

# Measuring Public Finance Sustainability and Financial Performance in Nigeria's Federal Treasury

**Onwuliri, Okechukwu (Ph.D) and Alozie, Christopher (FCA)**

Alozie, Christopher E. (B.Sc. (Econs), M.Sc. (Econs), M.Sc. (Accounting), M.Sc. (Banking & Finance), FCA): National Coordinator of Programmes, Centre for Community Development and Research (CCDR), Awka, Anambra State.

Dr. A. Sadiq (Ph.D): Bayero University and Committee Member, Research and Technical Committee, the Institute of Chartered Accountants of Nigeria.

Arumaologbede, Jude: B.Sc (Accounting), M. Sc (Accounting), Ph.D Research Fellow, University of Benin and Lecturer in Accounting, Ibinedion University, Okada, Edo State – Nigeria.

## Abstract

The study measure public debt-to-finance sustainability and government financial performance in federal treasury reports from 1999 through 2014. The purpose is to establish whether the carry public debt profile and available public financial resources in the nation's treasury is sustainable presently and in short term. Ex-post 'facto' empirical analysis is the research method was employed. Financial analysis with extraction of financial performance indicators; descriptive statistics, econometric evaluation processes, and combined multiple discriminant analysis, financial discounting (DCF) technique with logistic regression model and the dynamic debt estimation approach were used in analysis. Result yields "A" sustainability performance rating, indicating that Nigeria's sovereign treasury is solvent and in stable, holding other factors constant. The author observed that Nigeria has reverted to excessive debt accumulation, thus fiscal planners should take adequate precautionary measures to moderate debt exposure; prudent capital expenditure management in the light of fluctuations in price of crude oil.

**Keywords:** Public finance sustainability, Public Debt Sustainability Analysis (PDSA) Public Finance Management, Public Financial Performance Sovereign Treasury, Financial Sustainability Index (FSI), Nigeria.

## Introduction, Background to the Study

The paper analyzes pertinent financial variables in measuring public finance-to-solvency and sustainability in Nigeria's federal treasury. A sound public financial management and debt management practice necessitates requires appraisal and measure on a continuing annual basis, using appropriate quantitative analysis (Debt Management Office, Nigeria (DMO), 2014). The primary aim of this paper is to determine fiscal financing leverage solvency and sustainability; that is, financial capacity of the available financial resources in meeting its current and future debt obligations as and when due without recourse to exceptional financing and without compromising economic growth and development (DMO, 2013). The study also gauges the impact of debt service payments on government revenue on one angle and on service-level fiscal capacity and public capital investment.

Public finance sustainability involves analysis and measurement of the existing relationship between public debt portfolios and financial capacity in sovereign treasury. There are different types of solvency and sustainability measurement in public finance management system. These include budgetary insolvency, treasury illiquidity, service-level solvency, external treasury

vulnerability, public debt-to-public finance (leverage) insolvency. The study is concentrated on financial solvency and sustainability in the federal treasury.

Nigeria's experience in public treasury management, financial management performance and financial capacity health remains bitter, sweet and unpredictable. The statutory revenue accruing to Federation account has reduced drastically during the past four years due to steady decline in crude-oil price in the international market (FGN 2013, Okogu, 2014). The decline in petroleum revenue has caused serious difficulties in many states of Nigeria and induced some elements of fiscal budget distress and liquidity pressure in their central treasury. Most of the states are now facing fiscal difficulties to meet recurrent expenditure needs and financial obligations. Federal government on its part is equally facing serious liquidity challenges due to the dwindling revenues and insufficient revenue allocation from the federation account. Unfortunately, the sub-national governments surreptitiously relied on revenue from statutory allocation for the bulk of their spending needs and bail-out funds to meet part of their essential fiscal operations.

Public finance statistics indicate that Nigeria's public debt profile grew from N1216 billion in 1999 to N5767 billion in 2003 and increased to N6073 billion in 2004 before debt relief from the Paris Club of external creditors. A total sum of S18 billion in external debt waiver was granted to the national treasury in 2004 / 2005 during the debt relief process. This fact gives a simplified glimpse of the debt management practice to the discerning target audience and interested readers preview on management of financial resources in federal treasury for the past 16 financial years. Following developments in the Nigeria's fiscal space and general government sector, discerning citizens, trade partners, donor agencies, sovereign governments, stakeholders and all other interested users of FGN's general purpose financial statements and government financial statistics have expressed concerns over the true state of the financial condition in the federal treasury. For this reason, the target audience of this study, relevant authorities of government, and the various stakeholders groups deserve to be adequately known and be well informed of whether Nigeria's national treasury is financially solvent and sustainable in the short term (future) or otherwise.

## **1.2 Problem Statement**

Public finance issues and pertinent research problems in considered necessary for investigation for policy formulation and decision-making in the federal treasury in this paper include: practice of continuous deficit budgeting, fiscal imbalance, deficit financing with related excess accumulation of public debt; public finance leverage and debt vulnerability alongside the uncertainty about public finance-to-debt solvency and sustainability in short-to-medium term;

Studies conducted in Greece by Alogoskoufis, (2012), Kouretas and Vlamis (2010) for Greece established empirical evidence over indulgence in practice of continuous deficit budgeting alongside deficit financing which often lead to accumulation of excessive public debt and debt burden. These papers established that continuous use of overdraft financing induces negatively skewed public finance-to-debt leverage (financing structure), debt overhang, high debt service charges and transfer current debt to future generations (Roubini, 2006). Roubini (2006) opined that high leverage in an entity often result to acute debt burden, liquidity constraint and fiscal insolvency. However, to the best of this researcher's knowledge no studies so far have been conducted and reported on public finance solvency and sustainability in the Nigerian federal treasury. The present study bridges gap in paucity or non-existence of empirical studies on public finance sustainability for Nigeria and knowledge.

Back home in Nigeria, Okonjo-Iweala and Kwaafor, (2007) confirmed that lack of accurate and proper record of public debts, debt sustainability analysis, debt management strategies and balancing of public finances-to-debt vis-à-vis weak-based fiscal consolidation system

compounded Nigeria's debt problems in the pre-debt relief era. Okonkwo (2013) observed that the Nigerian government have reverted to excessive accumulation of public debt and the resurgence of excessive debts in sovereign treasury within the past three fiscal years could worsen fiscal solvency and result in inter-generational transfer of debt burden. Yet, no empirical studies that measured financial sustainability in federal treasury to date.

