. The results indicate that the marginal benefit incidence is higher (or at least not systematically lower) for the poor than for the non-poor in education, but this is not the case for many basic infrastructure services. More generally, the poor seem to gain access only once the non-poor already have high levels of access. This suggests that pro-poor policies must be implemented if the poor are to reap the benefits of gains in access faster.

John Gibson and Scott Rozelle (2002): Poverty and Access to Infrastructure in Papua New Guinea.

The overall goal of this study is to understand how effective access to infrastructure is in reducing poverty in PNG. To meet this goal, we examine poverty in PNG, and seek to show the relationship between poverty and access to infrastructure and then identify the determinants of poverty. In the analysis, we test whether or not access to infrastructure is a significant factor in a household's poverty status. Finally, we want to understand what policies will be effective in overcoming poverty in PNG. The results show that poverty in PNG is primarily rural and is associated with those in communities with poor access to services, markets, and transportation. The simulations illustrate that improving access to school leads to large declines in poverty. Increasing access to poverty for those that are currently most isolated would have a significant effect in decreasing the severity of poverty.

Paul C. Hewett Mark R. Montgomery (2001): Poverty and Public Services in Developing-Country Cities.

This study examines the availability of services in the cities and towns of developing countries, using data drawn from the Demographic and Health Surveys. Particular attention is given to the urban poor, who will form a group of increasing numerical and policy significance as levels of urbanization rise. We find that wide rural-urban gaps remain in service delivery, and that smaller cities-where about half of urban residents live-are notably under-served by comparison with larger cities. Poor urban households are much less likely than other urban households to enjoy access to public services. Inequities such as these underscore the need for continued public sector investments in service delivery. But the political economy of urban governance is changing in a way that may well frustrate efforts to improve services. Across the developing world, national governments are increasingly decentralizing their service delivery functions to lower tiers of government, often without making commensurate transfers of funds or revenue-raising authority. As nation-states

recede from the local scene, local governments may be left without the means to fill the gaps in service delivery.

Empirical Results

(i)The Average Benefit Incidence Analysis of Access to Public Services Programs (Current Access)

Based on per adult equivalent consumption as a welfare indicator of individuals or households and the amount received by participants (users or access) of a specific program, the linkage of data in our survey and Gadarif government expenditure of these public services program in 2009 has been made to estimate the benefit incidence analysis which is shown in table1.

It is noted that, transfers received by all population in Gadarif State of electricity and health programs are low (a lower participation rates), and this is due to low government expenditure on those programs and hence the limited the population access, and therefore the need to pay to access these services instead of participate.

Table 1: Basic Statistics on Access to Public Services Programs of Gadarif State in 2009

Variables Category	N	Mean	Min	Max	p1	p50	p99
Adult Equivalent Size	5,846	5.6	0.9	11.2	1.8	5.4	10.7
Adult Equivalent Poverty Line	5,846	167.0	167.0	167.0	167.0	167.0	167.0
Household Weights	5,846	235.7	235.7	235.7	235.7	235.7	235.7
Adult Equivalent Adjustment	5,846	6.9	1.0	12.0	2.0	7.0	12.0
Access to water program	3,407	532.0	86.4	1,075.2	172.8	518.4	1,036.8
Access to electricity program	1,861	16.3	3.0	33.6	5.4	15.0	33.3
Access to health program	2,101	169.3	27.9	347.2	58.9	155.0	341.0
Annual water expenditure	2,439	568.1	120.0	3,600.0	120.0	480.0	1,800.0
Annual electricity expenditure	3,985	366.1	60.0	1,800.0	96.0	300.0	1,200.0
Annual health expenditure	3,745	536.7	108.0	3,600.0	120.0	480.0	1,800.0
Annual per Capita Consumption	**5,846**	**1,755.1**	**534.9**	**10,482.1**	**666.8**	**1,524.2**	**5,005.4**

Source: Field Survey, 2009.

Note: p_1, p_{50} and p_{99} are population percentiles.

On the other hand as shown in table 2, access rate of water, health and electricity programs are computed by dividing the number of households with access by the total number of households. Accordingly, in Gadarif State the access rate of water program is 52% followed by health program 48%, and electricity program 45%, respectively. This result indicates that about half (45%) of population in Gadarif State have not access to public services programs; and it indicates the coverage of these services is moderately low.

