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A Macro Econometric Model of Human Capital Development and Activity Sectors Performance in Nigeria

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Abstract
Several studies on human capital development have ignored its effects on activity sectors of the economy in developing countries like Nigeria. This paper examined the effects of human capital development on the Nigerian real sector activity 1981 to 2022 with data from Central Bank of Nigeria's Statistical Bulletin, and National Bureau of Statistics. This paper utilized a macro-econometric model approach anchored on the endogenous growth theory. Results show that a 1% increase in HCD significantly led to diverse effects on the activity sectors through public spending channel - agricultural output dropped (9.9%), industrial output improved (6.6%) and services sector increased (15%). This implies that human capital development is a significant determinant of agricultural output in Nigeria; however, human capital development does not have significant effect on industrial output, though its relationship with the sector is positive and human capital development is a significant determinant of output in the services sector. This paper recommended among others that the ministry of agriculture should incentivize through that availability of credit facilities and technological innovation so as to make agricultural activities attractive.
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1 Introduction

The activity sector of the Nigerian economy involves the agricultural, industrial and services sectors as recognized by the Central Bank of Nigeria (CBN, 2010, 2022). The activity sector includes agriculture, industry, building and construction, and services. The sector is strategic for a good number of reasons. First, it produces, and distributes tangible goods and services, required to satisfy aggregate demand in the economy. Second, the performance of the sector can be used to measure the effectiveness of macroeconomic policies as government policies can only be evaluated based on the impact of public policy to promote production and distribution of goods and services which improves the welfare of the citizenry. Third, a vibrant activity sector, particularly the agriculture and manufacturing activities creates more linkages in the economy than any other sector and thus reduces pressure on the external sector. Four, it has the capacity to create greater employment opportunities (Anyanwu, 2010)

Human capital has been variously defined and made empirical evident by different scholars(Appleton & Teal, 1998; Dae-Bong, 2009; Omojimite, 2011; Asaju et al, 2013; Shuaibu & Oladayo, 2014; World Bank, 2010, Ndulu, 2010; Odia & Omofonmwa, 2010; Kern, 2009). However, one thing that's outstanding is that human capital development is very critical for economic development and growth. Meanwhile, none of these existing studies examined the effect of human capital development on real sector activities in terms of agriculture, industry and services. As already established, these sectors have a higher linkage than any other sector of the Nigerian economy. There are scores of empirical studies that examined the relationship between human capital and single components of these activity sector(Amassoma & Nwosa, 2011; Adelowokan, 2012; Isola & Alani, 2012; Ajadi & Adebakin, 2014; Jaiyeoba, 2015; Borojo & Jiang, 2015; Osoba & Tella, 2017; Ogunleye et al., 2017; Dawud, 2020; Leshoro & Leshoro, 2013; Kifordu, 2015; Karim & Shabbir, 2020; Widani & Malanga, 2015; Asghar & et al.,2017; Adejumo & Adejumo, 2017; Hena et al., 2019; Obukwelu, 2019; Eichengreen & Gupta, 2009; Bingilar & Etate, 2014; Gidado et al., 2014 , Worlu & Omodero, 2016). The results of these studies are mixed-up and the macro econometric approach is quite novel to these studies. This is the justification of this study.

2 Theoretical Framework and Model Building

2.1 Theoretical Framework

The framework of this study is anchored on the endogenous growth theory of Romer (1990). Accordingly, endogenous growth occurs as a result of accumulating technology (or knowledge) and thus establishing a relationship between the level of human capital and growth. Thus, the theory assumes creation of knowledge as a side product of investment and takes knowledge as an input in the production function of the following form:

$$Y = A(R)\ F\ (Ri,\ K_i,\ L_i) \qquad (2.1)$$

where Y is aggregate output: A is the public stock of knowledge from research and development R; R_i is the stock of results from expenditure on research and development by firm $_i$: and K_i and L_i are capital stock and labour stock respectively. Theory assumes the function F homogenous of degree one in all its inputs R_i, K_i and L_i and

treats R_i as a rival good.

2.2 Model Specification.

The equations built for this study consist a structure of small macroeconomic model of the activity sectors (agriculture, industry and services) as defined by the CBN (2010). The model considered measures of investment and output of the considered activity sectors as dependent variables and captured human capital development (HCD) as one of the key explanatory variables in the four sectors. The behavioral equations in the macro econometric model are estimated using ordinary least square (OLS) with the inclusions of lags for both dependent and independent variables in each behavioral equation. Fair (1984) describes the possible use of OLS in estimating the model of equations. According to Fair (1984), macroeconomic models are normally nonlinear, simultaneous and very large, thus they tend to have serially correlated error terms. However, the features of the model allows for the correction of these problems in modeling the equations. The macro model provides a convenient way of correcting for the problem of serial correlation by treating the serial correlation coefficients as structural coefficients and transforms the equations into equations with serially uncorrelated error terms. In the model, the variations in the output of the sectors are stated to be a function of HCD and other control variables. The algebraic form of Equation 2.2 is given as:

$YG + f(HCD, C)$ (2.2)

where YG is total output, HCD is human capital development and C is control variables

2.2.1 The Behavioral Equations

This block is primarily concerned with modeling the impact of human development index on productive activities in Nigeria. Remaining consistent with CBN (2010), production output is divided into three activities sectors. The key dependent variables captured in the output models are; YGRA (agricultural sector output), YIND (industrial sector output) and YS (services sector output). All variables in the model were captured in log form except variables in rate and percentage. The behavioral equations are stated below:

Agricultural Output Model

In this model, assuming other things being equal, agricultural output is influenced by rainfall, human capital index, private sector credit, government capital expenditure, Real exchange rate and agricultural investment.

