Modelling Millennium Development Goals' Indicators: A Comparative Analysis

Dr. Bello Malam Saaidu[1] and Roslan Abdul Hakim[2]

[1] Modibbo Adama University of Technology Yola, Adamawa State, Nigeria.

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Abstract

This research was triggered by enthusiasm to conduct a comparative models experiment of indicators of Millennium Development Goals (MDGs) interaction with economic growth. To achieve the objectives of this research, three sets of econometric model were developed and thoroughly subjected to statistical analysis to determine MDGs models efficiency. The methodology employed is experimental approach to MDGs? indicators in the economy. The research revealed that, the second model is the best, more robust and contributes more in explaining the relationship between MDGs indicators and the economic growth. The third model was rated poor, while the first model was rated moderate in explaining MDGs indicators influence in the economy. The paper concludes that, this short run dynamic analysis can be extended to a long run analysis. It further provides policy makers in developing countries with unique analytical relationship between real growth rate of the economy and MDGs i ndelling.

Index terms— Comparative Models, MDGs? Models, Indicators, Experimental Approach.

1 Introduction

t is a known fact that the Millennium Development Goals are outcomes of United Nations series of international conferences in the 1990s. This new development paradigm has come to stay, we are witnessing over a decade of the signing of Millennium Development Goals declaration. The declaration was endorsed in September 2000, at the United Nations Millennium Summit, world leaders agreed to a set of time bound and measurable goals and targets for combating poverty, hunger, disease, illiteracy, environmental degradation, discrimination against women and so on. The Millennium Development Goals contained eight goals, eighteen targets and forty-eight indicators.

The overall theme of the MDGs as a whole is poverty alleviation. This can be seen from the emphasis on the reduction of poverty and hunger in the first and most prominent goal, and also from the copious documentation that accompanied the MDGs' issuance. For example, in presenting the MDGs to the General Assembly for consideration, the former United Nations Secretary General Kofi Annan (Annan, 2000) advocated their adoption and said, we must spare no effort to free our fellow men and women from the abject and dehumanizing poverty in which more than 1 billion of them are currently confined. In a similar vein, the United Nations press release on the edited 2001 goals referred to their major focus as being on eliminating poverty (http://www.un.org/News/Press/docs/2001/pil380.doc.ht m, p. 2).

The World Bank's press release quoted Bank President James Wolfensohn expressing support for them as concrete targets for everyone to rally around in the global fight against poverty (see Gwatkin, 2002) and the presentation of the goals on the United Nations Development Programme website refers to them an ambitious agenda for reducing poverty (http://www.undp.org/mdg/). One may deduce from the foregoing statements that the improvement of conditions among the poor is the intent underlying all of the MDGs, accompanying targets and indicators. The goals, targets and indicators vary greatly in the degree to which they are expressed in specific terms to the circumstances of population group.

Furthermore, short run econometric analysis has not been studied by the previous researches found in the area, namely; Black and White (2004), Fukuda-Parr (2004), **??**genor et al (2005;, **??**NDP (2005) and others. But, Logfren and Diaz-Bonilla (2005), focus on economy-wide simulations analysis of Ethiopian MDG Strategies, while, James (2006) showed only loose links between the goals and their ultimate impacts on human functionings such as gender equality or freedom from illness. Also, Martin (2011) work dwelled on national focus State of the Future Index (SOFI) and did not capture the synthetic analysis of modelling like this research. More so, Rodriguez (2010) The rest of the paper is structured as follows; section two contains a brief literature review. Section three provides the methodology and comparison of three models, viz; Core MDGs, Health MDGs, and Envipartnership MDGs. This is followed by data analysis in section four and conclusions drawn from the findings are presented in section five.

2 II.

3 Literature Review

The MDGs endorsed by the UN preceded three 'development decades' of the 1960s, 1970s and 1980s, during which the emphasis was on structural economic and social change as the primary definition of 'development' (see Fukuda-Parr, 2004). It was the reassessment of these approaches during the 1990s that led to the 1996 espousal of the 'International Development Targets' by OECD countries, comprising seven quantifiable goals in the areas of economic wellbeing, social development and environmental sustainability and regeneration (Black and White, 2004). During the UN conferences in the late 1990s the MDGs were uphold as their successors, and adopted as such by 189 countries at the UN Millennium Summit in September 2000 and in the 'Millennium Declaration'. This committed its signatories to jointly reduce poverty and to build a secure and peaceful world conducive to human development. The partnership between rich and poor countries was reaffirmed at the November 2001 launch of the Doha round on international trade and the March 2002 International Conference on Financing for Development in Monterrey, Mexico (UNDP, 2005;