Table 2: Sample and Population Sizes

Public Services Programs	Sample size			Population		
	Households	Individuals	Recipients	Households	Individuals	Recipients
All Observations	**989**	**5,846**	**5,846**	**233,137**	**1,378,078**	**1,378,078**
For households that receive the indicated transfer only						
All Programs	**546**	**3,764**	**4,587**	**128,709**	**887,288**	**1,081,294**
Water	518	3,541	3,407	122,108	834,720	803,132
Electricity	450	3,021	1,861	106,079	712,140	438,694
Health	474	3,196	2,101	111,736	753,393	495,269

Source: Field Survey, 2009.

Table 3 indicate that, a high consumption share of the rich population rather than in the poor; where the average consumption of population in the richest 20% quintile (167.0 SDG) is equal to five times the poorest ones (30.5 SDG). The policy makers in Gadarif State must increasing efforts to raise the consumption of the poor population through economic distribution policies of aiming to reduce inequalities and poverty. In other words, the task here for policy makers is making growth and it is distribution more pro-poor (meaning more poverty reducing) entails some combination of higher growth and a more pro-poor distribution of the gains from growth fruits.

Table 3 : Population Demographics

Public Services Programs	Total	Quintiles of per Adult Equivalent Consumption					Poverty Status		Area of Residence		Locality			
		Q1	Q2	Q3	Q4	Q5	P	NP	Urban	Rural	Galabat	Gadarif	Fashaga	Rahad
Share of total population	**100.0**	**54.1**	**19.6**	**12.2**	**8.6**	**5.5**	**72.7**	**27.3**	**24.8**	**75.2**	**28.6**	**31.3**	**9.6**	**30.5**
Share of poor population	**100.0**	**38.6**	**25.2**	**16.8**	**11.8**	**7.5**	**100.0**	**0.0**	**19.8**	**80.2**	**29.6**	**27.1**	**8.7**	**34.5**
Share of urban population	**100.0**	**3.2**	**1.6**	**11.2**	**15.8**	**68.2**	**41.9**	**58.1**	**100.0**	**0.0**	**0.0**	**73.4**	**8.5**	**18.1**
Share of rural	**10**	**49**	**2**	**1**	**10.**	**6.2**	**77.**	**22.**	**0.0**	**10**	**38.0**	**17.**	**10.0**	**34.**

population	**0.0**	**.5**	**0.8**	**2.6**	**9**		**6**	**4**		**0.0**		**4**		**5**
Share of total consumption	**100.0**	**15.1**	**18.1**	**19.4**	**19.9**	**27.6**	**21.6**	**78.4**	**79.4**	**20.6**	**28.1**	**33.6**	**12.5**	**25.9**
Mean consumption	**57.8**	**30.5**	**35.2**	**42.1**	**55.8**	**167.0**	**50.5**	**217.7**	**64.8**	**56.2**	**62.9**	**56.7**	**70.6**	**49.7**

Source: Field Survey, 2009.

Table 4 shows a high coverage of all programs of direct beneficiaries only for urban areas (more than ninety percent) while the rural areas also have a high coverage (more than seventy percent) of all programs of direct beneficiaries only. It is also noted that, the coverage of all programs among localities are more favorable to Gedarif and Galabat localities than for the other localities. In other words, all programs are pro-poor and pro-urban areas, but when we look at the individual program, all programs for direct beneficiaries only tend to be pro-rich pro urban areas, i.e., almost all poor are covered by a combination of programs. It is noted that a higher beneficiaries in the field of water program compared to other programs of all beneficiaries, direct and indirect, and for direct beneficiaries only. On the other hand, for direct and indirect beneficiaries, all programs coverage are pro- poor and pro-rural areas and more favorable to Fashaga and Gedarif localities, while for direct beneficiaries only, all programs are pro-rich and pro-urban areas and more favorable to Gedarif and Galabat localities.