$$LogYAGR_t = \theta_{0,1} + \theta_{1,1}LogYAGR_{t-2} + \theta_{2,1}RF_t + \theta_{3,1}RF_{t-2} + \theta_{4,1}LogINVI_t + \theta_{5,1}LogINVI_{t-2} + \theta_{6,1}LogPSC_t + \theta_{7,1}LogGCE_t + \theta_{8,1}LogGCE_{t-2} + \theta_{9,1}YG + \theta_{10,1}HCD + \mu_1 \quad 2.3$$

Industry Output Model

In this model, it is highlighted that industry output is influenced by index of energy consumption, human capital index, private sector credit, government capital expenditure, real exchange rate, Capacity utilization rate and manufacturing sector investment.

$$LogYIND_t = \beta_{0,2} + \beta_{1,2}LogYIND_{t-2} + \beta_{2,2}IEC_t + \beta_{3,2}LogPSC_{t-2} + \beta_{4,2}LogGCE_t + \beta_{5,2}LogGCE_{t-2} + \beta_{6,2}LogINVI_t + \beta_{7,2}LogINVI_{t-2} + \beta_{8,2}NER_t + \beta_{9,2}YG + \beta_{10,2}HCD + \mu_2 \quad 2.4$$

Services Sector Output Model

Output of the service sector is influenced by private consumption, maximum lending rate, total government expenditure, Real exchange rate, manufacturing output and human development index

$$LogYS_t = \delta_{0,3} + \delta_{1,3}LogYS_{t-2} + \delta_{2,3}LogCON\_H_t + \delta_{3,3}RM_t + \delta_{4,3}LogTGE_t + \delta_{5,3}LogTGE_{t-1} + \delta_{6,3}LogYIND_t + \delta_{7,3}LogYIND_{t-2} + \delta_{8,3}YN_t + \delta_{9,3}HCD_t + \delta_{10,3}YG_t + \mu_3 \quad 2.5$$

Oil Exports Equation

$$LogXO_t = \lambda_{0,4} + \lambda_{1,4}LogXO_{t-2} + \lambda_{2,4}PO_t + \lambda_{3,4}PO_{t-2} + \lambda_{4,4}OPEC_t + \lambda_{5,4}OPEC_{t-2} + \lambda_{6,4}LogYF_t + \lambda_{7,4}LogYF_{t-1} + \mu_4 \quad 2.6$$

Non - Oil Exports Equation

$$LogXN_t = \Phi_{0,5} + \Phi_{1,5}LogXN_{t-2} + \Phi_{2,5}RER_t + \Phi_{3,5}LogYF_t + \Phi_{4,5}LogYF_{t-2} + \Phi_{5,5}YN_t + \Phi_{6,5}LogYN_{t-2} + \mu_5 \quad 2.7$$

Service Export Equation

$$LogXS_t = \Pi_{0,6} + \Pi_{1,6} LogXS_{t-2} + \Pi_{2,6} YG_t + \Pi_{3,6} LogX_t + \Pi_{4,6} LogX_{t-2} + \Pi_{5,6} RER_t + \Pi_{6,6} RM_{t-1} + \\ + \mu_6 \quad 2.8$$

Import Equation

$$LogM_t = \Omega_{0,7} + \Omega_{1,7} LogM_{t-2} + \Omega_{2,7} YD_t + \Omega_{3,7} YD_{t-2} + \Omega_{4,7} RER_t + \Omega_{5,7} RM_t + \Omega_{6,7} RM_{t-1} + \\ \Omega_{7,7} LogRES_t + \Omega_{8,7} LogRES_{t-1} + \mu_7 \quad 2.9$$

External Reserves Equation

$$LogRES_t = \psi_{0,8} + \psi_{1,8} LogRES_{t-2} + \psi_{2,8} RER_t + \psi_{3,8} PO_t + \psi_{4,8} EDS_t + \psi_{5,8} EDS_{t-1} + \psi_{6,8} LogM_t + \\ \psi_{7,8} LogM_{t-2} + \mu_8 \quad 2.10$$

Nominal Exchange Rate Equation

$$NER_t = \chi_{0,9} + \chi_{1,9} NER_{t-2} + \chi_{2,9} LogRES_t + \chi_{3,9} LogRMT_t + \chi_{4,9} LogRMT_{t-1} + \chi_{5,9} IRD_t + \chi_{6,9} IRD_{t-1} + \\ \chi_{7,9} X\_M_t + \chi_{8,9} CPI_t + \chi_{9,9} CPI_{t-1} + \chi_{10,9} LogTGE_t + \chi_{11,9} LogTGE_{t-1} + \\ + \chi_{12,9} Po_t + \chi_{13,9} Po_{t-2} + \mu_9 \quad 2.11$$

Foreign Direct Investment Equation

$$FDI_t = \eta_{0,10} + \eta_{1,10} FDI_{t-2} + \eta_{2,10} LogPCGDP_t + \eta_{3,10} PCGDP_{t-2} + \eta_{4,10} LogXN_t + \eta_{5,10} LogXN_{t-2} + \mu_{10} \quad 2.12$$

Foreign Portfolio Investment Equation

$$FPI_t = \rho_{0,11} + \rho_{1,11} FPI_{t-2} + \rho_{2,11} LogYG_t + \rho_{3,11} LogYG_{t-1} + \rho_{4,11} LogYF_{t-2} + \rho_{5,11} SMR_t + \rho_{6,11} INTF_t + \\ \rho_{7,11} INTF_{t-2} + \rho_{8,11} NER_t + \rho_{9,11} NER_{t-2} + \mu_{11} \quad 2.13$$

Foreign Debt Equation

$$FDF_t = \sigma_{0,12} + \sigma_{1,12} FDF_{t-2} + \sigma_{2,12} LogM_t + \sigma_{3,12} LogMT_{t-2} + \sigma_{4,12} IRD_t + \sigma_{5,12} IRD_{t-1} + \sigma_{6,12} NER_t + \\ \sigma_{7,12} NER_{t-2} + \sigma_{8,12} LogYF_t + \sigma_{9,12} LogYF_{t-2} + \mu_{12} \quad 2.14$$