In September 2005 the UN Member States gathered at the 2005 World Summit to review progress against the goals, and all members reaffirmed the Millennium Declaration. The eight MDGs are to halve the proportion of people living in poverty and suffering from hunger, ensure gender equality in education, reduce under-five mortality by two-thirds and maternal mortality by three quarters, and to halt and reverse the spread of HIV/AIDS, malaria and other diseases -all to be achieved between 1990 and 2015.

The proponents of the new MDGs paradigm include Fukuda-Parr (2004), who argued that, in comparison to earlier approaches, they put human development at the centre of the global development agenda, provide a framework for accountability, and address not only development outcomes but also inputs from rich countries, thus forming a compact that holds both rich and poor governments accountable. Likewise Devarajan et al (2002) favoured the MDGs for their results orientation, emphasis on quantitative analysis, and their role in donor coordination. Moreover, Clemens et al (**??**004) made a critical assessment, they argued base on historical evidence that many of the MDGs are unrealistic, foster an excessive focus on donor resources, and hypothesize a risk of 'development disillusion' among the public if their realisation fails. Furthermore, White (2004) noted inconsistencies in the MDG time frame -with most goals for 2015 but some for 2005 -and observes that several envisaged MDG 'outputs' are not the products of 'investment', and not all outcomes are measures of welfare. This prevents valid performance monitoring and taking the steps necessary to achieve the outcomes.

The questions that pertinent to this paper are therefore; is there any relationship between MDGs indicators and the height or weight of the economy? How is this relationship (if any) does translate into the economy? Can we determine MDGs interaction with economic growth? What is the implication of the relationship? Do MDGs indicators improve or impede the rate of economic growth? What are the implications to policy issues? Thus, the broad hypothesis is; MDGs indicators have no significant effects on the economy (H = 0) and the alternative hypothesis is; MDGs indicators have significant effects on the economy (H ? 0). Thus, the objectives of this research are; to establish the relationship between MDGs indicators and their effect on the economy; to develop three MDGs' models base on sector-like indicators and determine their interactions with real growth rate of the economy; to ascertain MDGs models of indicators improve the rate of economic growth and to assess the implications of the findings to policy issues.

Similarly, White (2004) further observed, definitional defects; access to reproductive health is not measured; the proxy for contraceptive prevalence is problematic; the child survival terminology is flawed demographically. Consequently, Agenor et al **??**2005; 2006) address this problem by proposing a macroeconomic monitoring framework that explicitly connects MDG indicators to policies such as aid and debt relief, and apply it empirically to Sub Saharan Africa. In another study, James (2006) points to evidence showing only loose links between the goals and their ultimate impacts on human functionings such as gender equality or freedom from illness. Notwithstanding, Vandermoortele (2004) questioned the feasibility of the MDGs project, including its monitoring. In a review of progress towards the MDGs during the 1990s he found an uneven pattern across regions and countries and between different socioeconomic groups within countries. This highlights the possibility of global success masking widespread local failure. Also, Vandermoortele (2004) further found evidence that, disadvantaged groups are often by-passed by 'average' progress that is the cheapest way to satisfy MDG standards, but this need not be pro-poor. The data used in this study are annual data for the period 1990-2008. The data were

obtained from various issues of Central Bank of Nigeria for the LGDP and LYUR. Other variables were obtained from various issues of United Nations statistics division, UN Millennium Development Goals database, MDG Office Nigeria, UNICEF, World Fact Book, National Bureau of Statistics and UNDP. In addition, to obtain the data real values of the variables which were originally in percentages were converted into natural logarithm.

LRGDP defined as the log of real gross domestic product. To arrive at this, data was obtained on GDP at 1990 constant basic prices (in million Naira), this was converted to percentages so as to be in harmony with MDGs variables which were already in percentages.

LPPL defined as the log of population below poverty line. LUWC defined as the log of underweight children (< 5 years of age). LNEP Log of net enrolment in primary education (both sexes). LPSC described as the log of primary school completion rate (both sexes).

LGPI defined as the log of gender parity index (as a ratio of women to men). LWNP termed as the log of seat held by women in national parliament. LIMR defined as the log of infant mortality rate (0-1 year) per 1,000 live births, to coordinate the data, the values were converted to percentages.