### **1.3 Objectives of the Paper**

The main objective is to measure public finance sustainability and government financial performance in the Nigerian federal treasury. The specific objectives of the study include:

1. Examine the extent public debt and government revenue ratio affect financial sustainability
2. Evaluate the extent which external debt and exports revenue influence sustainability
3. Assess the extent, to which the association between public debt and gross national product (GDP) influence short term fiscal sustainability,

### **1.4 Research Questions**

The research questions for this study include:

1. To what extent has debt-to-revenue ratio influence sustainability?
2. To what extent has external debt-to-exports ratio affect sustainability?
3. Which direction does public debt and GDP relationship affect fiscal sustainability?

### **1.5 Research Hypotheses**

These hypotheses were therefore stated in the null form are as follows

Ho<sub>1</sub>: Debt-to-revenue ratio does not affect financial sustainability in sovereign treasury.

Ho<sub>2</sub>: External debt to exports does not influence fiscal sustainability in federal treasury.

Ho<sub>3</sub>: The association between debt and national output does not induce sustainability.

### **1.6 Significance and Policy Relevance of the Study**

This research is extremely relevant in development of debt management strategies in a sovereign treasury, fiscal policy and early detection of treasury illiquidity, fiscal insolvency and prevention of fiscal distress. For the state actor, this study has developed a credible and dynamic debt financial model to determine realistic financial condition, solvency and sustainability in national or sub-national treasury in Nigeria and other countries. The study has provided researchers, stakeholders, consultants, government employee and practitioners and with requisite financial performance measurement system for the Nigerian public sectors. Policy analysts, financial analysts, financial journalists, monetary authorities, central banking community, researchers, local and international investors, operators in Nigeria's capital, financial and money markets, particularly bond market participants, net-worth individuals who invest in government bonds in appraising financial solvency and sustainability of sovereign nations.

### **1.7 Scope of the Paper**

The paper is primarily conceptualized to perform a dynamic debt financial estimation, and through the process measure and establish public finance-to-debt sustainability in Nigeria's sovereign treasury. The research covered a period of 16 financial years, from 1999 to 2014.

### **1.8 Structure of the Paper**

The rest of the paper is organized into four sections. Section II provides conceptual framework, theoretical literature with review of empirical studies. The research design, theoretical framework guiding empirical models adopted, and the main frame of the methodology of the research were laid out in section III. Section IV presents empirical results discussions, while the paper is summarized in section V.

## **SECTION 2: LITERATURE REVIEW**

### **2.1 CONCEPTUAL LITERATURE**

Public finance solvency and sustainability are the main concepts used in public debt management and debt portfolio management reference to the dynamic financial estimation and analysis of the relationship between debt and selected fiscal resource aggregate. However, public debt sustainability analysis (PDSA) deals exclusively on the association between public debt and available public financial resources. It is used as measure of capacity of the available public financial resources –government revenues, export revenues, foreign reserve balance in comparison to total debt, external debt and also debt service to determine the state of fiscal solvency and sustainability in the treasury (Padovanni, 2016).

Public finance solvency and sustainability commonly referred as public debt sustainability (PDSA) analysis in literature gauges the relationship between available public financial resources and the carrying public debt profile in the public financing structure of a government treasury. It is defined by Roubini (2006) as a measure of the summation of annual primary balance in a government entity required in recouping aggregate outstanding debt at the current market values. Public financial performance and financial health is interwoven with financial solvency and sustainability. Public finance or treasury sustainability can be broadly defined as government's ability to meet its obligations on a continuing basis (Plummer and Patton, 2015). In other words, PDSA can be used to estimate the length of fiscal periods (in years) it takes to accumulate budget surpluses in order to fully offset outstanding carrying public debt balances. It is one of the latest approach and best practice adopted in debt management strategies in public treasury, globally. The variable in the model structure of a debt sustainability analysis conventionally reflect market values price of the carrying public finance resources (fiscal aggregates) and debt stock on point-to-point basis together with debt management strategies and fiscal policies adopted as criteria for government financial performance evaluation particularly in the sovereign treasury.

In assessing the financial condition of a government, emphasis is placed on the government's ability to meet its obligations within the fiscal year (budget solvency), its ability to pay its current obligations as and when due (cash solvency), its ability to maintain existing service levels (service-level solvency), as well as meet outstanding obligations in the future (long-term solvency). Generally, financial condition or fiscal health is examined using indicators such as budgetary, cash, service, treasury liquidity and long-term public finance (short and long term) solvency (27, 25, 28) and debt sustainability. However, the common feature is that of examining whether an organization's financial condition is improving or not with the view to assessing the impact on its ability to meet stakeholder's demands.

Kattelus (2013) summarized three main factors that determine financial solvency and or contribute to prevalence of financial distress in government treasury to include environmental factors, financial factors and organizational factors. Kattelus (2013) stressed further that the financial factor include revenue generating capacity, aggregate public expenditure, size of government fiscal operating balances, debt portfolio, unfunded liabilities and state of public infrastructure. The financial capacity or condition of a government entity influences both the short and long-term treasury solvency and sustainability of countries. In view of this, the

financial capacity of an entity provides a clue as to the sustainability of the organization in terms of survival and ability to meet expectations of stakeholders.

## **2.2 Public finance sustainability and financial management performance**

The dependent variable of the study is public finance sustainability and independent fiscal variables consists three pair-wise sustainability indicators; present value (PV) debt-to-public revenue; PV of debt-to-foreign debt-to-exports; PV of debt-to-Gross domestic product (GDP). Financial sustainability represents dependent variables. In some studies, other pair-wise variables used may include debt service-to-government revenues or aggregate expenditure; interest rate of debts versus interest of Bonds and / or annual rate GDP growth. It is pertinent to state that interest rate on debts, bonds / treasury bills interest rates and GDP annual growth rate are used primarily as discounting factor of the carrying book values of debts to derive estimate of future values of debt, while holding values of other variables (revenue, exports, foreign reserve and GDP constant).