Remittances Equation

$$LogRMT_t = \Gamma_{0,13} + \Gamma_{1,13} RMT_{t-2} + \Gamma_{2,13} LogYUS_t + \Gamma_{3,13} LogNER_t + \mu_{13} \quad \textbf{2.15}$$

Government Recurrent Expenditure Equation

$$LogGRE_t = \omega_{0,14} + \omega_{1,14} LogGRE_{t-2} + \omega_{2,14} LogGCE_t + \omega_{3,14} CG_t + \omega_{4,14} FDF_t + \omega_{5,14} LogYG_t + \mu_{14} \quad 2.16$$

Government Revenue (Non-Oil) Equation

$$LogGRVN_t = \Sigma_{0,15} + \Sigma_{1,15} GRVN_{t-2} + \Sigma_{2,15} LogYN_t + \Sigma_{3,15} LogM_t + \Sigma_{4,15} LogM_{t-2} + \Sigma_{5,15} TAR_t + \\ \Sigma_{6,15} TAR_{t-2} + \mu_{15} \quad 2.17$$

Government Revenue (Oil) Equation

$$LogGRVO_t = \Delta_{0,16} + \Delta_{1,16} GRVO_{t-2} + \Delta_{2,16} LogYO_t + \Delta_{3,16} LogYO_{t-2} + \Delta_{4,16} NER_t + \Delta_{5,16} PO_t + \\ \Delta_{6,16} PO_{t-2} + \Delta_{7,16} LogPPT_t + \Delta_{8,16} LogPPT_{t-2} + \Delta_{9,16} LogXO_t + \Delta_{10,16} LogXO_{t-2} + \mu_{16}$$

3.17

Human Capita Development Equation

$$HCD_t = \Theta_{0,17} + \Theta_{1,17}HCD_{t-1} + \Theta_{2,17}LE_t + \Theta_{3,17}LE_{t-2} + \Theta_{4,17}SCH_t + \Theta_{5,17}GNI_t + \Theta_{6,17}GNI_{t-2} + \Theta_{7,17}LogYG_t + \Theta_{8,17}LogGCE_t + \Theta_{9,17}LogGCE_{t-2} + \mu_{17}$$

2.18

Oil Output Equation

$$LogYO_t = \Lambda_{0,18} + \Lambda_{1,18}LogYO_{t-2} + \Lambda_{2,18}PO_t + \Lambda_{3,18}OPEC_t + \Lambda_{4,18}OPEC_{t-2} + \mu_{18}$$

2.19

Non-Oil Output Equation

$$LogYN_t = \acute{\Upsilon}_{0,19} + \acute{\Upsilon}_{1,19}LogYN_{t-2} + \acute{\Upsilon}_{2,19}LogPSC_t + \acute{\Upsilon}_{3,19}RM_t + \acute{\Upsilon}_{4,19}IEC_t + \acute{\Upsilon}_{5,19}TAR_t + \acute{\Upsilon}_{6,19}LogMt_t + \acute{\Upsilon}_{7,19}HCD_t + \mu_{19}$$

2.20

Table 2.1: Data sources and Variable Definitions

S/NO	VARIABLE	DEFINITION/DESCRIPTION	SOURCE
ENDOGENOUS VARIABLES			
1	XO	Oil Export	CBN 2019
2	XN	Non - Oil Export	CBN 2019
3	XS	Services Export	CBN 2019
4	M	Imports	CBN 2019
5	RES	Reserves	CBN 2019
6	NER	Nominal Exchange Rates	CBN 2019
7	FDI	Foreign Direct Investments	CBN 2019
8	FPI	Foreign Portfolio Investments	CBN 2019
9	FDF	Foreign Debt Flow	CBN 2019
10	RMT	Remittances	World Bank (WDI), 2015
11	GRE	Government Recurrent Expenditure	CBN 2019
12	GRVN	Government Revenue (Non-Oil)	CBN 2019
13	GRVO	Government Revenue (Oil)	CBN 2019
14	HCD	Human Capital Development	UNDP 2019
15	YAGR	Output From Agriculture	CBN 2019
16	YIND	Output from Industries	CBN 2019
17	YS	Output from Service Sector	CBN 2019
18	YO	Oil Output	CBN 2019
19	YN	Non-Oil Output	CBN 2019
SHOCK VARIABLES			
20	LE	Index of Life Expectancy	UNDP 2019
21	SCH	Index of Number of School Years	UNDP 2019
22	GNI	Index of Per Capita Income	UNDP 2019
EXOGENOUS VARIABLES			
23	PO	World Oil Prices	UNDP 2019
24	OPEC	World Oil Supply	UNDP 2019
25	YUS	Output from United States of America	UNDP 2019
26	YF	Foreign Output (OECD)	OECD Data, 2017
27	X	Value of Exports	CBN 2019
28	RER	Real Exchange Rates	World Bank (WDI), 2019
29	YD	Personal Disposable Income	CBN 2019
30	EDS	External Debt Services	CBN 2019
31	IRD	Interest Rate Differentials	World Bank (WDI) 2019
32	X_M	Terms of Trade	World Bank (WDI)2019
33	CPI	Consumer Price Index	World Bank (WDI) 2019
34	TGE	Total Government Expenditure	CBN 2019
35	PCGDP	Per Capita Gross Domestic Product	CBN 2019
36	SMR	Stock Market Returns	CBN, 2019

S/NO	VARIABLE	DEFINITION/DESCRIPTION	SOURCE
37	INTF	Foreign Interest rates (OECD)	OECD Data, 2019
38	RM	Interest Rates	CBN, 2019
39	INVI	Investment Income	CBN, 2019
40	GCE	Government Capital Expenditure	CBN, 2019
41	YG	Total Output	CBN, 2019
42	FDF	Fiscal Deficit Financing	CBN, 2019
43	PPT	Petroleum Profit Tax	CBN, 2019
44	TAR	Tariffs	CBN, 2019
45	PSC	Private Sector Credit	CBN, 2019
46	CG	Credit to Government	CBN 2019
47	RF	Rainfall	CBN 2019
48	IEC	Index of Energy Consumption	NBS, 2019
49	CON_H	Consumption	CBN, 2019