LCIM identified as the log of proportion of children immunized against measles (1 year old). LMMR defined as the log of maternal mortality rate (per 100,000 live births). The 100,000 live birth values were transformed to percentages for data synchronization. LHIV is the log of human immune virus prevalence rate (proportion of people living with HIV). LPTB described as the log of prevalence of Tuberculosis (per 100,000 people). This was converted to percentages to harmonize the data. LASW is the log of access to safe water. LABS identified as the log of access to basic sanitation. LIUS defined as the log of internet users (per 100 people). LYUR is the log of youth unemployment rate (both sexes).

4 b) Method of Estimation

To conduct experiment on the relationship between MDG indicators and real Gross Domestic Product of the economy, three set of multiple regression models were developed, viz: Core MDGs, Health MDGs, and Envi-partnership. Next, each model was subdivided into two, separating the years (one takes from 1990-1999; the other takes from **??**2000] **??**2001] **??**2002] **??**2003] **??**2004] **??**2005] **??**2006] **??**2007] **??**2008]. Preliminary studies of the scatter plots of the data showed curvilinearity, thus, we convert them into natural logarithms and use econometric analysis.

The three set of models can be specified as follows:Model 1 : Core MDGs LRGDPi = ? + ? 1 LPPLi + ? 2 UWCi + ? 3 NEPi + ? 4 LPSCi + ? 5 GPIi + ? 6 WNPi i =1,? 19 (1)

Model 2 : Health MDGs.RGDPi = ? + ? 1 IMRi + ? 2 CIMi + ? 3 MMRi + ? 4 HIVi + ? 5 PTBi i =1,?.19 (2) Model 3 : Envi-partnership. RGDPi = ? +? 1 ASWi +? 2 ABSi +? 3 IUSi -? 4 YURi i =1,?. 19 (3)

IV.

5 Empirical Results and Their Implications

The intercept coefficient of model 1 in Table 1 is directly related to the dependent variable. The coefficients of LPPL, LUWC, LNEP, and LWNP have correct signs. But, LPSC, and LGPI are supposed to be directly related to RGDP on theoretical grounds. But LNEP, LPSC, and LWNP were found to be statistical significant, icating a rejection of null hypothesis, meaning that MDGs have significant effect on economic growth, whereas other t-ratios are not different from zero. The R-square and adjusted Rsquare are 0.95 and 0.92 respectively, both high in terms of regression fit and when adjusted for degree of ind freedom. The F-test suggests a rejection of null and acceptance of alternative hypothesis that these MDGs indicators have significant effect on the rate of growth of the economy. The Durbin-Watson (DW) statistics is 2.37 meaning that, there is presence of negative autocorrelation.

The first part of the separated equation one, shows correct signs for five (LPPL, LUWC, LNEP, LGPI and LWNP) coefficients of the variables, while coefficient of LPSC show wrong sign. But, the intercept is positive and insignificant at 5% level. The t-ratios for the variables were also statistically not significant at 5% except coefficient of LNEP that is significant. R-square is 0.88 while adjusted R-square is 0.65 portraying very high explanatory powers. F-Statistic is 3.72 less than the tabular value of 6.26, therefore we accept null hypothesis that MDGs have no significant impact on economic growth. DW is inconclusive with a value of 1.96.

Whereas, the second part of the separated model **??** (2000-2008) shows only the coefficients of LPSC and LGPI have wrong signs while others have correct signs on theoretical grounds. The coefficient of intercept exerts positive effect on dependent variable and is the only one that is significant, whereas the tratios of the six independent variables were found to be statistically insignificant at 5%. Thus, the R-square is 0.985, having very high explanatory powers on the dependent variable. Overall significance shows a rejection of null hypothesis at a value of 21.85, which means MDGs have significant effect on economic growth. DW is 2.55, still within inconclusive region. From Table 2, the intercept coefficient of model 2 is negative and significant. Coefficients of three variables (LIMR, LCIM, and LPTB) carrying the wrong signs contradicting theoretical postulation. The t-ratios are statistically significant except that of LHIV, which is statistically insignificant. The results of the five t-ratios implied that MDGs have significant effect on economic growth. Thus, R-square is 0.92 and adjusted R-square is 0.88, DW is 1.77, still inconclusive. Also, we reject null hypothesis with F-test of 28.12. Therefore, MDGs have significant effect on economic growth. Again, when we reduce the data to a decade (1990-1999), only