Table 4: Coverage of Programs for Direct and Indirect Beneficiaries

All Public Services Programs	**Total**	**Quintiles of per ae consumption, net of each SP transfer**					**Poverty Status**		**Area of Residence**		**Locality**			
		Q1	**Q2**	**Q3**	**Q4**	**Q5**	**P**	**NP**	**Urban**	**Rural**	**Galabat**	**Gadarif**	**Fashaga**	**Rahad**
Direct and indirect beneficiaries														
All Programs	**64.4**	**98.0**	**98.9**	**100.0**	**71.1**	**24.3**	**65.0**	**39.9**	**50.1**	**69.1**	**69.5**	**56.9**	**67.7**	**66.3**
Water	**60.6**	79.4	96.0	94.2	68.7	23.9	61.1	39.9	49.4	64.2	65.0	54.7	64.5	61.2
Electricity	**51.7**	48.5	74.0	86.0	66.9	21.8	52.3	27.7	49.0	52.5	47.5	50.3	56.7	55.5
Health	**54.7**	67.9	72.1	89.1	69.5	22.7	55.1	38.5	43.5	58.4	55.8	51.1	57.1	56.5
Direct														

beneficiaries only													
All Programs	**78.5**	**79.4**	**77.7**	**79.1**	**75.4**	**80.1**	**78.6**	**71.6**	**94.1**	**73.3**	**78.7**	**91.2**	**58.3**	**71.5**
Water	**58.3**	59.6	56.1	62.4	57.4	57.8	58.1	66.2	92.5	47.0	55.5	74.4	55.5	45.1
Electricity	**31.8**	26.3	32.9	31.2	27.9	26.3	31.6	40.5	76.7	17.0	11.9	50.5	28.2	32.5
Health	**35.9**	40.3	31.4	33.7	33.6	38.9	36.1	29.7	43.6	33.4	32.2	60.8	21.8	18.4

Source: Field Survey, 2009.

Table 5 shows, water program are strongly pro-poor for direct beneficiaries of population. The government of Gadarif State should therefore increase the coverage rates of all programs as a way for targeting the poor; and would ultimately decrease the under coverage rates of all programs, particularly, electricity and health programs.

Table 5: Under-coverage and Leakage of Programs

Total Poor					
All Public Services Programs	**Coverage of the poor (1)**	**Under-coverage (2)**	**Leakage (of beneficiaries) (3)**	**Leakage (benefits) (4)**	**Targeting differential (5) = (1) - (3)**
Direct and indirect beneficiaries					
All Programs	**76.2**	**23.8**	**13.9**	**7.9**	**62.2**
Water	71.4	28.6	14.3	7.6	57.1
Electricity	60.1	39.9	15.4	7.1	44.7
Health	63.5	36.5	15.6	9.5	47.9
Direct beneficiaries only					
All Programs	**76.2**	**23.8**	**29.4**	**18.4**	**46.8**
Water	56.0	44.0	30.1	17.7	25.9
Electricity	27.7	72.3	36.8	22.0	-9.2
Health	32.5	67.5	34.3	21.5	-1.8

Source: Field Survey, 2009.

Table 6 shows, the water program is the most important program that increases the share of households who receive other programs in Gadarif State, followed by health and electricity, respectively. i.e., the electricity program has lower share of households who receive other programs. It is noted that all programs participation rates are pro-poor and in favor of rural areas, with a higher inequality between localities and households groups.

Table 6: Program Overlap (%)

Public Services Programs	Total	Quintiles of per ae consumption					Poverty Status		Area of Residence		Locality			
		Q1	Q2	Q3	Q4	Q5	P	NP	Urban	Rural	Galabat	Gadarif	Fashaga	Rahad
No transfer	**35.6**	**2.0**	**1.1**	**0.0**	**28.9**	**75.7**	**35.0**	**60.1**	**49.9**	**30.9**	**30.5**	**43.1**	**32.3**	**33.7**
Water	**5.2**	23.4	10.7	5.5	0.8	0.6	5.3	1.4	1.0	6.6	10.8	1.0	6.2	4.0
Electricity	**0.7**	3.6	1.9	0.0	0.0	0.0	0.7	0.0	0.0	0.9	0.0	0.6	1.4	1.1
Health	**3.0**	15.0	0.0	5.8	2.3	0.4	3.1	0.0	0.0	4.0	4.5	1.1	1.8	4.0
Health& electricity	**0.2**	0.0	1.0	0.0	0.0	0.0	0.2	0.0	0.6	0.0	0.0	0.5	0.0	0.0
Water & other programs	**55.4**	56.0	85.4	88.7	68.0	23.2	55.8	38.5	48.4	57.7	54.2	53.7	58.3	57.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: Field Survey, 2009.