Source: Researchers' Compilation, 2023

In this study, the inter relationships between the components of the domestic economy and the effects of changes in the HCD are examined using a structural macroeconomic model. Structural macroeconomic models are built using economic relationships established from theory. The model rely on a system of simultaneous equations in trying to measure the whole economy or a sub – sector of the economy, with each equation specifying a single relationship (Cohen, 2004). The model methodology follows, in principle the Cowles Commission approach as used in Tinbergen's (1939) macroeconomic model. Other studies that initially employed the SMM approach include Klein (1950), Klein and Goldberger (1995), and Duesenberry *et al* (1965, 1969). In this approach, economic theory determines the nature of relationship between the right-hand side and left-hand side variables for all stochastic equations used in building the macro- model. The resulting equations can then be estimated using a consistent estimation technique (Fair, 2013). Abstracting form Fair (2013, 2004) SMM model, the SMM model is specified in its non – linear form;

$f_i = (y_t, y_{t-1}, y_{t-p}, x_t, \alpha_i) = \mu_{it}$ $\quad i = 1 \ldots n, \quad t = 1 \ldots T,$

Where y is an n – dimensional vector for all endogenous variables, x, is also a vector of all predetermined exogenous variables including lags of endogenous variables, α, is a vector of all unknown coefficients and μ, represents the stochastic error term for equations i for period 1. The f_i equations are assumed to be stochastic and the remaining equations identities. Thus, specifying the model will entail choosing the variables that will enter into each equation with non – zero elements, the functional form for each equation, and the probability structure of the error term (for the SMM to be used in this study, we will ensure that the variables of interest are trend stationary).

3. Result Presentation and Analysis

3.1 Results of Unit Root Test

Table 3.1 presents the results for the Augmented Dickey Fuller (ADF) test for unit roots in each variable used in estimating the SMM. These tests are based on the null hypothesis that there is the existence of unit root in the variables against an alternative hypothesis of the variables being stationary. The decision rule on the test statistic is based on its absolute values. Thus, we reject the null hypothesis of a unit root, if the computed test statistic in absolute values is greater than the critical (table) value, and accept the alternative of no unit root in the variables. The results from the ADF unit root test indicates that all variables of interest are integrated at order one, I(1) with exception of Output from Service Sector (YS), Stock Market Returns (SMR), and Index of Energy Consumption (IEC), which is stationary at levels, I(0).

Table 3.1: Augmented Dickey-Fuller Unit Root Test

Variables	Level	1st Diff	Conclusion
YAGR	0.131311	-2.963325**	I(*1*)
YIND	--0.637174	--4.803992***	I(1)
YS	-6.046031***	----------	I(0)
XN	-0.493587	-11.38690***	I(1)
XO	-0.778057	-12.06029***	I(1)
XS	0.335892	-11.11741***	I(1)
M	0.104227	-8.965740***	I(1)
RES	-0.982161	-4.134495***	I(1)

Variables	Level	1st Diff	Conclusion
NER	-0.590496	-11.28325***	I(1)
FDI	-1.531964	-10.67598***	I(1)
FPI	-1.895755	-7.069068***	I(1)
FDF	-1.895755	-7.069068**	I(1)
RMT	0.385520	-5.429930***	I(1)
GRE	-0.704251	3.964591***	I(1)
GRVN	0.327090	-4.867700*	I(1)
GRVO	-0.717744	-4.735901***	I(1)
HCD	-1.090336	-0.941950**	I(1)
YO	-0.366399	-4.680094***	I(1)
YN	-0.504485	-6.818670***	I(1)
RER	-2.060609	-3.422871***	I(1)
PSC	3.015922	-8.282731***	I(1)
RMT	0.385520	-5.429930***	I(1)
SMR	-8.496941***	----------	I(0)
TGE	1.438086	-4.538406***	I(1)
X	-0.755872	-12.14331***	I(1)
YG	0.450553	-2.218502**	I(1)
X_M	-2.109021	-14.60570***	I(1)
RF	-3.284214	-10.58916***	I(1)
IEC	0.0773*	----------	I(0)
YN	-0.504485	-1.633409**	I(1)
YD	0.456963	-2.310420*	I(1)
YF	0.755630	-3.748156***	I(1)
CPI	-0.113648	-12.76183***	I(1)
LE	0.871514	-2.580475*	I(1)
SCH	-1.050744	-5.176292**	I(1)
GNI	-1.100692	0.074278***	I(1)
OPEC	1.594865	-5.460647***	I(1)
PO	-0.521565	-4.726179***	I(1)
PCGDP	0.802230	-5.914532***	I(1)

Source: Researchers' computation using EView 10

Note: The assumption of "intercept" and/or "trend" is assumed using the graphs of each variable. *. **, and *** indicates significance level at 10%, 5% and 1% respectively.

3.2: Macro Model Results

3.2.1: Results for Core Endogenous Variables of Interest

Agricultural Output Equation Results

Table 3.2 shows the results of the estimated agricultural output function. The results reveal that seven out of the ten or 70% of the explanatory variables turned out significant. HCD which is a core variable of interest to this study turned out to be a significant determinant of agricultural output. Specifically, a unit increase in HCD brings about 0.099 decreases in agricultural output. One of the plausible economic intuitions behind this result may be the time lag that it takes for HCD to impact on the agricultural sector. The model reinforced internal consistency, given that one period lag of agriculture (YAGR(-1)) positively and significantly affect the current value of agricultural sector output. Expectedly, private sector credit (PSC), government capital expenditure (GCE), GCE (1), investment income (INVI) and total output (YG) positively and significantly impact on agriculture output. The insignificant variables within the function are the rainfall in Nigeria (RF), and INVI (-1).