coefficients of LIMR, LCIM and LHIV are having the wrong signs and the intercept exert a negative influence on the dependent variable. Fascinating discovery, all the t-ratio of this sample were statistical not different from zero except that of LMMR. The R-square is high at 0.78, but when the fit is adjusted for degree of freedom it indicates low at 0.5. Surprisingly, both values are lower than the 9 years observation and all observations when compared. The DW statistics is 2.8 showing negative autocorrelation. Joint significance of this sample shows that we accept null hypothesis that, MDGs have no significant effect on economic growth.

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The third column contains data (2000-2008) of the same model; the coefficient of the intercept shows a direct relationship with the dependent variable. The coefficients of LCIM, LMMR, and LHIV are holding wrong signs base on theoretical a priori, while the coefficient of LIMR and LPTB have correct signs. In the sample only LIMR and LMMR are statistically significant, implying that MDGs have significant effect on economic growth. Furthermore, R-square is 0.999 suggesting a very high fit. The DW is inconclusive at 2.79. When the parameters are join together to observe the overall significance, it was found that F-statistics is extremely high at 1118.62, suggesting that alternative hypothesis is accepted, but it does not say which variables is important. This implied that MDGs have significant effect on economic growth.

In model 3, the coefficients of variables, were consistent theoretically except LABS and LYUR, whereas coefficients of LIUS and LYUR are statistically significant. The regression fit is high at R-square 0.86. The coefficient of LYUR shows a positive value, this empirical discovery invalid the theoretical a priori.

Probably, additional explanatory variable may resolve the problem. F-Test indicates rejection of null hypothesis and acceptance of alternative that, MDGs have significant effect on economic growth. There is inconclusiveness in autocorrelation decision because DW is 1.44.

The coefficient of the intercept of the separated model **??** (2000-2008), shows negative value, meaning that it exerts negative influence on the dependent variable. It is also statistically not significant at 5% level. A possible explanation for this is that, government policies on basic sanitation and employment has not yielded desire results, also internet users and possession of personal computers were very low couple with saturated labour market in recent years.

First part of the separated model **??** (1990-1999) shows positive coefficient of intercept, while LASW and LYUR contradicts theoretical postulation about their signs. The coefficients of LABS and LIUS have the correct sign. All the t-ratios of this sample are statistically insignificant at 5% level. Again, it has very low explanatory powers, because R-square is 0.18 and when it is adjusted for degrees of freedom it assumes negative value of -0.47. The DW is 1.53, within the inconclusive region. According to F-test, we accept null hypothesis that, MDGs have no effect on economic growth. The second part of the separated Model 3 (2000-2008) has correct signs for coefficients of LASW, LABS, and LIUS. The coefficient of LYUR is positive; this empirical evidence contradicts the theoretical expectation. Also, intercept exert inverse effect with the dependent variable. R-square and adjusted R-square are both very high at 0.987 and 0.976 respectively, which indicates the fit of the regression line and adjustment for degrees of freedom. The F-Test indicates rejection of null hypothesis and acceptance of alternative that, MDGs have significant effect on economic growth, while DW is 2.96 suggesting a strong negative autocorrelation.

When the above are observe cumulatively, Rsquare is 0.86 and adjusted R-square is 0.83, though lower than the second part. Again, on the whole F-test of 22.13 (recall $F^* > F$?) confirms a rejection of null hypothesis that model 3 variables have impact on economic growth in Nigeria. Also, DW statistic of 1.44 values is inconclusive.

7 V. Conclusions and Further Research

The paper concludes that second model is the best, more robust and contributes more in explaining the relationship between MDG indicators and the economic growth of Nigeria. The results revealed that model 2 in Table 2 has nine significant t-ratios, R-square all high and F-test indicated two rejection of Null hypothesis; model 3 in Table 3 has five t-ratios significant, two R-square high and two F-test were rejected. Whereas, model 1 in Table 1 also showed five t-ratios significant, R-square all high and two F-tests were rejected. Therefore, in the entire analysis, model 1 is moderate in explaining MDGs indicators influence in the economy, model 3 is poor and model 2 turns out to be the best in the analysis in explaining the interaction. Generally, the implication of the results of the three models is that MDGs have significant effect on economic growth (F-test was rejected twice by each model), implying that government and international community should continue to support this new development paradigm so as to boost economic growth of Nigeria via improvements in social and economic indicators of MDGs.