While suddenly absence of all public services programs transfer; the mean of (PAE) consumption falls from 281 SDG per annum (in table 7) to 57.8 SDG per annum (in table 3); it falls from 672.9 SDG per annum to 30.5 SDG per annum for the first poorest quintile; and falls from 287.5 SDG per annum to 50.5 SDG per annum for the poor population. The re-ranking of individuals into quintiles in table 7 compared to table 6 is larger average benefits, and the numbers of beneficiaries of the public services programs which tend to increase the per capita consumption of households through access to these programs with low cost, and hence decreases poverty. Given the fact that, all programs are pro-poor, the government in Gadarif State should allocate more resources to all programs particularly, in the field of electricity and health programs where by pro-poor policy that is more favourable to rural area increases the beneficiaries and decreases poverty.

Table 7: Average Transfer Value, Per Capita - All households

Public Programs	Total	Quintiles of per ae consumption					Poverty Status		Area of Residence		Locality			
		Q1	Q2	Q3	Q4	Q5	P	NP	Urban	Rural	Galabat	Gadarif	Fashaga	Rahad
All Programs	**281.0**	**672.9**	**507.5**	**459.3**	**236.0**	**45.0**	**287.5**	**31.4**	**251.5**	**290.8**	**317.2**	**279.3**	**279.1**	**249.6**
Water	**231.2**	550.1	420.6	386.0	194.5	33.4	236.5	26.7	210.2	238.1	266.3	224.9	228.8	205.4
Electricity	**3.6**	7.7	7.9	6.2	2.5	0.5	3.7	0.5	4.2	3.4	3.1	4.1	4.0	3.5
Health	**46.3**	115.1	79.0	67.1	39.0	11.2	47.4	4.2	37.1	49.3	47.8	50.3	46.3	40.7

Source: Field Survey, 2009.

Table 8 shows the variation of the average per capita transfer for individual program across quintiles, which indicates that, the benefits of poor population are progressive, because the per capita benefit level for all programs of direct beneficiaries and direct and indirect beneficiaries falls from the richest quintiles to the poorest ones; it indicates that all programs have an element of targeting the poor. That is to say, all programs are pro-poor and pro-rural areas.

Table 8 : Average Transfer Value, Per Capita, Direct and Indirect Beneficiary Households of Indicated Transfer Only

Public Services Programs	Total	Quintiles of per ae consumption					Poverty Status		Area of Residence		Locality			
		Q1	Q2	Q3	Q4	Q5	P	NP	Urban	Rural	Galabat	Gadarif	Fashaga	Rahad
Direct and Indirect beneficiaries														
All Programs	**436.5**	**687.0**	**513.2**	**459.3**	**332.2**	**185.2**	**442.2**	**78.8**	**502.4**	**420.7**	**456.5**	**490.9**	**412.1**	**376.7**
Water	**381.6**	693.2	438.0	409.6	283.0	139.8	386.9	67.1	425.0	370.6	409.7	411.2	354.5	335.5
Electrici	**7.0**	15.	10.	7.2	3.7	2.1	7.1	1.6	8.6	6.5	6.6	8.1	7.1	6.3

ty		9	7											
Health	**84.6**	169.5	109.6	75.4	56.2	49.5	86.0	11.0	85.4	84.4	85.7	98.4	81.1	72.0
Direct beneficiaries only														
All Programs	**479.3**	**848.1**	**653.5**	**580.6**	**468.2**	**283.1**	**486.5**	**177.7**	**553.0**	**448.1**	**500.9**	**526.2**	**524.6**	**384.0**
Water	**532.0**	923.7	749.7	618.3	512.6	316.0	542.9	165.4	478.1	567.1	607.0	499.7	483.0	519.3
Electricity	**16.3**	29.3	24.1	19.8	16.0	9.8	16.7	5.3	15.2	17.9	18.3	15.5	15.5	17.2
Health	**169.3**	285.9	251.8	199.0	161.7	104.6	171.8	52.5	152.9	176.4	170.6	164.7	154.1	188.8

Source: Field Survey, 2009.

It is noted that in table 9 relatively, a high incidence of water programs compared to other programs to poor population in Gadarif State, followed by health and electricity. However, with exception of health program which is more favourable to rural areas, all other programs are more favourable to urban areas, i.e. relatively, all programs incidences are pro-poor-pro-urban areas.