In contrast to “high and low leverage ratios” used in the traditional public finance solvency measurements, specific international bench mark for selected sets of fiscal aggregates ratios and range of fiscal aggregates values have been established and applied as measures of sustainability (World Bank, 2013; DMO, 2014). Thus, to determine sustainability or unsustainability within the financing structure in sovereign treasury, an evaluator must ensure that the fiscal ratios or indicators falls within the lower range of the specified threshold / benchmark for given criteria for an entity. If otherwise, then, it is an indication of potential danger or risk of fiscal insolvency. Some of the main consequences of public finance unsustainability are almost the same as in high debt ratio, because it imposes financial constraints flowing from lack of resource capacity in meeting its obligations to its creditors and current expenditure commitments when due. In essence, the underlying effect of relationship between public finance solvency and sustainability in treasury management has a diverse impact on financial capacity of government entity, economic growth and development.

### **2.2.4 Developments in Nigeria’s sovereign treasury, debt and public finance management**

Nigeria’s public finances and public debts appeared to be improperly handled during the period preceding debt year 2000. For instance, Okonjo-Iweala and Kwaafor, (2007) observed that lack of accurate and proper record of public debts, debt sustainability analysis, debt management strategies and balancing of public finances-to-debt vis-à-vis weak-based fiscal consolidation system compounded Nigeria’s debt problems. Okonjo-Iweala (2010) suggested that the budget was not good enough to proper growth in the economy. Annual budgetary allocation for public capital investment and infrastructure development is less than 30 percent of approved total annual expenditures. Total annual actual capital spends is about an average of 15 percent yearly during the last decade (FGN, 2014). Okonkwo (2014) observed that Nigeria’s public debt is increasing in leaps and bounds in the recent years, before the sharp and steady decline in crude oil export revenues. Okonkwo (2014) warns that the FGN desist from the practice of excessive accumulation of public debt and there resurgence of excessive debts in sovereign treasury within the past three fiscal years could worsen fiscal solvency and result in inter-generational transfer of debt burden. Going by the current revenue generating capacity, the latest trend in debt accumulation, may lead the country into another round of debt burden, and the resultant effect of excessive public debt, debt overhang is fiscal distress.

## **2.3 Theory of public finance-to-debt sustainability**

Public finance solvency and sustainability model a specialized dynamic debt financial analysis model which measures ratios of public debt with suitable fiscal resource aggregates available in a government treasury to its ability to meet recurrent obligations and debt service payments

without constraining other fiscal commitments (Masengo, 2011), Blanchard, (1990) cited in Mupunga and Le Perox (2015); Masengo (2011), Roubini, 2006). Alogoskoufis (2011) opined that it is common knowledge that governments do not always operate a balanced budget; thus, they maintain either budget deficit or surplus which compels them to indulge in deficit financing. Public finance sustainability model presupposes that governments operate and maintain primary surpluses with present values that are greater or equal to the carrying debt balance (Alogoskoufis (2011), Roubini, 2006).

Several approaches of public debt sustainability have been developed by authors and currently in use in empirical literature include: (i) borrowers-(Accounting) based approach, (ii) lenders-approach, (iii) present value of primary balance approach and (iv) hybrid approach (DMO, 2014, Roubini, 2006) Masengo, 2011, Mupunga et al). According to Johnson et al, (2004) cited in Masengo, 2011 the borrower-approach also known as ‘accounting approach’ is the main basic approach adopted in the PDSA. It states that fiscal deficit in a sovereign treasury is sustainable if the entity generates a constant debt-to-GDP ratio (Johnson et al, (2004) cited in Masengo, 2011. This approach lies at the root of PDSA methodology as it measures ability of an entity to meet future debt service obligation (Roubini, 2006; Masengo (2011, Mupunga & Le Poux, 2013). These authors state that so long as the economy’s real GDP grows at higher rate than the interest rate (debt or deposit funds) it is possible to run sustainable primary fiscal deficits. The Lenders-based approach refers to present value constraint approach, reckons that a government treasury is in state of public finance solvency and sustainability if expected values of fiscal aggregates inflow is at least equal to the face value of debt. Buiter and Urijit (2005), Roubini (2006) opined that lenders’ approach differs from borrower-base accounting approach which imposes an upper band to the debt-to-GDP ratio. Whilst the lenders’ present value of budget balance-approach stipulates that if real growth rate of GDP or debt is lower than real interest rate deposit money, then the requisite budget constraint correction adjustment is satisfied. this approach does not require the public debt to be fully repaid This is in contrast to borrower-based accounting method which requires GDP growth rate being greater than rate of interest even though debt-to-GDP ratio may be growing through time-paths.

Present Value of Budget Constraint Approach–PVBC method guides the theoretical approach of debt sustainability; and also the empirical strategy is within the co-integration framework. Cointegration between revenues and expenditures is the necessary condition for debt sustainability analysis. Thus, expenditure of government is increasingly greater than revenue overtime, accumulated budget deficits eventually develop into a domestic debt burden. Therefore, sustainability requires that the co-integrating vector be (1,-1). If revenues and expenditures are both are both difference at first level, I (1) and co-integrated, then, domestic debt is sustainable.

Buiter et al, Mupunga and LeRoux, 2014, Onyelakukwe and Viegi (2005) and Roubini, 2006 explained further that where debt / GDP ratio converge to a predetermined optimum level,  $r_t < g_t$  (indicating that  $r_t$  – debt interest rate is less than growth rate  $g_t$  and or interest income or fiscal stock variables). However, if  $r_t > g_t$ , public debt portfolio would the predetermined optimal path (Mupunga & LeRoux, 2014). In essence debt sustainability presupposes that debt stock of a nation or government entity does not rise but reduces instead (Aktas & Tiftik, 2013). This simply implies that if interest rate accrued or service charges on debt is greater than growth rate of the economy, interest burden on existing debt stock increases while debt-to-GDP ratio and or those of other fiscal flows or stock increases. Similarly, where government entity borrows for servicing its debt, a form of ponzi game scheme, further increases public debt stock and debt burden. Then, a trend of excessive deficit budgeting with continuous public borrowing in financing fiscal deficit that often result in excess public loans usually transfer debt burden to

future generation and trigger adverse financial condition. This theoretical framework illustrates the impact of public debt sustainability.

