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FORMULATION AND IMPLEMENTATION OF STRATEGIES FOR EFFECTIVE MANAGEMENT OF EXTERNAL RESERVES: COUNTRY EXPERIENCE

By ***Akpan H. Ekpo and Sam Omoruyi****

I. Introduction

Reserve management is a process that ensures that adequate official public sector foreign assets are readily available to and controlled by the authorities for meeting a defined range of objectives for a country or Union[1] (IMF, 2003). The formulation and implementation of strategies for effective management of external reserves are pursued through the institutional framework and decision-making structure at the central bank in virtually all countries of the world. However, in a limited number of countries reserve management function is exercised by the central bank in collaboration with government (Minister of Finance).

Typically central banks manage reserves by taking active management positions at strategic and tactical levels. Strategic positions involve deployment of reserves in investment instrument with set time horizon which is often discussed and decided upon at the bank's investment committee. The tactical position involves the determination of operational benchmarks including risk mitigation parameters that ensure the ultimate realisation of set reserve management objectives.
All this effort underscores the importance of sound reserve management in macroeconomic management.

In particular, sound reserve management practices are important because they can increase a country's or region's overall resilience to shocks. Through their interaction with financial markets reserve managers gain access to valuable information that keeps policymakers informed of market developments and views on potential threats. The importance of sound reserve management practices has also been brought into bold relief by country experiences where weak or risky reserve management practices have limited the ability of the authorities to respond effectively to financial crises, which may have exacerbated the severity of these crises.

Moreover, weak or risky reserve management practices can also have significant financial and reputational costs. A great many countries have incurred large losses that have had direct, or indirect fiscal consequences. A fortiori, appropriate portfolio management policies concerning the currency composition, choice of

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[1]*The word union is used to represent monetary or exchange management unions that also undertake reserve management.*

investment instruments and acceptable duration of the reserves portfolio, and which reflect a country's specific policy circumstances, are put in place to ensure that assets are safeguarded, readily available and support market confidence.

Moreover, weak or risky reserve management practices can also have significant financial and reputational costs. A great many countries have incurred large losses that have had direct, or indirect fiscal consequences. **A fortiori,** appropriate portfolio management policies concerning the currency composition, choice of investment instruments and acceptable duration of the reserves portfolio, and which reflect a country's specific policy circumstances, are put in place to ensure that assets are safeguarded, readily available and support market confidence.

Of importance is the caveat that sound reserve management policies can support, but not substitute for sound macroeconomic management. Given links between reserves and macroeconomic polices, weak or risky reserve management may lead to inappropriate economic policies (fiscal, monetary, exchange rate, financial and real sector) which may pose serious risks to the ability to manage reserves.
The purpose of this paper is to review the formulation and implementation of strategies for effective management of external reserves in Canada, Brazil and Nigeria through a review of their institutional framework and decision-making structure at their central banks. While not representative of the wide spectrum of countries in the developed, emerging and developing world, these countries contain robust evidence of cutting edge reserve management practices across the world.

In that regard, the paper is divided into six parts for ease of presentation. Part I is this introduction. Part II highlights the objectives and scope of reserve management while Part III focuses on Optimality Issues and the nexus linking reserves with macroeconomic policies. Part IV dwells on country experience: Canada, Brazil and Nigeria. Part V articulates the commonalities and differences in country reserve management practices.
Part VI is the conclusion of the paper.

II Objectives and Scope

II.I Objectives

External reserve management relates to policies or actions of the central bank to achieve efficient holding (that is availability of adequate reserves levels) and optimal deployment of the country's foreign exchange reserves. The holding and deployment activities are designed by the reserve management entity (the central bank) to meet a defined range of **objectives** for a country. The objectives of reserve

management encompass the objectives of the monetary authorities and the objectives of a portfolio manager or the custodian of reserves.

- As a monetary authority, a central bank's primary objectives are to ensure macroeconomic and financial stability in general and external sector stability in particular.

- As a custodian, the central bank's main objectives are to ensure:
  - maintenance of adequate liquidity;
  - preservation of capital (safety); and
  - maximizing the rate of return while ensuring that total risk remains at a sustainable level (yield on deployment of reserves).

- The objectives of reserve management vary across countries. In this regard, IMF **Guidelines** (2001) provides an array of reserve management country objectives in its recent survey of reserve management practices of selected countries:

- first, most countries hold reserves to support monetary policy, through primarily ensuring liquidity to smooth out undue fluctuations in foreign exchange market;

- second, smaller countries hold reserves mainly for **transaction** motives to meet external payment imbalances as well as a **store** of wealth. A few countries hold reserves for precautionary purposes to mitigate adverse external shocks;

- few countries explicitly use external reserves as backing for monetary base and to maintain the stability and integrity of the financial system.

- most countries effect informal coordination between debt management and reserve management policies. As part of informal coordination, the out turn and movement of external debt indicators, particularly the maturity composition of short-term and long-term debt, are taken into account in reserve management by most countries;

- liquidity and safety (low risks) are in most countries cardinal objectives of reserve management; and

- For most countries it is also an objective to design and use benchmarks to manage currency composition of reserves.

II.2 Scope

External reserves of a country may be defined as "... the assets which its authorities have available to meet payments to other countries. The nature and ownership of these funds may be quite varied. The two tests of the reserve, or near reserve, character of any item which may be in doubt are, first, its **availability** to the monetary authorities of the country in case of need and, second, its **acceptability** by potential creditors" (IMF staff papers, Vol. III, No 2, October 1952).

The definition of external reserves (monetary reserves) of a country emphasises two characteristics, which define the scope; namely, **availability** to the monetary authority and **acceptability** by potential creditors. On the first characteristic, the assets must be held by the monetary authorities; or the assets, if not held by the monetary authorities, must be readily available to the monetary authorities for use. With regard to the second characteristic, i.e. its acceptability, the assets classified as monetary reserves, must be readily convertible into traded or transaction currencies as such currencies would be acceptable to potential creditors. From the view-point of these two characteristics, the assets that qualify for inclusion in monetary reserves (the scope) in Nigeria, for example are as follows:

i. gold coin or bullion;

ii. balance at any bank outside Nigeria where the currency is freely convertible and in such currency, notes, coins, money at call and any bill of exchange bearing at least two valid and authorised signatures and having a maturity not exceeding 90 days exclusive of grace;

iii. Treasury bills having a maturity not exceeding one year issued by the government of any country outside Nigeria whose currency is convertible;

- securities of or guarantees by a government of any country outside Nigeria whose currency is freely convertible and the securities shall mature in a period not exceeding 10 years from the date of acquisition;

- securities of or guarantees by international financial institutions of which Nigeria is a member if such securities are expressed in currency freely convertible and maturity of the securities shall not exceed 5 years;

- Nigeria's gold tranche at the International Monetary Fund; and

- Allocation of Special Drawing Rights (SDRs) made to Nigeria by the International Monetary Fund. Note, however, that allocation of SDRs by the

IMF is a liability; holdings of SDRs are assets. This is a recent classification by the IMF.

- Thus a country's monetary assets would exclude external assets held by private persons and institutions (because they would not be readily available to the monetary authorities for use) and non convertible foreign exchange because such assets would not be acceptable to potential creditors

- It must be stressed that this is a broad scope/definition of monetary assets of a country (Nigeria) and that depending on the organisational structure of any particular country, nothing prevents a country from including in its monetary reserves the external assets held by its private persons, institutions and commercial banks **as long as** such assets broadly met the two characteristics discussed above, that is, availability to the monetary authorities for use and acceptability to potential creditors. It is also conceivable that other items that meet only one of the characteristics may be included in reserves, depending on the items and peculiar circumstances of the country.

III. Optimality Issues and Macroeconomic Policy Nexus

The level and composition of international reserves is an important element or input in the formulation of macroeconomic policies across the world; in the emerging and developing economies in particular the adequacy of international reserves is an issue in the assessment of a country's vulnerabilities in the vortex of capital flows and globalization.

Also the impressive pace of reserve growth in the developed world and some emerging economies has become an important issue on the international policy agenda, calling attention to issues of sustainability of reserve accumulation. On all cases, developed, emerging and developing, there is need to take a look at issues of optimality in reserves holdings as well as the role of reserves in macroeconomic policy nexus. In what follows is an analysis that seeks to address the points involved.

III.1 Appropriate Level of External Reserves

Country circumstances vary, and there is no precise level of reserves universally considered either sufficient or optimal. Advanced economies do not need to keep large holdings of precautionary reserves, given their highly liquid, floating currencies and stable financial market access in domestic currency.

However, in developing and emerging market economies, where currencies are less liquid and market access more difficult, there is need to keep large reserve holdings to reduce both the risk and impact of current account shocks or capital account crises.

There are a few reserve adequacy benchmarks depending on which issues are being considered, that is, there are benchmarks for **vulnerabilities** and for **confidence** in the value of local currency.

The vulnerability indicators include:

- **Reserves to Import** (import cover)
  Reserves that can cover 4 to 6 months normal imports is perhaps the most frequently cited benchmark. The benchmark is useful for low income countries without significant access to capital markets and are vulnerable to current account shocks, such as a fall in the price of a country's main export or a drop in tourism receipts due to natural disaster.

- **Reserves to short-term external debt**
  Greenspan (1999) and Guidotti (1999) developed a measure of reserve adequacy for developing countries: that such countries should hold reserves **equal** to all external debt falling due within the next year the so-called **Greenspan Guidotti rule**. That is, a ratio of reserves (R) to all short-term external debt (TSTED) must equal unity: R/TSTED = 1 must be maintained. A great many academic pundits would prefer this benchmark to the reserves to imports ratio which is the widely used measure of vulnerability to capital account crises. However, it is perhaps necessary to support the reserves import cover measure with the R/TSTED measure in view of volatility of capital flows that is, both reserves/import and R/tsted ratios should be considered and used jointly to guage a country's reserves adequacy.

- **Reserves to M_2**: Countries facing a risk of capital flight may adopt money-based measures, as reserve balances held against a measure of total monetary liabilities or total liquidity can increase confidence in the value of local currency. Thus it has been suggested that reserves equivalent to 5 20% of M2 is adequate as capital flight is difficult to measure.

III.2 Reserves in Macroeconomic Policy Nexus
Integration with Nexus of Economic Policies

The links between international reserves with the chain of economic policies may be seen in its theoretical relationships with monetary policy (monetary survey), external sector policies (Balance of Payment, exchange rate), fiscal policy (government budget deficit) and the real sector policies (savings and investment flows).

Link with monetary policy (monetary survey) and balance of payments

External reserves are indicated in the monetary survey-the consolidated balance sheet for the entire banking system-as Net Foreign Assets (NFA). Assuming that the monetary authorities have effective control of the net foreign position of the deposit money banks, an increase in external reserves (ΔRES) has the same coverage as ΔNFA of the banking system

$$\Delta RES = -\Delta NFA \quad .....(1)$$ (An increase in reserves has a negative sign).

The identity between assets and liabilities of the banking system (monetary survey) implies that the stock of money (M_2) is identical to the sum of its counterparts, namely net foreign assets (NFA) valued in domestic currency and net domestic assets:

$$M_2 = NFA + NDA \quad .....(2)$$

Since NDA consists of Net Domestic credit (NDC) and Other Assets Net (OAN), equation 2 can be re-written as:

$M_2 = NFA + NDC + OAN$ .....(3)

Since NDC + OAN = NDA, equation (3) can be re-written in changes as:

$\Delta NFA - \Delta M_2\ \Delta NDA$ .....(4)

Since ΔRES = ΔNFA, equation 4 can be re-written as

$\Delta RES = \Delta NFA = \Delta M_2\ \Delta NDA$ .....(5)

Links to Balance of Payments

The overall balance of payments position gives the change in external reserves as indicated below:

$\Delta RES = CAB + \Delta FI$ .....(6)

where

CAB = external current account balance

ΔFI = net capital inflow

ΔRES = change in net external reserves

But S I = x M[1)] .....(7)

Substituting S I for CAB in Equation 6 gives

$\Delta RES = S\ I + \Delta FI$ .....(8)

Links with Real Sector Policies

Equation 8 links reserves with the product account (Real Sector Policies) and overall balance of payments positions. In sum external reserves is linked with the National Income and Product Account through changes in National Income (ΔGDP) = savings Investments (S I), the Balance of Payments (BoP) through current A/C Capital A/C = Change in NFA, the Government Budget (GFS) through Revenue Expenditure =Change in Credit to Government Cg (net) and finally the Monetary Survey through NFA + NDA = M_2. All the economic polices are interrelated through

their respective relevant indicator variables. (See equations 9 11 below):

$\Delta R = \Delta NFA = \Delta M_2 - \Delta Cp - \Delta Cg - \Delta OA$ (net) ..... (9)

or S I + ΔFl = ΔM_2 Cp Cg OA (net) ..... (10)

or ΔM = S I + ΔFl + ΔNDA = (Sp Ip) + (Sg Ig) + ΔFl + ΔNDA ..... (11)

(Where S I + ΔFl = ΔR).

Of particular importance is the role of external reserves in monetary policy formulation. The monetary survey identity, (Equation 5), indicates that any excess of domestic credit expansion over the increase in money stock (which, in equilibrium, is equal to the demand for money) is reflected in a decline in the external reserves (or net foreign assets (that is, ΔNFA is negative). This relation constitutes the basis of the monetary approach to the balance of payments and provides the theoretical justification of setting ceilings on net domestic assets (NDA) in IMF supported programmes.

1V. COUNTRY EXPERIENCE

1V.I CANADA

Objectives and Scope

The objectives of reserves management are to:

- provide general foreign currency liquidity for the government;
- provide funds to help promote orderly conditions in the Canadian dollar in the foreign exchange market.

With the increase in the level of external reserves in recent years the reserves managers have had to focus on asset-liability, and risk management and on reducing the cost-of-carry of these reserves while maintaining a high degree of **liquidity** and Capital **safety**.

In order, to meet these objectives, the liquid reserves are sub-divided into that proportion held in highly liquid US. Dollar-denominated assets to fund immediate foreign currency liquidity requirements and intervention activity; the remainder is held in a diversified portfolio of high-quality assets, denominated in US dollars, euros and yen.

Reserve management activities in Canada, consist of the management of foreign currency assets and liabilities, which includes **the use of derivative financial instruments** Reserve management follows a well coordinated Asset Liability Management (ALM) framework.

Institutional Framework

Legal Foundation

Canada's reserve assets are governed by the Currency Act which serves as legal framework for the Exchange Fund Account (EFA) asset management and investment operations. **The Minister of Finance approves policies for managing the EFA,** mainly through a set of investment guidelines.

Internal governance

The management of EFA is jointly shared by the department of Finance and the Bank of Canada while the management policies are set by the Minister of Finance. The Bank of Canada, acting as a fiscal agent, administers and effects transactions for the Account on behalf of the Minister of Finance.

The Director of the Financial Markets Division at the Department of Finance and the Chief of the Financial Markets Department at the Bank of Canada are responsible for the ongoing management of the EFA. A **Policy Committee** composed of Senior officials from the Department of Finance and the Bank of Canada meets semi annually to review developments and major policy initiatives, and provide guidance and accountability on the management of the Account. The **Risk Management Committee** (RMC), which consists of managers from the Department of Finance and the Bank of Canada meets quarterly to advise on the management of risk related to the government's debt programme, including foreign exchange reserves.

The responsibilities for the day-to-day portfolio management and **strategy implementation** of the EFA rest with the staff of the **Foreign Reserves Management Team** at the Bank. The Risk Management Unit (RMU) at the Bank oversees and manages the risk associated with EFA.

Investment Instruments. The EFA's eligible currencies are the US dollar, euros and yen. The EFA portfolio must be composed of a minimum of 50 percent US dollars with the rest allocated in euros, and Japanese Yen. This currency composition reflects the important role of the US dollar as a reserve currency, and the fact that intervention in support of the Canadian dollar has been historically undertaken through the US dollar.

The currency Act allows the EFA to transact in:

- foreign exchange on a spot and forward basis;
- to invest in deposits of supranational organisations and financial institutions;
- securities issued by sovereigns and their agencies;
- lend any of the eligible instruments and enter into derivative transactions based on any of the eligible instruments;
- **extensive use of collateral** in reserve management operations to protect against current and potential credit exposure.

Indeed, government has put in place a collateral management framework for the government's derivative counterparties. **An external firm is being used to manage securities posted as collateral to the government.**

VI.2 BRAZIL

Reserve Management Objectives

Brazil has a floating currency regime and interventions are infrequent with no sizable changes in reserve holdings.

The main objectives in holding external reserves are to:

- support monetary policy;
- control excessive volatility of the foreign exchange market; and
- guarantee payment of foreign exchange debts.

Based on these objectives reserves are managed to ensure safety, liquidity and profitability.

1. **Institutional framework and Decision-making Structure**

   Banco Central do Brasil (BCB) is the role authority empowered by the Constitution to manage Brazilian foreign exchange reserves. BCB Board of Governors is responsible for the reserves strategic allocation and defining the investment policies. Therefore the Board has established a detailed benchmark and guidelines and opted for an **active management** of the reserves.

   The Vice Governor responsible for the monetary policy Dipom is responsible for the active management, as decided by the Board. The International Reserves Operations Department Depin executes the necessary transactions to follow up the benchmark and Dipom's active strategies.

Depin is also responsible for suggesting modifications in the benchmark to reflect changes in long-term market conditions and/or other factors. An **Investment Policy Committee** (IPC) for active management meets monthly to analyze the market scenarios and to propose active strategies.

The following officers participate at the meetings as voting members:

- Vice Governor responsible for Monetary Policy (retains veto power);
- Head of International Reserves Department;
- Deputy Head of International Reserves Department;
- Head of International Reserves Investment Division;
- Interest Rate Portfolio Managers (1 joint vote)
- Foreign Exchange Portfolio Manager
- Interest Rate Strategies (1 joint vote); and
- Foreign Exchange Strategies

1.1 Implementation of Strategies

Active management positions may be taken at strategic and tactical levels. Strategic positions have an investment horizon of 1 to 3 months and are subject to discussion and decision at the Investment Policy Committee.

The International Reserves Operations Dept (Depin) is organized in three distinct areas: Front office (trade desk), middle office (compliance, risk management, performance evaluations pricing and IT) and back office (accounting and settlement) In the middle office, a compliance area checks all guidelines defined by the Board on a daily basis and is responsible for standardizing procedure manuals.

The BCB Board of Governors defined that investment strategy should match reserves with sovereign external liabilities in terms of currency exposure. In this way, BCB has an integrated Asset/Liability Management (ALM) in terms of foreign exposure. This strategy helps to prevent short-term loss of reserves caused by a mismatch of currencies between reserves and short-term obligations.

1.1.1 Risk Management

Banco Central de Brasil investment policy for foreign exchange reserves is based on three pillars the reference portfolio, investment guidelines and

performance measurement. The **first pillar** reference portfolio or the benchmark reflects the Board of Governors' risk/return preferences for the international reserves. The **second pillar** is the list of guidelines that define operational limits, allowed investment instruments, risk assessment methodologies and deviation limits for the active management.
The **third pillar** is a quarterly performance measurement report for the Board, which states the results of passive (reference portfolio) and active management.

1.1.2 Investment Guidelines

Investment guidelines have been established for each aspect of risk management. To control market risk, a daily value at risk (VAR) limit is in place for derivatives from the benchmark.

In terms of liquidity and credit risk, there are different approaches to money markets and fixed income portfolios.

For the money market, the following investment guidelines are in place:

- maximum expected and unexpected default probabilities for the actual portfolio derivation from the benchmark;

- minimum rating limits of "A" and "P 1" for each counterpart according to Moody's;

- maximum allocation per counterpart calculated as a percentage of the counter part; total assets, limited to a certain maximum amount per counterpart; and

- three to six months' maximum maturity depending on the institution's rating.
  For the fixed income portfolio, the restrictions are:
- List of permissible countries for investment in terms of sovereign debt. All of them must have a minimum rating of "A" according to Moody's;

- Bonds issued by any country in a currency other than its own are submitted to additional restrictions in terms of rating; and

- Investment in "AAA" government-sponsored agencies and in supranational debt are restricted to a maximum percentage of the fixed income portfolio;

- Options investments are not allowed, but currency forwards and futures, interest rates and gold futures, interest rates and gold futures and swaps commercial papers issued by financial institution, CDs, CP, repos and reverse repos can be used.

VI.3 NIGERIA

Objectives

The objectives of managing Nigeria's external reserves include:

- financing some government's current expenditures including foreign debt service and contractual agreements, diplomatic and military expenditures, as well as funding of the Foreign Exchange Market which aims at financing private sector expenditure in respect of importation of capital and intermediate goods and services;

- funding the Capital account. This consists of investments to hedge governments foreign liabilities with the aim of providing income and capital streams from which future interest and capital payments of loans can be made; and

- building confidence in the international business community.

The rationale for **holding** external reserves by the Central Bank of Nigeria may be summarised as follows:

- to safeguard the value of the domestic currency. Foreign reserves are held as formal backing for and confidence in the domestic currency;

- to effect timely settlement of international payment obligations e.g trade obligations. Towards the end, the Central Bank of Nigeria actually provides the foreign exchange through auctions sessions at which authorised dealers buy foreign exchange on behalf of importers. However, in industrialised countries where the manufacturing sector produces for the export markets, the transaction need for holding reserves is less important;

- to accumulate wealth. Some Central banks use the external reserve portfolio as a store of value to accumulate excess wealth for future consumption purposes. Such central banks e.g Bank of Botswana could segregate the reserve portfolio into a liquidity tranche and a wealth tranche with the latter including longer-term securities such as bonds and equities and managed against a different set of benchmarks emphasizing return maximization;

- for intervention by the monetary Authority. Foreign reserves can be used to manage the exchange rate;

- to boost a country's credit worthiness. External reserves provide a cushion at a time when access to the international capital market is difficult or not possible.

A respectable level of international reserves improves a country's creditworthiness and reputation by enabling a regular servicing of the external debt thereby avoiding the payment of penalties and charges. Country risk models used by credit rating agencies depend on the level of reserves;

- to provide a fall back for the "Raining Day" and

- to provide a Buffer against external shocks.

Ownership Structure

Nigeria's external reserves comprise of three components, by ownership": Federation, federal government and Central Bank of Nigeria.

- **Federation**: consists of sterilized funds (unmonetized) **held in the excess crude** and **PPT/Royalty** accounts at the CBN belonging to the three tiers of government. This portion has not yet been monetized for sharing by the federating units. It is sometimes referred to as the reserves of the country;

- **Federal Government Component**:
  This consists of reserves belonging to some governments agencies such as the NNPC, for financing its Joint Venture expenses, PHCN and Ministry of Defence, for Letters of Credit opened on their behalf, etc;

- **Central Bank of Nigeria Portion**:
  The CBN portion consists of funds that have been monetized and shared. This arises as the Bank receives foreign exchange inflows from crude oil sales and other oil revenues on behalf of the government. Such proceeds are purchased by the Bank and the Naira equivalent credited to the Federation account and shared, each month, in accordance with the Constitution and the existing revenue sharing formula. The monetized foreign exchange thus belongs to the CBN. It is from this portion of the reserves that the Bank conducts its monetary policy and defends the value of the Naira.

Institutional and Decision-making Structure

Legal Framework

The Central Bank of Nigeria Act of 1958 as amended severally, the last being in 2009, empowers the Central Bank of Nigeria to manage Nigeria's external reserves. Specifically, the CBN is directed to "maintain external reserves to safeguard the international value of the legal tender currency"

In this regard, the power to manage the reserves is vested in the Governor of the Central Bank. However, the power is exercised by a broad Committee of Governors (CoG), comprising the Governor, four Deputy Governors and a Secretary. The Committee provides the guidelines for the management and seeks the approval of the Board of Directors of the Bank.

The Board itself consists of the CoG and six directors. The implementation of the operation of the management of the external reserves resides in the Department in charge of foreign operation, with the CoG overseeing the process.

Governance Framework

The reserves are managed in-house and through third-party managers. In this regard, there are three major frameworks of governance:

- Oversight Function / Committee
- Investment Policy Committee; and
- On-going Portfolio Management Team.

The Oversight Committee determines or approves the asset mix and composition based on Central Bank's guidelines. Members of the Committee are drawn from within the Bank. The Investment Committee is expected to select specific benchmarks by which to measure and monitor portfolio performance while the portfolio management Team actively manages the reserves by allocating the assets into specific investment instruments based on credit quality, maturity and risk tolerance.

Asset Allocation

The reserves management strategy of the Central Bank of Nigeria (CBN) is anchored on **liquidity** management, and **capital preservation**.

Hence the bank holds a larger proportion of its reserves in secure, liquid though low yield assets such as foreign government bonds and time deposits with reputable international financial institutions. The principal instrument of choice for investment is the United States debt securities. These include treasury bonds and bills and notes of varied maturity. The treasuries are backed by the US government and therefore command a high rating and remain relatively liquid. International convertible currencies also feature prominently in Nigeria's reserve portfolio as well as investments in high grade bonds issued by sovereign entities such as international financial institutions and supranationals such as IMF, World Bank, International Finance Corporation, (IFC), African Development Bank (ADB) European Banks. etc.

