POVERTY, INEQUALITY AND MILLENNIUM DEVELOPMENT GOALS' EXPENDITURE: A PROBABILISTIC LINKAGE

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ABSTRACT

The objective of this paper is to investigate the linkage between poverty, inequality and Millennium Development Goals' (MDGs) expenditure. To achieve the set objective, probit and logit models were empirically employed using a panel data series. The results revealed that a unit increase in expenditure on MDGs would lead to increase in poverty by a single digit and income inequality by double digits. This is not to blame the MDG funding or discourage it. Plausibly the expenditure on MDGs has been constrained due to technical, managerial, institutional, macro-economic imbalances, and policy bottlenecks. Therefore, government and agencies should ameliorate these constraints. Consequently, this work has originated applied logit and probit models to explore poverty-inequality-MDGs' expenditure nexus.

Keywords: Poverty, Inequality, Probability, MDGs' expenditure.

Jel Classification: C43, C82, O1, O55.

Contribution/Originality

The paper contributes the first logical analysis of probabilistic linkages between poverty, inequality and MDGs' expenditure. It has originated applied logit and probit models to explore poverty-inequality-MDGs' expenditure nexus. It founds plausibly that expenditure on MDGs has been constrained due to technical, managerial, institutional, and policy bottlenecks among others.

1. INTRODUCTION

The inquiry into the field of development economics in developing countries, especially Nigeria has not been a new aspect before the 1990s, in view of the fact that the country has been struggling using different options such as National Development plans and strategies to develop it economy since independence in 1960 from Britain. Historically, Nigeria has had four National Development plans; it also had austerity measures, structural adjustment program, and so on. But, recent discourse on development globally has been dominated by the Millennium Development Goals (MDGs) as a new development paradigm that will improve the living conditions of developing economies (Ali, 2010). Consequently, this paradigm came immediately after the United Nations development decades of the 1960s, 1970s, and 1980s, while 1990s ushered in the MDGs, which was backdated to 1990 even though it was launched in September, 2000.

Interestingly, the empirical paper of Fukuda-Parr *et al.* (2013) enlisted Nigeria among the 20 countries showing highest improvements in 16 MDGs indicators, and rated it among top performers by *absolute pace of progress* in only 5 indicators, using an alternative framework of MDGs benchmarks.

Poverty reduction has been in the forefront of development discourse and it was the first goal in MDG agenda. Several studies such as, Bourguignon (2004), Ravallion (2005), Ravallion and Chen (2003) and Lopez (2006) have shown that the distribution of income indeed matters for the poor. Although, poverty outcomes differ among countries and largely depends on the success of development strategies focusing on the specific impact of inequality and growth on poverty. In addition, Lopez and Serven (2006), Ravallion (1997) and Lopez (2006), opined that higher initial inequality tends to reduce the positive, decreasing impact of growth on absolute poverty.

Besides, it is widely agreed that economic growth alone is not a sufficient condition for successfully achieving the goal of poverty reduction I (See(Addison and Cornia, 2001; Ravallion and Datt, 2002; Iniguez-Montiel, 2014)). Economic growth is self-evidently good for poverty reduction, since without growth, the average incomes of the poor cannot rise over time, with attendant implications for poverty. But growth is not the only requirement. At any given level of average income, the incidence of poverty is determined by income distribution. The larger the share of any increment to growth captured by the poor, the faster the rate of poverty reduction (Iniguez-Montiel, 2014). Growth is not the only requirement for poverty reduction, but income distribution or it similitude in form of MDGs spending (MDGs' expenditure) along development fulcrum, it is on these issues that this work hinges. In addition, Dagdeviren *et al.* (2004) opined that, redistribution is far more effective in reducing poverty than increases in economic growth that are distribution neutral. Also, Weinhold *et al.* (2013) study suggests that increased soybeans production reduces poverty indicators and raises median rural incomes, but is associated with increased measures of inequality in Brazilian Amazon (Weinhold *et al.*, 2013).

There are two major contenting arguments on inequality and poverty; first, the induced growth argument which formalizes the long standing view that inequality hinders growth, thus impedes progress in reducing absolute poverty (Alesina and Rodrik, 1994; Ravallion, 2005; Easterly, 2007; Berg and Ostry, 2011; Stiglitz, 2012)

Second, the growth-elasticity argument states that, even if the distribution of income is irrelevant to the rate of growth, inequality per se, or its decline, is indeed important in order to guarantee that the distributional gains from growth are more proportionally shared by the poor and do not benefit mostly the rich (Ravallion, 2005; 2007; Stiglitz, 2012). Thus, redistribution contributes directly to the reduction of poverty by allowing the poor to have a bigger share of the benefits, in the form of a better payment or higher salaries. Hence, redistribution can be through taxes and income transfer system.