For the public debt to remain stable, the primary budget surplus balance needs to cover accrued interest charges. However, where past debt stock are too large and or interest rate on debts are very high compared to GDP or other fiscal flows / stock variables, then, an entity is expected to raise its primary fiscal balance otherwise debt stock would rise sporadically because the portion of payment can no longer be sustained by annual budget surpluses, rather through issue of new bonds. Public finance-to-debt sustainability theory is the most appropriate and relevant theoretical framework used in prescribing the association between public financial resources and debt on one side and in developing empirical models used in assessing sustainability. It has proved efficient and effective for gauging on adequacy or inadequacy of revenue flows, aggregate spending, inter-temporal budget balances and fiscal capacity for recouping debt from primary budget balances in future. Apparently, adequacy in resource availability to public expenditure is the root of financial health in government treasury.

### 2.3.2 Empirical review

Contemporary studies that assessed public finance-to-debt sustainability in sovereign treasury which were reviewed here include: Aktas and Tiftik (2013), Mupunga and Le Roux (2014), Alogoskoufis (2012); Kouretas and Vlamis (2010). Aktas and Tiftik (2013) constructed sovereign financial risk model for Turkey, using data on public finance resource and public debt indicators to measure fiscal solvency and sustainability from 1991 to 2010. Results indicated that the fiscal stance adopted by Turkey during the review period has a sustainable outlook in the short term future. Mupunga and Le-Roux (2014) paper's results from simulation analysis show that debt dynamics in Zimbabwe are largely composed of huge stock flow adjustments to finance social and political expenditures. This underscores the need for prudent debt management to protect the treasury against unexpected changes in public debt stock, which are not explained by public investments and growth. Masengo (2011) assessed government revenue with public debt leverage (solvency) for Zambia. Results suggested that domestic debt of Zambia is sustainable with and or without grants. The author further observed that fiscal revenue was boosted by increase in raw copper price with GDP rising at well over five percent for the past seven years. The author expressed concerns that not minding the prevailing public finance sustainability, Zambia's domestic debt might still be threatened by her over dependency on revenue from coppers as the main source of fiscal revenue.

Result from Roubini (2006)'s study for Mexico suggests that a country that solvent can be trapped in self-full filling debt trap, and remain in default; and that debt rescheduling can lead to even greater defaults levels. The result further stated that if there are pure or semi-pure liquidity cases, there are other measures to mitigate such solvency problems that do not involve debt forgiveness. Mendoza and Oviedo (2003) utilized debt-to-GDP indicator in its public money and debt leverage analytics study. Results showed that a four percent of the GDP reduction in government total spending during fiscal crises, in a simulated model for Mexico yielded a natural debt limit at 0.05 which is slight above the observable average debt-to-GDP ratio of 0.0459 for year 1999-2002. The authors concluded that natural debt limit is very sensitive to small variations to changes in tax revenues, interest rate and public expenditure. Result from Kouretas and Vlamis (2010) revealed that since November 2009, Greek's fiscal budget deficit and public debt profile were un-sustainable. The study established that the cause of debt crisis in Greece economy was not directly linked to the year 2007 sub-prime mortgage loan market crisis that triggered global financial crisis. It confirmed that the Greece government gladly accepted a 'Fiscal Rescue Plan' worth *Euro* 110 billion designed and financed by the European Union and the International Monetary Fund (IMF). Research finding in Alogofikous (2012) on sovereign debt crisis in Greece confirms that the proposal being implemented in the Greek economy for

tackling the financial crisis and speeding up the recovery process is sufficient to resolving the prevailing situation.

### SECTION 3: METHODOLOGY

#### 3.1 Research Design

The paper adopted ex-post ‘facto’ empirical financial analysis and quantitative methods in its dynamic financial estimation model used as measures of public finance sustainability. This approach follows the procedure adopted in Alogofikus (2013) and Roubini (2006).

#### 3.2 Data sources and method of collection

Secondary data were extracted from Nigeria’s official public debt reports contained Central Bank of Nigeria and Debt Management Office’s annual reports from 1999 and 2014 – both years inclusive. The procedure followed in data gathering is the archival data retrieval collection system which involved extraction of the necessary secondary data required in deriving fiscal variables adopted obtaining the pertinent financial performance indicators used in the construction and measure of public financial sustainability indicators.

#### 3.3 Public Finance Sustainability Empirical Model

Theoretical framework supporting empirical model used in public finance sustainability analysis in this paper is combination of the borrowers’ accounting-based approach, lenders’ valuation method, and PVBC, which is referred as the hybrid approach. The hybrid approach which integrate the borrower (accounting-based) method, lender-based approach, the PVBC method with ‘baseline-scenario’ in deriving pertinent sustainability indicators. This empirical model is borrowed from Roubini (2006), Alogosfikous (2013). This approach utilize variety fiscal aggregates including revenues, expenditures, exports and GDP which also incorporate interest rate and growth rate elements as discounting factors on one side. This debt dynamic financial modeling approach of this study is in tandem with debt sustainability analysis used in practice by national debt management agencies globally including Nigeria (DMO, 2014, 2015; World Bank, 2014; Moody (2014; 2015).

Furthermore, the paper adopted modified version of the contemporary Altman and (2010) Z-score financial distress prediction model (FDPM) technology as its public finance sustainability index (FSI) to measure and test the level of fiscal sustainability in Nigeria sovereign treasury. Altman and Hotchkiss (2010) Z-Score model of financial distress index developed a standard bench-mark for measuring corporate financial distress in developing countries and emerging markets (Zakaria, 2013; Mungai, 2016) is given as:

$$FCI / FSI \text{ Z-Score } (Z) = 3.25(X_1)+6.56(X_2)+3.26(X_3)+6.72(X_4)+1.06 (X_5) \quad (3.1)$$

Whilst, a modified public financial Sustainability index (FCI) developed by the author in the paper is:  $FSI = Z\text{-Score } (Z) = 0.5X_1 + 0.50X_2 + 0.50X_3 + 0.05X_4 + 0.50 X_5$  (3.2)

Where:  $X_1$  = fiscal operating surplus indicator;  $X_2$  = financial leverage solvency indicator;  $X_3$  = public finance sustainability indicator;  $X_4$  = budgetary solvency indicator,  $X_5$  = Institutional Quality-governance indicator. To determine the zones of discrimination (solvency or insolvency in public finance / public financial distress prediction model;  $Z > 5.00$  is a safe zone;  $Z = 4.00 < 5.00$  is considered as in a grey zone (under watch) while  $2.5 < 4.00$  is seen as fully distress zone. Failure grade point is not applicable is this performance measurement metric system. Financial sustainability performance rating score, with values ranging from 0.01 to 1.00; grade rating score from 0.50 and 0.99 represent solvency while 0.01 to 0.49 indicative of unsafe financial condition. A continuous achievement of composite financial distress index score of less than 0.5 for three consecutive financial years confirms the likelihood that the entity will experience acute financial distress / instability in short and medium term (Altman, 1977). Probability score

of the financial distress is further categorized in five distinct states of financial conditions depend on the range of grade point score yield.