Table 9: Relative Incidence- All households

Public Services Programs	**Total**	**Quintiles of per ae consumption**					**Poverty Status**		**Area of Residence**		**Locality**			
		Q1	**Q2**	**Q3**	**Q4**	**Q5**	**P**	**NP**	**Urban**	**Rural**	**Galabat**	**Gadarif**	**Fashaga**	**Rahad**
All Programs	**750.1**	**1,207.1**	**1,206.8**	**1,304.2**	**1,089.1**	**110.5**	**869.2**	**15.2**	**775.3**	**743.3**	**725.3**	**865.4**	**579.3**	**744.3**
Water	**617.0**	986.7	1,000.2	1,096.0	897.4	81.8	714.9	13.0	647.8	608.5	608.9	697.0	474.8	612.5
Electricity	**9.7**	13.8	18.9	17.5	11.6	1.1	11.2	0.2	13.0	8.7	7.1	12.6	8.4	10.4
Health	**123.5**	206.5	187.7	190.6	180.1	27.5	143.2	2.0	114.4	126.0	109.2	155.9	96.1	121.4

Source: Field Survey, 2009.

The results reviewed in table 10 indicate that the rich population gain the most benefit for all programs in rural areas. In other word, the higher incidence of all beneficiaries for all public services programs, particularly in rural areas, would of course be consistent with pro-rich and pro-rural distributional weights in the social welfare function of local governments for these programs.

It seems from this analysis that identification of poor on the basis of consumption does capture to a large extent the capability deprivation aspects of poverty. This suggests that if policy focuses on increasing poor people's income (meaning of consumption), it may reduce deprivation in many other areas of capability deprivation. Alternately, Gadarif local governments may focus on policies and projects that would directly deal with specific kinds of deprivation, such as the lack of water, electricity, good roads, education and health. A more effective approach may be a combination of pro-poor policies that enhance people's income or consumption and as well as reduce specific deprivations.

Table 10: Distribution of Beneficiaries

Public Services Programs	**Total**	**Quintiles of per ae consumption**					**Poverty Status**		**Area of Residence**		**Locality**			
		Q1	**Q2**	**Q3**	**Q4**	**Q5**	**P**	**NP**	**Urban**	**Rural**	**Galabat**	**Gadarif**	**Fashaga**	**Rahad**
Direct and indirect beneficiaries														
All Programs	**100.0**	**15.2**	**23.9**	**22.1**	**24.3**	**14.4**	**98.4**	**1.6**	**19.3**	**80.7**	**30.8**	**27.7**	**10.1**	**31.3**
Water	100.0	13.1	24.7	22.2	25.0	15.0	98.3	1.7	20.3	79.7	30.7	28.3	10.3	30.8
Electricity	100.0	9.4	22.3	23.7	28.5	16.1	98.6	1.4	23.6	76.4	26.2	30.5	10.6	32.7
Health	100.0	12.5	20.5	23.2	28.0	15.8	98.2	1.8	19.7	80.3	29.2	29.3	10.1	31.5
Direct beneficiaries only														
All Programs	**100.0**	**10.1**	**15.4**	**14.4**	**21.2**	**38.9**	**97.7**	**2.3**	**29.8**	**70.2**	**28.7**	**36.4**	**7.2**	**27.8**
Water	100.0	10.2	15.0	15.3	21.7	37.8	97.1	2.9	39.4	60.6	27.2	40.0	9.2	23.6
Electricity	100.0	8.3	16.1	14.0	19.3	42.3	96.8	3.2	59.8	40.2	10.7	49.7	8.5	31.1
Health	100.0	11.2	13.6	13.4	20.6	41.2	97.9	2.1	30.1	69.9	25.6	53.0	5.9	15.6
Targeting														

Accuracy													
All Programs	**100.0**	**24.0**	**28.1**	**23.3**	**18.5**	**6.1**	**99.7**	**0.3**	**22.2**	**77.8**	**32.3**	**31.1**	**9.6**	**27.1**
Water	100.0	23.9	28.3	23.8	18.6	5.5	99.7	0.3	22.6	77.4	32.9	30.5	9.5	27.1
Electricity	100.0	21.4	34.1	24.3	15.3	4.9	99.7	0.3	29.0	71.0	24.6	35.1	10.8	29.5
Health	100.0	24.9	26.5	20.7	18.6	9.2	99.8	0.2	19.9	80.1	29.5	34.0	9.7	26.8

Source: Field Survey, 2009.