Risk Management

The CBN establishes benchmarks in its risk management of international reserves. The benchmarks establish a risk return measurement for actively managed portfolio. These provide a yardstick for measuring the success or failure of any specific asset class and also act as the instrument for efficient long-term risk management.

External Reserves management by external managers

The Central Bank of Nigeria has always engaged the services of external managers to manage the country's external reserves. A major external manager has been Morgan Guaranty Trust of New York. However, recently the stanace is that external managers would have to manage the reserves along with local banks. Thus, the local banks could no longer be by stranders but active participants in the management process (Tella, S. A, 2007).

The external managers and the local banks (internal managers) conduct the management of reserves through some criteria given them by the Bank. For example, any external manager of the reserves must have a local counterpart and must have minimum credit rating of AA by international financial indices. In this regard, the Central Bank expects the local banks to piggy-back on the professionalism of the external mangers; thus the local banks could be galvanized into indispensable global players in asset management, creating opportunities for Nigerians to be versed in the field.

In the first phase of selection of external reserves managers, 14 of them were appointed with their local partners. These include Black Rock and Union Bank of Nigeria PLC, J. P. Morgan and Chase Zenith Bank Plc, H. S. B. C. and First Bank of Nigeria. BNP Paribas and Intercontinental Bank Plc. BNP Paribas and International bank Plc etc.

Each selected external manager has assets under its management in excess of US$50 billion. There is no exact information as to how much of the external reserves that each manager would manage.

V. Commonalities and Differences in reserve management practices across countries.

1. Commonalities

Similarity of institutional management for formulation and implementation of reserves management strategies

2. Diversification

Countries reviewed have tended to foster diversification of external reserves along the yield curve and across asset classes. In this regard, general approach has been to split foreign reserves into a liquidity portfolio and an investment portfolio.

3. Wider investment spectrum

(1) Investment in new instruments, e.g heritage/funds has become an increasingly important feature of reserve management in several countries. The investment spectrum, which was mostly limited to time deposits and government bonds until quite recently now include:

(i) Other interest rate products such as interest rate derivatives and debt instruments bearing a spread over US Treasuries (eg BIS instruments corporate bonds and government linked issues.

(ii) Sometimes even equities However, only a minor part of reserves has historically been invested in corporate bound and equities.

Even so, the US dollar is still by far the most dominant reserve currency, for obvious reasons:

- the breadth, depth and liquidity of US fixed income markets (and US financial markets in general) compared with those of the euro area Japan and other areas;

- the fact that all the largest reserve accumulators can be expected, at least for the time being, to continue to use the US dollar as a vehicle for intervention, either primarily or exclusively; and

- the increasing use of derivative s by central bank portfolio managers, which allows for more flexibility than in the past (e.g. by investing in one currency while shouldering interest rate for risk in a different market for instance by using foreign exchange swaps;

4. **Rational for holding reserves**
   The reasons for holding external reserve assets are broadly the same: liquidity, safety and return maximization.

5. **Institutional Structure**
   All the countries have similar institutional structures for the formulation and implementation of external reserves management. Reserves Management is always backed across the countries reviewed is always backed by appropriate legislation and Constitution provisions, much in line with the IMF Guidelines (2001) for Foreign Exchange Reserves Management.

6. **Risk Management**
   All the countries implement risk management approaches and optimal asset allocation with varying degrees of sophistication. The developed and emerging economies in the sample have adopted value at risk (VAR) and asset-liability management (ALM) techniques in the design of their risk management strategies.

7. **Purpose of holding Reserves**
   The developing countries in the sample mostly Nigeria and Botswana analysed consider official reserves to be a cushion for paying for imports and ensuring the servicing of external debt in foreign currencies. In those countries the reserve currency composition is often linked to the composition of trade and financial flows.

Differences

While the approaches to reserve management are broadly in the same direction in the six countries analysed, **the major difference has been the**

8. **varying degrees of sophistication in the application of the techniques** to reserve management. Also there are differences in the inclusiveness of instruments into which external reserves are deployed. All this is a reflection of the differences in the stage of development of the countries spanning developed, emerging and developing.

9. Canada's extensive use of collateral in reserve management operations against credit exposure. An external firm does this for the Bank.

10. Department of Finance at the Ministry (Director of Financial Markets Division) and the Bank of Canada (Chief of Financial Markets Department) formulate reserves management strategies in Canada while Foreign Reserves Management Team at the Bank Implements the strategies.

VI Conclusion

This paper has reviewed the recent experiences of three countries that cut across the development divide-developed, emerging and developing-in the management of their international reserves. In particular it has discussed the objectives, institutional structure including the legal framework underpinning the formulation and implementation of reserve management strategies, diversification of reserves portfolio, the split of reserves portfolio into liquidity portfolio and investment portfolio and the various approaches to risk management of the portfolio.

The paper has noted the commonalities and differences in the approaches to reserves management. Areas of similarities have included diversification, investment profile, rationale for holding reserves, institutional structure and risk management.

The differences seem to lie in the varying degrees of sophistication across countries in the application of reserve management tools. There were also differences in the inclusiveness of the instruments in which reserves have been invested and in the countries investment guidelines.

Central banks have been and are still diversifying their reserves portfolio along the yield curve and across asset classes by taking on more interest rate and credit risk in search of higher yields, but they are doing this to different extents.

Parts of the reserve holding by central banks of some countries such as Singapore, Korea are sometimes transferred to separate private sector institutions or banks to manage on behalf of the central banks. This set up does seem to be in place in the countries analysed, except in Brazil. The Central Bank of Nigeria recently assigned US$500 million of its external reserves to some 14 external asset managers with their local partners.

Sound reserve management policies and practices can support sound macroeconomic management. Given the links between reserves and macroeconomic policies, weak or risky reserve management practices could easily translate into inappropriate economic policies. (Fiscal, monetary, exchange rate, financial and real sectors).

Finally, although institutional arrangement and general policy environment can differ, surveys of actual practices indicate that there is increasing convergence on what are considered sound reserve management practices. This paper holds that sound reserve management practices are reflected on issues that encompass the

following elements:

- Clear objectives for the management of reserves;
- a framework of transparency that ensures accountability and clarity of reserve management activities and results;
- sound institutional and governance structures;
- prudent management of risks; and
- the conduct of reserve management operations in efficient and sound markets.

APPENDIX 1

IMF GUIDELINES FOR FOREIGN EXCHANGE RESERVES MANAGEMENT: an overview

II. PURPOSE OF THE GUIDELINES

The guidelines presented in this paper are **intended to assist governments in strengthening their policy frameworks for reserve management so as to help increase their country's resilience to shocks that may originate from global financial markets or within the domestic financial system.** The aim is to help the authorities articulate appropriate objectives and principles for reserve management and build adequate institutional and operational foundations for good reserve management practices.

The **guidelines identify areas of board agreement** among practitioners on reserve management principles and practices that are applicable to a board range of countries at different stages of development and with various institutional structures for reserve management. In doing so, the guideline serve to disseminate sound practices more widely, while recognizing that there is no unique set of reserve management practice or institutional arrangements that is best for al countries or situations. In this respect, they should be regarded as nonmandatory and should not be viewed as a set of binding principles.

In their usage, the guidelines are intended primarily for voluntary application by members in strengthening their policies and practices. They could also play a useful role in the context of technical assistance and, as warranted, as a basis for informed discussion between the authorities and the fund on reserve management issues and practices.

Although institutional arrangements and general policy environments can differ, surveys of actual practices indicate that there is increasing convergence on what are considered sound reserve management practices that taken together constitute a board framework for reserve management. In the context of this paper, these practices are reflected in guidelines that encompass: (i) clear objectives for the management of reserve; (ii) a framework of transparency that ensures accountability and clarity of reserve management activities and result; (iii) sound institutional and governance structures (iv) prudent management of risk; (v) the conduct of reserve management operations in efficient and sound markets.

III. THE GUIDELINES

1. Reserve Management objectives, scope, and Coordination

1.1 Objectives

Reserve management should seek to ensure that: (i) adequate foreign exchange reserves are available for meeting a defined range of objective; (ii) liquidity, market, and credit risks are controlled in a prudent manner; and (iii) subject to liquidity and other risk constraints, reasonable earnings are generated over the medium to long term on the funds invested.

1.2 Scope

Reserves consist of official public sector foreign assets that are readily available to and controlled by the monetary authorities.

Reserve management activities may also encompass the management of liabilities, other short foreign exchange positions, and the use of derivative financial instruments.

1.3 Reserve Management Strategy And Coordination

Reserve management strategies should be consistent with and supportive of a country's or union's specific policy environment, in particular its monetary and exchange arrangements.

Evaluation of alternative reserve management strategies and their respective implications for reserve adequacy are likely to be facilitated by a cost/benefit analysis of holding reserves.

Reserve management strategies may also need to take into account strategies for the management of external debt for purposes of reducing external vulnerability.

2. Transparency And Accountability

2.1 Clarity of roles, responsibilities, and objectives of financial agencies responsible for reserve management.

The allocation of reserve management responsibilities, including agency arrangements, between the government, the reserve management entity, and other agencies should be publicly disclosed and explained.

The board objectives of reserve management should be clearly defined, publicly disclosed,and the key elements of the adopted policy explained.

2.2 Open Process For Reserve Management Market Operations

The general principles governing the reserve management entity's relationships with counterparties should be publicly disclosed.

2.3 Public Availability Of Information On Foreign Exchange Reserves

Information on official foreign exchange reserves should be publicly disclosed on a preannounced schedule.

2.4 Accountability And Assurances Of Integrity By Agencies Responsible For Reserve Management

The conduct of reserve management activities should be included in the annual audit of the reserve management entity's financial statements. Independent external auditors should conduct the audit and their opinion on the financial statements be publicly disclosed.

General principles for internal governance used to ensure the integrity of the reserve management entity's operations should be publicly disclosed.

3. Institutional Frmework

3.1 Legal Foundation

Sound institutional and governance arrangements should be established through a legislative framework that clearly establishes the reserve management entity's responsibilities and authority.

3.2 Internal Governance

The internal governance structure of the reserve management entity should be guided by and reflect the principles of clear allocation and separation of responsibilities.

Sound Management of internal operations and risks requires appropriately qualified and well-trained staff, following sound business practices.

Effective monitoring of internal operations and related risks should supported by reliable information and reporting systems, and an independent audit function.

Staff involved in reserve management should be subject to a code of conduct and conflicts of interest guidelines regarding the management of their personal affairs.

Effective recovery procedures should be in place to mitigate the risk that reserve management activities might be severely disrupted by the failure of operating systems, or other catastrophic events.

4. Risk Management Framework

There should be a framework that identifies and assesses the risks of reserve management operations and that allows the management of risks within acceptable parameters and levels.

The risk management framework should apply the same principles and measures to externally managed funds as it does to those managed internally.

Risk exposures should be monitored continuously to determine whether exposures have been extended beyond acceptable limits.

Reserve managers should be aware of and be able to account for potential financial losses and other foreign currency operations.

To assess the risk and vulnerability of the reserve portfolio, the reserve management entity should regularly conduct stress tests to ascertain the potential effects of macroeconomic and financial variables or shocks.

5. The Role of Efficient Markets

Reserve management, and any related policy operations, should be conducted in markets that have sufficient depth and liquidity, and can process transactions in a sound and efficient manner.

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RELATIVE EFFECTS OF PUBLIC AND PRIVATE INVESTMENT ON ECONOMIC GROWTH IN NIGERIA

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ABSTRACT

This paper assesses the relative effects and effectiveness of public and private investment expenditure on short and long-run economic growth in Nigeria over 1970-2007. Findings of the dynamic error correction and the vector error correction models are threefold. First, public investment has a positive and relatively stronger effect on growth in the short run. Second, the impact of private investment increases from short to long term; in the long run private investment clearly exerts stronger influence on growth performance. Nevertheless, private investment positively affects economic growth in Nigeria only in the long run while the positive impact of public investment is observed in the short as well as long term. Finally, the contribution of human capital investment is overwhelmingly higher than that of physical capital, both private and public. Thus, the results indicate that massive direct public investment in critical economic infrastructure like power and transportation and human capital development (especially on education and health) is crucial for more impressive growth record in Nigeria.

1.0 Introduction

Many African economies seem to have moved to a path of faster and steadier economic growth until recently. Their performance in 19952005 reversed the collapse in 197585 and the stagnation in 198595. And for the first time in three decades, the economies in Africa grew in tandem with the rest of the world. Average growth in the sub-Saharan economies was 5.4 percent in 2005 and 2006, and the consensus from the projections before the global economic crisis was that growth would be strong. Leading the way were the oil and mineral exporters, thanks to high prices. But 18 non-mineral economies, accounting for 36 percent of Sub-Saharan Africa's people, have also experienced strong growth (World Bank, 2007).

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In particular, the Nigerian economy has witnessed remarkable improvement in its growth record. Real GDP increased steadily from N54.1 billion in 1970 to N143.9 billion in 1981 and N174.5 billion in 2007. However, significant reduction was recorded in real GDP in the 1980-84 period when real output declined by about N16 billion. This reflected the relatively low production level occasioned by the glut in the world oil market in the early 1980s. During the period, capacity utilization declined steeply from 71.5 percent in 1979 to 43.0 percent in 1984, reflecting shortage of foreign exchange needed for imported inputs for industrial production.

On average, the Nigerian economy grew at the rate of 7.5 percent between 1970 and 1979. This performance compared favourably with the 4.6 percent average annual growth rate recorded for all low-income countries, 5.5 percent for all middle-income countries, and 3.2 percent for the industrialized countries over the same period (World Bank, 1981). The economy recorded higher GDP growth in 1970-74. In part, this was because achievement of the highest possible growth rate was accorded top priority in the second post-independence national development plan (1970-74). The Plan envisaged an annual average real GDP growth rate of 6.6 percent. The target was exceeded as the average real output grew by 13.9 percent during the plan period.

That significant achievement largely reflected the effects of the unprecedented increase in crude oil export during the period. However, the average real GDP growth recorded in 1970-74 contrasted sharply with the 2.3 percent recorded in the second half of the decade. As indicated in Table 1, real output declined between 1975 and 1984. This could not compare favourably with the projected annual average real GDP growth rates of 9.5 percent and 4.0 percent in the Third National Development Plan (1975-80), and the Fourth Plan (1981-85), respectively. The performance of real output during the Fourth Development Plan was the worst. Between 1981 and 1984, the real GDP consistently fell, averaging 3.4 percent annually. The growth targets in the third and fourth development plans were not realized due largely to financial constraints.

Table 1
Nigeria: Dynamics of Real Gross Domestic Product

Year	Real GDP (N billion)+	GDP Annual Growth (%)
1970-1974	7.0	13.9
1975-1979	29.4	2.3
1980-1984	161.1	-6.4
1985-1989	213.7	5.9
1990-1994	270.9	4.0
1995-1999	300.0	2.4
2000-2003	399.2	5.9
2004-2007	579.9	6.3
2008-2010	721.5	7.0

Sources: Central Bank of Nigeria, Statistical Bulletin, 2009.
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Given the distortions in the Nigerian economy in the mid-1980s, it became obvious that the economy needed some structural adjustments to address the fundamental problems of the economy. Therefore, the authorities introduced the structural adjustment programme (SAP) in 1986 to ensure a more sustainable growth and development. Also, it was thought that the five-year planning model had become unrealistic as the country depends on revenue from crude oil, whose price and output are determined internationally. The volatile nature of the world crude oil market made it increasingly difficult to project resources over a long period. With SAP, the government adopted the Three-year Rolling Plan in the management of the economy in late 1988. Evidence suggests that these efforts had significantly positive impact on aggregate output afterwards. In real terms, GDP grew by nearly 9 percent in 1988-89. The economy continuously witnessed real GDP growth since the implementation of SAP. However, growth trended downward from 5.9 percent in 1985-89, through 4.0 percent in 1990-94, to 2.4 percent in 1995-99. More impressive performance was recorded in subsequent periods: 2000-2003 (5.9 percent), 2004-2007 (6.3 percent) and 2008-2010 (7.0 percent), following the introduction of macroeconomic reforms dictated by government responses to the global financial crisis of 2007 2008.

While most studies have analyzed the impact of capital and labour on economic growth, this paper decomposes capital into its private and public components. Hence, the general objective of this study is to analyze the relationship between public and private investment and growth with a view to drawing policy lessons from the findings. Specifically, the study seeks to:

i) determine the differential effects of public and private investment on economic growth in Nigeria; and

Ii) examine the relative effectiveness of private and public investment in the short and long run.

The impact of public and private investment on economic growth, is a long-standing issue in macroeconomics, and has attracted renewed attention in recent years. Despite the theoretical recognition of the impact of both public and private investment on growth, empirical analysis for African countries has been few and far between. Some contributions over the years have included IMF (2008), Aka (2008), World Bank (2005), Casero and Varoudakis (2004), Khan and Reinhart (1990), Khan and Kumar (1997) and Odedokun (1997). Clearly, academia and policy makers in Nigeria can benefit from stylized facts about how public and private investment can impact growth and help reduce poverty.

The worldwide shift towards a growth strategy underscoring market forces and private sector leadership led in many countries to a curtailment of the public sector from production and to a redefinition of its role in the development process. The guiding principle is that the public sector should concentrate its resources in areas where it supports, rather than replacing, the activity of the private sector. In effect, an assessment of the impact of public investment on economic performance is crucial in the design and implementation of effective fiscal policies for pro-poor growth. If public investment stimulates long run economic growth, any fiscal adjustment that is biased against this kind of spending would likely impact negatively on economic growth and, therefore, on the people's standards of living in Nigeria. Such an assessment would particularly be useful in guiding the Nigerian government on how to channel the additional fiscal space created by debt relief and excess crude oil revenues.

The rest of the paper is organized into six parts. Section II which follows, outlines the trend in capital formation and private and public investment in Nigeria between 1970 and 2007. A brief review of the literature is presented in section III, while section IV contains the analytical model and methodological framework. The results are presented and discussed in the fifth section while the final section summarizes and concludes the study.

2.0 Background

Among the determinants of growth, the ratio of fixed investment to GDP has been found to have the greatest explanatory power (Levine and Renelt, 1992). At the end of 1960, gross capital formation (GCF) in Nigeria stood at 258.2 million Naira of which the private sector accounted for N135.2 million or about 52.0% of total GCF. By 1963, out of the total GCF of 354 million Naira, the private sector accounted for about 227.2 million Naira or 64.0 percent of total. Within this time frame, the role of the

public sector in economic activity was minimal, reflecting the concentration of the colonial government on governance and security. However, the positive oil shocks of 1973/74 and 1979 generated massive savings and created investment booms. Investment expenditure, measured in current prices increased at an annual average rate of 53.0 percent between 1970 and 1975 period but the highest rate of growth was attained between 1974 and 1975 when capital formation reached a peak growth rate of 74.1 percent within a single year.

In effect, the oil windfalls of the 1970s changed the sectoral composition of the gross fixed capital formation (GFCF) in favour of government. The government increased participation in the economy based on the belief that industrialization is the engine of economic growth, and key to transforming the traditional economy. The view was made possible because government was the major beneficiary of the windfall. Various five-year development plans were put in place and they emphasized investment in large (state run) projects.

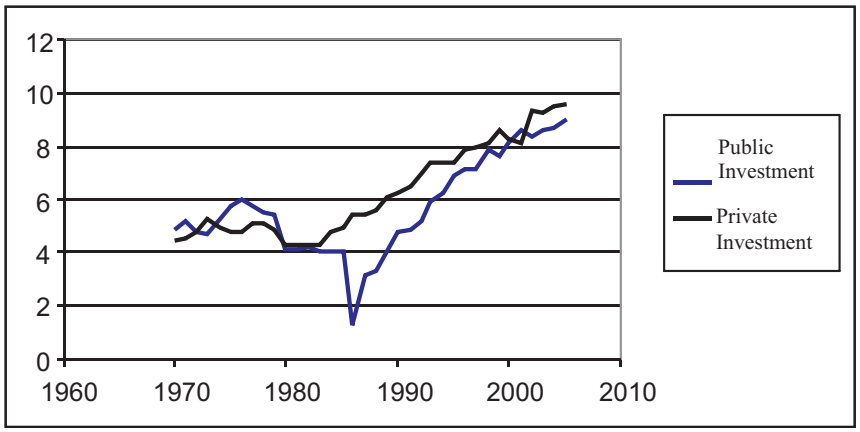
From 1974, the public sector controlled a high proportion of GFCF. As a share of the GDP, the private sector contributed less than an average of 3.0 percent in the 1980s, as against an annual average of 8.8 percent in the period 1973 through1980. With the collapse of oil prices in 1980 and 1986, the government adopted a far reaching economic reform programme. Given the high share of public capital formation in total GFCF, the reforms were designed to emphasize downsizing the public sector and improving the efficiency of public asset management. Consequently, Nigeria witnessed significant reduction in public capital formation during this period.

The relationship between public investment, private investment and growth was generally a key issue in the growth process of African countries at that time. As expected, these two components of total investment can have diverse impacts on economic growth. In view of the poor performance of state-based growth process, African countries were urged by international institutional partners in development to change their development strategies by relying on private investment as the driving force of economic growth.

In Figure 1 is shown the performance of public and private investment per capita over the period 1970-2007 in Nigeria. In the 1970s, the growth in public and private investment was quite dramatic. In the 1980s, both private and public investment declined to their lowest levels. Public investment, which for the larger part of the 1970s was greater than private investment, lost its dominance. Since the 19990s, public investment continually grew at lower rates than private investment and private investment growth recovered faster than public investment. Clearly, the decline in public investment was in part the natural outcome of such reform efforts

like privatization and other policy reforms in Nigeria which sought to improve the environment for private investment, giving the private sector a more central role in economic activity.

Figure 1: Public and Private Investment per Capita in Nigeria, 1970-2007 (Log level)



The problem is that capital accumulation overtime has been based on income from oil exports managed by government, which has concentrated financial resources in its charge, thus modelling the path of economic growth. Two questions are therefore germane: what is the relative effect of public and private investment on growth in Nigeria? How effective are the two types of investments in the short and long run?

3.0 Review of Literature

Economic growth has received much attention in the economic literature overtime. Classical economics considers labour and capital as the main determinants of economic growth. Similarly, the neoclassical exogenous growth model [Solow (1956), Swan (1956)], suggests that government policy does not have any long-run effect on economic growth. However, the emergence of the endogenous growth theory has encouraged pundits to question the role of other factors in explaining the economic growth phenomenon. In particular, public and private investment spending is considered as important variables which may determine changes in national income in developed as well as developing countries (see Barro, 1990; Barro and Sala-i-Martin, 1995; Aschauer and Lächler 1998). In endogenous growth models some fiscal policy instruments are inhibitive of growth while others are not [Barro (1990), Lucas (1990)].

Investment is the flow of spending that adds to the physical (and non-physical) stock of capital. Hence, human capital investment can be described as a form of non-physical investment. Traditionally, the focus was on private sector addition to stock of capital or private investment. This treatment neglected public capital investment, which recent works have shown contributes to economic productivity and should therefore be included in aggregate investment. Kneller et al. (1999) for instance finds that productive government expenditure enhances growth, while non-productive government expenditure does not. Investment is very important for certain reasons. First, investment links the present to the future. Second, investment spending is very volatile and thus responsible for much of the fluctuation of GDP across the business cycle. More importantly, investment over long periods determines the size of the stock of capital and thus helps determine long-run growth. (Dornbusch and Startz, 2004).

There is a significant support that investment ratio is an important determinant of the long run growth rate in the cross country works of De Long and Summers (1991), Levine and Renelt (1992) and Sala-i-Martin (1997). More recently Greiner, Semmler and Gong (2005) find, with country specific data, that investment is an important determinant of the long run growth rate in the early stages of development of a country. However, in all these studies there is no distinction between the long and short to medium term growth effects of the rate of investment. Cross country methods are a pragmatic option when country specific data on growth enhancing variables are not available for longer periods and if such data were available the variance of the variables is too small.

Therefore, cross country studies are useful for identifying the more important (fundamental) determinants of growth. Durlauf, Kourtellos, and Tan (2005) summarise the findings by several cross country studies as follows. The fundamental determinants of growth are (1) economic institutions (2) legal and political systems (3) climate (4) geographical isolation (5) ethnic fractionalization and (6) culture. However, it is hard to imagine that any one of these variables will interest policy makers and politicians of the developing countries. The latter want quick improvement in per capita income and its growth rate. Among these fundamental factors (3) to (5) are virtually impossible to change through short and medium term policies.