Performance rating score system for credit worthiness of a public entity is a minimum of 50 percent (0.50) and similar to the sovereign credit rating commonly adopted by the CRAs in evaluation of financial condition and macroeconomic performance of sovereign countries (Fitch, 2014; Moody, 2015; Standard & Poor, 2015).

### 3.4. Specification of Sustainability Measurement Model

Three core financial sustainability indicators employed in model development and in analysis and measures of financial health in Nigeria’s federal treasury are provided in table 3.1.

**Table 3.1: Financial Performance Indicators used as Predictors of FGN Financial Health**

Category / Indicators	Indicators	Bases	Measures	Thresholds
<b>DEBT SUSTAINABILITY - DYNAMIC FINANCIAL ESTIMATION MODEL</b>				
Criteria for Public Debt Sustainability:				
i)	PV of Debt / Public Revenue	Public Debt / Revenue	Sustainability	100 : 250
ii)	PV of External Debt/Exports	External Debt/ Export	Solvency	30 : 150
iii)	PV of Debt / Nigeria R-GDP	Total Debt /NGDP	Efficiency	56 : 100
<i>Total of 3 Indicators</i>				

Source: Author’s Compilation (2015): Debt Management Office, 2014

#### 3.4.1 Evaluation and econometric estimation procedure

Unit root, serial correlation or co-integration tests will be performed as part of the data screening, and evaluation procedure. In addition, a simple moving average approach and or an econometric estimation method as well as financial (fiscal resource discounting (DCF) technique may be employed to the present values of models variables as the tools of analysis and were facilitated through the use of modern computer technology and software packages including SPSS, compustat, E-views 6 and respectively.

#### 3.4.2 Public finance sustainability index (FSI) measurement Model

Classical financial ratio analysis is used to obtain raw financial performance indicators (KPIs) adopted in a combined multiple discriminant analysis (MDA) with dynamic financial estimation and logistic regression models to obtain composite financial sustainability index (FSI or  $Y = Z$ ). The pair-wise variables include: total public debt / revenue, external debt / exports and total debt / GDP. Econometric model equation function is express as follows: The equation can therefore be written as econometric equations as follows:

$$FCI = \beta_0 + \beta_1 T1 + \beta_2 T2 + \dots + \beta_n Tn + \epsilon \tag{1}$$

Financial sustainability (or condition) index model equation:

A dual model is specified the model of this study. This commence with specification of MDA of the financial distress prediction model (FDPM) commonly employed in the conventional accounting and corporate financial analysis and configured in a logistic regression model (LRM) following the empirical model adopted in Mupunga and Le-Roux (2014) in a public finance sustainability researches. The parameter of the predictor in our model follows Altman and Kotchkiss (2010)’s modified Z-Score for developing countries and emerging markets; the

CRA's (Fitch, 2014; Moody, 2014) credit worthiness performance rating score system now blended into a hybrid FDI model score-rating and now modified by this author (Alozie) in 2017 in this paper as public financial condition index.

Financial sustainability (or condition) index model equation:

$$FSI = f(X_1 \text{ (pd/rev)}, X_2 \text{ (ed/rev)}, X_3 \text{ (pd/gd)}, \dots) \quad (2)$$

Then, followed with construction of MDA / Logistic regression model and given as

$$FSI_{or} (Z) = W_1 * X_{2.1} + W_2 * X_{2.2} + \dots + W_n * X_n / n \quad (3)$$

where:  $FSI_{or} (Z)$  is composite financial index and parameter to measure of model test  $W_1 * X_{2.1} + W_2 * X_{2.2} + \dots + W_n * X_n$  are the representative values of each sustainability indicators.

Technique of analysis for Model 3 include: ratio analysis, derivation of financial performance indicators, descriptive statistics, financial discounting method, multivariate discriminant analysis, logistic regression analysis, equal-weighting of performance indicators, and derivation of public finance sustainability index.

### 3.5. Construction of Public Finance Sustainability Index

#### 3.5.1 Constructing sustainability indicators (FSI Overall) index

The procedures followed in constructing key performance indicators (the raw financial ratios) and financial distress index is given as follow.

Step 1: Develop and construct relevant dimensions of financial performance indicators

Step 2: Derive of standard performance indicator from series of sub-performance indices

Step 3: Determine dimension index in a model- ratios or correlation coefficient

Step 4: Index Construction–Equal Weighting; using simple average of the performance indicators

Step 5: Establish the composite financial condition index

#### 3.5.2 Operationalization of financial sustainability index

The score grading system of the international credit rating agencies used by Standard & Poor (2014), Fitch (2014) and Moody (2015), which is similar to the grade score point system currently adopted in the academia is adopted in operationalizing raw financial solvency indicators derived to determine the ultimate financial condition index of the model. Values of financial distress index of a predictor in each models one, four and five, ranges from 0.01 to 0.99 (Ritonga, 2014); “A” = Excellent, “B” = Very Good, “C” Average, “D” = fair but below average and “E” = Weak. The values from 1-49 in these first category models, signify financial distress while 50 and above is an indication of positive financial performance, solvency and sustainability (Roubini, 2006). There is no outright failure grade in sovereign credit rating system.

#### 3.5.3 Decision Criterion

If FCI calculated falls within the range from 0.01 to 0.49 or 0.50 (50 percent) < 0.51; accepts  $H_0$ , but where FCI calculated ranges from 0.51 < 0.51 and up to 0.99 (precisely 99 percent),  $H_{a3}$  is accepted and  $H_{o3}$  is rejected.

## SECTION IV: ANALYSIS AND RESULTS

### 4.1 Analysis and Results

#### 4.1 Screening, refinement and evaluation

Consistent with the procedure in contemporary empirical research, pertinent statistical analysis, screening, evaluation and estimation were undertaken for financial variables, in nominal terms and ratios before unit root, auto-correlation, stationarity and other routine diagnostic tests were performed on the data sets. This ensures that results of analysis did not contain spurious defect. Augmented Dickey-Fuller (ADF), Bresch-Godfrey co-integration rank test and Eigen(s) trace statistics were performed to examine estimation power and evaluate existence of long-run relationship co-integration between public debt, revenue, exports and GDP data sets.