The analysis presented in this paper can be extended in various directions and it would be important, for instance, to account for the effects of MDG office Nigeria on economic growth which is a qualitative factor by using a dummy variable and observe the behaviour of other independent variables as well. Another issue worth investigating is the possibility of extending this short run dynamic analysis to a long run analysis. In addition, several other effects could be envisioned. Finally, this work provides policy makers in developing countries

Figure 1:

1

RESULTS OF CLASSICAL LEAST SQUARES ESTIMATES
(REAL GROSS DOMESTIC PRODUCT AS DEPENDENT VARIABLE)

	1990-1999	2000-2008	All obs
? (Intercept)	2.87	14.18	1.49
	(0.3)	(3.05)*	(0.56)
? 1 (Poverty Level)	-0.58	-1.28	-0.08
	(-1.53)	(-1.54)	(-0.9)
? 2 (Underweight Children)	-0.87	-1.71	-0.11
	(-0.55)	(-0.92)	(-0.27)
? 3 (Net Enrolment in Primary)	1.7	0.26	0.88
	(3.02)*	(0.47)	(4.6)***
? 4 (Primary School Completion)	-0.73	-0.66	-0.76
	(-0.63)	(-1.85)	(-2.54)**
? 5 (Gender parity Index)	0.92	-1.06	-0.84
	(0.76)	(-0.77)	(-1.77)
? 6 (Women in Parliament)	0.45	0.17	0.24
	(1.77)	(1.29)	(5.96)***
N	10	9	19
R 2	0.88	0.985	0.95
Adjusted R 2	0.65	0.94	0.92
F C	3.72	21.85	35.4
DW	1.96	2.55	2.37

[Note: Source: Authors computations from Gretl Computer Package. Figures in parentheses are t-ratios, not standard errors. Significance at 1%; ** Significance 5%; *** Significance 10%.]*

Figure 2: Table 1 :

2

	1990-1999	2000-2008	All obs
? (Intercept)	-10.75	5.04	-3.8
	(-1.45)	(13.52)***	(-3.1)***
? 1 (Infant Mortality Rate)	0.25	-0.09	0.28
	(1.34)	(-3.45)**	(3.26)***
? 2 (Children Immunized against Measles)	0.67	0.02	1.17
	(1.23)	(0.32)	(7.2)***
? 3 (Maternal Mortality Rate)	–0.86	0.78	-0.61
	(-2.88)**	(14.15)***	(-4.98)***
? 4 (Prevalence of HIV)	0.45	0.04	-0.01
	(0.99)	(1.66)	(-0.08)
? 5 (Prevalence of Tuberculosis)	-1.06	-0.01	0.22
	(-1.07)	(-0.46)	(2.78)**
N	10	9	19
R 2	0.78	0.999	0.92
Adjusted R 2	0.5	0.998	0.88
F C	2.8	1118.62	28.12
DW	2.69	2.79	1.77

*[Note: Source: Authors computations from Gretl Computer Package. Figures in parentheses are t-ratios, not standard errors. * Significance at 1%; ** Significance 5%; *** Significance 10%.]*

Figure 3: Table 2 :

3

	1990-1999	2000-2008	All obs
? (Intercept)	2.65	-0.75	0.55
	(0.58)	(-1.08)	(0.48)
? 1 (Access to Safe Water)	-0.38	0.53	0.29
	(-0.37)	(3.08)**	(1.04)
? 2 (Access to Basic Sanitation)	0.05	0.04	-0.08
	(0.13)	(0.64)	(-0.58)
? 3 (Internet Users)	0.02	0.05	0.03
	(0.24)	(4.73)***	(2.31)**
? 4 (Youth Unemployment Rate)	0.23	0.17	0.19
	(0.66)	(3.26)**	(2.89)**
N	10	9	19
R 2	0.18	0.987	0.86
Adjusted R 2	-0.47	0.976	0.83
F C	0.28	80.81	22.13
DW	1.53	2.96	1.44

*[Note: Source: Authors computations from Gretl Computer Package. Figures in parentheses are t-ratios, not standard errors. * Significance at 1%; ** Significance 5%; *** Significance 10%.]*

Figure 4: Table 3 :

especially Nigeria with unique analytical relationship between economic growth and Millennium Development Goals indicators. [1]

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