Country specific time series studies have investigated the growth effects of variables such as the investment ratio, trade openness, education, budget deficits, public investment in the infrastructure, aid per capita and progress of the financial sector etc. Time series data on these variables are generally available for many developing countries for longer periods. These variables can be quickly influenced by the policy makers compared to reforming institutions. Durlauf, Kourtellos, and Tan (2008) also find support for the growth effects of short to medium term

macroeconomic policies using cross country approach and evaluation techniques. In the empirical growth literature Sachs and Warner (1997) claim that openness is such an unimportant determinant of investment that the impact coefficient on investment will be insignificant in growth regressions, which already account for openness. Hoeffler (2001) re-examined this result using the model specification and estimation method of the authors. Hoeffler (2001) suggests that their ordinary least squares estimation suffers from both endogeneity and omitted variable bias. Using panel data analysis, Hoeffler (2001) show that ignoring unobserved country-specific effects and endogeneity problems make investment to be insignificant. Estimating the model with the Blundell and Bond system general method of moments estimator, which allows addressing the omitted variable as well as the endogeneity bias, the paper found that investment is significant in the SachsWarner (1997) model despite controlling for openness. Thus, Hoeffler (2001) confirm that openness has a significant, positive effect on income but not so important that it drives investment out of the model.

In contrast to these works Rao and Cooray (2008) examine the dynamics of the growth effects of the investment ratio. The authors investigated the view of Pritchett (2006) that there is a wide gap between growth literature and the policy needs of the developing countries. Growth literature has focused on the long term growth outcomes but policy makers of the developing countries need rapid improvements in the growth rate in the short to medium terms. With data on Singapore, Malaysia and Thailand the authors find that the short to medium term growth effects of investment rate are much higher than its long run effects. Dynamic simulations for Singapore showed that these short run growth effects are significantly higher than the steady state growth rate for up to 10 years.

The question now is which one of the investments, private or public, has greater impact on the economic growth of a nation or of Nigeria in particular. It is pertinent to mention here that there is no consensus on which type of investment promotes economic growth more than the other. The available literature presents conflicting opinions and results. While the theoretical literature is reasonably clear about the relationship between private investment and economic growth, empirical literature is still ambiguous about the direction and the strength of the relationship.
Studies in this area using Nigerian data include Ekpo (1999) and Sola (2008). Ekpo (1999) presents empirical evidence to support the view that public expenditure crowds out private investment and therefore is detrimental to economic growth between 1960 and 1992. In addition, the author find that in terms of economic growth, private investment was more efficient than public investment. These findings by Ekpo (1999) lent credence to the claim by Diamond (1989) that any increase in government expenditure, by increasing the share of productive

resources used by government, would slow economic growth in the economy as a whole and may impede the accumulation of human and physical capital and the pace of innovation in the private sector. Sola (2008) considers the direction and strength of the relationship between public investment and economic growth in Nigeria, using time series data from 1975 to 2004. Using the Vector Autoregressive (VAR) framework, the author finds that public expenditure impacted positively on economic growth and that there was no link between gross fixed capital formation and GDP. However, both Ekpo (1999) and Sola (2008) did not separate the influence of public and private investment on economic growth into short and long run.

Underlying this controversy in the public-private cum growth literature is the method used in the analysis. Basically, three approaches are identified: production function approach, the exogenous Solow model and the canonical endogenous growth model. The production function approach has come under heavy criticism over its violation of the standard marginal productivity theory by treating public investment like private investment and labour. As a result of this shortcoming, Ashipala and Haimbodi (2003) used endogenous growth models approach. The canonical endogenous growth models use different factors to explain the observed persistent growth in per capita incomes in the advanced countries. In Barro (1990) variant of the endogenous model, government expenditure on infrastucture causes growth. However, Mankiw, Romer and Weil (1992) have argued that the Solow model can explain the observed facts better than the endogenous models. Jones (1995) argues that observed time series facts do not support the conclusions of the endogenous models, especially in the short to medium term. Solow (2000: 153) himself observes that

> "the second wave of runaway interest in growth theory the endogenous growth literature sparked by Romer and Lucas in the 1980s, following the neoclassical wave of the 1950s and 1960s appears to be dwindling to a modest flow of normal science. This is not a bad thing".

The main purpose of endogenous growth models is to show theoretically how in a model with optimizing agents endogenous factors can cause sustainable growth of per capita income in the long run. On the other, the Solow model can be used to analyze both the short and long run effects of changes in the investment rate on the level of income and its medium term use of the dynamics of growth rate during the transition period; a fact which Rao and Cooray (2008) acknowledged has made it more relevant for policy in developing countries. Kandenge (2007) investigates the

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Aschauer (1989), Shah 1992, Rioja (1998), Nourzad (2000), Devarajan et al (1996), Miller and Russek (1997), Kneller et al (1999) and Ashipala and Haimbodi (2003).

impact of domestic public and private investment on economic growth in Nambia using the new Neo-classical Solow model. The study finds that there exists a short run and long run relationship between public and private investment and economic growth in Namibia. Specifically, public and private investment impact positively economic growth in the short run and long run process. In addition, it confirms that private investment is more effective in the long run than public investment. Thus, the policy recommendation is to encourage private investment in the short run through public investment. The present study aims at better understanding of the effects of public and private investment on short and long run economic growth in Nigeria using both the error correction and vector autoregressive model.

Empirical studies are not yet clear on the effect of public and private investment on economic growth. There is no consistent evidence for a significant relationship between public investment and economic growth, either negative or positive. Results tend to differ based on the category of public investment, the country or region under study and the method of investigation. Therefore, from a country perspective, it is important for policy makers to know the relationship, so as to make precise and well-informed decisions. The importance of this in this era of widespread privatization of public concerns cannot be overemphasized.

4.0 Analytical Model and Methodological Framework

4.1 Model Specification

Assuming an augmented production function of the Cobb-Douglas variant given by:

$$Y_t = A_t KP_t^{\alpha} Kg_t^{\beta} (H_t L_t)^{1-\alpha-\beta} \quad (1)$$

where A is the index of technological progress
Y is real domestic product (or income)
KP is private investment
KG is public investment
L is labour employment
H is a measure of human capital

Expressing equation (1) in skill adjusted per worker terms it becomes:

$$y_t = A_t (kp)^{\alpha} (kg)^{\beta} \quad (2)$$

where y = Y/HL ; kp = KP/HL and kg = KG/HL.

Taking the log of equation (2) gives the following linear equation:

$$\ln y_t = \ln A_t + \alpha \ln kp_t + \beta \ln kg_t \quad (3)$$

This is the estimable long run equation.

4.2 Data Issues

Public investment (KG) is measured by public investment per capita, while private investment (KP) is private investment per capita. Economic performance (Y) is measured by real GDP per capita. To estimate the model, yearly data for Nigeria covering the period 19702007 was used. Economic growth data for the period 1970-2006 was obtained from the *Statistical Bulletin, Volume 17, 2006* of the Central Bank of Nigeria while the 2007 data was sourced from the *2007 Annual Report and Statement of Accounts*. Data on public investment expenditure and private investment spending for the period 1980 to 2007 was obtained from the African Development Bank database while the data for the period 1970-79 was interpolated from the yearly issues of the World Bank's *Discussion Papers*.

4.3 Estimation Procedure

Prior to estimation, the time series properties of the variables were determined using the Augmented Dickey Fuller method. Also, Cointegration tests were performed using the Johansen system estimation technique. This was done to determine whether long run relationship exists between the variables in the model. Finally, estimation results were obtained via two approaches namely, the dynamic error correction and vector error correction models. The estimation was first performed using an unrestricted general to specific Hendry-type error correction model (ECM) where the long run relationship is embedded within the dynamic specification, including lagged dependent and independent variables as follows:

$$\Delta \ln y_t = c_1 \Delta \ln kp_t + c_2 \Delta \ln kg_t + \psi (\ln y_{t-1} - \ln A - b_1 \ln kp_{t-1} - b_2 \ln kg_{t-1}) + e_t \quad (4)$$

Ψ is the speed of adjustment. The model is estimated using Non-linear least squares technique.

5.0 Empirical Results and Discussion

5.1 Unit Root Test Results

Table 1 presents the time series property of the variables. All the variables are integrated of order one. The ADF test indicates that the variables are stationary after differencing once.

Table 1 ADF unit root test for Stationarity

Variable	ADF statistics		MacKinnon Critical Value (5%)		Remarks	lag
	level	*1st difference*	*level*	*1st difference*		
Lny	-0.6908	-4.1125	-3.5468	-3.5514	I(1)	1
Lnkp	-1.5464	-5.0981	-3.5468	-3.5514	I(1)	1
Lnkg	1.8305	-4.9214	-3.5468	-3.5514	I(1)	1

5.2 Cointegration Test Results

The results of the Johansen Cointegration test are contained in Table 2. Test results indicate the existence of one cointegrating equation at 5 percent significance level. Table 2 shows that the likelihood ratio of 12.06 is less than the 5% critical value for the null hypothesis of 'At most one' cointegrating relations, hence the acceptance of alternative hypothesis that there exist a single cointegrating relationship between economic growth, public investment and private investment.

Table 2: Johansen Cointegration Test

Eigenvalue	Likelihood Ratio	Critical Value (5%)	Critical Value (1%)	Cointegrating Equations
0.734263	55.79091	29.68	35.65	None **
0.300114	12.0577	15.41	20.04	At most 1
0.00851	0.282027	3.76	6.65	At most 2
*(**) denotes rejection of the hypothesis at 5%(1%) significance level				
L.R. test indicates 1 cointegrating equation(s) at 5% significance level				

5.3. Error Correction Results

The regression results with the diagnostics statistics are reported in Table 3. The dynamic ECM equation is reported as follows:

$$\Delta \ln y_t = -0.092 \Delta \ln kp_t + 0.0001 \Delta \ln kg_t - 0.447[\ln y_{t-1} - 7.681 + 0.150 \ln kp_{t-1} - 0.00036 \ln kg_{t-1} \quad (5)$$

The speed of adjustment to equilibrium rate of growth of 0.45 or 45% indicates that 45% of deviation from the long run equilibrium level of economic growth is corrected within a year.

Table 3: Dynamic ECM Regression Results

Variable	Coefficient	T-statistic
ECM(-1)	-0.447	-3.219
$\Delta lnkp_t$	-0.092	-0.774
$\Delta lnkg_t$	0.0001	1.531
$lnkp_{t-1}$	-0.150	-1.994
$lnkg_{t-1}$	0.0004	5.146
C	7.681	18.936
Adjusted R^2	0.342	
F-statistics	4.541	p-value: 0.022
Akaike Info. Criterion	-0.418	
Schwarcz Criterion	-0.151	
Durbin Watson statistic	1.942	

Paradoxically, the result reveals significant positive short run public investment effect on economic growth with a year lag at 1 per cent level of significance. Hence, the response of economic growth to public investment was rather slow. The result also indicates that private investment was not an important factor driving short run growth in Nigeria during the period. This does not support our theoretical analysis which suggests that private investment has a strong positive effect on GDP. However, this does not invalidate our theoretical hypothesis since it depends mainly on the type of investment undertaken during the time under study. It could be that the type of private investment undertaken takes time to have a significant effect on economic growth, such as investment in training. It could also be that the type of investment undertaken works through a feedback mechanism such that there is no significant direct impact.

Though the F-statistic suggest that the combination of public and private investment spending significantly influenced growth performance during the study period, the low R^2 indicates existence of other crucial factors excluded from the model which principally drove economic growth during the period in Nigeria. Among such factor is macroeconomic instability. Macroeconomic instability negatively affects both private and public investment, and therefore economic growth. Thus, there seem to be an additional link between macroeconomic instability and economic growth due to the possible complementarity between public and private investment (Bleaney, 1996; Egwaikhide et al, 2007).

The long-run equation derived from the dynamic ECM is as follows:

$$\ln y_t = 7.4612 + 0.107\ 1\mathrm{n}\, kp_t + 0.00031\mathrm{n}\, \mathrm{kg}_t \qquad (6)$$
$$(33.036)\ (2.670)\ (7.548)$$

Thus the elasticities are a = 0.107 and β = 0.0003. The elasticity of skill adjusted labour is 1 - 0.107 0.0003 = 0.892. Therefore, the complete long run equation is:

$$\ln y_t = 7.4612 + 0.1071\mathrm{n}\, kp_t + 0.00031\mathrm{n}\, kg_t + 0.8921\mathrm{n}\, (H_t L_t) \qquad (7)$$

The resulting production function is expressed as follows:

$$Y_t = 1739.23 KP_t^{0.107}\, KG_t^{0.0003}\, (H_t L_t)^{0.892} \qquad (8)$$

Equation (8) shows that in the long-run, the quality of the human capital has a prominent role to play in economic growth and development. Increase in skilled workers contributes 89% of the increase in GDP growth, while both private and public investment account for the remaining 11%. However, the contribution of private investment to economic growth (10.7%) is greater in the long-run than in the short period. These results indicate that public investment in the Nigerian economy has not had substantial effect on growth performance and may be considered unproductive or inefficient even in the long-run. It is important therefore to characterize and address the factors responsible for the inefficiency of public investment spending during the period. Efficiency of the private investment can be improved by redirecting some of the inefficient public investment spending to human capital development (especially health and education) and upgrading economic infrastructure such as power and transportation to boost the productivity of private investment.

5.4. Results of the Vector Error Correction (VEC) model

One major criticism of the single equation model is the existence of a simultaneous bias in the estimation procedure, namely, that the procedure ignores the existence of a multivariate relationship common among macroeconomic variables, such as GDP and investment. For instance, inferences from the growth model and investment acceleration model suggest that economic activity and private investment are mutually reinforcing variables. Thus, the existence of high interdependence between economic growth and investment informs the use of an interactive model of the VAR type. The VECM was used because the ADF unit root test show that the variables are unstationary in levels. Though the VECM output contains three separate equations for growth, public investment and private investment, only estimates of the growth equation is reported here in line with the

focus of the paper. The long run relationship from the VAR is reported as:

$$\ln y_t = -8.277 + 0.189 \ln kp_t + 0.000056 \ln kg_t$$
$$(2.937) \quad (0.062)$$

The results show clearly that the contemporanous impact of the two sources of investment varies. Private investment though insignificant in the first two periods is significant in the long run equation. Conversely, public investment that is insignificant in the long-run equation is significant in the short-run as indicated by the coefficient of the one-year lag of public investment. This result is largely in agreement with that of the dynamic error correction estimates. Al-Faris (2002) suggested that the weak causal effect of public investment on growth could be that a significant proportion of public investment is devoted to non growth-promoting activities, such as defence procurement.

Table 4: Vector Error Correction Model (VECM) Results

Variable	Coefficient	T-statistic
ECM(-1)	-0.166	-1.726
Δlny_{t-1}	-0.444	-1.760
Δlny_{t-2}	0.662	2.388
$\Delta lnkp_{t-1}$	-0.022	-0.159
$\Delta lnkp_{t-2}$	0.185	1.338
$\Delta lnkg_{t-1}$	0.0004	3.488
$\Delta lnkg_{t-2}$	0.00009	0.740
C	-0.085	-1.462
Adjusted R^2	0.510	
F-statistics	4.218	P-value: 0.031
Akaike Info. Criterion	-0.132	
Schwarcz Criterion	0.230	

Thus, the way forward in Nigeria is to boost private sector development and engender high level of economic growth through massive public investment in critical sectors of the economy. So, efforts should be made to ensure that the Nigerian economy is private sector driven in the long run. In the short run, public investment is required to provide favourable business environment for private sector development. Evidence suggests progressive improvement in the effect of private investment on economic performance in Nigeria. The reverse is the case for public investment.

The variance decomposition results in Table 5 enable us to infer the intertemporal response pattern of economic growth to innovations in the three variables. Variance decomposition is the breaking down of the variance of unanticipated changes in dependent variable according to the contribution of each variable's innovation. From Table 5, we observe that even though it is marginal in the first 10 years, the relative contribution of public investment is higher. However, from the 15th year, the relative contributions of private investment become higher.

Table 5: Variance Decomposition of Economic Growth

Period	S.E.	LNY	LNKP	LNKG
1	0.18	100.00	0.00	0.00
2	0.29	88.05	0.82	11.13
3	0.34	84.56	1.78	13.66
4	0.41	71.83	9.32	18.85
5	0.47	65.69	12.33	21.98
6	0.55	60.81	15.91	23.28
7	0.64	57.31	18.20	24.48
8	0.74	55.15	19.96	24.89
9	0.87	52.90	21.72	25.38
10	1.02	50.94	23.25	25.81
11	1.20	49.02	24.84	26.14
12	1.40	47.30	26.25	26.45
13	1.64	45.85	27.50	26.64
14	1.92	44.62	28.59	26.79
15	2.25	43.60	29.51	26.89
16	2.64	42.73	30.31	26.96
17	3.09	41.98	31.00	27.01
18	3.61	41.34	31.61	27.05
19	4.22	40.79	32.13	27.08
20	4.94	40.32	32.58	27.10

To further study the dynamic properties of the VAR, impulse-response function was employed. Figure 2 presents the impulse-response function for GDP growth of innovations in public and private capital stocks over a 20-year period. The solid line in the figure traces the response of GDP growth to 1 standard deviation innovations in private investment while the dashed line represents the output growth response to public investment.

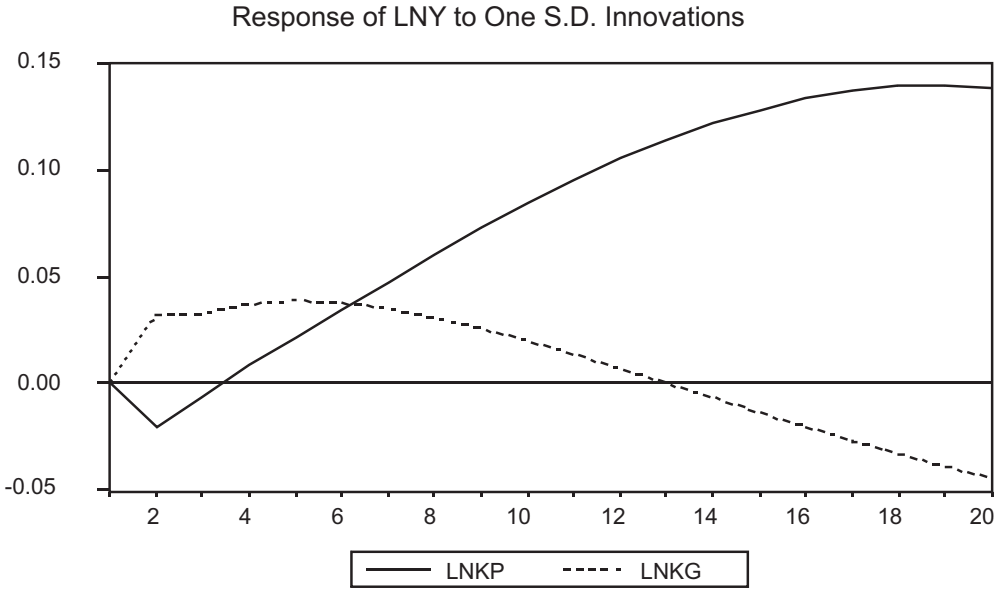

Figure 2: Impulse Response Graph

Both impulse response lines clearly demonstrate the short run efficacy of public investment and the long run potency of private investment. GDP growth responds strongest to innovations in private investment. However, the effect of a 1 percent increase in private investment per capita on economic growth is negative in the first four years. Thereafter, private investment continues to make positive impact on economic growth. A positive shock to public investment, on the other hand, begins with positive effect on growth, but in the long run it has negative impact.

6.0 Concluding Remarks

This study provides evidence that fiscal policy does indeed matter for economic growth. Towards this end, the study investigated the empirical relationships between public investment, private investment and economic growth in Nigeria over the period 1970-2007. The focus was on discovering the relative impact of each component of investment, private and public. The main findings are in three-fold. First, public investment has a relatively stronger effect in the short run than

private investment. Second, the impact of private investment increases from short to long term, and in the long run private investment clearly exert a stronger impact on economic growth than public investment. Finally, the contribution of human capital development to economic growth is overwhelmingly higher than the contribution or impact of physical capital, both private and public. The result is indicative of the complementarity between various forms of investment, namely, private, public and human capital.

The policy implications of the results are straightforward. Over the last four decades, governments in Nigeria have expressed concern over the low level of private investment in the country and several policies have failed to reverse the trend. The reason for this is not far fetched. The low level of income depresses purchasing power and saving leading to shortage of investible funds and low aggregate demand. In addition, many years of political instability, uncertainty and policy-reversals have increased fears about the future and heightened liquidity preference a reluctance to invest risk-capital. The paralysis of standard tools of mobilizing resources for investment informed the recourse to bolder set of policies, including foreign direct investment incentives. More important is the poor state of infrastructure in Nigeria. From the study, the reliable way to fast track the growth process in Nigeria is massive direct public investment in critical infrastructure like power and transportation, rather than relying on ineffective incentives to stimulate private investors. There is therefore need to review public policy in Nigeria in favour of higher public investment.

Apart from the direct crowd-in effects of public investment on private investment, most public investments flow through to boost private investment via procurement contracts and also have a beneficial multiplier effect on production generally. This strategy may violate some idealized notion of the superiority of markets at allocative efficiency. It may also be viewed as being against the growing support for market-oriented strategies and for a greater role of private investment in Nigeria. However, as the results show, massive productive public investment in critical sectors is a pre-condition towards the achievement of a globally competitive economy and private investment boom in the country.

This strategy needs the support of the legislative arm of government. It is imperative to ensure that adequate funds are provided for updating and expanding critical economic infrastructure like power and transportation. It is also very important to scale up legislative oversight activities to fast track the completion of the public projects and ensure value for public funds spent. In addition, there is need to increase public spending on human capital development as this investment has the highest positive long run growth elasticity in the estimated model.

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FOREIGN AID AND ECONOMIC GROWTH: EVIDENCE FROM NIGERIA

By ***Patricia A. Adamu and Clement A. Ighodaro****

Abstract

This paper investigates the impact of foreign aid on the economic growth of Nigeria using time series data covering the period 1980 through 2009. The Error Correction Modelling (ECM) technique was utilized. The Error correction term has a conversely-adjusted effect on the long-term equilibrium relationship between economic growth and foreign aid. We verified the temporal properties of the variables used in the model via unit root tests, to confirm the stationarity of the variables, and the short-run and long-run relationship between the dependent and the explanatory variable were also determined. Foreign aid and exports were found to have significant and positive effects on growth in Nigeria. A vital policy implication of the result is that the government in Nigeria should solicit for foreign aid as it would accelerate the economic growth. In addition, policies geared towards export promotion would increase investment and contribute to growth in the country.

JEL Classification: 011; C33; F21; F43.

Key Words: Foreign aid, Economic growth, Error correction modelling.

1.0 Introduction

Foreign aid or official development assistance on concessional terms is often channeled to developing countries either directly or indirectly through multilateral institutions or private voluntary organizations for the purpose of supporting social and economic development. Foreign aid can boost investment, increase public pro-poor expenditure, and improve the living standards of the people. Specifically, aid contributes to development in two ways. First, aid can accelerate the attainment of a steady-state potential output growth rate by a country with limited capital. Second, aid can improve a country's ultimate steady growth rate of output because it brings transfer of technology (know-how), enhances efficient use of resources, and encourages good governance and practices (transparency and accountability). Hence, aid can promote sustained economic development.

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Nigeria has monumental development challenges to contend with. The per capita income declined from a peak of US$861.5 in 1980 to a miserable US$259.3 in 1990, and rose marginally to US$368.3 and US$512.9 in 2000 and 2009 respectively. This drastic decline in income per head partly explains Nigeria's dismal economic performance, particularly on poverty reduction. Although the net official development assistance (ODA) as a percentage of GDP received by Nigeria rose from 0.4 in 2001 to 5.5 and 9.0 in 2005 and 2007 respectively, and slumped to 5.5 in 2008, it was nothing comparable to the amount received by other WAIFEM countries during the same period. For instance, Ghana, The Gambia and Sierra Leone received 12.1, 12.8, and 46.1 per cent, respectively in 2001. On the average, WAIFEM countries absorbed 18.0 in 2001, 16.0 in 2005 and 12.0 per cent as ODA in 2008. Faced with insufficient resources to implement development programmes/projects, coupled with the declining trend in ODA received, the sub-region, especially Nigeria, needs to grow much faster to significantly raise living standards and appreciably reduce poverty.

Nigeria is also experiencing a phenomenon known as a 'resource curse'. This situation is referred to as the coexistence of vast wealth in natural resources and extreme personal poverty in the economy, although, "resource curse" is more widely understood to mean an abundance of natural resource that fuels official corruption, resulting in a violent competition for the resource by the citizens of the nation. Efforts have been made to address the basic deficiencies in the economy through the implementation of various economic reforms such as the National Economic Empowerment Development Strategy (NEEDS), 7- Point Development Agenda, and Vision 20:2020. However, the country is far from achieving the goals of eliminating extreme poverty and hunger, reducing child and maternal mortality, and combating diseases such as human immunodeficiency virus/acquired immune deficiency syndrome (HIV/AIDS) and malaria. In addition, the heavy dependence on oil has led to the underdevelopment of other sectors (Dutch Disease) such as the agricultural and manufacturing sectors with the resultant effect of high rate of unemployment, low capacity utilization, widespread poverty, especially in rural areas, collapse of basic infrastructure and social services, and upward trend in social vices.