A providing of these services alone does not improve the economic situation of the Gadarif population; it can play an important role in making these and other sustainable contributions to the community, it is important for those who make economic policies, to distribute these public services in a way which help the poor benefit from these services. Therefore continuous evaluation must be made to know the beneficial and non- beneficial, their characteristics and the places of their residence. However, knowing the effect of these public services programs on the poor planning for them with precision and efficacy to achieve their objectives of the eradication of poverty through adoption of pro-poor polices, the government in Gadarif State should adopt strong distributional weights in the allocation of resources among localities and households.

Table 11: Cost-Benefit Ratios

Public Services Programs	**Simulated poverty gap without transfer**	**Actual poverty gap**	**Difference (dPG)**	**Total amount spent in the program (X)**	**Cost-Benefit (dPG0/X)**
All Programs	**2,749,012,204**	**1,738,225,532**	**1,010,786,672**	**387,287,394**	**0.26**
Water	2,745,331,659	1,738,225,532	1,007,106,127	318,545,533	0.32
Electricity	2,715,409,857	1,738,225,532	977,184,325	4,982,790	0.01
Health	2,734,850,888	1,738,225,532	996,625,356	63,759,072	0.02

Source: Field Survey, 2009.

Again, water and health programs are good programs for playing a greater role of increasing benefits and decreasing poverty in Gadarif State as shown in table 12.

Table 12: Decomposition of Program Impact

Public Services Programs	**Generosity**			**Program size**	
	Targeting	**Average transfers**	**Poverty gap**	**Number of beneficiaries**	**Number of poor**
All Programs	**1.00**	**436.5**	**1,982.7**	**887,288**	**882,102**
Water	1.00	381.6	1,972.5	834,720	882,102
Electricity	1.00	7.0	1,778.6	712,140	879,037
Health	1.00	84.6	1,938.5	753,393	879,037

Source: Field Survey, 2009.

(ii)The Marginal Benefit Incidence Analysis of Access to Public Services Programs (Increase in Access)

The results presenting in table 13 indicate that the marginal benefit incidence is higher (or at least not systematically lower) for the poor than for the non-poor in water and health programs, but this is not the case for electricity program, which seems to increase gains for the richest households from any expansion in these services. This suggests that an expansion of water and health programs would be decidedly pro-poor at the margin, while an expansion of electricity program would be pro-rich at the margin.

However, the households in the first and second poorest quintiles benefit more than the average household from increases in access of water and health programs. Importantly, even when the marginal benefit incidence suggests that the poor benefit more than the non-poor from gains in access, the non-poor still benefit more at the margin than they do currently. Improvements in access to water and health program are pro-poor, because in these sectors, even those in the highest quintiles still lack universal access. Electricity program is pro-rich at the margin, while the distribution of the gains in access for water and health are more pro-poor. Thus, Gadarif government must increasing efforts to maximize average expenditure in the field of water and health programs in particular, and in electricity program by making it more pro-poor, i.e. the allocation of investments at the local level is an important decision for policymakers, where they need pro-poor policies to accelerate the speed at which the poor benefit from the expansion of public services programs.

Table 13 : Marginal Benefit Incidence of Public Services Programs by Expenditure Quintiles in Gadarif State 2009.

Quintile	Water Program		Electricity Program		Health Program	
	Coef	t-ratio	Coef	t-ratio	Coef	t-ratio
Poorest	1.20	3.14	0.50	1.22	1.79	6.27
2nd	1.19	9.69	0.42	1.06	1.19	7.83
3rd	0.86	6.79	0.20	0.74	0.89	6.02
4th	0.56	3.98	0.17	0.97	0.70	9.07
Richest	0.39	4.46	0.29	2.40	0.47	9.79

Source: Field Survey, 2009.

Conclusion

The study investigates whether the poor benefit more or less than the non-poor from an expansion in public services in Gedarif State from eastern Sudan, and how government expenditure affects the welfare of different groups of people or individual household, using a combination of primary and secondary data in 2009, with an aim helping of policy makers to draw effective polices with respect to this issue. The study investigates the allocation of water, electricity and health programs across localities. Results indicate that the marginal benefit incidence is higher for the poor than for the non-poor in water and health programs, but lower in the case of access to electricity program. A model proposed is suggested that water and health programs displayed strong pro-poor and have a greater role for decreasing inequality and poverty in Gadarif State. This maximization appears to occur without policymakers taking into account distributional weights in their implicit social

welfare function. An expansion of water and health programs would be decidedly pro-poor, while an expansion of electricity program would be pro-rich.

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