Moreover, Iniguez-Montiel (2014) wrote that, economic growth reduces poverty, and an economic downturn or recession increases it generally. An improvement along the distribution of income (inequality decline) reduces poverty, while an inequality rise increases the poverty level correspondingly. Also, to improve the wellbeing of the poor on a constant basis and thus attain the goal of poverty elimination, a country has to focus on two possible, non-mutually exclusive types of policies: those that spur growth and those that reduce the level of inequality. Ideally, win–win types of policies, leading to faster growth and lower inequality, should be pursued when the overarching policy objective is the reduction of poverty.

Some studies, such as Aghion *et al.* (1999) and Stiglitz (2012) support the well-established view that inequality can be destructive for growth. Likewise, Berg and Ostry (2011), Stiglitz (2012) explains that, inequality is destructive to growth due to its adverse effects on the economy, and because the price paid for a high level of inequality may even exceed the overall benefits. Thus, if less inequality is good for both growth and the reduction of poverty, then equity considerations should be promoted to encourage the sustainable growth and development of an economy. This research tries to look at the probabilistic linkages between poverty, inequality and MDGs' expenditure or poverty-inequality-MDGs' expenditure connections. This connection has not been explored previously by MDGs proponents. The work is closely related to Ahluwalia (1976) that connects poverty-inequality-development, Basu (2006) on Globalization-Poverty-Inequality, Bourguignon (2004) on poverty-growth-inequality triangle, Weinhold *et al.* (2013) connects soybeans production-poverty-inequality, and also similar to the researches of Bhalla (2002), Iniguez-Montiel (2014), Ravallion (2005; 2007); Stiglitz (2012) and Lopez (2006), on poverty-inequality-growth nexus.

2. THE THEORY OF MDGs

The theory of MDGs postulate that by 2015 eight key aspects of human endeavour are expected to improve and other negative aspects to at least reduce thereby generally improving Human development and standard of living. These MDGs eight key goals are:[1]

a) to halve poverty and hunger levels between 1990 − 2015,[2,3]

b) achieve universal primary education,

c) to eliminate gender disparity in primary, secondary education and all levels of education,

d) reduce child mortality by 2/3 between 1990 and 2015,

e) reduce maternal mortality by ¾ between 1990 and 2015,

f) combat HIV/AIDS, malaria and other diseases,

g) ensure environmental sustainability (i.e. improving sustainable access to safe drinking water and basic sanitation by 50% by 2015), and

h) to develop a global partnership for development, i.e. improves bilateral trade, debt relief for heavily indebted poor countries (HIPC), decent and productive employment for the youth, sustainable affordable essential drugs, make available technologies, information and communications (e.g. telephones, cellular and internet access).[4,5]

Theoretically, these MDGs are impliedly anticipated to close income gaps (income inequality) between individuals, hence the poor's welfare and wellbeing would be improved by the target date (i.e. 2015). This scenario produces a technical triangle (Figure 1).

In addition, increase in MDGs' expenditure produces improvement that reduces poverty and income inequality; poverty reduction increases migration of low income group to middle or higher income group and closes income gaps, these scenarios accelerate progress towards the MDGs. Consequently, directly and indirectly, MDGs' expenditure is expected to reduce both poverty levels and income inequality in the society and that plausibly produces improvement of human development and the MDGs (Figure 1).
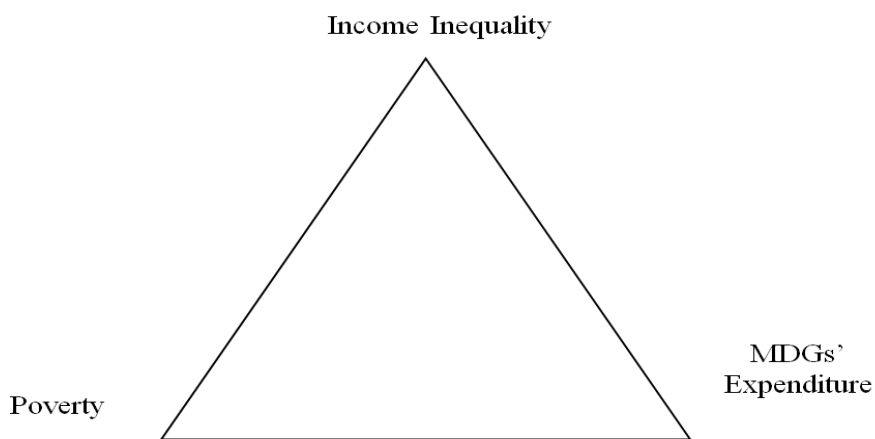
Income Inequality