Table 3.2: Agricultural Output Equation Results

Variables	OLS	
	Coefficient	**t-statistic**
C	0.4751	6.9995
HCD	-0.0989*	-1.3421
YAGR(-1)	2.4947*	23.3297
RF	-0.0017	-1.5175
RF(-1)	-0.0004	-1.3134
INVI	0.1570*	1.8242
INVI(-1)	-0.4021	-1.5338
PSC	0.0078*	3.2911
GCE	0.0681*	27.5714
GCE(-1)	-0.1650*	-20.5829
YG	0.0018*	2.1575
Adj R^2	0.99	

Source: Researchers' Computation using EView 10

Industrial Output Equation Results

Out of ten variables that entered the industrial output equation, 60% impacts positively on industrial output. In this instance, HCD does not have significant effect on the industrial output, though its relationship with the sector emerged to be positive. In conformity with a priori expectations, lagged value of industrial output (YIND (-1)), index of energy consumption (IEC), and government capital expenditure (GCE) have significant and positive effect on industrial output. On the other hand, the model tracked the effects of HCD, Private Sector Credit (PSC), and Investment Income (INVI) on industrial output to be non-significant.

Table 3.3 Industrial Output Equation Results

Variables	OLS	
	Coefficient	**t-statistic**
C	0.4165	4.4022
HCD	0.0655	1.1459
YIND(-1)	3.0359*	28.4615
IEC	0.0092*	3.9690
PSC	-0.0004	-0.2448
GCE	0.0640*	32.2005
GCE(-1)	-0.1962*	-25.8986
INVI	-0.0006	-0.2846
INVI(-1)	0.0002	0.0926
NER	0.0049*	1.8269
YG	0.0096*	2.1078
Adj R^2	0.99	

Source: Researcher's Computation using EView 10

Results for the Services Output Equation

The results that emerged from the calibration of the services output equation revealed that HCD is one of the significant determinants of output in the services sector. A unit increase in HCD brings about a 0.15 increase in services sector. Lagged output from the service sector positively and significantly affects its present value. Similarly, remittances (RM) emerged as one of the negative and significant determinants of services sector output. This result is unrealistic of the current situation in the country where the penchant to migrate abroad and later invest back home is the case. However, the reasonable explanation for the negative sign could be that most remittances to Nigeria are not invested in the services sector. Expectedly, output from the industrial sector positively and significantly impacts on the services sector, thus demonstrating the interrelatedness of the activity sector. Contrary to economic expectation, non-oil output (YN) and total output in the economy do not significantly affect the services sector output.

Table 3.4: Services Output Equation Results

Variables	OLS	
	Coefficient	**t-statistic**
C	-0.4149*	-1.8298
HCD	0.1474*	1.2712
YS(-1)	2.7483*	22.0185
CON_H	0.0046	0.0151
RM	-0.0006*	-2.0932
TGE	-0.0028	-0.3444
TGE(-1)	-0.0006	-1.5623
YIND	0.8676*	25.5217
YIND(-1)	-2.4394*	-18.6617
YN	0.0087	0.6070
YG	0.0084*	-0.8633
Adj R^2	0.99	

Source: Researchers' Computation using EView 10

Oil Exports Equation Results

The estimated behavioural equation for oil exports shows that the lag of oil exports has positive and significant impact on oil exports. Again, the model shows a significant positive impact of oil price (PO) and foreign output (YF) on oil exports. This result is in line with economic theory, given that increase in oil price has the tendency to motivate oil producing countries to, at least, meet the prevailing OPEC quota. In addition, increase in the output of foreign countries increases the demand for crude oil, other things being equal. Surprisingly, world oil supply (OPEC) was not found to have significant impact on oil export. This result is unanticipated given that in reality, individual country's oil export mirrors the dynamics in the world oil market.

Table 3.5: Result of Oil Exports

Variables	OLS	
	Coefficient	**t-statistic**
C	-1.5207*	-3.3495
XO(-1)	1.2344*	14.2277
PO	0.0033*	2.2018
PO(-1)	-0.0005	-0.2527
OPEC	-0.0016	-0.4391
OPEC(-1)	0.0062	1.0370
YF	0.3395*	3.4903
YF(-1)	-0.2548*	-2.4620
Adj R^2	0.99	

Source: Researchers'' computation using EView 10

Non–Oil Export Equation Results

The estimates of non–oil export equation shows that previous quarter values of non-oil exports has strong effect on current value of non-oil exports. Also, non-oil output (YN), real exchange (RER) rates and foreign country output (YF) significantly explain variations in Nigeria's non-oil exports. The negative impact of RER on non–oil exports negates economic theory. Other things being equal, the negative sign of the RER depicts that its increase might not result into increase in non–oil exports vice-versa.

Table 3.6: Result of Non - Oil Exports

Variables	OLS	
	Coefficient	**t-statistic**
C	-2.8335*	-2.7465
XN(-1)	1.2709*	14.7718
RER	-0.0038	-1.0830
YF	-0.0141	-0.1189
YF(-1)	0.0125	0.0648
YN	5.1182*	4.1766
YN(-1)	-7.8489*	-3.5702
Adj R^2	0.99	

Source: Researchers' Computation EView 10

Service Export Equation Results

Estimates of the service export equation suggest important relationships between lag of service exports and exports from the sector. Also, the coefficients of domestic output (YG) and Value of Exports (X) are found to have positive

signs in explaining the variations in service exports. Expectedly, the value of exports significantly impacts on service exports. It is also observed that the first lag of exports value shows a negative relationship between it and service exports. This demonstrates that countries possibly act to counteract the previous occurrence in the value of exports.