The overarching issue in macroeconomic response to aid inflows is that aid raises the stakes in the development challenge, promising great benefits to the recipient countries if well used, but also risking an exchange rate appreciation that could make the economy uncompetitive and impair the prospects for export-led growth. If Nigeria is to achieve the desired development results, there is a critical need for better management of aid to complement domestic resources. Therefore, the aid-growth issue is of great importance to developing countries, and Nigeria in

particular. If the question of the impact of aid on growth were to be abandoned by researchers, then the issue would be open to speculative and unhelpful contributions (Arndt et al, 2010). Although, there has been a lot of studies on aid-growth relationship, in particular, aid effectiveness, using either cross-country analysis or panel data or both, have been conducted by Bauer (1971); Burnside and Dollar (2000); Hansen and Tarp (2001); Collier and Dollar (2002); Alesina and Weder (2002); Clemens et al (2004); Roodman (2007); and Dalgaard et al (2004); none of these studies has concentrated on the Nigerian economy (Adamu and Ighodaro, 2011).

The main thrust of this paper is to empirically examine the impact of foreign aid on economic growth of the Nigerian economy, using time series data covering the period 1980 to 2009. Most studies on aid-growth relationship had used mainly panel data or cross-country analyses which ignored country specific characteristics. Therefore, this study intends to fill the gap by employing the Error Correction Methodology (ECM). The paper is organized into five sections. Following the introductory section is section 2, which reviews relevant literature. Section 3 articulates to the theoretical framework and methodology, while section 4 analyzes the empirical results. The last section summarizes and concludes the paper.

2.0 Theoretical Literature

The theoretical foundation for the proposition that aid can promote economic development is the 2-gap model (McKinnon, 1964) which posits that development may be hampered in the developing countries by the existence of two gaps, viz., the savings gap and the foreign exchange gap. The savings gap arises from the fact that, for a variety of reasons, domestic savings tend to be low in the typical developing country. Thus, savings will inevitably fall short of "required investment", i.e., investment needed to grow at a target rate. Foreign savings in the form of aid can fill this gap. The role of foreign capital in this sense is that it permits the developing country to invest more than it can save domestically. Similarly, the import surplus, or balance-of-payments deficit, constitutes a foreign exchange gap, which can naturally be filled by aid flows. It has been argued that even when a country has enough savings; it may not be able to "transform" them into foreign exchange for the purchase of needed capital imports. Thus, there can be a foreign exchange gap without a savings gap. There can also be a savings gap without a foreign exchange gap. Sometimes, both gaps exist. As regards the foreign exchange gap, many analysts believe that capital imports, financed by aid flows, will tend to accelerate the rate of capital formation by their very nature (Iyoha 2004).

There is a plethora of literature on the controversies trailing the effectiveness of foreign aid on economic growth of recipient countries. Iyoha (2004), reckons that the large aid flows to Africa have done little to promote growth and alleviate poverty. Friedman (1958); Bauer (1972); and Easterly (2001) are of the view that aid has resulted in corruption, bad government and accentuated poverty levels in Africa and therefore called for the elimination of aid. Aid advocates argue that although, aid has failed to elicit growth at one time or the other, it has helped to reduce poverty (Stiglitz, 2002); Stern, 2002). To corroborate this fact, Radelet et al, (2004) is of the opinion that in the 40 years since aid became widespread, poverty indicators have fallen in many countries across the world, and health and education indicators have risen faster than any other 40-year period in human history. Aid is an important tool for enhancing the development prospects of poor countries. Thus, to reduce poverty, accelerate growth and improve the standard of living of the people, there should be more inflow of aid and improvement on its effectiveness (Hansen et al, 2001). This can be achieved if there is effective aid management in the recipient country. Such aid management should be an integral part of a country's general resources planning so that aid flows would complement other domestic resources and promote the desired goal of rapid economic growth and development (Iyoha, 2004).

It has been found that not all aid is alike in terms of its impact on growth. Most studies look at the relationship between total aid and growth, but large portions of aid are not directed at growth. For example, food aid, provision of medicines, bed nets, disasters, humanitarian relief efforts. Since growth is not the objective, the impact of aid on growth will be negative or insignificant. Similarly, aid for education and health may appear as high aid and zero growth in standard cross-country growth regression because of the long period of time needed for the impact to be felt. But aid for infrastructural development such as good roads, electricity supply, bridges, telecommunication facilities, etc, will enhance growth quickly. Therefore, a positive relationship between aid and growth can be obtained even in the short-term. Radelet et al (2004) conclude that a combination of the two kinds of aid discussed above could lead to mixed results that will translate to an overall weak aid-growth relationship.

A recent development in the aid-growth literature is the analysis of impact of different categories of aid on growth. Researchers are moving away from analyzing the impact of aggregate aid to analyzing its different components. Raghuram et al (2008) suggest four different bases of differentiating aid to include: (i). motives for granting aids (why?), (ii). donor type (who is granting aid?), (iii). the use to which aid is put (for what: health, social sector, technical assistance?), and (iv). the timing of impact (when?). They however, warned that making distinctions between aid

categories will lead to fungibility, that is, raising issues as to how well aid gets translated into growth. The impact of aid may not depend on the specific purpose the aid was meant for, or the intent behind it, but what matters according to the theory is how well the recipient translates all expenditure to growth.

Arndt et al (2010) have classified studies on the aid-growth relationship into three generations. In the taxonomy, first generation studies show that aid tends to increase total savings, but not by as much as the aid flow, using the Harrod-Domar growth model and the two-gap Chinery-Strout extension. Easterly (1999) criticizes this approach by saying that growth is less related to physical capital investment than is often assumed. The second generation posits a positive relationship between aid and investment, based on cross-sectional data. This generation also argues that if the productive impact of aid depends more on incentives and relative prices, as well as the policy environment, then it is vital to consider these factors. It was, however, noted that if aid affects growth through a fixed investment ratio and a constant level of human capital, then aid works through channels that impact on total factor productivity. But if aid leads to the acquisition of inappropriate technology, there will be a negative effect of aid on investment. This may be due to institutional "destruction" (Hansen et al, 2001). The third generation relies on panel data analysis to investigate the aid-growth relationship. This relationship is perceived to be non-linear reflecting to the weaknesses of previous studies based on panel data.

Several reasons have been adduced to buttress the idea that aid might not promote growth. These include: mismanagement (waste), corruption, likelihood of currency appreciation that will undermine the profitability of the production of all tradable goods (Dutch disease), reduction in savings (both private and government), perpetuation of bad governments in power, and hence poor economic policies (Radelet et al, 2004).

2.1 Empirical Literature

In extant and even current literature, there is evidence to support the proposition that aid is effective in increasing capital accumulation and hence in furthering growth. In their growth equation for a sample of 53 countries, Hansen et al, (2001), included investment and human capital. Results of regression analysis have corroborated the proposition that aid impacts positively on growth through capital accumulation and that aid-investment growth nexus is important. Therefore, they concluded that aid increases growth through investment and human capital, which is not conditional on good policy. Again, in assessing the effectiveness of foreign aid, Hansen and Tarp (2000) provide a survey of empirical analyses from the last 30 years, based on cross-country regressions. The empirical evidence from 131

such regressions show that (i) aid increases aggregate saving, although not by as much as the aid flow, (ii) aid increases investment, and (iii) aid has a positive effect on the growth rate whenever growth is driven by capital accumulation. However, other studies found aid stimulated growth in countries with good policies and institutions (Islam et al, 1995; Burnside et al, 2000; Collier et al, 2002; and Radelet et al, 2004).

Divergent views arising from aid effectiveness have been found to be due to the analytical framework utilized (cross-country or panel data analysis), and the choice of methodology. Burnside et al (2000) using cross-sectional data, examined the impact of trade on growth conditional on the quality of economic policy. They found that aid has a positive impact on growth in developing countries with good fiscal, monetary and trade policies, and that in the presence of poor policies, aid does not propel growth. They concluded that aid contributes positively to growth only in good policy environment. Likewise, Hansen et al (2001) used a panel data analysis to examine the aid-growth relationship, and concluded that growth would be greater, the fewer the policy distortions affecting the incentives of economic agents. Contrary to these findings, Raghuram et al (2008) examined the effects of aid on growth in cross-sectional and panel data framework, and found no robust positive relationship between aid inflows into a country and its economic growth. In particular, they found no evidence that aid works better in better policy or geographical environment, or that certain forms of aid work better than others.

Similarly, results of studies on aid effectiveness, based on panel data analysis of a sample of more than 90 countries for a period of 20 years showed that aid has no impact on investment and growth (Boone, 1994 and 1996). Also, Rajan et al (2008) used data for 1970 2000 for SSA and East Asia, and employed OLS technique to determine the impact of aid on growth. They found no systematic effect of aid on growth, and concluded that aid has no impact on growth. They averred that political economy dynamics explains the non-positive effect of aid on growth.

Criticizing the Boone, Rajan et al submission of negative aid-growth relationship, Hadjimichael et al (1995); Durbarry et al (1998); Obstfeld (1999); Linsink et al (1999); and Burnside et al (2000), who found a positive impact of aid on growth, argues that the reason for Boone's assertion that aid has no impact on growth is that the result follows his treatment of aid-growth relation as linear, whereas it is a non-linear growth model. Hansen et al (2001) maintains that diminishing returns to aid best captured the non-linear relationship between aid and growth. Also, Roodman (2007) pointed out that the choice of methodology influences on the results. He concluded that while some aid is likely to increase investment and growth, aid is probably not a fundamentally decisive factor for development. Again, the choice of estimator

matters in determining aid effectiveness. Hansen et al (2001), reckon that the effects of aid may seem excessively high in the Generalized Method of Moments (GMM) regression than in an OLS regression.

Arndt et al (2010) replicated Rajan et al (2008), but developed a better instrumentation strategy, and improved on the specification. He obtained results which provided a solid support that the effect of aid on growth is positive. Their findings suggest that an inflow of aid on the order of 10 percent of GDP spurs the per capita growth rate by more than one percentage point per annum in the long-run. Their result is also consistent with the view that foreign aid stimulates aggregate investment and may also contribute to productivity growth, despite some fraction of aid being allocated to consumption. On the other hand, in their studies, Trumbull et al (1994) and Alesina et al (2000) post a negative relationship between aid and income per capita.

The reason for possible endogeneity of aid in growth regressions is the difficulty in perceiving aid as a lump-sum transfer, independent of the level of income. Correlation between aid and growth is negative for levels and insignificant for the differences (Hansen et al, 2001). This is an example of differences between cross-section and time series analysis. Therefore, it can be argued that high aid/GDP ratio is related to low growth, while increases in aid/GDP ratio is related to increasing growth rates.

Few studies have addressed the issue of an appropriate prior with respect to the impact of foreign aid on economic growth. But Rajan et al (2008), using a neo-classical growth model, and assuming that aid only augments physical capital investment and has no effect on productivity, found that a 10 percent increase in the ratio of aid to GDP increases the growth rate of per capita by one percent.

Determining an appropriate timeframe for the manifestation of aid on growth, Arndt et al (2010) found that the aid-growth relationship will emerge over a long time horizon. This is because many aid investments in education and health, take a longer time to translate into more rapid economic growth although the contribution of these investments to growth is likely to be relatively modest. Therefore, for Arndt et al (2010), the impact of aid on growth is difficult to discern in the shorter term, but maintained that in the long-run, macro-evidence is combined with the evidence of the micro and meso levels to produce a consistent case for aid effectiveness; hence, there is no micro-macro paradox. Radelet et al (2004) also lend support to the use of a longer time period but cautioned that the longer the time period, the more difficult it is to isolate the impact of aid on growth from other factors. Advancing reasons for support of the long time horizon, Kraay, 2004; Wacziarg, 2004,

and Raghuram et al, 2008; asserted that short period growth regressions are prone to be affected by cyclical factors, which are hard to control for, and so suffer from the problem of extra 'noise'.

3.0 Theoretical Framework and Methodology

The empirical analysis in this study is based on growth theory and follow from the work of Batu (2010). Consider a generalized neoclassical aggregate production function augmented with exports and other policy variables represented by V as below:

$$Y_t = A_t F(K_t, N_t, X_t, V_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The production function in equation (1) is assumed to follow the Inada conditions[1]. Also, for each time t, Y_t is the aggregate output, K_t is capital input, N_t is population, At is total factor productivity, X_t are exports and V_t comprise other policy variables like broad money supply, and lending interest rate. The production function in equation (1) follows Ballasa (1978) export led growth model. Following Burke et al (2006), and assuming capital (K) can be decomposed into foreign aid and savings; where international reserves in our own case is taken as savings, equation (1) can be rewritten as:

$$Y_t = A_t F(RES_t, AID_t, N_t, X_t, V_t) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where is international reserves, is foreign aid, the main variable of interest.

Equation (2) can further be decomposed to determine the contribution of each variable to economic growth. Suppose the economy can be described by a Hicks-Neutral Cobb-Douglas production function of the form:

$$Y_t = A_t(RES_t^{\theta}, AID_t^{\phi}, N_t^{\lambda}, X_t^{\alpha}, V_t^{\beta}) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where is stochastic, and taking the natural log of both sides of equation (3) yields:

$$Log(Y_t) = \theta Log(RES_t) + \phi Log(AID_t) + \lambda Log(N_t) + \alpha Log(X_t) + \beta Log(V_t) + Log(A_t) \quad \ldots (4)$$

It is therefore implied in equation (4) that there are six deterministic sources of growth, viz: savings proxied by international reserves, foreign aid, population,

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[1] *Six conditions for Inada conditions to hold are: (i) the value of the function at 0 is 0; (ii) the function is continuously differentiable; (iii) the function is strictly increasing in its arguments; (iv) the second derivative of the function is decreasing (thus the function is concave); (v) the limit of the derivative towards 0 is positive infinity; and (vi) the limit of the derivative towards positive infinity is 0.*

exports, and policy variables (lending interest rate, broad money supply) embedded in V, and stochastic source of growth from total factor productivity (A). A vital interest of this paper is the sign of the parameter, that is, the marginal effect of aid on economic growth.

That is. $\frac{\partial LogY_t}{\partial LogAID_t} = \phi \text{ f } 0$

Thus the marginal effect of Foreign Aid on economic growth is not constant; rather, it rises with the amount of foreign aid. The coefficients are interpreted as elasticities since all variables are expressed in natural logarithms terms.

However, to avoid spurious regression, we explored the existence of cointegrating relationship among the series to determine if there is a long run linear relationship among the variables. The combination of both long run and short run information in the same model can be done with the presence of cointegration. This however overcomes some of the disadvantages associated with the loss of valuable information that may occur through differencing in an attempt to address non stationarity problem.

3.1 Test for Stationarity

Prior to the empirical estimations, the data for unit root was tested in order to avoid spurious regression and erroneous inferences (Komolafe, 1996; Iyoha, 2004). This was done using the Augmented Dickey- Fuller (ADF) unit root test. Dickey-Fuller (1981). This paper used two test specifications of the Augmented Dickey-Fuller unit root test. These specifications are shown below:

$$\Delta z_t = \beta_0 + \lambda z_{t-1} + \gamma \sum_{t=1}^{P} \Delta z_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

$$\Delta z_t = \beta_0 + \beta_1 t + \lambda z_{t-1} + \gamma \sum_{t=1}^{P} \Delta z_{t-p} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (6)$$

In the two expressions above, $z_t = [Y, RES_t, AID_t, N_t, X_t, V_t]$ which are the variables of interest in our study. The expression in (5) is the equation with intercept and (6) is the ADF test equation with trend and intercept. From equation (5) and (6), the relevant test statistic can be calculated from $\hat{\lambda}$ as:

$$\tau = \frac{\hat{\lambda}}{se(\hat{\lambda})} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (7)$$

Note that $\hat{\lambda}$ is estimated from equations (5) and (6) while the denominated in (7) is the estimated standard error. If the absolute value of (7) is greater than the absolute value of the MacKinnon critical value at the chosen level of significance, the variable is stationary, and non-stationary if otherwise.

3.2 Stationarity Results

The stationarity results presented in table 1 show that all the variables used are not stationary at level except population which is I(0) but others become stationary after first differencing that is, I(1). The results therefore suggest that to eliminate the possibility of spurious regression and erroneous inferences, the first differences of the relevant variable was used in the estimation procedure.

Table 1: Unit Root Result**

Variable	Test Equation Include:	ADF Test Statistic	Critical Value	Remark
LPCY	Intercept Only	-0.188288	-3.689194	Non-Stationary
	Trend and Intercept	-1.944551	-4.323979	Non - Stationary
?LPCY	Intercept Only	-3.689194	-2.971853	I(1)
	Trend and Intercept	-3.803139	-4.323979	I(1)
LXPORT	Intercept Only	-1.217181	-3.711457	Non-Stationary
	Trend and Intercept	-.2.268202	-4.309824	Non - Stationary
? LXPORT	Intercept Only	-4.724789	-3.699871	I(1)
	Trend and Intercept	-5.244900	-4.394309	I(1)
LLINT	Intercept Only	-2.310924	-3.711457	Non- Stationary
	Trend and Intercept	-2.193075	-4.356068	Non- Stationary
?LLINT	Intercept Only	-8.038904	-3.711457	I(1)
	Trend and Intercept	-7.871527	-4.356068	I(1)
LRES	Intercept Only	-0.588531	-3.699871	Non- Stationary
	Trend and Intercept	-2.812083	-4.339330	Non- Stationary
?LRES	Intercept Only	-5.273986	-3.699871	I(1)
	Trend and Intercept	-5.177317	-4.339330	I(1)
LAID	Intercept Only	-0.933804	-3.699871	Non- Stationary
	Trend and Intercept	-2.892898	-4.374307	Non- Stationary
?LAID	Intercept Only	-5.302625	-5.699871	I(1)
	Trend and Intercept	-5.199247	-4.339330	I(1)
LPOPN	Intercept Only	-4.563366	-3.679322	I(0)
	Trend and Intercept	-4.545197	-4.309824	I(0)
LRES	Intercept Only	-0.588531	-3.699871	Non- Stationary
	Trend and Intercept	-2.534614	-4.374307	Non- Stationary
?LRES	Intercept Only	-5.273986	-3.695921	I(1)
	Trend and Intercept	-5.177317	-4.338210	I(1)
LM2	Intercept Only	-2.991412	-3.679322	Non-Stationary
	Trend and Intercept	-2.963219	-4.339330	Non - Stationary
?LM2	Intercept Only	-3.778255	-3.689194	I(1)
	Trend and Intercept	-4.037607	-3.580623	I(1)

**: All the variables are stationary at 1% level of significance except PCY which is stationary at 10% level of significance.

3.3 Cointegration Test

The Johansen (1988), cointegration test was used to determine the number of cointegrating vectors if the variables are non-stationary and are integrated of the same order. Generally, the unrestricted VAR can be expressed in order of lag *p* and can be expressed as:

$$z_t = A_0 + z_{t-1}A_1 + z_{t-2}A_2 + \ldots + z_{t-p}A_p + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (8)$$

Where the lag order can be determined by the model, that is, the one that minimizes the Akaike Information Criterion (AIC) and Schwarz Bayesian Information Criterion (SBIC).

Suppose the appropriate lag order has been found then the expression in (8) can be rewritten in its Vector Error Correction (VEC) form as:

$$\Delta z_t = A_0 + z_{t-1}\prod + \Delta z_{t-1}\Gamma_1 + \Delta z_{t-2}\Gamma_2 + \ldots + \Delta z_{t-p+1}\Gamma + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (9)$$

$\Gamma_i = -\sum_{j=i+1}^{p} A_j$ and $\Pi = \sum_{j=1}^{p} A_j$ The matrix shows the long run relationship between the z_t variables.

The Trace Test is used to test the null hypothesis, in which the number of distinct cointegrating vectors is less than or equal to *r*, against a general unrestricted alternative that the rank of . The trace statistic test is given as:

$$\lambda_{trace} = -T\sum_{i=r+1}^{p} \ln(1-\lambda_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (10)$$

Where: λ_i is the smallest value eigenvectors (p - r) and is the number of observations. The estimation was done using E-Views 7.0.

3.4 Cointegration Results

This test procedure proposed by Johansen (1988) and Johansen and Juselius (1990) requires that the optimal lag lengths must be determined carrying out the test. The optimal lag lengths are found from the unrestricted vector autoregression equation that minimizes the Akaike Information Criteria (AIC) or Schwarz Bayesian Information Criteria (SBIC).

Table 2: Lag Order Selection Criteria

VAR Lag Order Selection Criteria
Endogenous variables: LPCY LRES LAID LPOPN LXPORT LLINT LM2
Exogenous variables: C
Sample: 1980 - 2009
Included observations: 28

Lag	LogL	LR	FPE	AIC	SC	HQ
0	140.3910	NA	1.72e-13	-9.527929	-9.194878	-9.426112
1	407.3573	381.3805	3.33e-20	-25.09695	-22.43254	-24.28242
2	499.3820	85.45143*	3.30e-21*	-28.17014*	-23.17437*	-26.64288*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The result from table 2 suggests that the optimal lag length is 2 because it is where the AIC, SC and HQ are at their minimum. The cointegration result reveals that the variables in the model are cointegrated. Specifically, the Trace statistic indicates six cointegrating equations as shown in table 3.

Sample (adjusted): 1982 – 2009

Included observations: 28 after adjustments

Trend assumption: Linear deterministic trend

Series: LPCY LRES LAID LPOPN LXPORT LLINT LM2

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**

None *	0.963578	264.9821	125.6154	0.0000
At most 1 *	0.900067	172.2296	95.75366	0.0000
At most 2 *	0.813065	107.7385	69.81889	0.0000
At most 3 *	0.585938	60.78268	47.85613	0.0020
At most 4 *	0.496004	36.09397	29.79707	0.0082
At most 5 *	0.385254	16.90873	15.49471	0.0304
At most 6	0.110714	3.285421	3.841466	0.0699

Trace test indicates 6 cointegrating equation(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Since the variables are cointegrated, estimation was carried out in first difference with an inclusion of ECM term. On the basis of these findings, we re-specify equation (4) for the ECM model as:

$$\Delta L(PCY_t) = \theta\Delta L(RES_t) + \phi\Delta L(AID_t) + \lambda\Delta L(POPN_t) + \alpha\Delta L(XPORT_t) + \beta\Delta L(LLINT_t) + \delta\Delta L(LM2_t) + ECM(-1) + \mu_t \quad \ldots\ldots (11)$$

Where L before a variable is the log of that variable:

PCY = Real per capita income (proxy for economic growth)

RES = Level of international reserves

AID = Foreign aid

POPN = Population growth, proxy for labour

XPORT = Exports (proxy for trade)

LINT = Lending interest rate

LM2 = Broad money

υ1 = stochastic error term.

4.0 Analysis of Regression Results

Table 4: Static and Preferred ECM Regression Results
Sample Period: 1980 2009
Included Observations: 30

	Static Model (Equation 4)	**ECM Model (Equation 11)**
Dependent Variable: Per capita Income (PCY)		
Constant	5.296951 (6.099491)	0.158583 (3.110369)
LRES	0.029599 (1.394487)	
D(LRES(-2))		0.008460 (0.743892)
LAID	0.083268 (4.350300)	
D(LAID(-2))		0.045168 (3.096454)
LPOPN	-1.630511 (-2.619486)	
D(LPOPN(-1))		-51.37090 (-3.73615)
D(LPOPN(-2))		-38.71452 (-2.722051)
LXPORT	-0.042220 (-1.252746)	
D(LXPORT(-1))		0.041843 (2.135450)
LLINT	-0.045612 (-0.696428)	
D(LLINT(-1))		0.146160 (2.726069)
LM2	0.265512 (4.063777)	
D(LM2)		-0.204309 (-2.812113)
D(LM2(-1))		-0.208626 (-2.829245)
D(LM2(-2))		0.313036 (3.923576)
ECM(-1		-0.096313 (-0.851583)
R-squared	0.90	0.72
F-statistic	33.60	3.59
D.W. Statistic	1.04	1.90

As revealed in table 4, the static equation shows a significant positive relationship between economic growth and foreign aid. This supports the evidence from Nigeria that increase in foreign aid increases economic growth. Contrary to expectation, population and total exports have the contrary signs, implying that increase in population and total exports are counterproductive. This may result from the fact that our primary exports cannot compete in international markets while increase in population may lead to surplus labour which may not be favourable to output. Though, lending interest rate and international reserves were not significant in the determination of economic growth, they have the expected signs. The coefficient of determination shows that more than 89% of the dependent variable is explained by the independent variables taken together. The F-statistic shows that all the independent variables are jointly significant in the determination of per capita income growth in Nigeria.

The parsimonious ECM (preferred model) reveals that foreign aid has significant and positive relationship with economic growth in Nigeria, though, with a delayed effect. The one lagged first difference of population has a negative effect on economic growth, but became positive at two lagged period. The negative effect is not surprising as population is a poor proxy for labour force in our context. Specifically, education and the quality of human capital, stocked in labour force, which are very vital for the growth of the economy are not properly captured by population. This arises because of the existence of surplus labour in Nigeria; hence, an increase in population growth would have a negative impact on per capita income growth. The coefficient of Exports has the expected positive sign and significant in the determination of per capita income in Nigeria. Lending interest rate has a surprisingly contrary sign, though, but significant in the determination of per capita income. The positive sign means that higher lending interest rate propels economic growth, contrary to economic theory.