Poverty

MDGs' Expenditure

Figure-1. Poverty-Inequality-MDGs Expenditure Nexus

Source: Author's Plausible Illustration

Growth is not the only requirement for poverty reduction, but income distribution or it similitude in form of MDGs spending (MDGs' expenditure) along development fulcrum, it is on

these issues that this work hinges. It is a widely expected that MDGs spending comes in a big push, that can airborne the poor to be flying, just like growth, it reduces poverty and income gaps (income inequality). The MDGs spending can be viewed as growth stimulant. In this work, we firmly hold the growth-elasticity argument and growth–poverty–inequality nexus. Presuming growth as surrogate to MDGs' expenditure, thus; MDGs' expenditure–poverty–inequality nexus be holds leaning on several works such as; Iniguez-Montiel (2014), Ravallion (2005; 2007); Stiglitz (2012) and Lopez (2006), Ahluwalia (1976), Basu (2006), Weinhold *et al.* (2013) among others. Again, Iniguez-Montiel (2014) put forward that, economic growth reduces poverty and recession increases it generally, inequality decline reduces poverty, while an inequality rise increases the poverty level correspondingly.

3. METHODOLOGY

3.1. Probit and Logit Models

I introduce probit and logit models to empirically observe the probabilistic effects of poverty and inequality to Millennium Development Goals. An extensive coverage of these modeling has been provided by Wooldridge (2002; 2009), Nerlove (2002), Powers and Xie (2000), Studenmund (2001), Rose (2000) and Gujarati and Porter (2009). The logit model is specified in Table 1, equations (1) and (2). Furthermore, the empirical probability of poverty and inequality on MDGs' expenditure is denoted as G (Z). Where; $Z = \beta_0 + \beta_1\, rpov_{it} + \beta_2\, cgin_{it}$; the logit model uses the cumulative distribution function (CDF), therefore, equation (1) represent the logistic CDF. Thus, Z_i ranges from $-\infty$ to $+\infty$, P_i ranges between 0 and 1 and that P_i is nonlinearly related to Z_i (in a range of explanatory variables). In their text, Gujarati and Porter (2009) had treated an introduction to this model. Presumably, $P_i = 1$, is the probability of success in reducing poverty and inequality given MDGs' expenditure, while $P_i = 0$, probability of failure in reducing poverty and inequality. I control for other MDGs' indicators, international agencies, Non Governmental Organizations (NGOs) and civil society.

Table-1. Equations

Equations	Number
$\mathrm{Pr}(Exmdg_{it} = 1 \mid rpov_{it}, \beta_1 + cgin_{it}, \beta_2 + u_{it}) = G\,(Z)$	(1)
$G\,(Z) = \exp(Z) / [1 + \exp(Z)] = e^Z / 1 + e^Z$	(2)
$G(Z) = \Phi(Z) \equiv \int_{-\infty}^{Z} \Phi(v)\,dv$	(3)
$F\,(Exmdg_{it}) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{Exmdgit} e^{-\frac{z2}{2}}\,dz$	(4)
$\frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta0+\beta1 rpov+\beta2 cgin} e^{-\frac{z2}{2}}\,dz$	(5)
$Exmdg_{it} = F^{-1}(Exmdg_{it}) = F^{-1}(P_i) = \beta_0 + \beta_1\, rpov + \beta_2\, cgin$	(6)

Source: Ali (2010).

The parameter β_0 is the intercept term and the remaining coefficients (β_1, β_2) represent the 'effects' of poverty and inequality. Accordingly, the probit function is given in Table 1, equations

(3), where; Φ (Z) is the standard normal density. Φ (Z) = $2\pi^{-1/2}$ exp (-$Z^2/2$). The normal cumulative distribution function (CDF) has been found useful in estimating probit model.

$$P_i \; [p \; (Exmdg_{it} = 1 \mid rpov_{it,} \, \beta_1 + cgin_{it,} \, \beta_2 + u_{it}) = p(rpov_{it}^* \leq rpov_{it\,;} \, cgin_{it}^* \leq cgin_{it})$$

$$P \; (Zi \leq \beta_0 + \beta_1 \, rpov_{it} + \beta_2 \, cgin_{it}) = F \; (\beta_0 + \beta_1 \, rpov_{it} + \beta_2 \, cgin_{it})$$