Table 3.7: Result of Service Export

Variables	OLS	
	Coefficient	t-statistic
C	-0.3413	-0.6409
XS(-1)	1.2301*	15.1107
YG	0.0162	0.3008
X	0.4852*	5.9021
X(-1)	-0.6652*	-4.8727
RER	-0.0063	-1.6390
Adj R^2	0.99	

Import Equation Results

From economic theory, Nigeria's imports are modelled to depend on lags of imports (M (-1)), Personal Disposable Income (YD), real exchange rates (RER), interest rates (RM) and reserves (RES). The estimated equation reveals inertia properties for imports, where previous period imports had causal effects on current imports. Also, lag of personal disposable income negatively but significantly explained possible variations in imports. This result does not conform to economic theory which suggests that increases in consumption (via increases in disposable income) will increase the demand for imported commodities, other things being equal. The current values of YD, RM as well as the lagged values of RM and RES are not found to be significant in explaining the variations that occur in imports in Nigeria.

Table 3.8: Result of Import

Variables	OLS	
	Coefficient	t-statistic
C	-0.4494	-2.7927
M(-1)	1.2857*	16.1147
YD	0.0875	1.0021
YD(-1)	-0.0655	-0.4756
RER	-0.0091*	-1.8689
RM	-0.0066	-0.8902
RM(-1)	0.0178	2.4328
RES	0.0169*	0.4629
RES(-1)	0.0563	1.3270
Adj R^2	0.99	

Source: Researcher's Computation using EView 10

External Reserves Equation Results

According to CBN (2013), one of government's core objectives is to preserve the value of the Naira, which is directly linked to the country's reserves. The explanatory variables that entered the external reserve equation are its lags, the real exchange rates (RER), oil prices (PO), external debt servicing (EDS), and imports (M). From the estimates of the equation, there is evidence of negative responses of lags of reserves in explaining current reserve levels. Also, it is found that oil prices, and RER have positive and significant effect on external reserves. Crude oil being the major foreign exchange earner for Nigeria, it is expected that increase in its price will bring about increase in external reserves. External debt services were found to have positive feedback in explaining the variations in reserves although not significant.

Table 3.9: Result of External Reserves

Variables	OLS	
	Coefficient	**t-statistic**
C	1.3460*	3.7044
RES(-1)	0.7009*	8.4970
RER	0.0139*	1.6906
PO	0.0025*	1.7978
EDS	-0.0003	-0.2765
EDS(-1)	0.0003	0.3323
M	0.1300	0.6167
M(-1)	-0.0439	-0.1304
Adj R^2	***0.99***	

Source: Researchers' Computation EView 10

Nominal Exchange Rate Equation Results

Exchange rate is a key factor in Nigeria's external sector because it reflects changes in both the domestic and foreign country's macroeconomic fundamentals. Based on this, it was modelled to be explained by its lags (NER(-1) (Assuming that exchange rates follow a random walk (CBN, 2013), reserves (RES), remittances (RMT), interest differentials (IRD), terms of trade (X_M), consumer price index (CPI), total government expenditure (TGE), Reserves (RES) and oil prices (PO). The results obtained from the estimation showed that the first lag of nominal exchange rates has positive effect on current nominal exchange rates. Other variables show a mixture of positive and negative effects at different level of lags. For instance, X_M, and PO are the two variables that significantly explain variations in Nominal Exchange Rate. While the effect of X_M is positive, that of PO turned out to be negative. The economic implication of the negative result obtained for PO is that when the country acquires more foreign exchange earnings through increase in oil prices (PO), the value of nominal exchange rate falls, other things being equal. This finding reinforces standard economic theory. Interest rate differentials and the first lag of consumer price index relate negatively with NER although they are not significant explanatory variables. Conversely, RMT, TGE, TGE (-1), PO (-1) and CPI, have positive but non-significant effects on the nominal exchange rate.

Table 3.10: Result of Nominal Exchange Rate

Variables	OLS	
	Coefficient	**t-statistic**
C	3.1736	0.3265
NER(-1)	1.0296*	11.6512
RES	-0.2713	-0.2541
RMT	1.5652	1.4799
RMT(-1)	-1.0016	-0.9618
IRD	-0.3177	-0.7963
IRD(-1)	-0.0286	-0.0721
X_M	0.6299*	2.1150
CPI	1.3023	1.1517
CPI(-1)	-1.3375	-1.2063
TGE	-1.6200	-1.3157
TGE(-1)	0.8328	0.6895
PO	-0.2507*	-3.1706
PO(-1)	0.1951	1.6561
Adj R^2	0.98	

Source: Researchers' Computation EView 10

Foreign Direct Investments Equation Results

The sustained rise in FDI and its consequent importance on the Nigerian economy has been traced to economic reforms that allowed for foreign investments in telecommunication, construction and the oil and Gas sectors (CBN, 2013b). Thus, we modelled FDI as a function of per capita GDP (PCGDP), non-oil exports (XN) and lags of FDI to capture inertia effects where current FDI flows are affected by previous FDI flows. From the estimated equation, we found inertia effects on FDI, while per capita GDP is seen to have both positive and significant effect on FDI, its lag negatively and significantly impacted on FDI. The effect of PCGDP on FDI is supported by economic theory. However, non-oil exports showed a positive and significant effect on FDI whereas its effect at first lag is not significant. FDI. There are negative feedback innovations for foreign direct investments equation.