The error correction term is well signed, though not significant. The speed of adjustment of the error correction term shows that about 9% of the deviation of short run per capita income from the long run is covered up within a year. The coefficient of determination shows that more than 72% of the dependent variable is explained by the independent variables in the model. The f-statistic also reveals that all the variables are jointly significant in the determination of economic growth in Nigeria.

The diagnostic tests for homoscedasticity, autocorrelation and residual normality were carried out. The result reveals that the residuals are identically and independently distributed with a zero mean. However, there was no evidence of normal residual based on the Jarque Bera test. Based on the Cusum and the Cusum of Squares, the model can be inferred to be stable (See Appendix).

Granger Causality

The multivariate Granger causality result reveals that there is unidirectional causality between per capita income (PCY) and foreign aid with causality running from PCY to foreign aid and from export to PCY. The implication therefore is that PCY can be used to predict foreign aid assistance and policy directed towards achieving economic growth should be done with caution as this may have adverse effect on foreign aid assistance. Also, export expansion could spur growth via foreign aid for increased investment. (Appendix 4).

5.0. Summary and Conclusion

This paper has examined the impact of foreign aid on economic growth of the Nigerian economy based on data for 1980 through 2009, and the parsimonious ECM estimation method. A major rationalization for the study on foreign aid growth nexus has been its focus on Nigeria contrary to previous studies that were mainly cross country, panel data analyses.

The major findings from the paper are that Nigeria has relatively abundant labour; hence an increase in population would have a negative impact on per capita income growth with a delayed effect. Most importantly, foreign aid is found to be significant and positively related to economic growth in the Nigerian economy which is consistent with results from previous related studies. A vital policy implication of the result is that the government in Nigeria should solicit for foreign aid as it would accelerate the economic growth given adequate human capital. Also, policies geared towards export promotion would increase investment and contribute to growth in the Nigerian economy.

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Appendices

Appendix I. Regression Results

Appendix 1: Residual Tests

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.065906	Prob. F(2,13)	0.9365
Obs*R-squared	0.271017	Prob. Chi-Square(2)	0.8733

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 11/03/11 Time: 23:26
Sample: 1983 2009
Included observations: 27
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000111	0.055313	-0.002009	0.9984
D(LRES(-2))	-0.000764	0.012759	-0.059887	0.9532
D(LAID(-2))	-0.001651	0.017223	-0.095868	0.9251
D(LPOPN(-1))	0.596068	14.80380	0.040265	0.9685
D(LPOPN(-2))	-0.590602	15.28786	-0.038632	0.9698
D(LXPORT(-1))	0.001287	0.021741	0.059213	0.9537
D(LLINT)	-0.003003	0.061838	-0.048560	0.9620
D(LLINT(-1))	-0.006574	0.060764	-0.108192	0.9155
D(LM2)	0.005718	0.091430	0.062542	0.9511
D(LM2(-1))	0.005257	0.087930	0.059784	0.9532
D(LM2(-2))	-0.011405	0.090887	-0.125489	0.9021
ECM(-1)	-0.040207	0.166451	-0.241553	0.8129
RESID(-1)	0.100865	0.398629	0.253030	0.8042
RESID(-2)	0.101796	0.378497	0.268948	0.7922

R-squared	0.010038	Mean dependent var	1.30E-17
Adjusted R-squared	-0.979925	S.D. dependent var	0.011921
S.E. of regression	0.016774	Akaike info criterion	-5.031854
Sum squared resid	0.003658	Schwarz criterion	-4.359938
Log likelihood	81.93002	Hannan-Quinn criter.	-4.832058
F-statistic	0.010139	Durbin-Watson stat	1.987397
Prob(F-statistic)	1.000000		

Heteroskedasticity Test: Breusch -Pagan-Godfrey

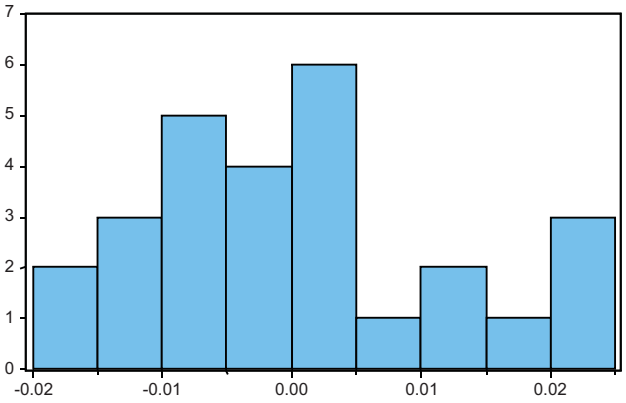
F-statistic	0.670396	Prob. F(11,15)	0.7455
Obs*R-squared	8.898924	Prob. Chi-Square(11)	0.6312
Scaled explained SS	2.057747	Prob. Chi-Square(11)	0.9983

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 11/03/11 Time: 23:27
Sample: 1983 2009
Included observations: 27

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000346	0.000598	0.578106	0.5718
D(LRES(-2))	-0.000198	0.000133	-1.483247	0.1587
D(LAID(-2))	0.000149	0.000171	0.870084	0.3980
D(LPOPN(-1))	-0.148192	0.161184	-0.919393	0.3724
D(LPOPN(-2))	0.138038	0.166753	0.827802	0.4208
D(LXPORT(-1))	-8.18E-05	0.000230	-0.355939	0.7268
D(LLINT)	0.000517	0.000637	0.811505	0.4298
D(LLINT(-1))	-9.33E-05	0.000629	-0.148494	0.8839
D(LM2)	-0.000838	0.000852	-0.983973	0.3407
D(LM2(-1))	-0.000997	0.000865	-1.152641	0.2671
D(LM2(-2))	0.001040	0.000935	1.112085	0.2836
ECM(-1)	0.000284	0.001326	0.214260	0.8332

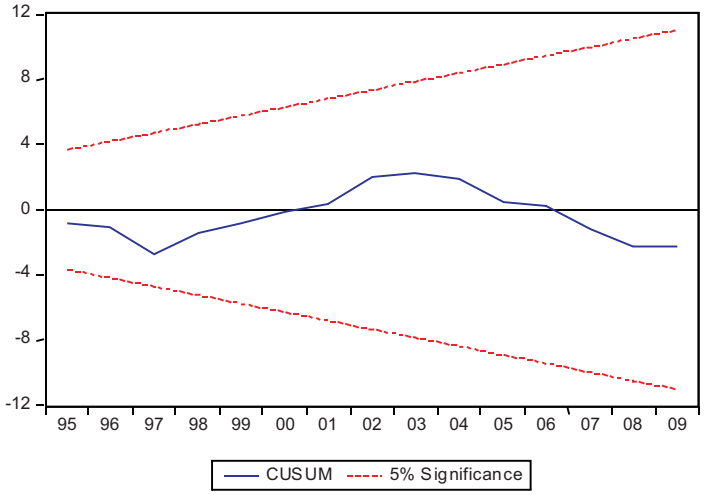
R-squared	0.329590	Mean dependent var	0.000137
Adjusted R-squared	-0.162044	S.D. dependent var	0.000171
S.E. of regression	0.000184	Akaike info criterion	-14.06206
Sum squared resid	5.08E-07	Schwarz criterion	-13.48613
Log likelihood	201.8378	Hannan-Quinn criter.	-13.89080
F-statistic	0.670396	Durbin-Watson stat	2.067498
Prob(F-statistic)	0.745498		

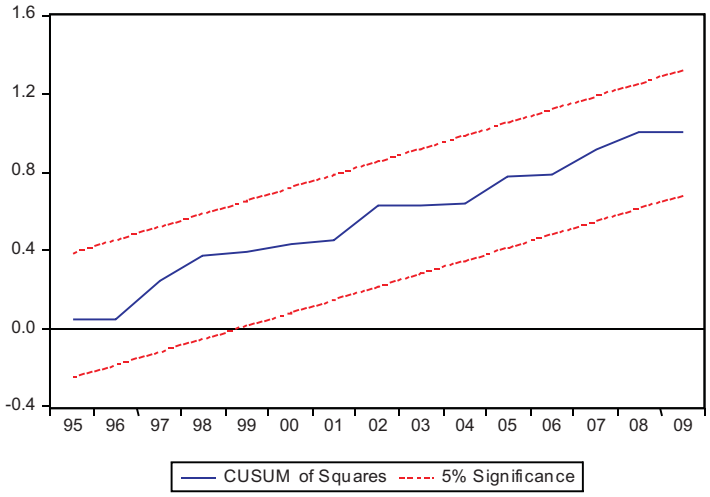
Appendix 2: Normality Test



Series: Residuals	
Sample 1983 2009	
Observations 27	
Mean	1.30e-17
Median	-0.000537
Maximum	0.023793
Minimum	-0.018448
Std. Dev.	0.011921
Skewness	0.533390
Kurtosis	2.498406
Jarque-Bera	1.563317
Probability	0.457646

Appendix 3: Stability Test





Appendix 4: Granger Causality Results

Pairwise Granger Causality Tests
Date: 11/03/11 Time: 23:35
Sample: 1980 2009
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LRES does not Granger Cause LPCY	28	1.46174	0.2526
LPCY does not Granger Cause LRES		1.61891	0.2199
LAID does not Granger Cause LPCY	28	0.47390	0.6285
LPCY does not Granger Cause LAID		6.04018	0.0078
LPOPN does not Granger Cause LPCY	28	4.30284	0.0259
LPCY does not Granger Cause LPOPN		1.89406	0.1732
LXPORT does not Granger Cause LPCY	28	2.50512	0.1037
LPCY does not Granger Cause LXPORT		0.27019	0.7656
LLINT does not Granger Cause LPCY	28	0.61044	0.5517
LPCY does not Granger Cause LLINT		0.25203	0.7793
LM2 does not Granger Cause LPCY	28	3.72618	0.0396
LPCY does not Granger Cause LM2		0.56362	0.5768
LAID does not Granger Cause LRES	28	2.43045	0.1103
LRES does not Granger Cause LAID		3.37811	0.0517
LPOPN does not Granger Cause LRES	28	6.30116	0.0066
LRES does not Granger Cause LPOPN		1.40759	0.2650
LXPORT does not Granger Cause LRES	28	4.65579	0.0201
LRES does not Granger Cause LXPORT		0.32945	0.7227
LLINT does not Granger Cause LRES	28	0.74287	0.4868
LRES does not Granger Cause LLINT		1.52754	0.2383
LM2 does not Granger Cause LRES	28	5.00754	0.0157
LRES does not Granger Cause LM2		1.27446	0.2986
LPOPN does not Granger Cause LAID	28	3.26552	0.0565
LAID does not Granger Cause LPOPN		0.30902	0.7372
LXPORT does not Granger Cause LAID	28	2.80936	0.0810
LAID does not Granger Cause LXPORT		0.00069	0.9993
LLINT does not Granger Cause LAID	28	0.47786	0.6261
LAID does not Granger Cause LLINT		0.29426	0.7478
LM2 does not Granger Cause LAID	28	3.40810	0.0505
LAID does not Granger Cause LM2		4.57738	0.0212
LXPORT does not Granger Cause LPOPN	28	0.55803	0.5799
LPOPN does not Granger Cause LXPORT		7.12371	0.0039
LLINT does not Granger Cause LPOPN	28	0.18080	0.8358
LPOPN does not Granger Cause LLINT		3.03915	0.0674

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THE DETERMINANTS OF NON-OIL COMPONENT OF BALANCE OF TRADE OF NIGERIA: 1980-2008

By ***H.E. Oaikhenan and S.O. Aigheyisi****

ABSTRACT

The paper examines empirically the effects of income growth and exchange rate volatility on Nigeria's non-oil trade balance. Domestic inflation rate, the degree of openness of the economy, and real money supply were used as control variables in the model that was specified. Cointegration and error correction techniques were employed in the estimation of the model using data that covered the 1980-2008 sample period. The empirical evidence suggests that the effect of income growth on the country's trade balance is positive. The impact of the volatility in exchange rate that was occasioned by the sweeping deregulation that came in the wake of the Structural Programme (SAP) in 1986 on the non-oil component of the country's BOT was significantly negative. The impact of real money supply was negative and statistically significant. The paper argues that overdependence on imports, financed mainly by earnings from oil exports engenders deterioration in the country's non oil component of the country's balance of trade

1.0 Introduction

Recent upsurge in the volume of trade amongst nations of the world, resulting from the relaxation of trade barriers among participating nations has brought about varying levels of trade balance across the nations. While some countries, mostly the developed ones have consistently enjoyed positive trade balances in their trade relations with their trading partners, others, especially those in the so-called Third World have only on a few occasions managed to record marginal positive trade balances since they opened up their economies.

Positive trade balance, otherwise known as trade surplus or, favourable trade balance arises when total earnings from the export of goods and services exceed total payments for imports. Negative trade balance or trade deficit results from total payment for imports of goods and services exceeding total receipts from exports. Unfortunately, deficits in trade balance have tended to become a key feature of most less-developed economies, in view of their overdependence on imports. Where a country's total export receipts equal the total payment for imports, the

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country is said to enjoy a balanced trade position. Most countries of the world strive to achieve a balanced trade position or better still, a surplus in their trade position. Although achieving this desire may be realistic for some countries, for most others, it may at best be an illusion. And this depends significantly on the productive capacity of the economy of the country. An interplay of a host of factors, internal and external serves to influence the movements of a country's trade balance.

1.1 The Problem

Empirical evidence confirming that the Nigerian economy became afflicted by the Dutch Disease malaise since the discovery of crude oil in commercial quantities is in the extant literature (Edo, 2002) Consequently, between 1970 and 2005 (with the exception of 1992), Nigeria recorded negative balances in her trade in non-oil exports (see The Central Bank of Nigeria **Statistical Bulletin,** 2005). By contrast, however, the country recorded positive trade balance in crude petroleum oil export within this period.

On balance, the massive balances in the country's trade account reflected the impact of crude oil export, which significantly overwhelmed the negative balances that were recorded in the non-oil exports. Indeed, crude oil has ever since become the main-stay of the Nigerian economy, contributing largely to the country's GDP, employment and government revenue. In fact, the country's annual budget is based on expected earnings from this commodity. Since the 1970s, Nigeria has been a net importer of non-oil commodities, including refined petroleum (oil). These imports are financed largely from exports of crude oil.

In the light of the precarious dependence of the country's economy on crude oil, it is hardly contentious that fundamental problems loom large in the Nigerian economy, having regard to the fact that crude oil is a wasting asset and once exploited is not replaceable ***in situ***. In the absence of crude oil, Nigeria's trade balance is unfavourable (see figure 1). This thus makes it imperative for policy makers to proactively articulate and implement policies that are critical to the revival of the comatose non-oil sector of the economy. The failure of policy makers in this direction has the potential of making the country one that is not only incapable of catering for her population, but also one that lacks the finance to import goods and services from other countries. Accordingly, it becomes important to x-ray, in an empirical

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We are grateful to Mr. Sam Omoruyi who did a thorough review of an earlier draft

fashion factors that impinge on the country's non-oil trade balance. This could shed light on those macroeconomic variables that policy makers may target in an effort to move the country's non-oil trade balance in a desired direction.

The paper seeks to explore the determinants of the country's non-oil component of the balance of trade. Specifically, it aims at quantifying the impact of income growth and exchange rate volatility, amongst other variables on the trade balance, based on Nigeria's trade data for the sample period 1980 through 2008. In doing that the paper is organized, following the introductory section into five sections: Section 2 discusses the problems of the Nigerian economy with respect to her trade structure. Section 3 reviews the literature on balance of trade and also highlights the theoretical *a priori* expectations. In Section 4, the paper outlines the theoretical framework. Sections 5 and 6 contain the analysis of the empirical results and the concluding remarks, including policy recommendations, respectively.

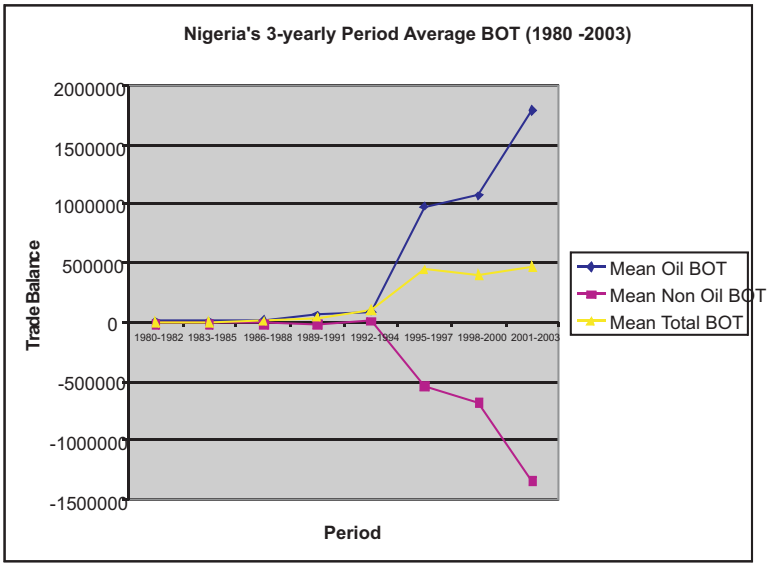

Figure 1

2.0 Literature Review

Every nation of the world is involved in bilateral or multilateral trade pact. To ensure free flow of goods and services across national borders, trade barriers have to be relaxed in participating nations. More often than not, nations strive to achieve and maintain favourable trade balances (or trade surpluses) in their trade relations with their trading partners. A country's trade balance whether in surplus or in equilibrium depends on a number of factors. These factors may be grouped as internal and external factors. Some of the internal factors affecting a country's balance of trade are country-specific. Among these are such factors as domestic income growth, exchange rate of the domestic currency, domestic inflation rate, degree of trade openness, demand for domestic goods relative to foreign goods, government expenditure, domestic interest rate, money supply, etc. External factors affecting a country's trade balance include the level of barriers (tariff and non-tariff) to a country's export in the foreign market, exchange rate of the currencies of the trading partner(s), elasticity of demand for a country's export in the foreign market, foreign trade policy, foreign interest rates, foreign government's expenditure, income levels of the trading partners, etc. While the country-specific factors are largely within the control of the country, control over the external factors is quite limited and in most cases non-existent.

The literature on the determinants of trade balance is quite broad and it will continue to expand to the extent that countries, in the absence of global depression and de-globalization will continue to engage in cross-border economic activities and transactions. For example, Rawlings and Praveen (1993) investigated whether or not exchange rate devaluation improved the trade balance for nineteen sub-Saharan African countries, in an analysis that synthesized both the Keynesian and the monetarists' views. They found, amongst others, that for 17 of the 19 countries[2] studied, real exchange rate depreciation improved the countries' trade balances in the year of the devaluation and that this effect lingered on in subsequent years. There was no evidence, however, that indicated sustained improvement in the trade balance in response to devaluation of the real exchange rate. For the other two countries (Tanzania and Gabon), the empirical results indicated the existence of a J-curve, in that in the first year of the devaluation, the trade balance deteriorated. In the two years following, however, trade devaluation worked to improve the trade balance. The improvement was significant, however, only in the case of Tanzania.

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[2]*The countries include Burkina Faso, Central African Republic, Cote d'Ivoire, Gabon, The Gambia, Ghana, Kenya, Madagascar, Mauritius, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Tanzania, Togo, Zaire and Zambia*

Employing the ordinary least square (OLS) regression technique for the estimation of a trade balance model for the Nigerian economy, Agu (2002) found that with the exception of nominal effective exchange rate, other exogenous variables were significant explanatory factors of the trade balance-GDP ratio. While real exchange rate (RER) misalignment and the Niger-Delta crises impacted negatively on the dependent variable, the impact of terms of trade, output (income), openness and nominal effective exchange rate were positive. The estimating model used expressed trade balance to GDP ratio as a function of terms of trade, real exchange rate (RER) misalignment, output, openness, man-days lost owing to industrial disputes and the Niger Delta crisis and nominal exchange rate.

In a study to examine the relationship between exchange rate and trade balance for five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore and Thailand) with respect to their trade with Japan in the sample period 1986 1999, Liew, Lim and Hussain (2003) found that the role of exchange rate changes in initiating changes in trade balance had been exaggerated. They argued that trade balance is affected by real money (defined as nominal money divided by the consumer price index). Based an their findings, they recommended that in order to cope with trade deficit, the governments of the five ASEAN economies should resort to policy measures that focus on the real money variable.

Using a structuralist post Keynesian approach in a study of Brazilian trade structure in 2002, Barbosa-Filho found that with price-inelastic and income elastic imports, Brazil may have to compensate an additional percentage of income growth with about seven percent of real exchange rate devaluation in order to keep its trade balance in relation to GDP stable. The study found that Brazil's income elasticity of import was so high that even a moderate increase in income tended to lead to a substantial increase in imports (in the short run). Barbosa-Filho, therefore, recommended a substantial devaluation of real exchange rate to avoid the deterioration of the country's trade balance.

3.0 Theoretical Framework and Model Specification

The objective in this sub-section is to examine the relationship between trade balance and some of the relevant economic variables that affect it in the light of theoretical postulations. Although factors that affect a country's trade balance are both external and internal, the focus in this paper is on the internal factors.

3.1 Exchange Rate Volatility and Trade Balance

The impact of exchange rate volatility on trade balance in an economy depends on the exchange rate regime in place. In theory, under a flexible/ floating exchange rate regime, persistent trade surplus could bring about appreciation of the domestic

currency as a result of the increase in the inflow of foreign exchange which, *ceteris paribus*, could reduce the competitiveness of the country's export in the foreign markets. This could bring about a deterioration of the trade balance. A deficit in trade, on the other hand, could result, *ceteris paribus*, in the depreciation of the domestic currency. This could have mixed effects on the economy; it could, for example, lead to gradual improvement in the trade balance through its effect on the international competitiveness of a country's export, and it could trigger off crises in an economy through its effects on prices.

For a country that operates the fixed or managed float exchange rate system, although trade surplus could bring about an appreciation of the domestic currency, the government intervenes in the foreign exchange market to buy-up the excess supply of the foreign currency at a "reasonable exchange rate"[1] with a view to maintaining the desired exchange rate.

This serves to build up the country's foreign exchange reserves position. This could result in an excess supply of the domestic currency (that is increase in money supply) which in turn could engender inflationary tendencies in the economy (assuming there is an increase in aggregate demand). This has the potential to affect adversely a country's trade balance position. A country that operates the fixed exchange rate system whose trade balance is in continuous deficits, will have to deplete part of her reserve holdings to cater for the excessive demand for foreign exchange that is engendered by a high demand for imports. This has the potential to prevent the depreciation of the domestic currency. This strategy is clearly an anti-development strategy as the depletion of the country's reserve of foreign exchange could have an adverse effect on growth and development prospects.

3.2 Response of Trade Balance to Capital Flows

Capital flows also have implications for a country's trade balance. The impact of capital flows on trade balance manifests via. its impact on the exchange rate. High and rising net capital inflows serves to engender an appreciation of the exchange rate. Exchange rate appreciation in turn tends to reduce the competitiveness of a country's exports but at the same time make possible permissiveness in import demand, bringing about, on balance, deterioration in the country's terms of trade. The impact of capital flows on Nigeria's trade balance is worthy of empirical

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[1] *"Reasonable" in the sense that it should not be less that the parallel (or black market) rate, otherwise government's desire to mop up the excess foreign exchange may not be achieved as holders of foreign currencies will like to sell them at an exchange rate they consider "reasonable"*

verification, especially with what appears to be a resurgence in capital inflow into the country since the restoration of democratic governance in the country in 1999, deriving from what appears to be the newfound confidence by foreign investors in the country's economy.

Barbosa-Filho (2004) has suggested that a country that has unfavourable trade balance could put measures in place to attract abundant foreign finance, while that with favourable trade balance could minimize the inflow of foreign finance. However, the amount of foreign finance that flows into most developing economies has always been very low compared to what flows into the highly industrialized and emerging market economies. For example, in 2004, the entire African continent received a total foreign direct investment of US$18 billion, while China, Brazil and Mexico had FDI inflows of US$60.630 billion, US$18.1630 billion and US$16.602 billion, respectively (Sayila, 2005; Green, 2005). Apart from being meagre, the foreign finance that flows into the LDCs has, over the years, fluctuated considerably. Fluctuations in the flow of foreign finance impacts adversely on the growth of the economies of the LDCs and on their exchange rates, and one way to minimize this consequence is for the LDCs to keep their trade balances at sufficiently high levels so that they do not have to rely too much on foreign finance to maintain exchange rate (and hence price) stability (Barbosa-Filho, 2004). Another strategy recommended by Barbosa.Filho is some sort of control or taxation of capital flows. Since most LDCs do not take the latter strategy for fear that it could hinder the inflow of foreign capital, the former strategy will most likely be the appropriate strategy for them

3.2.1 Income Growth and Trade Balance

Economic theory posits the existence of a positive relationship between income growth and import demand and export supply. The reasoning here is that income growth is a pointer to prosperous climate that serves to make possible high and possibly rising output levels. Accordingly, the net effect of income growth on trade balance depends on whether the growth being experienced in the economy is biased in favour of the tradable sector of the economy relative to the non-tradable sector. A net expansion in the tradable sector would, in all likelihood translate to a rise in export supply and a fall in import demand, in view of the fact that the rise in the output of the import competing sector would tend to engender a fall in the demand for import. Taken together, a rise in export supply and a fall in import demand will, on balance, result in a favourable balance of trade position. If the growth in income is, on the other hand in favour of the non-tradable sector, the impact of income growth on the balance of trade will tend to be negative.