The necessary screening tests were undertaken to ensure that data sets used in analysis and measuring of solvency the model are from spurious defect and that they are not serially correlated. Augmented Dickey Fuller (ADF) and Bresch-Godfrey residual co-integration LM test were performed to check for unit root and existence of co-integration in long-run relationship between the pair-wise variables notably public debt/revenue, external debt / exports, and public debt / GDP. Unit root test showed negative results; whilst Breusch-Godfrey co-integration tests for partial regression of revenue (Models 1, 2, and 3) tested positive to co-integration at level. Thereafter, the affected variables treated and normalized at  $I(1)$  first difference. Furthermore, Trace statistics indicated no co-integration at 5 percent (0.05) significance level. Wald and Dublin-Watson test all yielded values below minimum threshold of 2.4. Generally, results of these diagnosis checks and evaluation procedures undertaken established that the relevant pair-wise model variables were suitable for use in analysis of financial performance and hybrid MDA / LR analysis and also fitted the model very well. Summary of the relevant statistical analysis for the respective models are provided in the relevant tables for each model in the appendix pages (appendices).

#### 4.2 Results of Analysis

Following model equation functions specified in sub-section section 3.4 and plugging the relevant key financial performance indicators obtained from financial analysis of the model variables into the system equation financial sustainability index as:

$$\text{MDA / FSI}_3 = (Z_3) = W_1 * X_{2.1} + W_2 * X_{2.2} + \dots + W_n * X_n / n \quad (4.1)$$

Blending simple average equal-weighted financial sustainability indicators into logistic regression model structure of equation 4.1 to derive financial sustainability indicator as re-stated below:

$$\text{FSI / LRM} = (Y_{2i=1}) = 1 / (1 + e^{- (B_0 + B_1 X_{i1} + B_2 X_{i2} + \dots + B_n X_{in})}) = 1 / (1 + e^{-Z_i}) \quad (4.2)$$

$$\text{FSI}_3 = (Z) = 1 / (1 + (0.76 X_3 + 0.74 X_3 + 0.78 X_3 / 5; \dots)) \quad (4.3)$$

= 0.76 or 76 percent and “A” credit-worthiness or sustainability rating

$\text{FSI}_3 = 0.76 < 0.50$ . Therefore,  $H_{03}$  adopted; in effect public finance-to-debt sustainability of the Nigerian federal treasury is significantly positive, highly sustainable. From this dimension of the Federal Government’s financial management performance, the federal treasury is not distress but financially solvent.

#### 4.3 Results of the Supplementary Analysis Performed

Aside from the individual model financial sustainability indicators used in the composite public finance sustainability metrics and the composite sovereign credit-risk rating (‘A+++’) for Nigeria’s federal treasury for the review period; the paper produced a supplementary research

finding relating to simulated dynamic estimates of the numerical fiscal aggregates for the current MTEF / rolling plan cycle, ending 2017. Based on a moving average financial estimation methodology, Nigeria's public debt will hover around N10000 billion; external debt at N2000 billion whereas export revenue, federal (FGRR) revenue and gross national output will reach N12000 billion, N5500 billion and N93000 billion by the end of 2017. The result of the dynamic estimation of public finance-to-debt sustainability for Nigeria's federal treasury is the same as in the ex-post empirical analysis in 4.3 above, that is, 78 percent and "A"+++ . Hence it is not duplicated.

#### **4.3 Robustness checking (test) and External Validity of Results**

The study adopted 0.50 or 50 percent as bench-mark cut-off point and minimum pass mark of public finance solvency and sustainability in hypothesis testing sovereign financial sustainability for Nigeria's federal treasury. This is tandem with the authors' modified version of Altman and Hotchkiss (2010) Z-score's  $4.2 < 5.00$  cut-off mark for developing economies. It is assumed stronger credit worthiness rating than grading score-point system used by the CRAs  $0.5 > 0.99$  as for public treasury solvency and sustainability in a public treasury. Thus, it is assumed that the standard prior range of the probability of financial distress or solvency and sustainability in developing our models is the five percent level of significance. We evaluated The fiscal aggregates used as model variables were duly screened, refinement and evaluated on five percent significance level were confirmed satisfactory prior to test results yielded.

For external validity, Nigeria's sovereign credit worthiness and financial risk credit rating of issued by the international credit rating agencies including Standard & Poor (2014), Fitch, (2014 and 2015) and Moody (2014 and 2015) is adopted for external comparison and validation of the research results and they are on the same performance ranking score.

### **SECTION 5: SUMMARY OF RESULTS AND CONCLUSIONS**

The summary of empirical findings obtained in this study, conclusions and pertinent recommendations for policy formulation and fiscal decision-making are presented in this last chapter. The overall objective of the study was to perform some measure of financial sustainability in the Nigerian federal treasury or otherwise.

#### **5.1 Summary of Results**

This research focused on assessment, evaluation of sustainability of public debt-to-public financial resources as a dimension of government financial performance in Nigeria's sovereign treasury. Summary of results are summarized as follows:

Model 1: Public debt-to-public revenue solvency / sustainability indicator = 76% (A++)

Model 2: External debt-to-exports revenue solvency / sustainability = 74% (A++)

Model 3: Public debt-to-Gross Domestic Product solvency / sustainability = 78% (A++)

Thus, overall credit worthiness rating of the public finance-to-debt sustainability drawn from debt management criteria of sovereign treasury management in Nigeria's federal treasury is 76 percent and A\*\*\* - excellent grade. This implies that the existing financial capacity of the national treasury is in a sound and stable condition.

Evaluation of hypotheses tests from each of the three models confirmed that debt and revenue; external debts and exports and public debt and national output with 'A' grade scores in every model as highly sustainable in the short run. This result is in tandem with results from similar debt sustainability reported by DMO (2014; 2015) and differ from the performance rating (B++) and (B\*) by Fitch in 2014 and 2015 and Moody in 2015 respectively. This sustainability rating is anchored on 'baseline scenario' assumptions which relies on estimates of revenue projection

from oil in rolling plan cycle, medium term expenditure framework and fiscal consolidation strategy and altering with the fiscal developments subsequently.