Where; p ($Exmdg_{it} = 1 \mid rpov_{it,} \, \beta_1 + cgin_{it,} \, \beta_2 + u_{it}$) is the probability that an event occurs given the values of the explanatory variables. Z_i = standard normal variable, $Z \sim N$ (0, σ^2); F = standard normal CDF. Hence, presented as equation (4) and (5) in the Table 1. Moreover, authors such as; Nerlove (2002), Wooldridge (2002), Powers and Xie (2000), Gujarati and Porter (2009) were kind to explain concisely. P represent the probability that the event will occur, here the probability of reducing poverty and inequality, is measured by the standard normal curve from - ∞ to + ∞. Thus, specified in Table 1 as equation (6).

3.2. Panel Data Sources

The data for poverty and income inequality were sourced from established institutions in Nigeria. The data for state GDP for 1991 and 2006 were derived from Central Bank of Nigeria's Statistical Bulletin (See CBN (2006)). The population data is sourced from Nigeria's National Bureau of Statistics (NBS) base on 1991 and 2006 population census conducted by the National Population Commission (See (NBS, 2005; NPC, 2007)). The poverty rate (head count ratio) is also from previous source, base on 1992 National Consumer Survey (NCS) and 2004 National Living Standard Survey (NLSS). In addition, the income inequalities (i.e. covariance coefficients) were sourced from World Income Inequality Database (UNI-WIDER, 2005).

4. EMPIRICAL RESULTS

The descriptive statistics of the variables are presented in Table 2, *Exmdg* is MDG expenditure, a limited dependent variable, assign with binary number; pre-MDG is denoted by zero and post-MDG is denoted by one. The *rpov* represent poverty head count and *cgin* symbolize income inequality. From the Table 2, *rpov* across Nigeria have the mean of about 48.4, with the minimum and maximum been 20.11 and 95.07 respectively. The *cgin* has a mean of 0.42, with minimum of 0.30 and maximum of 0.64 across the nation. This variable has lower standard deviation of 0.07 when compared to *Exmdg* of 0.51 (Table 2).

Table-2. Descriptive Statistics

variable	Mean	Median	Std. Dev.	Min.	Max.	Description
Exmdg	0.500000	0.500000	0.504082	0.000000	1.00000	1 if expenditure ≥ year 2000; else 0.
Rpov	48.3789	44.1000	18.3201	20.1100	95.0700	Head count poverty ratio in percent
Cgin	0.415373	0.392350	0.0705066	0.300000	0.642900	Estimated gini-coefficient

Source: Ali (2010).

As can be observed from Table 3, the signs of estimated coefficients are consistent across the models and the variables are uniformly statistically significant as well. For the probit model, the interpretation of intercept of -20.76 gives the probability that at poverty level and income inequality zero, MDGs' expenditure will be -20.76. In view of the fact that this value is negative and probability cannot be negative, we treat this value as zero, which is sensible in this illustration. The slope value of 0.058 means that, for a unit change in head count poverty (by one person), on average the probability of MDGs' expenditure increases by 0.058 (or 5.8 percent). The slope value of *cgin* means that for a unit change in income inequality (income gap), on average the probability of MDGs' expenditure increases by 44.78. On the other hand, the logit model values are similar to the probit model and so goes the interpretation. For instance, if the level of poverty goes up by a unit, on average the (probability of someone becoming poor) on average the probability of MDGs' expenditure goes up by 0.088 units in the logit model. Likewise, if inequality goes up by a unit, on average the probability of MDGs' expenditure goes up 83.46 units. The unique variation in the two models is that the logit coefficient estimates are higher than the probit.

Table-3. Probit and Logit models Result

Dependent variable: Exmdg		
Independent variables	Probit (MLE)	Logit (MLE)
Rpov	0.058 (2.1)	0.088 (1.75)
Cgin	44.76 (3.8)	83.46 (3.36)
constant	-20.76 (-3.7)	-37.88 (-3.35)
Percentage correctly predicted	93.5	95.2
Log-likelihood value	-9.42	-9.29
Pseudo *R*-squared	0.781	0.784

Source: Ali (2010).
Note: Figures in parenthesis are t-values.