Increases in income, in the absence of trade barriers and subject to other conditions, engender an increase in import demand. Trade deficit results where a country's demand for imports exceeds the country's export supply and the demand for these exports. The extent to which growth in income affects import demand in an economy is largely dependent on income elasticity of import (Barbosa-Filho, 2000), which itself depends on the country's demand for import. Where import is income-elastic, we may expect the theoretical proposition to hold. Contrariwise, an income-inelastic import demand may invalidate the theoretical proposition. A highly import-dependent country such as Nigeria, will most likely have a high income elasticity of import demand. For such countries, import expenditures grow with income. In this case, the possibility of trade deficit as an aftermath looms very large. Countries that are less import-dependent tend to have low (inelastic) income demand for import. In such cases, growth in income does not bring about significant changes in the demand for imports.

Most less developed economies, Nigeria inclusive, have high income elastic demand for import, since they are characterised by weak productive base and therefore depend largely on import, which are partly financed by borrowing. This is a major contributor to the deterioration of their trade balances, especially in non-oil commodities. An immediate consequence of high level of demand for imports is the over flooding of the domestic markets of the highly import dependent economies with foreign goods, bringing along its path, the crowding out or weakening of the domestic firms that would have produced the output needed for both domestic consumption and export.

The use to which a country puts her income has much bearing on her trade balance. For example, a deficit in the balance of trade will inevitably result where a large share of the national income is used to finance import of consumables as it seems to be in the case of Nigeria. However, where it is used to build domestic productive capacity and for import of capital equipment and relevant services to be utilized in building domestic productive capacity, backed up by appropriate trade policies, the deficits will gradually give way to surplus over time. What easily becomes obvious here is that deficit may be acceptable (at least in the shortrun) if it results from the importation of capital equipment, services and essential raw materials that are needed for the strengthening of the productive base of an economy rather than the importation of finished goods or consumables.

The impact of the reported impressive growth statistics on the country's balance of trade is an empirical issue, having regard to the fact that much of the country's growth statistics has been dominated by activities in the crude oil sector. The reported rebound of non-oil sector activities as revealed by published official

statistics tend to suggest the country's trade balance may be significantly influenced by the growth in the country's income that is accounted for by this sector.

3.2.2 Exchange RateTrade Balance Relationship

International trade theory establishes a relationship between the exchange rate of the domestic currency of an economy and country's trade balance. The theory posits that a highly devalued domestic currency discourages imports, as the prices of imported items become very high compared to those of domestically produced items. In the same vein, the devaluation (or depreciation) of the domestic currency encourages exports as the prices of home-made goods become very low and thus competitive, pricewise, in the foreign markets. A major implication of this is that currency devaluation could engender a favourable trade balance. While this may not hold in the short run, it is likely to be so in the long run, following the J-curve proposition.

International trade theory also posits that an overvalued currency could be harmful to a nation's balance of trade position as this could encourage import, *ceteris paribus* (since imported goods and services become relatively cheap in the domestic economy). On the other hand, an overvalued currency serves to discourage exports, which become relatively expensive in the foreign market. In practice, there are exceptions to this strand of reasoning. In this connection, it can be argued that while such countries as China and Japan have achieved and continue to achieve positive trade balance position as a result of the deliberate devaluation of their currencies, this strategy has not worked for most developing economies whose currencies have undergone severe depreciation or several bouts of devaluation over the years, even after opening up to international trade (Aluko, 2003).

Depreciation/devaluation of domestic currencies of many developing has simply not encouraged exports, especially in the light of the fact that most of the LDCs have little or nothing to export. Apart from such economies with extractive industries as Angola, Nigeria, Egypt etc. the share of export in the GDP of many of the economies of the LDC group has been quite insignificant. The depreciation of the domestic currencies has simply worked in a direction that is opposite to what the theory postulates. High and possibly prohibitive exchange rate makes importation of capital equipment needed for domestic production costly, bringing about a fall in domestic output and hence in export. Moreover, preference for foreign goods (obviously due to taste, quality, et cetera) over home-made goods in the LDCs to a large extent, defeats the purpose of depreciating/devaluing the domestic currency. And although currency depreciation/devaluation increases the prices of foreign goods in the domestic market, such increases have hardly served to discourage the demand for these goods in most LDCs.

It could, therefore, be argued in the light of the foregoing, that the extent to which currency devaluation(depreciation) affects a country's import demand depends largely on the price elasticity of import ((Barbosa-Filho, 2004). And price in an import dependent economy is a function of exchange rate. Where import is price-inelastic, the thinking that demand for imports can be curtailed through a depreciation/devaluation of the domestic currency will, at best, be an illusion. If import demand is price-elastic on the other hand, the demand for import may be affected by changes in the prices of foreign goods, working through changes in exchange rate. This will be subject, however, to the availability of close substitutes for the imported commodity. Furthermore, exchange rate devaluation is clearly a monetary policy action whose anticipated result could be negated by expansionary fiscal policy, manifesting by way of increases in government expenditure. This is especially so where such increases are not channelled into domestic investment (Rawlins and Praveen, 1993).

3.2.3 Domestic Inflation Trade Balance Linkage.

Economic theory also establishes a linkage between domestic inflation rate and a country's trade balance. Simply put, high rate of domestic inflation deteriorates the balance of trade, while low inflation rate improves it. The reasoning here is that a country's exports tend to be less competitive in the face of high and possibly rising inflation rate. This can be accounted for by the impact of domestic inflation on the cost of production, which tends to rise as a consequence. Furthermore, the demand for the country's export would tend to fall as a shift away from the country exports by trading partners, wary of the deleterious consequences of imported inflation ensue. Moreover, increases in import that are aimed at eliminating the shortfall in domestic supply, which is the source of the inflationary situation in the first case would serve to further engender deterioration in the country's trade balance. This actually has been the situation of most LDCs, Nigeria inclusive. Indeed, Nigeria is one country that is characterized by low level of domestic output relative to aggregate demand, making it imperative for the country to make resort to import demand in the absence of adequate and possibly underutilized productive capacity.

3.2.4 Trade Openness Trade Balance Relationship

International trade theory asserts that trade openness or liberalization benefits participating nations. The gains from trade are usually explained in terms static and dynamic effects, as for example, improvement in welfare, access to technology etc. An open economy is that which is engaged in trading relationship with the rest of the world, as opposed to that which is closed and thus operating in autarky. The higher the degree of a country's involvement in trading relationship with the rest of the world, the more open the economy is. The degree of trade openness could be measured in different ways (Ogujiuba, Oji and Adenuga, 2004), the commonest

being the ratio of the sum of exports and imports to GDP. This measure could be split into export GDP ratio and import GDP ratio. While the former measures the contribution of exports to the national income, the latter measures the import penetration (or the import dependency) of an economy. A composite measure is the ratio of the sum of import and export to domestic output (GDP). The extent to which trade openness affects a country's trade balance depends on the sizes of each of the ratios. Countries with relatively large export-GDP ratios will, *ceteris paribus*, have favourable trade balance, while countries with high import-GDP ratios experience, *ceteris paribus*, unfavourable trade balance. On balance therefore, the impact of openness on the country's trade balance is an issue to be resolved empirically.

3.2.5 Real Money Supply and Trade Balance Relationship

Theory suggests also that the level and the growth rate of domestic money supply has an effect on a country's trade balance. Liew Lim and Hussain argue that if the real money of a country is lower than that of its trading partner(s), this could lead to favourable trade balance. The reverse would be the case when the country's real money is higher than that of its trading partner(s). The economic logic behind this argument, according to them is that whenever the real money of a country is less than that of its trading partner(s), the purchasing power of the country's currency falls below that of the currency of the trading partner(s) and as such, the country's goods and services become cheaper in the foreign market. This could serve as an impetus for the trading partner(s) to import more goods and services from the country. On the other hand, citizens of the country will tend to import less goods and services from the trading partners as they are considered more expensive. Thus, it can be argued that the end result of the lower purchasing power of the domestic currency would be an improvement in the country's trade balance. In the same vein, there would be a deterioration of the country's trade balance relative to that of its trading partners if the purchasing power of its currency (that is its real money) is higher than that of her trading partner(s).

Liew, Lim and Hussain (2003), within the framework of such drastic assumptions as similarity of product or services, similarity of tastes in trading countries, absence of trade barriers, price and income elastic demand for imports and absence of transportation cost, amongst others, obtained empirical evidence showing that the real money supply-trade balance hypothesis held for the five ASEAN countries, namely Indonesia, Malaysia, the Philippines, Singapore and Thailand that they studied, with respect to their trade relations with Japan using data that covered the 1986-1989 sample period.

Clearly, most (or all) of the underlying assumptions are quite unrealistic, reason for which the hypothesis does not always hold. For example, the low purchasing power of the domestic currencies of most LDCs especially those of sub-Saharan Africa (Nigeria inclusive) has simply not improved their trade balance positions, especially in non-oil commodities. And although foreign goods and services seem more expensive than locally produced goods, consumers in the LDCs have not been dissuaded from demanding more of foreign goods and services than locally made ones ostensibly due to differentials in quality and standards.

4.0 Model Specification

In the light of the survey of the literature and the discussion and examination of the theoretical framework, the paper specifies a single equation multivariate econometric model to be tested in this study functionally as:

$$noilbot = f(gdp, exrv, infl, opn, rms) \quad (1)$$

In a form suitable for empirical testing, equation 1 above is stated in its empirical form as:

$$noilbot = \pm\beta_0 + \beta_1 gdpg - \beta_2 exrv - \beta_3 infl + \beta_4 opn + \beta_5 rms + U \quad (1a)$$

Where:

noilbot = non-oil balance of trade
gdpg = gross domestic product growth rate (proxy for income growth)
exrv = exchange rate volatility
infl = inflation rate
opn = degree of trade openness [(exp + imp)/gdp]
rms = real money supply (nm_2/cpi),
U = white noise error term assumed to satisfy the standard assumptions of zero mean, unit variance and zero covariance.

The *a priori* expectations with respect to sign are as indicated beside the coefficient of each variable.

The model represented by equations (1a) above is a single equation specification. Accordingly, it can be estimated using single equation estimation techniques. In the specification, noilbot is the non-oil component of the country's balance of trade.

4.1 Data description, sources and estimation Methodology

Inflation rate is obtained as the year-on-year changes in the Composite Consumer Price Index. Openness is measured as the ratio of total merchandise trade, obtained as the sum of imports and exports to GDP. Although this measure suffers the limitation

of being ex-post in nature, it is nevertheless the most widely used measure of trade openness in the literature. Exchange rate volatility is obtained by computing the standard deviation of monthly data on exchange rate. Thus, the standard deviation of the monthly observations for any year represents the volatility for that year. Real money supply is obtained by deflating the broad measure of money, M_2 by the price level.

Data employed for the analysis were obtained from a number of secondary sources, which included *Annual Report and Statement of Accounts* as well as *Statistical Bulletin*, publications of the Central Bank of Nigeria, (CBN), publications of the National Bureau of Statistics, as well as various issues of *International Financial Statistics* (IFS), published by the International Monetary Fund (IMF).

Nominal data series were utilized in estimating the models specified, owing to of lack of consistent real series in all the variables except of money supply in the specification,. The empirical methodology entailed first, testing the data on each of the variables in the specification for unit root, having regard to Engle and Granger's (1987) proposition that the use of non stationary data series to estimate the parameters of a regression model has the potential of yielding spurious correlation and could thus impair policies formulated on the basis of models estimated with such data. Next, the variables were utilized in the order in which they passed the stationarity test to estimate the parameters of the model. The third stage entailed testing the variables in the specification for cointegration. In doing this, we tested the residuals obtained from the second stage of the estimation exercise above for unit root. Finally, we estimated an error correction version of the specification since the variables were, in the light of the results of preliminary tests, appropriately admitted in their first difference form in the estimation of the model.

4.2 Unit Root Test Results

The unit root test results show that all the data series on the variables in the specification, when tested in their level form contained unit root, implying that they were non-stationary (see Table 1 below) as the absolute values of ADF test statistic of the variables (in level) were all less than the 95 percent critical value of the ADF statistic. Accordingly, we obtained the first difference form of each of the variables and tested again for unit root. The test results (also in Table 1 below) show that all the variables attained stationarity in their first difference form.

Table 1: Result of ADF Unit Root Test for Variables

Variable	ADF Lag	ADF Test Statistic	95% Critical Value For The ADF Statistic	Remark
noilbot	1	-1.9979	-3.6119	Non-Stationary
gdpg	1	-2.6248	-3.6119	Non-Stationary
exr	1	-1.5934	-3.6119	Non-Stationary
infl	1	-2.8256	-3.6119	Non-Stationary
opn	1	-2.8518	-3.6119	Non-Stationary
rms	1	-1.2801	-3.6119	Non-Stationary
dnoilbot	1	-3.9275	-3.6219	Stationary
dgdpg	1	-5.0161	-3.6331	Stationary
dexrv	1	-3.7718	-3.6219	Stationary
dinf	1	-4.5596	-3.6219	Stationary
dopn	1	-4.1924	-3.6219	Stationary
rms	1	-3.9068	-3.6219	Stationary

Note: Dickey-Fuller regressions include an intercept and a linear trend
Source: Authors' calculations using Microfit 4.1 for Windows Econometric software.

Accordingly, we utilized the variables in their first difference form in estimating the models. The results obtained are reported in Table 2 below.

Dependent variable is dnoilbot 29 observation used for estimation from 1980 to 2008			
Regressor	Coefficient	Standard Error	T-Ratio [Prob]
C	3.2475	1.5258	2.1285 [.911]
dgdpg	-0.3937	0.2064	-1.9082 [.620]
dexrv	-1.8549	1.0441	1.7766 [.418]
dinfl	3.4626	1.4822	2.3361 [.818]
dopn	5.7707	1.7815	3.2393 [.750]
drms	-0.2292	0.0839	-2.7329 [.788]

Source: Authors' calculations using Microfit 4.1 for Windows Econometric software.

The empirical results show that income growth, contrary to expectation, impacts negatively and significantly on the country's non-oil trade balance. The perverse finding may be explained by the fact that since the country's economic growth is largely oil-sector driven, the permissiveness in import demand that is made possible by oil earnings results in the non-oil export component of the balance of trade being significantly outstripped by the volume and value of non-oil import, thus engendering a deficit in the non-oil BOT position.

The empirical evidence show too that exchange rate volatility exerts a significantly negative effect on the country's non-oil BOT. An explanation for this could be that the wide swings and gyrations that are exhibited by exchange rate may serve to prompt economic agents to make demand for imports in the present period as a

way of overcoming the deleterious consequences of uncertainty induced by the volatility in exchange rate on their demand for imports. And if true, the rise in the import demand if unaccompanied by a counterbalancing rise in demand for the country's non oil export and/or the supply of same will simply lead to deterioration in this component of the country's trade balance.

The inflation rate variable, as expected exhibited a negatively signed coefficient estimate, an indication that the inflation rate in the economy engendered deterioration in the country's non-oil trade balance within the reference period. A possible explanation for this finding is that the inflationary trend in the economy, coupled with the high and rising cost of manufactures and non-oil exportables has simply served to make the country's non-oil export uncompetitive. And taken alongside the fact that the composition of the country's non-oil export trade is very narrow to start with, it makes sense to expect that the non-oil sector component of the balance of trade will suffer a deficit, especially in the face of permissiveness in import demand. The variable passed the test of statistical significance at the 5% level.

The openness variable was positively signed and statistically significant. The positive sign indicates that as the country gets integrated into international trade, the non-oil balance of trade improves. The finding is in agreement with *a priori* expectation and it can be interpreted as an empirical validation of the theoretical proposition that nations gain by engaging in trade.

The real money supply variable also was negatively signed and statistically significant. The negative sign is hardly surprising, given that the monetary authorities have had to grapple with the problem of frequently mopping up excess liquidity in the banking system. These empirical findings have implications for policy formulation in the country.

Cointegration Test (Test of Residuals for Unit Root)

We tested the residuals obtained from the regression exercise for unit root as a way of ascertaining whether or not the variables in the specification are cointegrated. The results obtained are presented in Table 2 below.

Table 2: Unit root tests of residuals

Based on ARDL regression of dbot on:					
bot(1)	C	Dgdpg	dexrv	dinfl	
dopn	drms				
29 observations used for estimation from 1980 to 2008					
	Test Statistic	LL	AIC	SPC	HQC
dR	3.5017	328.0445	329.0445	-329.6122	329.1872
ADF (1)	-6.0948	-321.4062	-323.4062	-324.5417	-323.6918
95% critical value for the Dickey Fuller statistic				*NONE*	
Critical value not available for the number of regressors in the regression					
LL Maximized log likelihood			AIC = Akaike Information Criterion		
SBC Schwarz Bayesian Criterion			HQC = Hannan Quinn Criterion		

We note in Table 2 above that there is no 95 percent critical value for the Dickey-Fuller statistics with which the ADF test statistic of the residuals can be compared to determine whether or not there is any long-run cointegration relationship. However, given that the absolute value of the ADF test statistic for the residual is evidently large (-6.0948), we can reasonably conclude that the variables in the specification are cointegrated. Thus, the empirical evidence strongly suggests the existence of a long-run (equilibrium) relationship between them. The existence of a long run equilibrium as revealed by the unit root test of residuals notwithstanding, there exist the possibility of deviations from the equilibrium relationship in the short-run. Such deviations may arise, for example, from shocks to the data-series on the variables in the specification.

According to the Granger Representation Theorem, if two variables are cointegrated, that is, they have long run empirical relationship, then the relationship between them can be expressed using an error correction mechanism, (ECM) (Gujarati, 2005). The ECM involves using lagged residuals to correct for deviations from long-run equilibrium relationship (Ekanem and Iyoha, 2002). The coefficient of the lagged residuals variable plays the role of error correction in the model. It is expected to be negatively signed and statistically significant, with its absolute value lying between zero and one. The absolute value of the ECM variable, being the speed of adjustment indicates how quickly equilibrium is restored in the system in the event of a temporary displacement therefrom. Accordingly, we proceed to estimate the error correction version of the specification as a way of retrieving the long run empirical relationship, which we lost in differencing to secure stationarity. The estimated long run model is presented in Table 3 below.

Table 3: Estimated Long Run Coefficient using the ARDL Approach

Dependent variable is ddbot 29 Observations used for estimation from to 1980 to 2008			
Regressor	Coefficient	Standard Error	T-Ratio [Prob]
dc	11.432	6.2212	1.8473 [.914]
ddgdpg	8.2657	4.2138	1.9616 [.536]
ddexrv	0.2994	0.11397	2.0218 [.190]
ddinfl	0.1063	0.06132	-1.7339[.816]
ddopn	0.2587	0.11821	2.1885 [.736]
ddrms	2.3269	1.3337	1.7447 [.773]
ecm (- 1)	-0.3939	0.1949	-2.0208 [.163]
R Squared	.84863	R-Bar-Squared	0.78873
S.E of Regression	48.5437	F-stat $F_{(6, 22)}$	31.5165[.232]
Mean of dependent Variable	37.2756	S.D. of Dependent Variable	26.1896
Residual Sum of Squares	23.9321	Equation Log-likelihood	34.8908
Akaike Info. Criterion	35.9008	Schwarz Bayesian Criterion	35.5240
DW statistic	1.8225		

Source: Authors' calculations using Microfit 4.1 for Windows Econometric software.

An examination of the estimated error correction representation (Table 3) reveals that the model has a good fit as the coefficient of determination (R^2) indicates that nearly 85 percent of the systematic variation in the dependent variable is explained by the regressors. The adjusted R^2 is also satisfactory. The F-Statistic of 31.5165 is highly significant, as it easily passes the test of statistical significance at the one percent level, indicating that the explanatory variables of the model taken together, significantly explain changes in the dependent variable. The DW statistic of 1.8225 passes the test of zero autocorrelation, an indication of the absence of serially correlated error term. The coefficient of lagged error term, as expected, is negatively signed and statistically different from zero. Its absolute value (which lies between zero and one) indicates that about 39 percent of the disequilibrium in the system is offset by short run adjustments annually to maintain long-run equilibrium. This result further confirms the fact that there is indeed a long-run cointegrating relationship between the dependent variable and the explanatory variables.

4.4 Implications of Findings

Our empirical results have far-reaching implications for policies that are aimed at influencing the country's non-oil trade balance in some desired direction. The results reveal the existence of an inverse relationship between income growth and non-oil component of the country's BOT. The results imply that the country was a net importer of merchandise goods within the period covered by this study. This result confirms the fact that the country is still highly import-dependent. It will be recalled that one of the objectives of the structural adjustment programme (SAP) which marked the formal liberalization of the Nigerian economy (in July 1986), was to reduce dependence on the oil sector and on imports. Our empirical findings reveal that the SAP package simply failed to achieve the objective of diversifying the

productive base of the economy away from a monocultural one, albeit largely due to poor implementation. It thus behoves policy makers to articulate and implement policies that are beneficial to the production of non-oil export goods. This should logically proceed through policies that are aimed at diversifying the productive base of the economy away from crude oil.

The negative sign of the coefficient of the inflation rate variable implies that domestic inflation had an adverse effect on the country's non-oil balance of trade. This effect is attributable to the fact that inflation could reduce the international competitiveness of a country's exports; it could reduce domestic output and this can, in turn, necessitate a rise in import demand to meet rising domestic demand for goods (services). The task for policy makers in the light of this empirical finding is to articulate and implement policies that are capable of boosting domestic output of goods and (services). And if this succeeds, it will serve to mitigate inflationary pressures in the economy while at the same time expanding the volume of non-oil exports. Taken together, these outcomes could be instrumental to engendering a favourable balance in the country's non-oil BOT.

Trade openness impacted adversely on the country non-oil balance of trade (noilbot) due obviously to the high level of demand for imports and low level of non-oil export, causing export-GDP ratio to be consistently below import-GDP ratio in the non-oil sector in the period under reference. This finding easily underscores the transient nature of the huge surpluses that have been recorded in the country's overall BOT data, since such surpluses were accounted for mainly by crude oil export in the merchandise trade account. Furthermore, it calls to question the wisdom, on the part of policy makers, in opening up the Nigerian economy to the outside world in the face of weak or even non-existent non-oil export base. The implication of the finding with respect to this variable for policy formulation is far reaching. It entails articulation and implementation of policy actions that are aimed at expediting an expansion and diversification of the output of the non-oil sector of the economy.

5.0 Summary Policy Recommendation and Conclusion

5.1 Summary

The paper examined the effect of income growth and exchange rate deregulation on Nigeria's non-oil trade balance. In doing this, it has specified and estimated a simple multivariate model in which were utilized income growth, exchange rate volatility, inflation rate and real money supply as arguments. The estimation of the model was done in three stages; first, we tested the data on the variables in the specification for stationarity. The results obtained showed that the variables failed this test in their level form. They passed it, however, in their first difference form.

Accordingly, we utilized the variables in this form to estimate the model. The empirical evidence obtained showed that the variables were largely *well behaved* in terms of the theoretical *a priori* expectation. The residuals obtained from the estimation exercise were tested for stationarity, as a way of testing for cointegration among the variables in the specification. The empirical evidence obtained showed the existence of a cointegrating relationship among the variables. Consequently, we estimated an error correction version of the specification in an attempt to retrieve the long run empirical relationship among the variables which we lost in differencing to secure stationarity. The results obtained from this exercise were robust and satisfactory as the error correction coefficient was rightly negatively signed with its value lying between zero and unity.

5.2 Recommendations for policy

(1) Since a major reason for the import-dependency of the Nigerian economy is the low level of domestic output, measures should be taken by government and all stakeholders to revive the productive sectors of the economy. In this regard, the agricultural, industrial and energy (or power) sectors should be rejuvenated to expand (or increase) the level of domestic output.

(2) Considering the adverse effect of inflation on the international competitiveness of the country's non-oil export commodities, measures should be taken by the monetary and fiscal authorities (collaboratively) to bring inflation rates to acceptable level (preferably, single digit).This calls for tight monetary and fiscal policies. We thus argue in this connection that there is the need for policy makers to be concerned by the quality and productive nature of any expenditure by the government. Indeed, there is palpable evidence that almost all of government expenditure in Nigeria is deployed to all areas with the exception of capital projects that have the capacity boosting domestic output.

(3) Considering the fact that Nigeria appears to be yet unprepared to face the challenges of full-scale liberalization, some protectionist measures should be put in place in order to protect some critical local industries. This will serve to shelter them from fierce competition which they face from better established international competitors. However, there is need to exercise some caution in doing this since governments that perceive that their economies are hurt by such measures could resort to retaliatory actions. One of the best measures in this regard is the provision of indirect subsidy to nascent local industries. In this connection, inputs for both agriculture and manufacturing should be subsidized by government. This measure (which is also practised by the highly developed countries) will, undoubtedly, assist in

boosting productive capacity of local firms as well as raising the percentage of installed capacity that is utilized.