Table 3.11: Result of Foreign Direct Investments

Variables	OLS	
	Coefficient	**t-statistic**
C	7.0853*	2.1062
FDI(-1)	0.6796*	7.6565
PCGDP	9.2059*	3.3085
PCGDP(-1)	-12.6959*	-2.5564
XN	0.7475*	2.7565
XN(-1)	-0.6118	-1.3478
Adj R^2	0.96	

Source: Resaerchers' computation using EView 10

Foreign Portfolio Investments Equation Results

Just like the FDI equation, foreign portfolio investments (FPI) remain an important component of Nigeria's capital and financial accounts. Due to reforms, especially those targeted at equity participation, there has been an increasing inflow of portfolio investment to the Nigerian Economy (CBN, 2013a[26]). Thus, FPI was modelled as a function of domestic output (YG), foreign country output (YF), stock market returns (SMR), foreign country interest rates (INTF), and nominal exchange rates (NER). From the estimates, domestic and foreign country's output are not significant in explaining the variations in FPI. While the effect of the first lag ofdomestic output on FPI is negative, the effect of foreign output is positive in the first lag. The stock market returns variable is negative, while foreign interest rates and nominal exchange rates show positive effects in explaining the variations in FPI. There are positive feedback innovations in the foreign portfolio investments equation. INTF and NER have similar pattern in their effect on FPI. Both variables negatively but significantly have impact on FPI. However, at their first lags, the converse of their effects holds.

Table 3.12: Result of Foreign Portfolio Investments

Variables	OLS	
	Coefficient	**t-statistic**
C	-779.58	-1.0841
FPI(-1)	1.4344*	17.4986
YG	-1251.10	-1.1866
YG(-1)	1333.41	1.2906
YF	148.0870	1.5520
YF(-1)	-211.82	-1.4324
SMR	-1.1474	-1.2482
INTF	-53.484*	-1.7450
INTF(-1)	96.0502*	1.9010
NER	-4.9470*	-3.5233
NER(-1)	9.1088*	4.6772
Adj R^2	0.96	

Source: Researchers' Computation using EView 10

Foreign Debt Flow Equation Results

The equation for foreign debt flow (FDF) is based on theoretical explanations on the expected determinants of FDF (CBN, 2013a). On this basis, we modelled foreign debt flow as a function of the amount of imports (M), interest rate differentials (IRD), nominal exchange rates (NER), foreign country output (YF), and lags of foreign debt flows (FDF(-1)). The estimated equation shows a negative and significant influence of the level of imports, nominal exchange rates at their first lags. However, Foreign Output (YF) has significant and inverse relationship with FDF, implying that YF matters in explaining the variations that exist in FDF. Further, the estimated results clearly show that imports, interest rate differentials (IRD), nominal exchange rates, foreign country output at lag one, lags of FDF are not significant determinants of variations in FDF. There are positive feedback innovations in the foreign debt flow equation.

Table 3.13: Result of Foreign Debt Flow

Variables	OLS	
	Coefficient	**t-statistic**
C	840.76	1.6534
FDF(-1)	1.2952*	13.8895
M	100.081	1.6578
M(-1)	-100.26	-1.0572
IRD	-2.3860	-0.4802
IRD(-1)	1.04147	0.2068
NER	4.1301	1.3183
NER(-1)	-6.5465	-1.1763
YF	-128.90	-1.2621
YF(-1)	66.3835	0.4346
Adj R^2	0.8900	

Source: Researchers'' Computation using EView 10

Remittances Equation Results

Remittances have become very important to the Nigerian Economy, given that it has become a viable source of foreign exchange and revenue for the government. Thus, it was modelled remittances as a function of United States of America's output (YUS), nominal exchange rates (NER) and lags of remittances (RMT(-1)). We found strong positive effects in the first lag of remittances while the nominal exchange rate shows negative but insignificant effects in explaining changes in remittances. Output from the United States of America is estimated to have positive and significant effect on remittances. There are negative feedback innovations for remittances equation.

Table 3.14: Result of Remittances

Variables	OLS	
	Coefficient	**t-statistic**
C	-3.9691*	-3.2513
RMT(-1)	0.8121*	9.5910
YUS	0.2571*	3.3390
NER	-0.0011	-0.6206
Adj R^2	0.98	

Source: Resaerchers' Computation using EView 10

Government Recurrent Expenditure Equation Results

Table 3.15 shows the results of Government Recurrent Expenditure equation. Interestingly, the coefficient of Government Capital Expenditure (GCE) was shown to be rightly signed and significant, suggesting that GCE is an increasing function of GRE. This result is theoretically appealing, considering the fact that capital expenditure propels investment in assets that are used over time in the provision of goods and services to taxpayers which in turn serve as revenue generating avenue for government to meet up its recurrent spending. Again, consistent with apriori expectation, one period lagged Government Recurrent Expenditure (GRE (-1)) has positive and significant effect on the current Government Recurrent Expenditure.

Table 3.15: Result of Government Recurrent Expenditure

Variables	OLS	
	Coefficient	**t-statistic**
C	-0.0705	-0.8224
GRE(-1)	3.1091*	47.1448
GCE	0.0065*	2.0639
CG	0.0043	0.7506
FDF	0.0029	-0.5095
YG	0.0081	0.9214
Adj R^2	0.99	

Source: Researchers' Computation using EView 10

Government Revenue (Non-Oil) Equation Results

The estimate of Government Revenue (Non-Oil) shows that one period lagged-GRVN(-1), has a huge significant positive effect on the current value of Government Revenue (Non-Oil). On the other hand, Imports (M) and the one period lagged Tariff (TAR(-1)) were significant with a depreciating effect on Government Revenue (Non-Oil). The decreasing effect of Imports on Government Revenue (Non-Oil) is not unanticipated as it aligns with economic theory while that of Tariff is theoretically puzzling. Conventional economic theorists posit that tariff is a major source and booster of government revenue. The plausible explanation for this could be that huge amount of revenue from tariff are not transmitted into government account. This is also evident given the over-reliance on oil revenue

for government budget expenditures.