## 5.2 Conclusion

Although results indicates that overall public finance-to-debt (leverage in financing structure) in Nigeria's sovereign treasury is highly sustainable. However, the prevailing trend in debt portfolio which reflects steady rise in public debt stock is not that encouraging. Similarly, the recent debt management strategy which is shifting concentration on domestic and resulting in tremendous increase in domestic public borrowings—bond, treasury bills etcetera recently is rather worrisome. These developments require adequate precautionary measures and more conservative towards accumulation of additional debts as well as prudent capital expenditure management in the light of fluctuations in price of crude oil and dwindling revenue inflow from oil sales.

## 5.3 Recommendation

The paper recommends that Nigeria's debt management authorities should restrict the limit deficit budgeting, financing and borrowing in all tiers of the Nigerian governments to amount not exceed 40 percent of aggregate revenue in previous year. Similarly, external debt should be minimized and restricted to total amount not exceeding 100 percent of exports. Government is encouraged to sustain public capital investment within the range from about a minimum of 15 – 25 percent of the aggregate annual spending in infrastructure particularly cash flow generating and financially viable projects with publicly verified implementation to boost gross domestic output. Finally, government borrowing both at the federal level and sub-national government tiers need to be restricted to 50 percent of revenue generating capacity or reserve financial assets in order to minimized excessive debt accumulation.

## REFERENCES

- Alogoskoufis, G. (2012). Greek's sovereign debt crisis: Retrospect and Prospect. GreeSee paper, No. 54, Hellenic Observatory Papers on Greece and South-East Europe. London School of Economics and Political Science
- Aktas, A. and Tiftik, M. E. (2013). Measuring fiscal sustainability for practical use in short-term policy making: Evidence from Turkey. Leicester University. Research Paper Series.
- Alfan, E., and Zakaria, Z. (2013). 'Review of Financial Distress: A case of Malaysian Construction Industry'. *British Journal of Arts and Social Sciences*; 12(11) 241- 263).
- Altman, E.I. (1968a). "Financial Ratios, discriminant analysis and the prediction of corporate bankruptcy, *Journal of Finance*; 23(4), 589–609.
- Altman, E.I. (1968b). "The prediction of corporate bankruptcy: A discriminant analysis", *Journal of Finance*, 23(1), 887–900.
- Baunsgaard, Thomas (2003). "Fiscal Policy in Nigeria: Any Role for Rules? IMF Working Paper, Fiscal Affairs Department, The International Monetary Fund. Washington D.C.
- Benno, Ferrarini, Raghendra, Jha and Arief, Ramayandi (eds) (2012). "Public debt sustainability in developing Asia: Chapters 2, 3, 4 and 7. London and New York. Co-Publication of the Asian Development Bank and Routledge.
- Buiter, W. H., and Urijit, R. (2005). India's public finances: Excessive budget deficits, a government – abused financial system and fiscal rules. Paper presentation at the Brookings Institution-NCAER India Policy Forum Second Conference, Delhi, India, July 2005. Published

in Summan Bery, Barry Bosworth and Arvind Panagariya, eds, *India Policy Forum 2005 / 2006*, SAGE Publications, New Delhi / Thousand Oaks, London, 2006; pp1 -54.

Calabrese, T., and Grizzle, G. (2012), “Debt, donors and the decision to give”. *Journal of Public Budgeting, Accounting & Financial Management*; 24(2), 221-251.

Carmeli, A. (2008), ‘The fiscal distress of local governments in Israel: Sources and coping strategies’, *Administration & Society*, 39 (8), 984-1007.

Casal, R.C., Gomez, E.B., and Tite, B. (2014). *Financial situation and political parties influence on local governments: Empirical Evidence from Spain*

Central Bank of Nigeria (1999 – 2015): *Annual Accounts and Report* (various).

Cheang, N., and I. Choy (2011), ‘The composition of aggregate financial stability index for an early warning system’. *Macao Monetary Research Bulletin*, Issue No. 21, 27-54.

Dabla-Norris, E. Allens, R. Zanna, F. Prakash, T., Kvitradze, E., Lledo, V., Yackovlev, I., and Gollwitzer, S. (2010), “Budget Institutions and Fiscal Performance in Low-income Countries.” IMF WP/1080, International Monetary Fund: Washington, D.C.

Debt Management Office (DMO) (2015). *Debt sustainability report*, Nigeria. Abuja.

Dimitrios, P., Louzis, P., and Vouldis, T.A. (2011). *A Financial System Stress Index for Greece*. Bank of Greece. Working Paper Series: Accessed On-line: <http://papers.ssrn.com/so13.cfm?> Assessed and Downloaded on 21/12/2015

Federal Government of Nigeria (various) *Government of Nigeria Financial Statements*

Federal Radio Corporation of Nigeria (FRCN) (2015 September 15): *Management of Public Funds by the States and Bail-out–24 States Owing over N706 billion and their Inability to their Workers Salaries and Payment Debt Obligations to the Banks*. Network News Broadcast (AM news), Network News Features-Editorial Report.

Fitch Ratings Incorporated (Fitch) (2010 – 2014): *A guide on the methodology of credit rating and bond reporting*. Accessed online; and downloaded on 15<sup>th</sup> December, 2015.

Ibrahim Index of African Governance (IIAG), (2014): *MO Ibrahim Foundation’ publication*, 2014 edition.

International Monetary Fund (IMF) (2009): *Fiscal implications of the global economic and financial crisis (SPN/09/13)* (June). IMF Publication, Washington D.C

International Monetary Fund (IMF) (2013): “Nigeria financial sector stability assessment”. IMF Country Report, No. 13/140.

International Monetary Fund (IMF) (2013): *Fiscal transparency code; manual and assessment*.

Kioko, S.N. (2013). ‘Reporting on the financial conditions of the states, 2002–2010. *Journal of Public budgeting and financial management*; 25(1); 165 -198.

Kioko, S.N., and Johnson, R. T. (2015). ‘Reporting on the fiscal sustainability of the states, 2005 – 2014. *Journal of Public budgeting and financial management*; 25(1); 165 -198.

Kouretas, G., and Vlamis, P. (2010). *The Greek financial crisis: Causes and implication*. *Panoeconomies*, 2010 (4), 391 -404

Lonzis, D. P., and Vouldis, A. T. (2013). *A Financial Stress Index for Greece*. Un-published Working Paper, No. 1563, Finish Government’s Financial Stability Study in 2014

Masengo, P.C. (2011). *Domestic debt sustainability: The case of Zambia*. A published M.A. (Economics) Dissertation, University of Zambia, Lusaka.