(4) There should be massive investment in human capital. This will help reduce the level of importation of skilled man-power in the country. This calls for a complete overhaul of the nation's education system to make it functional.

(5) The country should sign trade pacts with more countries, especially those in the African continent whose import structures match her exports. This will guarantee increased export earnings (especially earnings from non-oil exports).

(6) Nigeria as a *sovereign* nation should actively think out her own model of trade and development to attain the heights to which she aspires. Thus, copying wholesale some gimmicks and development paradigms that are crafted by foreign governments, bilateral and multilateral institutions and donor agencies is an indication that the country as yet remains unprepared to face the challenges of pursuing socio-politico and economic development.

5.3 Conclusion

This study has brought quantitative tools to bear on an examination of the impact of income growth and exchange rate volatility, amongst a battery of other control variables on Nigeria's non-oil trade balance. Nigeria's overall balance of trade, dominated by huge crude oil exports has consistently been in the positive. But the dominant nature of crude oil in the nation's merchandise trade largely masks the true picture of the country's balance of trade position. It is against this background that the paper isolated the non-oil component for a close examination, bringing empiricism to bear on examining the factors that affect the non-oil component of the country's balance of trade. The empirical evidence obtained was quite satisfactory and insightful and it bears eloquent testimony to the fact that there is an urgent and indeed an overarching need to revive the non-oil sector of the country's economy. This is expected to engender a reduction in the near-total dependence of the economy on imports and on the oil sector for export.

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AN ANALYSIS OF THE THRESHOLD EFFECTS OF INFLATION ON ECONOMIC GROWTH IN NIGERIA

By **Godwin Edet Bassey and Emmanuel A. Onwioduokit***

Abstract

This study represents an attempt to empirically determine the nature of the inflation-growth relationship and the existence of inflation threshold in Nigeria. The investigation is done using Classical Ordinary Least Square (OLS) and the Non-Linear Least Square (NLLS) techniques. Empirical evidence from the study strongly supports the existence of inverse relationship between inflation and economic growth in Nigeria. Further evidence suggests that there is inflation threshold for Nigeria at 18 percent. The obvious policy implication is that the Central Bank of Nigeria should endeavour to keep the rate of inflation bellow 18 percent as this will be growth inducing. It is further suggested that to achieve a sustainable level of economic growth in real terms, conscious efforts should be made to encourage private investment, increase financial liberalization, improve human capital development and embrace fiscal and monetary discipline at all levels of governance.

KEY Words: Inflation Threshold, Economic Growth, Nigeria.

Introduction

There is a general consensus among economists and policy makers that the maintenance of stable macroeconomic conditions is crucial for the attainment of rapid economic growth. It is in realization of this fact that macroeconomic policies in Nigeria since independence have been concerned basically with anti-inflationary measures, aimed at achieving price stability. Indeed the monetary policy framework adopted by Nigeria since 1993 has as overriding objectives, the achievement of single digit inflation (Essien and Ezioche, 2000). Over the years, a set of choices of policy options, consisting of monetary, fiscal, wage freeze, price control, exchange rate and other measures has been deployed to stem the rising tide of sustained increase in the general price level. In retrospect, it appears that in spite of all these measures, the achievement of a stable price regime has remained a mirage.

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It cannot be gainsaid that Nigeria's tortuous path to economic growth over the years has been dogged, among other things, by the problem of inflation. Inflation occurs when there is a "persistent" and "appreciable" increase in the general level of prices (Ladipo, 1982; Lambo 1987; Aboyade, 1993; Dwivedi, 2005). Such increases in the general level of prices are attributable to excess of demand over supply of goods and services (demand pull) or to rising cost of labour and materials (cost push inflation).

Account by Ekpo and Umoh (2000) however, aver that Nigeria never experienced a double-digit inflation during the 1960s. Even so, between 1970 and 1975, the rate of inflation rose from 13.8 to 33.9 percent, reflecting increased monetization of the oil revenue through salary increases/awards and unbridled imports (Nwankwo, 1982 ; Ladipo, 1982). Masha (1998) identifies four high inflationary episodes in Nigeria between 1970 and 1995. These are 33.9 percent in 1975, 39.6 percent in 1984, 40.9 percent in 1989 and 72.8 percent in 1995. Some of the reasons adduced for the different episodes of high inflation have included: excessive monetization of the oil export revenue, the worsening terms of trade as reflected in declining earnings from crude oil, fiscal expansion to reflate the economy under the structural adjustment programme and the absence of fiscal and monetary restraint, arising from continuous depreciation of the naira exchange rate.

An expanding body of both theoretical and empirical literature has emerged over the years to explain the nature of the inflation-growth relationship. Earlier studies based on Philips curve analysis postulate a positive relationship between inflation and economic growth (Samuelson and Lipsey, 1960; Mundel, 1963; Tobin, 1965). The monetarists, led by Milton Friedman of the University of Chicago, maintained that the long-run relationship between inflation and economic growth is neutral. While accepting the efficacy of the Philips curve in the short run, Friedman maintained that there existed no relationship between inflation (rise in money wage) and unemployment in the long run.

However, studies have confirmed that high rates of inflation have adverse consequences for economic growth even in the long run (Barro, 1991; Levine and Renelt, 1992; Fischer, 1993; De Gregorio, 1993; Ghosh and Phillips, 1998; Khan and Senhadji, 2001). Some studies have seriously doubted whether the empirically established inverse relationship between inflation and economic growth suggests any causal relationship. Romer (2006), avers that negative supply shocks are often associated with higher inflation and lower growth while a policy that seeks to reduce inflation may be growth inducing. Therefore, the fact that reduction in inflation and increase in growth occur together may not suggest any causal relationship.

While there is a sizable level of consensus among economists on the negative effect of inflation on economic growth, little or no agreement exists on the precise nature of the inflation growth relationship. Both theoretical and empirical evidence has been adduced to support the views that the inflation-growth relationship is not only inverse but also non-linear. The non-linear relationship is explained by Li (2005) as follows: "At lower rates of inflation, the relationship is not significant or even positive; but at higher rates, inflation has a significantly negative effect on growth" (p. 3). The contention that moderate inflation promotes economic growth led to an interesting policy issue of how much inflation is too much (Seleteng, 2005). This brings to the fore, the argument on what constitutes an inflation threshold for a particular economy.

From the forgoing analysis, the basic problems to which this research addresses itself to are whether inflation has any adverse consequences for growth and whether a threshold level exists for inflation in Nigeria. Given the complexity, the controversy and the unsettling theoretical and empirical evidence on these issues, this study seeks to examine them in the light of Nigeria data and to proffer some policy recipe for effective control of inflation in Nigeria.

The rest of the paper is arranged in five sections as follows. Section II discusses the stylized facts on inflation and economic growth in Nigeria. Section III discusses both the theoretical and empirical literature, relating to the inverse and non-linearity in the inflation-growth relationship. In section IV, the paper articulates the framework of analysis and research methodology. Section V presents and analyses the regression results. The summary of findings, policy inferences conclusion are presented in section VI

II. Stylized Facts on Inflation and Economic Growth in Nigeria

The growth pattern of real GDP and the rates of inflation for Nigeria are presented in Appendix 1 along with other right hand side variables in the growth equation. The trend shows major oscillations in the growth rate of real GDP, betraying fundamental instability within the economy. During the decade, 1970-1979, the real GDP witnessed a steady growth, averaging 10.7 percent. Between 1973 and 1974, the real GDP grew from 5.4 to 11.2 percent. The positive growth rates of those two years were largely accounted for by the massive inflow of oil revenue into the country, following the quadrupling of crude oil prices by OPEC member nations. The inflationary impact of the oil boom is reflected in the rise in the rate of inflation from 9.6 percent in 1970 to 33.6 percent in 1975. With the recycling of the 'petro-dollars' through massive imports and their subsequent monetization through jumbo salary awards, the real GDP growth tumbled to average of 2.17 percent between 1975 and 1979.

A discernable pattern that emerges from the trend analysis is that real GDP growth relates negatively with the rates of inflation. Periods of high inflation are associated with low rates of real GDP growth. For example, when the rate of inflation increased from 9.61.0 per cent in 1970 to 16.67 per cent in 1971, the real GDP growth rate dipped from 25.0 to 14.23 per cent over the same period. Similarly, when the rate of inflation rose to 33.55 percent in 1975, the real GDP growth plummeted to -5.22 per cent. A cursory perusal reveals that inflation does not only affect economic growth contemporaneously but also after a time lag. For instance, when the rate of inflation increased from 9.6 percent in 1970 to 16.7 percent in 1971, the real growth rate of the economy declined from 14.23 in 1971 to 3.36 percent in 1972. Conversely, when the rate of inflation declined from 16.7 in 1971 to 3.2 percent in 1972, the real GDP rose by 2.03 percentage points to 5.39 percent in 1973.

Over the second and third decades (1980-1999) developments in the Nigerian economy were largely influenced by the slump in crude oil prices, excessive debt payment burden which impacted negatively on the balance of payments and the negative and debilitating effects of the Structural Adjustment Programme (SAP). Consequently, the real GDP witnessed high negative growth rates in most of the years while a few other years recorded minimal growth rates, except in 1988, 1989 and 1990, when average growth rates of 8.23 percent was recorded. In tandem, the rate of inflation rose astronomically and peaked at 72.9 percent in 1995. The major forces driving the inflationary trend during these two decades were the massive depreciation of the naira following the adoption of floating exchange rate system in 1986, increased monetization of the economy, fueled by large fiscal deficits and the worsening terms of trade, occasioned by the sharp fall in crude oil prices.

Again a closer look at the data tends to lend credence to the proposition that inflation affects economic growth after a lag. For example, when the rate of inflation rose from 12.7 in 1991 to 44.8 percent in 1992, the real growth rate declined marginally from 3.91 in 1992 to 2.19 percent in 1993. As inflation soared further to 57.2 percent in 1993, the real GDP growth went down to 0.1 percent in 1994. But when inflation stabilized at that level in 1994, the real GDP growth rose to 2.5 percent in 1995. With the outset of civilian administration in 1999, the real GDP growth witnessed greater stability. Inflation rates rose but at a declining rate reflecting economic reforms that emphasized fiscal prudence.

The above analysis is represented graphically in Figure 1 below. The Figure shows clearly that inflation and economic growth tend to move in the opposite direction. Periods of low growth are proceeded by periods of high inflation.

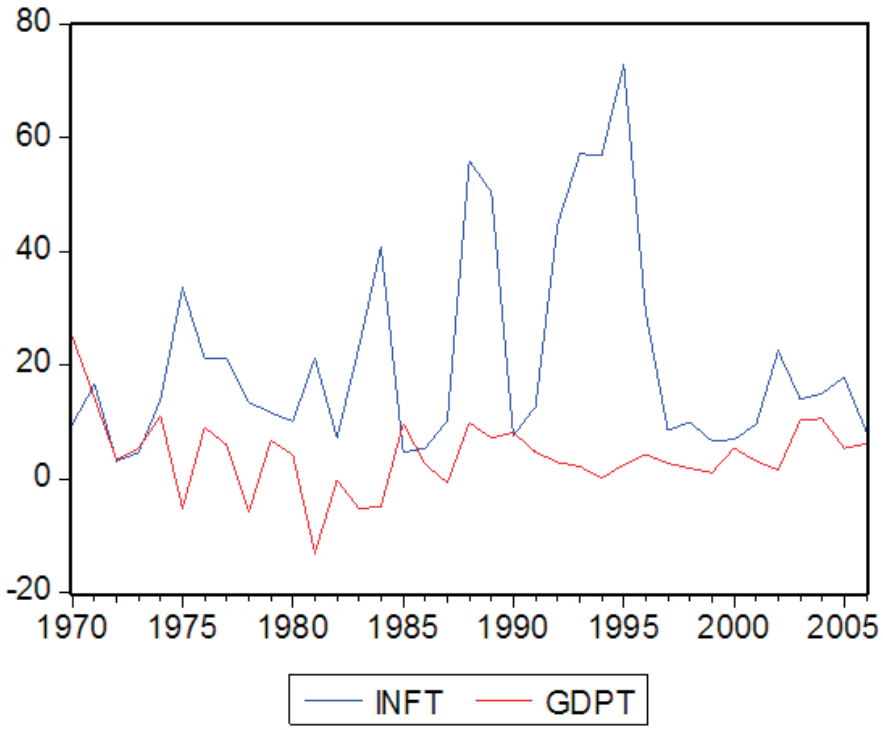

Figure 1: Trend in real GDP growth and inflation

III REVIEW OF THEORETICAL AND EMPIRICAL LITERATURE

III.1 Theoretical Literature

The first neo-classical attempt to explicitly incorporate money and inflation into growth equation was undertaken by Mundel (1963) and Tobin (1965). According to Mundel (1963) an increase in inflation or inflation expectation immediately reduces real money balances of the asset holders. This works through what he called "inflation tax". The inflation tax model is based on the fact that inflation acts as a tax on money holding. The theory is said to have a strong application in developing countries, where in absence of other means of raising revenue, the government can resort to inflation tax financing.

Similarly, Tobin (1965), in the neo-classical tradition of Solow (1956), Swan (1956) and Mundel (1963) developed a model that saw money as a store of value in the economy (Gokal and Hanif, 2004). Individual in this model substitutes current consumption for future consumption by either holding money or acquiring capital. Under this model, individuals maintain precautionary balances, in spite of a higher rate of returns on capital. Thus, the Tobin effect suggests that inflation causes individuals to substitute money for interest earning assets which leads to greater capital intensity and promotes economic growth.

Following the important contributions by Stockman (1981) in the cash-in-advance model, and Akerlof (1970), Myers (1984) and Stiglitz (1984) on asymmetric information problem in the financial market, the stage was set for providing theoretical explanations for the empirically observed negative relationship between inflation and economic growth. According to these theories, inflation increases financial market imperfections in the form of asymmetric information problem, resulting in credit rationing and lower level of financial intermediation, which impedes economic growth.

Arguing on this score, Lee and Wong (2005) observed that high inflation can repress financial intermediation by eroding the usefulness of money assets and by leading to policy decisions that distort the financial structure. Also, endogenous growth theorists led by Romer (1986), Lucas (1988), Malcallum and Goodfriend (1989), Grossman and Helpsman, (1991) and Gomme (1993) argue that inflation acts as a tax on human capital and would cause labour to leisure substitution that lowers rate of returns on human capital and can also lower growth rate.

Recent empirical studies have confirmed that the relationship between inflation and economic growth is not only negative but also non-linear (Khan *et al.,* 2001; Khan and Senhadji, 2001; Li, 2005). However, as noted by Li (2005), the mechanism that gives rise to a negative and non-linear correlation between inflation and long-run growth is far from being clear. However, by introducing "asymmetric information friction" into monetary growth model, Azariadis and Smith (1996), Huyben and Smith (1999) and Bose (2002) argue that higher rates of inflation increase the incentive to borrow and reduce the incentive to save. Thus "natural lenders" tend to become "natural borrowers" during periods of high inflation. This creates adverse selection problem, natural lenders become lower quality borrowers with higher default risks. The appropriate response of the financial system would be to impose credit rationing, which would impede efficient resource allocation, diminish financial intermediation and consequently impair economic growth (Khan *et al.,* 2001; Li, 2005).

However, if the rate of inflation is sufficiently low, credit rationing is not required to induce natural lenders to lend rather than borrow. Under that condition, the credit market is said to operate in a totally "walrasian way". The model therefore, generates a Mundel-Tobin effect in which, in the absence of credit rationing, an increase in the rate of inflation causes agents to substitute cash into investment in physical and human capital, thus stimulating economic growth. Thus, a critical rate of inflation exists below which inflation can stimulate economic growth and financial depth but above which inflation impairs economic growth. Thus, the Adverse Selection and Moral Selection Paradigm provide a theoretical explanation for the existence of a threshold in the inflation-growth relationship.

III.2 Empirical literature

In their review of empirical literature, Li (2005) and Lee and Wong (2005) indicated that the first attempt to empirically examine the non-linear relationship between inflation and economic growth and to detect an inflation threshold was undertaken by Fischer (1993). Fisher's finding is that while low inflation is not necessary for high growth even over long periods, high inflation is not consistent with sustained growth. However, it was the work of Sarrel (1996) that formally examined the existence of a structural break in the inflation-growth relationship. The study used a panel database combining annual data from 87 countries, covering the period 1970-1990. It found that there is evidence of a structural break that is significant when inflation rate is 8 percent. Below that rate, inflation does not have any effect on growth or it may even have a slightly positive effect. Above this rate, the estimated effect of inflation on growth rates is negative, significant and robust.

Ghosh and Phillips (1998) examine the issue of inflation threshold using a larger sample than Sarel (1996). The complete data set consisted of 3,603 annual observations in respect of to 145 countries, over the period 1960-1976. Surprisingly, the authors found a substantially lower threshold effect at 2.5 percent annual inflation and a significant negative effect above that level, which passed all robustness tests. In a similar work, Kristofferson and Doyle (1998), using unbalanced panel for the period, 1990-1997, estimated the threshold level of inflation at 13 percent for transition economies.

Khan and Sanhadji (2001) have also analyzed the inflation growth relationship for industrial and developing countries, using new econometric tools developed by Chan and Tsay (1998 and Hansen (1999, 2000). The sample included 140 countries, covering the period 1960-1998. To test for the existence of a threshold effect, a log model of inflation was estimated. The authors' results suggest the existence of a threshold beyond which inflation exerts a negative effect on growth but below which inflation has no effect on growth. They established the threshold level of inflation for industrial countries at 1-3 percent and that of developing countries at 11-12 percent. The thresholds were statistically significant at 1 percent, implying that they were very precise.

Rousseau and Wachtel (2002) examine impact of inflation on the finance-growth link. The authors used five-year averages of standard measures of financial development, inflation and growth for 84 countries from 1960 to 1995 to run a series of rolling panel regressions. Their results showed that there is an inflation threshold for the finance-growth nexus that lies between 13 and 25 percent. When inflation exceeds this threshold, finance ceases to increase economic growth. Using econometric model, Glyferson and Herbertson (2001) found that the long-run

average inflation in excess of 10-20 percent per year tended to impede economic growth and that an increase in inflation from 5 to 50 percent per year reduced the rate of growth of GDP per capita from 0.6 to 1.3 percent.

In another panel regression study, Li (2005) examined the relationship between inflation and economic performance, using data for 90 developing countries and 28 developed countries over the period 1961 to 2004. The study confirmed the existence of a non-linear relationship between inflation and growth and that developing and developed countries showed significantly different forms of non-linearity in the inflation-growth relationship. In particular, the study suggested that two thresholds existed in the function relating economic growth and inflation for developing countries. The first-threshold was estimated to be 14 percent and the second threshold was estimated to be 38 percent. For developed countries, only one threshold was detected at 24 percent. Below this threshold, inflation has a significantly positive effect on growth, while the impact of this positive effect diminishes as inflation exceeds this threshold. This finding was clearly in contradiction to a similar panel study by Drunker *et al.* (2005) who found two inflation thresholds in industrial countries at 2.5 and 12.6 percent and single threshold for non-industrial countries at 19.6 percent.

Lee and Wong (2005) employed a threshold autoregressive (TAR) model to investigate the existence of inflation threshold effects in the relationship between financial development and economic growth for Taiwan and Japan. The results indicated that there is one inflation threshold value for Taiwan and two for Japan. In particular, the inflation threshold below which financial development significantly promotes economic growth was estimated at 7.25 percent for Taiwan and 9.66 percent for Japan.

Kremer *et al*. (2008) undertook a balanced panel data study of 63 industrial and non-industrial countries, over the period 1960 to 2004. The study employed both the linear and non-linear regression models that provided for threshold effects. The findings from the study showed that inflation hampered growth if it exceeded threshold of 2 percent for industrial and 12 percent for non-industrial countries. Below these thresholds, however, the effects of inflation on economic growth are significantly positive.

Apart from panel data studies, a number of country specific studies based on time series data have been carried out to investigate the existence of inflation threshold for the individual countries. Singh and Kalirajan (2003) specifically sought to find out the threshold level of inflation for India, using time series data for the period 1971 through 1978. The study found no significant structural break in the inflation-growth nexus in India, but that inflation has significant negative effect, at all levels, if it

increases from the level of the previous period.

In another related study, Seleteng (2006) estimated the optimal level of inflation for Lesotho, using quarterly time-series dataset for the period 1981-2004. The data was converted from annual to quarterly time series by applying cubic interpolation technique embedded in E-views econometric software. The estimated model suggested a 10 percent optimal level of inflation, above which inflation is detrimental to economic growth.

Within Nigeria, empirical studies on the inflation threshold are scanty if any. To the best of the researcher's knowledge no study has yet been undertaken to empirically estimate an inflation threshold for economic growth in Nigeria. Nevertheless, Nwani *et al*. (2004) examined the empirical relationship between inflation, inflation uncertainty and inflation targeting overtime (1970-2002), using the Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. The results of the study suggested that there exists a positive relationship between the trend inflation and the measure of uncertainty. The study established the range of inflation threshold that would minimize inflation uncertainty at 9.75 to 10.96 percent and 9.64 to 11.58 percent as the forecasting horizon becomes longer.

Recently, Onwioduokit and Apo (2006) estimated the threshold level of inflation and financial depth for Nigeria, using annual data from 1976 to 2003. The estimation was carried out using non-linear regression technique as developed by Khan *et al.* (2001). The findings from their study confirmed the existence of threshold effects in the inflation-financial depth relationship for Nigeria. The threshold was estimated to be 10.0 percent.

IV Framework of Analysis and Research Methodology

In designing the framework of analyses and research methodology, the paper adopts two growth equations-the linear and non-linear equations- as in Li (2005) and Lee and Wong (2005).

The Linear Growth Model

The linear growth model is derived from the endogenous growth theory, using growth accounting framework. The growth accounting methodology, according to Dornbusch *et al.* (2004) explains what part of growth in total output is due to growth in the different factors of production. Following the framework of Ekpo (1995), Lee and Wong (2005) and Li (2005), the linear growth model for the Nigerian economy is specified as follows:

Let aggregate production function be given as:

$$Y_t = Y(K_t, L_t, P_t, Z_t) \ldots\ldots\ldots\ldots (1)$$

where Y_t = Real GDP
K_t = Capital Stock
L_t = Labour Input
P_t = The rate of inflation
Z_t = Other determinants of growth not yet specified.

To linearize equation (1), we take total differentiation and obtain:

$$dY_t = \frac{Y\,dK_t}{k} + \frac{Y\,dL_t}{L} + \frac{Y\,dP_t}{P_t} + \frac{Y\,dZ_t}{Z}$$

$$= Y_k dK_t + Y_L dL_t + Y_p dP_t + Y_z dZ_t \quad \ldots\ldots (2)$$

Where Y_i = partial derivatives of Y_t with respect to its arguments in the equation. Dividing equation (4.2) through by Y_t and rearranging the terms, we have

$$dY/Y = e_k dk/k + e_L dL/L + e_p dP/P + e_z dZ/Z \ldots\ldots (3)$$

where dY/Y, dk/k, dL/L. dPt/P and dZ/Z are proportional changes of real output, capital, labour, price index and other variables not explicitly specified in the model respectively and e_i = the elasticity of output with respect to the relevant independent variables.

Thus equation (3) can be stated in growth term as;

$$Y_t = {}_0 + {}_1K_t + {}_2L_t + {}_3P_t + {}_4Z_t \quad \ldots\ldots (4)$$

Where, the variables are expressed in growth terms.

Alternatively, equation (4) can be stated in log linear form as follows:

$$\ln Y = 0 + {}_1\ln K_t + {}_2\ln L_t + {}_3\ln P_t + {}_4\ln Z_t \quad \ldots (5)$$

Where, Bi = elasticity of output growth with respect to changes in the respective independent variables.

Based on the general framework provided above, the linear growth equations are explicitly specified as follows;

$$\ln GDP_t = {}_0 + {}_1 \ln INV_t + {}_2 \ln POP_t + {}_3 \ln INF_t + {}_4 \ln M_2 GDP_t + {}_5 \ln GEX_t + {}_6 \ln OPN_t + {}_7 \ln HDI_t + U_1 t \ldots\ldots\ldots\ldots (6.1)$$

where ${}_{1, 2, 4, 5, 6, 7} > 0$ and ${}_3 < 0$.

$$\ln GDP_t = {}_0 + {}_1 \ln INV_t GDP_t + {}_2 \ln PoP_t + {}_3 \ln INF_t + {}_4 \ln M_2 GDP_t + {}_5 \ln GEXGDP_t + {}_6 \ln OPN_t + {}_7 \ln HDI_t + U_2 t \ldots . (6.2)$$

where ${}_{1, 2, 4, 5, 6, 7} > 0$; ${}_3 < 0$

$$\ln GDPt = a_0 + a_1 \ln INVGDP_t + a_2 \ln POP_t + a_3 \ln INF_t + a_4 \ln CPS_t + a_5 \ln GEX_t + a_6 \ln OPN_t + a \ln_7 HDI_t + U_3 t \ldots\ldots\ldots (6.3)$$

where $a_1, a_2, a_4, a_5, a_6, a_7 > 0$; $a_3 < 0$.

$$\ln GDPt = {}_0 + {}_1 \ln INVGDP_t + {}_2 \ln POP_t + {}_3 \ln INF_t + {}_4 \ln CPS_t + {}_5 \ln GEXGDP_t + {}_6 \ln OPN_t + {}_7 \ln HDI_t + U_4 t \ldots\ldots (.6.4)$$

Where ${}_{1, 2, 4, 5, 6, 7} > 0$; ${}_3 < 0$.