Table 3.16: Result of Government Recurrent Expenditure

Variables	OLS	
	Coefficient	**t-statistic**
C	-0.0331	-0.2134
GRVN(-1)	3.3041*	50.8148
YN	0.0047	0.2760
M	-0.0158*	-1.7806
M(-1)	0.0105	0.8322
TAR	0.0007	4.0188
TAR(-1)	-0.0024*	-3.7251
Adj R^2	0.99	

Source: Researchers' Computation using EView 10

Government Revenue (Oil) Equation Results

The empirical results shown in Table 3.17 revealed that lagged Government Revenue (GRVO (-1)), Oil Output (YO) and Petroleum Profit Tax (PPT) were significant and positively associated with Government Revenue (Oil). Again, while lagged Oil Export (XO(-1)) was shown to significantly improve Government Revenue (Oil), the lagged Oil Output (YO(-1)) and lagged Petroleum Profit Tax (PPT(-1)) have deteriorating effect on Government Revenue(oil). The statistical significance of these variables implies that they are crucial in explaining the dynamism of Government Revenue (Oil) in Nigeria.

Table 3.17: Result of Government Revenue (Oil)

Variables	OLS	
	Coefficient	**t-statistic**
C	0.1213	1.0828
GRVO(-1)	3.1615*	49.4723
YO	1.6588*	2.1915
YO(-1)	-4.8522*	-2.3397
NER	-0.0079	-0.1020
PO	-0.0001	-0.8761
PO(-1)	-0.0001	-0.4989
PPT	0.5401*	10.0865
PPT(-1)	-1.6970*	-9.8437
XO	-0.0112	-1.2910
XO(-1)	0.0116*	1.0210
Adj R^2	0.99	

Source: Researcher's computation using EView 10

Human Capital Development Equation Results

The model for Human Capital Development shows that Index of Per Capita Income (GNI) and Government Capital Expenditure (GCE) have positive and statistically significant impact on human capital development, implying that higher Per Capita Income and increased Government Capital Expenditure (GCE) improve human capital development. The coefficients of Index of Life Expectancy (LE) and Index of Number of School Years (SCH) were wrongly signed, although not significant. The negative signs of LE and SCH are counterintuitive, given that theoretically, Human Capital Development is expected to have a positive relationship with Index of Life Expectancy (LE) and Index of Number of School Years (SCH). Again, it is striking to observe that while GNI was shown to have an increasing significant effect on Human Capital Development, its lagged value, GNI(-1) has a weakening effect on Human Capital Development, suggesting that previous value of GNI is decreasing contributory variable in boosting human capital development. This result is however confusing and requires further interrogation.

Table 3.18: Result of Human Capital Development

Variables	OLS	
	Coefficient	**t-statistic**
C	0.0224	0.3426
HCD (-1)	0.9611*	28.2984
LE	-0.4491	-1.3798
LE(-1)	0.3984	0.6837
SCH	-0.2114	-1.1662
GNI	1.7106*	3.1518
GNI(-1)	-1.1865*	-2.4446
YG	0.0009	0.9576
GCE	0.0105*	1.8093
GCE(-1)	-0.0099	-0.9972
Adj R^2	0.99	

Source: Researchers' compuuation using EView 10

Oil Output Equation Results

The estimated result for Oil output reveals that world oil supply (OPEC) has a significant negative effect on Oil output. This result seems plausible given that a glut in the world oil market pushes price down which in turn causes a reduction in oil output through OPEC quota regulation. Expectedly, the past value of Oil output was further shown to have significant positive impact in current oil Output. The effect of oil price (PO) on Oil output was revealed to have the right sign but not significant.

Table 3.19: Result Oil Output

Variables	OLS	
	Coefficient	**t-statistic**
C	-10.6897	-0.8051
YO(-1)	3.5040*	74.3537
PO	0.1317	1.1692
OPEC	-0.0080*	-1.8003
OPEC(-1)	0.0009	0.1269
Adj R^2	0.99	

Non-Oil Output Equation Results

The estimated result for Non-oil output indicates that Interest Rates (RM), Index of Energy Consumption (IEC) and Private sector credit significantly improve Non-oil output. The positive effect of Interest rate on Non-oil output is counterintuitive and does not conform to theoretical expectation, considering the fact that an increase in interest rate reduces investment which in turn crowds out output. The effect of private sector credit was shown to have more impact on Non-Oil Output with a coefficient of 0.0465, conforming to a prior expectation about the expansionary effect of private sector credit on output. Similarly, the lagged value of Non-oil output was revealed to have significant impact on Non-oil output. The coefficients of Tariffs (TAR) and Human Capital Development (HCD) were positive but not significant. Expectedly, the coefficient of Import (M) was rightly signed, although not significant.

Table 3.20: Result of Non-Oil Output

Variables	OLS	
	Coefficient	**t-statistic**
C	1.3068*	3.4120
YN(-1)	0.5426*	5.4846
PSC	0.0465*	2.5945
RM	0.0065*	4.6492
IEC	0.0004*	2.1765
TAR	2.0300	1.1294
M	-0.0013	-0.0742
HCD	1.0263	1.3955
Adj R^2	0.99	

Source: Researchers' Computation using Eview

4 Conclusions and Policy Recommendation

The research findings that emerged from this study were considered satisfactorily robust, and have significantly achieved the objectives of the study. Based on the empirical findings of this study vis-à-vis the effects of HCD on the individual activity sectors, the following conclusions were made;

i. HCD is a significant determinant of agricultural output in Nigeria.
ii. HCD does not have significant effect on industrial output, though its relationship with the sector is positive.
iii. HCD is a significant determinant of output in the services sector.

4.1 Policy Recommendations

From the findings of the study, the following policies were recommended.

i) Government should ensure that health policies that are capable of boosting life expectancy are put in place. It is possible that those who enjoy increased life expectancy are not engaging into agriculture, thus resulting in inverse relationship between life expectancy and agriculture output. To avert this scenario, the ministry of agriculture should ensure that agriculture is not just a gainful business but also an attractive profession.

ii) It is recommended that education as one of the key means through which the Service and Industry sectors of Nigeria can be revolutionized, the government through the ministries of agriculture and labour and employment should ensure that such people are engaged into Agricultural activities.

iii) The findings of the study demonstrated that increase in per capita GNI should be one of the viable policy options towards improving the agriculture output in Nigeria.

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