- Moody's Investors Service (Moody) (2010 – 2014): Credit rating and bond reporting (see the FGN's Financial Statements: Accessed online; and downloaded on 15<sup>th</sup> December, 2015.
- Mungai, R. G. (2016). Effect of capital structure on financial distress of non-financial companies in Naira Stock Exchange (NSE), Kenya. Ph.D (Finance) Thesis, Jomo Kenyatta University of Agriculture and Technology, Kenya.
- Mupunga, N., & Le Roux, P. (2014). Analyzing the theoretical and empirical foundations of public debt dynamics in Zimbabwe. Economic Research South Africa (Ersa), Working Paper Series 409, 1-20
- Ncube, M., and Vacu, N. (2015); "Managing Financial Distress in South African Local Government Sector". Policy Briefing, Fiscal Financial Commission of South Africa.
- Okonkwo, C. (2014, December, 22). "Down side of debt sustainability", This Day Newspaper On-Line Publication, (Monday December 22, 2014); [www.thisday](http://www.thisday.com) on-line news-reports. Downloaded on July 15, 2015.
- Okonjo-Iweala, Ngozi and Osafo-Kwaako, Philip (2007): "Nigeria's Economic Reforms: Progress and Challenges", The Brookings Institution.
- Polsiri, P and Sookhanaplubam, K. (2009). Corporate distress prediction models using governance and financial variables: Evidence from Thai listed firms during Asian crisis> Journal of Economic Management, 5(2), 273 – 304.
- Ritonga, T. I. (2014). Measuring and evaluating financial condition of local government in Indonesia. Un-published (Ph.D) Thesis, Department of accounting, Victoria University, Melbourne, Australia.
- Sarraf, M., and Jiwaji, M. (2010). Beating the resource curse: The case of Botswana. The World Bank Environment Department; Environmental Economics Papers, 24753 (1), 1 -36
- Standard and Poor, Standard and Poor's (1999 – 2014): Credit Rating and Sovereign Treasury Risk Reporting on Nigeria's Financial Statements –. Accessed online; and downloaded on 15<sup>th</sup> December, 2015. <http://www2.standardandpoor.com>
- Standard and Poor, Standard and Poor's Methodology for Credit Rating and Sovereign Treasury Risk Measurements; <http://www2.standardpoors.com/publication/html>.
- Trussel, J.M. (2013). "A Financial Risk Ranking System for the Municipal Governments in Pennsylvania"

## APPENDIX PAGES (APPENDICES)

### MODEL 1: PUBLIC DEBT AND REVENUE STATISTICAL ANALYSIS

Dependent Variable: REVENUE

Method: Least Squares

Date: 07/16/17 Time: 11:54

Sample: 1 16

Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TOTAL_DEBT	0.404255	0.166992	2.420799	0.0297
C	92.71778	901.3470	0.102866	0.9195
R-squared	0.295075	Mean dependent var	2173.355	
Adjusted R-squared	0.244723	S.D. dependent var	1249.632	
S.E. of regression	1086.014	Akaike info criterion	16.93488	
Sum squared resid	16511964	Schwarz criterion	17.03146	
Log likelihood	-133.4791	Hannan-Quinn criter.	16.93983	
F-statistic	5.860270	Durbin-Watson stat	0.345322	
R	0.54321			
Prob (F-statistic)	0.029662			

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	11.68621	Prob. F(2,12)	0.0015
Obs*R-squared	10.57204	Prob. Chi-Square(2)	0.0051

## MODEL 2: EXTERNAL DEBT-TO-EXPORT REVENUE SUSTAINABILITY STATISTICS

Dependent Variable: REVENUE(2)

Method: Least Squares

Date: 07/16/17 Time: 12:25

Sample: 1 16

Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXT_DEBT	-2.353100	0.646093	-3.642043	0.0027
C	12705.13	1622.502	7.830579	0.0000
R-squared	0.486511	Mean dependent var	7932.750	
Adjusted R-squared	0.449834	S.D. dependent var	5159.839	
S.E. of regression	3827.218	Akaike info criterion	19.45413	
Sum squared resid	2.05E+08	Schwarz criterion	19.55071	
Log likelihood	-153.6331	Hannan-Quinn criter.	19.45908	
F-statistic	13.26448	Durbin-Watson stat	0.449441	
R	0.69750			
Prob(F-statistic)	0.002667			

$$\text{REVENUE2} = 12705.13 - 2.353100 (\text{EXT-DEBT})$$

Wald Test:

Equation: Untitled

Test Statistic	Value	Df	Probability
t-statistic	-3.642043	14	0.0027
F-statistic	13.26448	(1, 14)	0.0027
Chi-square	13.26448	1	0.0003

### Model Diagnostic Checking

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	6.685460	Prob. F(2,12)	0.0112
Obs*R-squared	8.432281	Prob. Chi-Square(2)	0.0148

### MODEL 3.3: TOTAL PUBLIC DEBT AND GDP SUSTAINABILITY STATISTICS

Dependent Variable: GDP  
 Method: Least Squares  
 Date: 07/16/17 Time: 12:14  
 Sample: 1 16  
 Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
DEBT	13.52781	3.134096	4.316336	0.0007
C	-37894.20	16916.40	-2.240087	0.0418
R-squared	0.570957	Mean dependent var	31731.38	
Adjusted R-squared	0.540311	S.D. dependent var	30062.09	
S.E. of regression	20382.21	Akaike info criterion	22.79918	
Sum squared resid	5.82E+09	Schwarz criterion	22.89575	
Log likelihood	-180.3934	Hannan-Quinn criter.	22.80413	
F-statistic	18.63076	Durbin-Watson stat	0.622382	
R	0.75562			
Prob(F-statistic)	0.000711			

$$\text{GDP} = -37894.20 + 13.52781 (\text{DEBT})$$

Wald Test:  
 Equation: Untitled

Test Statistic	Value	df	Probability
t-statistic	4.316336	14	0.0007
F-statistic	18.63076	(1, 14)	0.0007
Chi-square	18.63076	1	0.0000

#### Model Diagnostic Checking

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	5.456254	Prob. F(2,12)	0.0206
Obs*R-squared	7.620297	Prob. Chi-Square(2)	0.0221