The two are comparable and to make them so, we multiply the probit by 1.61, which is very close to the simple thumb of rule for scaling up to the probit estimates (Wooldridge, 2009). For example, probit 0.058 (1.61) ≈ 0.093 is close to logit coefficient of 0.088. Similarly; 44.76 (1.61) ≈ 72.064 is close to logit coefficient of 83.46; constant probit coefficient of - 20.76 (1.61) ≈ 33.4236 is close to logit coefficient of 37.88. The Pseudo *R*-squared which indicate goodness of fit, shows almost the same value of 0.78 for the two models, depicting high explanatory power of the independent variables. Probit is correctly predicted at 93.5 percentage while logit at 95.2 percentage. The Log-likelihood values are similar at about - 9.2 (see Table 3). Moreover, the marginal effect of another year of income inequality on the probability of MDGs' expenditure is always 44.76 in probit model while it is 83.46 in logit model. Also, the marginal effect of someone

becoming poor, on the probability of MDGs' expenditure is always 0.058 units in probit model while it is 0.088 units in logit model.

5. CONCLUSIONS

From the foregoing, the poor has not benefitted more from government programs and programs implementation have not been quite successful, although, the UNDP (1998) reports asserted that, those who capture the benefits of the initiatives (i.e. poverty reduction programs) were not the poor, but the rich and powerful. This brought frustration, discontent and resentment to the poor. Moreover, we can see that, the marginal effect of another year of income inequality on the probability of MDGs' expenditure is always 44.76 in probit model while it is 83.46 in logit model. Also, the marginal effect of someone becoming poor, on the probability of MDGs' expenditure is always 0.058 in probit model while it is 0.088 in logit model.

Thus, the relationship between MDGs' expenditure and income inequality is positive and significant, a rise in MDGs' expenditure by 1%, leads to an increase of income inequality by 8%. Well, the MDGs' expenditure was expected to have an inverse relationship with income inequality on *a prior* ground. This means that, MDGs' expenditure has not substantially reduced income gaps over the years as suggested by the model. Thus, the increase in income inequality implies that the bulk of the funds coming from overall economic growth and specifically MDGs' spending are not used in the manner directed. Probably, the composition of MDGs' expenditure was directed more to other indicators not poverty reduction that could narrow the income gap. Another plausible explanation is that, the expenditure on MDGs has been constrained due to technical, managerial, institutional, macro-economic imbalances, and policy bottlenecks. Therefore, we are not to blame the MDG funding agencies or discourage them.

Furthermore, on findings between this work and Ahluwalia (1976), Basu (2006), Bourguignon (2004), Weinhold *et al.* (2013), Bhalla (2002), Iniguez-Montiel (2014), Ravallion (2005; 2007); Stiglitz (2012) and Lopez (2006), Fukuda-Parr *et al.* (2013) there is divergence; it is similar on poverty and inequality but dissimilar on the aspect of MDGs' expenditure (spending).

Generally, development or MDGs or even a well-defined economic progress is not only the question of abundance of resources, the socio-political framework of society matters; the people must be ready for development, upholding more firmly the rule of law and order, halting insurgency, curbing conflicts, sectarian violence among others. These could produce impetus for the MDGs agenda to succeed.

Notes:

1. For details see United Nations (2003) indicators for monitoring the millennium development goals, New York. Thus, on the basis of MDGs theory these big goals are expected to improve the Human Development by reducing poverty as well as income gaps.

2.   To intensify effort and demonstrate government commitment, virtual poverty fund (VPF) was established to house debt relief gains. The 2006 budget contains the debt relief gains to fund MDGs, totaled N100 billion, which was equivalent to US$750 million, the share that accrued to the federal government in the debt deal. In the year 2007, two innovative mechanisms for achieving the MDGs were put in place; first, conditional grants scheme (CGS) to states and subsequently to local governments to execute projects and programs. Second, social safety nets scheme which provides cash or in-kind transfer to the poorest in the society. Also, new initiatives for 2008 were put in place, which include capacity building schemes for federal, state and local employees, funding of national health insurance scheme, 'quick wins' constituency projects and intensive training of midwives in order to address maternal mortality (MDG Office, 2008).

3.   Nigeria's pro-poor programs are; NEEDS, NAPEP, PAP, FEAP, CAPPA, among others.

4.   The ODA from developed countries to Nigeria has been consistently increasing since 2001. It rose from US$167 million in 2001 to US$578 million in 2004 and US$11,433 million in 2006.

5.   International partners, includes; UNDP, UNESCO, UNICEF, EU, World Bank, USAID, JICA, DFID and AFDB.

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