Definition of Variables

The variables used in the linear growth equations for this study are defined as follows:

Dependent variable

Y_{it}	=	GDP_t	=	Growth rate of real GDP

Independent variables

K_{it}	=	INV_t	=	Growth rate of investment
	=	$INVGDP_t$	=	Investment GDP ratio
L_t	=	POP_t	=	Growth rate of population
P_t	=	INF_t	=	Inflation rate

M_2GDP_t = Based money/GDP ratio measuring financial depth

CPS_t = Credit to private sector/GDP, measuring financial depth.

OPN_t = Degree of openness of the economy, measured as (Export + Import)/GDP

HDI_t = Human development indicator, measured by primary school enrollment.

GEX_t = Government consumption expenditure growth rate

$GEXGDP_t$ = Government consumption expenditure/GDP ratio

The Threshold Model

The model specifies that individual observations can fall into discrete classes based on the value of an observed threshold variable (Lee and Wong, 2005). Following the framework of Li (2005), we specify the threshold model for the Nigerian economy as follows:

$$\ln GDP_t = {}_0 + {}_1 \ln INF_t\,[DM_t(INF_t < K^*)] + {}_2 \ln INF_t [DM_t(INF_t > K^*)] + {}_3 \ln INV_t + {}_4 \ln POP_t + {}_5 \ln M_2 GDP_t + {}_6 \ln GEX_t + {}_7 \ln OPN_t + {}_8 \ln HDI_t + U_{1t} \quad \ldots\ldots(7)$$

where DM_t = Dummy variable with values 1 if $INF_t > K^*$ or 0 otherwise.

INF_t = Annual inflation rate.

K^* =The threshold level of inflation which is to be estimated.

$_1$ = The effect of inflation below the threshold level.

$_2$ = The effect of inflation above the threshold level.

Other variables are as previously defined.

Data Requirement

Secondary data are used in the study. The data are obtained mainly from the Central Bank of Nigeria's *Statistical Bulletin* and the *Annual Abstracts of Statistics* published by the National Bureau of Statistics. Other sources of data include the *World Development Report* and *International Finance Statistics* published by the World Bank and International Monetary Fund (IMF) respectively.

Method of Data Analysis

In this study the different models specified are estimated using different econometric techniques appropriate to them. For the linear growth models, the study employs the Classical Ordinary Least Square Technique (OLS) as suggested by Min Li (2005). For the non-linear model, the study uses the non-Linear Least Square (NLLS) method as suggested by Khan *et al*. (2001). As explained by Khan *et al.* (2001), the method involves the following procedures: for any K*, the model is estimated by OLS, yielding the Residual Sum of Squares (RSS) as a function of K*. The least square estimate is found by selecting the value of K* that minimizes the sum of squared residuals. As part of the methodology adopted in this study, an analysis of the dataset is carried out to ensure its conformity with basic properties of the OLS estimate. In particular, the stationarity test using Augmented Dickey Fuller (ADF) and the co-integration test, using Engle-Granger Two-Step procedure (EGTS) are applied in this study.

Test of Significance

The various hypotheses developed in this study will be tested for significance, using a priori, statistical and econometric criteria. For the non linear model, the hypothesis of no threshold is tested against the existence of one threshold. That is, Ho= $_1$ = $_2$. Li (2005) explained that under the null hypothesis, the threshold level of inflation K* is not identified, so classical tests such as t test and likelihood ratio test, have non standard distributions and therefore, the conventional method of hypothesis testing cannot be applied. Hansen (1999) as cited in Lee and Wong (2005) suggested, as a solution to this problem, the use of Langrage Multiplier Bootstrap procedure to simulate asymptotic distribution of the following likelihood ratio test.

$LR_1 = (S_0-S_1)\backslash^2$ ..... (8)

where LR_1 = Likelihood ratio test under H_1

S_O = Residual sum of squares under Ho.

S_1 = Residual sum of squares under H_1

^{2} = residual variance under H_1

Hansen (1999) in Li (2005), explained that the asymptotic distribution of the likelihood ratio statistic $LR_{(K^*)}$ is non-standard yet free from nuisance parameters. The author therefore, formed asymptotic confidence intervals [C(a)] by using the inverse of the asymptotic distributional function of LR_{K^*} such that

C(a) = -2 ln (1 - 1 - a) ..... (9)

where 'a' is the critical value. The "no rejection region" of confidence level, 1-a is the set of values of K* such that LR_{K^*} C(a). In other words, if the computed LR_{K^*} > C(a), we reject Ho and conclude that the threshold is statistically significant.

V Analysis of Results: Inflation and Economic Growth in Nigeria

Before presenting and analyzing the regression results on both the linear and non-linear growth equations, the paper examines the correlation matrix and report on the time series properties of the variables, including the stationarity and co-integration tests. The correlation matrix of the variables used is presented in Table 1. From the Table, the highest correlation is surprisingly between M_2GDP_t (a measure of financial depth and population growth (POP_t). The lowest correlation (0.007) is between government expenditure/GDP ratio and real real investment/GDP ratio. Inflation rate maintains a correlation coefficient of 0.310 with real GDP. The rest of the correlation coefficients maintain values of between 0.009 and 0.588, which are acceptable to avoid the problem of multi-collinearity (Lee and Wong, 2005).

Table 1: Correlation matrix of the data set

Variables	GDP_t	$GDP\ CAP_t$	INV_t	POP_t	INF_t	$M2\ GDP_t$	GEX_t	OPN_t	HDI_t	CEX_t	$INV\ GDP_t$	$GEX\ GDP_t$
$lnGDP_t$	1											
$lnGDPCAP_t$	0.999	1										
$lnINV_t$	0.473	0.480	1									
$lnPOP_t$	0.317	0.342	0.415	1								
$lnINF_t$	0.310	0.310	0.446	0.154	1							
lnM_2GDP_t	0.453	0.464	0.323	0.576	0.021	1						
$lnGEX_t$	0.205	0.206	0.226	0.151	0.333	0.188	1					
$lnOPN_t$	0.025	0.023	0.168	0.046	0.240	0.295	0.149	1				
$lnHDI_t$	0.009	0.002	0.239	0.236	0.090	0.233	0.100	0.065	1			
$lnCEX_t$	0.253	0.253	0.074	0.055	0.568	0.286	0.106	0.067	0.056	1		
$lnINVGDP_t$	0.208	0.199	0.147	0.242	0.144	0.245	0.074	0.339	0.411	0.249	1	
$lnGEXGDP_t$	0.494	0.497	0.329	0.305	0.306	0.282	0.155	0.087	0.141	0.100	0.007	1

Source: Computed by the researcher based on annual data from CBN Statistical Bulletin (2006-2008) and National Bureau of Statistics (various issues).

Table 2: Unit root test: augmented Dickey-Fuller test results

	ADF test statistic		5% Critical values		Decision
Variables	Level	1st Difference	Level	1st Difference	
$lnGDP_t$	-5.4660	-	-2.9458	-	I(0)
$lnGDPCAP_t$	-5.4439	-	-2.9458	-	I(0)
$lnINV_t$	-4.4171	-	-2.9458	-	I(0)
$lnPOP_t$	-3.5730	-	-2.9458	-	I(0)
$lnINF_t$	-3.7111	-	-2.9458	-	I(0)
lnM_2GDP_t	-2.2301	-6.6995	-2.9458	-2.9484	I(1)
$lnGEX_t$	-6.5799	-	-2.9458	-	I(0)
$lnOPN_t$	-4.1858	-	-2.9458	-	I(0)
$lnHDI_t$	-6.3374	-	-2.9458	-	I(0)
$lnCEX_t$	-5.0668	-	-2.9458	-	I(0)
$lnINVGDP_t$	-1.1124	-5.6523	-2.9458	-2.9511	I(1)
$lnGEXGDP_t$	-7.9151	-	-2.9458	-	I(0)
$lnCPS_t$			-2.9458		

Source: Computed by the researcher

The regression results of the unit root tests as presented in Tables 2 and 3 show that most of the variables are stationary at levels, with the exceptions of M2GDP ratio (a measurement of financial depth) and the Investment GDP ratio (INVGDPt) which are stationary at first difference. Thus at 5 percent level of significance, the null hypothesis of non-stationarity can be rejected in all except the two variables mentioned earlier, which are stationary at first difference. The obvious conclusion from these results is that the OLS regression may not produce "spurious" results since all the variables are difference stationary..

Table 3: Unit root test: Phillips-Perron test results

	Phillips-Perron statistic		5% Critical values		Decision
Variables	**Level**	**1st Difference**	**Level**	**1st Difference**	
$\ln GDP_t$	-5.4660	-	-2.9458	-	I(0)
$\ln GDPCAP_t$	-5.4439	-	-2.9458	-	I(0)
$\ln INV_t$	-4.2379	-	-2.9458	-	I(0)
$\ln POP_t$	-3.4804	-	-2.9458	-	I(0)
$\ln INF_t$	-3.4093	-	-2.9458	-	I(0)
$\ln M_2GDP_t$	-2.2038	-6.8602	-2.9458	-2.9484	I(1)
$\ln GEX_t$	-6.5686	-	-2.9458	-	I(0)
$\ln OPN_t$	-4.1799	-	-2.9458	-	I(0)
$\ln HDI_t$	-6.3272	-	-2.9458	-	I(0)
$\ln CEX_t$	-5.0343	-	-2.9458	-	I(0)
$\ln INVGDP_t$	-0.9348	-9.2401	-2.9458	-2.9484	I(1)
$\ln GEXGDP_t$	-8.2483	-	-2.9458	-	I(0)
$\ln CPS_t$					

Source: Computed by the researcher

To examine whether the variables maintain long run relationship, we carried out the Engle-Granger two- step procedure tests on each of the growth equations in the study (Equations 8.1 8.4). The results of our EGTS test (Table 4) show that there is a stable long run relationship between the variables, although there might be some deviations in the short run.

Table 4: Co-integration analysis using Engle-Granger two-steps (EGTS) procedure

Residual	ADF test		PP test		Decision
	ADF statistic*	**1% Critical value**	**PP statistic***	**1% Critical value**	
Equation 8.1	-7.1864	-2.6308	-7.3951	-2.6308	I(0)
Equation 8.2	-6.5418	-2.6308	-7.9249	-2.6308	I(0)
Equation 8.3	-5.7541	-2.6327	-5.7684	-2.6327	I(0)
Equation 8.4	-5.7090	-2.6327	-5.7195	-2.6327	I(0)

***** The test shows a rejection of null hypothesis at 1% level of significance.
Source: Computed by the researcher

V.1 Presentation and Analysis of Estimation Results for Linear Growth Equations

The estimation results for the linear growth equations 6.1 to 6.4 are presented in Table 5. The equations represent different formulations of the hypothesis that the growth in real output in Nigeria depends on the growth rate of real investment (INV_t), money stock (M_2) to GDP ratio (measure of financial depth), the real growth rate of government expenditure (GEX_t), the degree of openness of the economy (OPN_t) and human capital development (HDI_t).

The specification for each equation was done in order to avoid the problem of multicolliniarity and to test the robustness of the inflation coefficient. For instance, in equation 8.1 and 8.3, real investments and real government expenditures are expressed in growth terms while in equations 8.2 and 8.4, they are expressed as a ratio of GDP. This is in line with the different specifications found in the literature. Similarly the two measures of financial development, namely M_2GDP and CPS_t were specified separately to compare their individual contributions to the growth process in Nigerian economy.

Taken together, the equations represent a "fairly good fit" with about 57 percent of the systematic variation in the real growth rate being explained by the model on the average. The equations also passed the F-test for significance at 5 percent level. An examination of individual equation shows that equation 8.3 performs the best, posting the highest adjusted R^2 of 74 percent and F statistic of 15.5 percent. The worst performing equation is 8.2, which records the lowest adjusted R^2 of 36 percent and F statistic of 3.9 percent.

This result suggests that expressing the explanatory variables in growth terms yields better results than expressing them as ratios of GDP. It also suggests that credit to private sector is more related to GDP growth than money stock (M2) GDP ratio, and therefore a better measure of financial depth.

Table 5: Estimation results for linear growth models (6. 1-6.4)

Dependent variable: log of real GDP growth rate (GDP_t)																
Equation number	**8.1**				**8.2**				**8.3**				**8.4**			
Explanatory variables	**Co-efficient**	**Std. Error**	**t-stat**	**Prob.**	**Co-efficient**	**Std. Error**	**t-stat**	**Prob.**	**Co-efficient**	**Std. Error**	**t-stat**	**Prob.**	**Co-efficient**	**Std. Error**	**t-stat**	**Prob.**
Constant	0.1998	(1.4927)	0.1339	0.8944	2.8504***	(1.5883)	1.7946	0.0832	2.8932*	(1.0736)	2.6947	0.0118	6.2885*	(0.7991)	7.8696	0.0000
$lnINV_t$	0.5672*	(0.1474)	3.8490	0.0006					0.6277*	(0.1106)	5.6774	0.0000				
$lnPOP_t$	-0.1083	(0.7477)	-0.1448	0.8859	-1.2535	(0.9884)	-1.2683	0.2148	-0.7462	(0.5287)	-1.4115	0.1691	-1.0479	(0.6271)	-1.6770	0.1059
$lnINF_t$	-0.2483***	(0.1473)	-1.6861	0.1025	-0.4324*	(0.1657)	-2.6098	0.0142	-0.3863*	(0.1160)	-3.3293	0.0025	-0.5409*	(0.1210)	-4.4684	0.0001
$DlnM_2GDP_t$	-0.8534**	(0.4040)	-2.1123	0.0434	-0.7375	(0.5472)	-1.3476	0.1882								
$lnGEX_t$	0.0379	(0.1213)	0.3121	0.7572					-0.0449	(0.0948)	-0.4734	0.6396				
$lnOPN_t$	-0.3387	(0.2657)	-1.2748	0.2125	-0.1163	(0.3060)	-0.3802	0.7066	-0.0523	(0.2076)	-0.2521	0.8028	0.2336	(0.2394)	0.9759	0.3375
$lnHDI_t$	-0.0637	(0.1310)	-0.4859	0.6307	0.0822	(0.1613)	0.5097	0.6141	-0.0943	(0.1001)	0.9416	0.3545	-0.0678	(0.1186)	-0.5914	0.5723
$DlnINVGDP_t$					-0.4161	(0.2879)	-1.4452	0.5191					0.6010	(0.4706)	1.2772	0.2120
$lnGEXGDP_t$					0.1039	(0.1432)	0.7254	0.4740					-0.3499*	(0.0924)	-3.7858	0.0007
$lnCPS_t$									-2.2737*	(0.4292)	-5.2970	0.0000	-2.3094*	(0.5471)	-4.2208	0.0002
R^2	0.6362				0.4873				0.7947				0.7115			
Adjusted R^2	0.5483				0.3635				0.7433				0.6394			
D.W. Statistic	2.3420				2.1696				1.9665				1.9544			
F. Statistic	7.2448				3.9372				15.4795				9.8652			
Akaike information	1.9802				2.3233				1.4440				1.7841			
Schwarz criterion	2.3285				2.6716				1.7959				2.1359			

*Significant at 1% level. **Significant at 5%. ***Significant at 10% level.
Source: Computed by the researcher

A close examination of the major arguments in the growth equations reveal that while some conform to economic theory, others do not. Starting with our variable of interest, which is inflation, it is heartening to note that the coefficients of this variable maintain consistent negative sign in all the four equations (6.1 6.4), in line with our a priori expectation. This suggests that the relationship between inflation and economic growth in Nigeria is negative. With the exception of equation 8.1, where inflation passed the test of significance at 10 percent, the t-test confirms that inflation coefficients in the other three equations are statistically significant at 1 percent. Thus, the null hypothesis that there is no inverse relationship between inflation and economic growth in Nigeria can be safely rejected.

A further interpretation of inflation coefficient in equation 6.3 shows that a 10 percent increase in the rate of inflation will reduce the real growth rate of the economy by 3.8 percent, other things being equal. This finding is in tandem with that of Min Li (2005), Lee and Wong (2004) and Bose (2002) who reported negative inflation coefficients in cross country panel regression studies. Another important variable that has met the a priori expectation is the real investment when expressed in growth terms. In equation 6.1 and 6.3 real investment growth does not only possess the expected sign (positive) but is also statistically significant at 1 percent level. Thus, going by equation 6.3, a 10 percent increase in the growth rate of real investment will induce growth in real output by 6.3 percent. However, when measured as ratio of GDP, real investment performs poorly depicting contradictory signs and remaining statistically insignificant. This suggests that it is the growth in real investment and not just the rate of investment that impacts positively on economic growth in Nigeria.

An interesting result is presented by the credit to private sector as a ratio of GDP. This variable is used in this study to measure financial depth. Theoretical reasoning holds that increased financial depth would promote economic growth by reducing asymmetric informational problem. Our result shows that this variable does not only have a negative sign but is statistically significant in all equations used. This surprising outcome can be attributed to the weak link that exists between the real sector and the financial sector in Nigeria. Financial institutions in Nigeria are hardly engaged in financing of venture capital or equity investment that would promote real growth in the economy. Rather, they are into currency trading, foreign exchange transactions, money market operations and other rent-seeking activities that do not impact on real growth and development. Another measure of financial depth used in this study is the M2 GDP ratio. This variable performs poorly in the two equations used, depicting negative signs and only being statistically significant at 5 percent level in one of them. Although widely used in cross country panel studies as indicator of financial depth (Lee and Wong, 2005; Gilman and Harris, 2004; Rousseau and Watchel, 2002), this variable is rejected by the Nigerian data.

Government expenditure both specified in growth terms or as a ratio of GDP, portrays contradictory signs and remain insignificant except in equation 6.4, where, as a ratio of GDP, it is statistically significant at 5 percent level. Yet the negative sign it displays weakens any statistical inferences that can be made. It must be said that the negative sign and the non-significance of its parameter estimate should not come as a big surprise. Because of the high level of corruption, most public sector projects are executed on paper while the actual funds go into wrong hands. Besides, the persistent deficits maintained by the public sector act as a drain on the resources of the private sector, thus impeding economic growth.

Other variables in the growth equations that displayed consistently negative signs, contrary to a priori expectations are the population growth (POP_t) and growth in index of human capital proxied by primary school enrollment. Although these variables have been extensively used in growth regressions, they hardly yield satisfactory result (Roussau and Watchell, 2002; Gylfason and Hebertsson, 2001). The parameter estimates of the population growth show negative signs in all the equations. This may be due to the poor quality of the work force and the fact that there is the growing level of unemployed that still form part of the population, thus depleting the available output. For the human development index (HDI_t), which displayed negative signs and statistically insignificant, this can be attributed to the low level of funding of education in Nigeria. Besides, Gylfason and Herbertsson (2001) have attributed the poor performance of this variable to specification error, saying that it is misleading to measure output (human capital) by input (number of pupils).

The degree of openness of the economy also displays contradictory signs and remains statistically insignificant in all the growth equations. This debunks the much taunted "growth by trade" arguments. Obviously, the growing openness of the economy is detrimental to economic growth since it weakens rather than strengthen the competitiveness of domestic products.

V.2 Presentation and Analysis of Estimation Results for the Threshold Model

The existence of threshold in the relationship between economic growth and inflation is estimated using the procedure proposed by Hanson (1999). This procedure involves estimating equation 7 by OLS method and computing the residual sum of squares (RSS) for the different or chosen threshold levels of inflation ranging from K = 3% to K = 30%. The threshold estimate of inflation is found by selecting the one that minimizes the sequence of the RSS, thus maximizing the adjusted R^2.

The estimation results, based on repeated estimation of equation 7 for the different values of expected threshold (K), are reported in Table 6. The first column labeled K, gives the range over which the search for the threshold is conducted. The dummy variable DM_{1t} represents the effect of inflation below the chosen threshold (K) value while DM_{2t} represents the effect for inflation above the threshold. Only the explanatory variables that are statistically significant are reported along with the inflation dummies to conserve space

Table 6: Estimation results of non-linear threshold model and determination of inflation threshold

K	Variables	Coefficient	Std. error	t-stat.	Probability	RSS	R^2
3%	DM_1t	-	-	-	-	9.9058	0.5607
	DM_2t	-0.0138	0.0071	-1.9332	0.0630		
	$lnINV_t$	0.5743	0.1426	4.0253	0.0004		
	lnM_2GDP_t	-0.8934	0.4008	-2.2288	0.0337		
5%	DM_1t	-0.1975	0.2026	-0.9749	0.3380	9.6228	0.5580
	DM_2t	-0.0151	0.0073	-2.0728	0.0475		
	$lnINV_t$	0.5563	0.1449	-0.9749	0.0006		
	lnM_2GDP_t	-0.9348	0.4047	-2.0728	0.0285		
7%	DM_1t	0.0469	0.0580	3.8504	0.4260	9.5284	0.5624
	DM_2t	-0.0105	0.0078	-2.3101	0.1878		
	$lnINV_t$	0.5463	0.1449	0.8078	0.0008		
	lnM_2GDP_t	-0.9064	0.4003	-1.3499	0.0315		
9%	DM_1t	-0.0018	0.0420	3.7703	0.9668	9.8761	0.5464
	DM_2t	-0.0128	0.0079	-2.2643	0.1176		
	$lnINV_t$	0.5695	0.1459	-0.0420	0.0005		
	lnM_2GDP_t	-0.9079	0.4104	-1.6148	0.0353		
10%	DM_1t	-0.0221	0.0314	3.9027	0.5467	9.8898	0.5458
	DM_2t	0.0140	0.0076	-2.2124	0.0744		
	$lnINV_t$	0.5988	0.1430	-0.6102	0.0003		
	lnM_2GDP_t	-1.0186	0.4315	1.8535	0.0264		
11%	DM_1t	0.0016	0.0344	4.1876	0.9647	9.8405	0.5480
	DM_2t	-0.0123	0.0080	-2.3448	0.1332		
	$lnINV_t$	0.5668	0.1458	0.0446	0.0006		
	lnM_2GDP_t	-0.9226	0.4122	-1.5465	0.0333		
12%	DM_1t	0.0098	0.0340	3.8881	0.7750	9.7309	0.5531
	DM_2t	-0.0112	0.0081	-2.2383	0.1763		
	$lnINV_t$	0.5678	0.1442	0.2886	0.0005		
	lnM_2GDP_t	-0.9328	0.4081	-1.3872	0.0301		
14%	DM_1t	0.0141	0.02792	0.5049	0.6176	9.5426	0.5617
	DM_2t	-0.0099	0.0081	-1.2268	0.2301		
	$lnINV_t$	0.5619	0.1430	3.9291	0.0005		
	lnM_2GDP_t	-0.8629	0.4015	-2.1494	0.0404		
16%	DM_1t	0.0122	0.0266	0.4578	0.6506	9.5560	0.5611
	DM_2t	-0.0095	0.0083	-1.1417	0.2633		
	$lnINV_t$	0.5740	0.1426	4.0246	0.0004		
	lnM_2GDP_t	-0.8125	0.4086	-1.9888	0.6566		
18% = K*	DM_1t	0.0233	0.0260	0.8931	0.3794	9.1906*	0.5779*
	DM_2t	-0.0069	0.0084	-0.8243	0.4168		
	$lnINV_t$	0.6053	0.1414	4.2796	0.0002		
	lnM_2GDP_t	-0.7098	0.4121	-1.7225	0.0960		

* Threshold level of inflation K* = 18%
Computed by the researcher

As can be seen from the Table 6, the minimization of RSS occurs at the threshold point 18 percent, where the RSS records the lowest value of 9.1906. To further confirm the threshold effect, the adjusted R^2 from the estimation at 18 percent yields the highest value of 57.8 percent. A close study of Table 6 shows that the coefficient of inflation dummy for inflation below the threshold (DM_{1t}), has a positive sign constraint indicating that below 18 percent, the effect of inflation on growth may be positive. Conversely, the coefficient of inflation dummy DM_{2t}, representing effect of inflation above the threshold level possess negative sign, suggesting that, inflation level beyond 18 percent is detrimental to growth. Thus the threshold level of inflation for Nigeria is identified at 18 percent. It should be noted, however, that the two parameters of the dummy variables, DM_{1t} and DM_{2t} are not statistically significant at conventional levels.

The non significance of these coefficients of the inflation dummies at the threshold level is hard to explain, considering the fact that the signs and magnitude they exhibit are in line with the theoretical and a priori expectations on inflation threshold. One possible explanation could be that the smallness of the sample size used and the large number of variables used in the model impacts negatively on the degrees of freedom, thus leading to the acceptance of the null hypothesis, which could otherwise have been rejected.

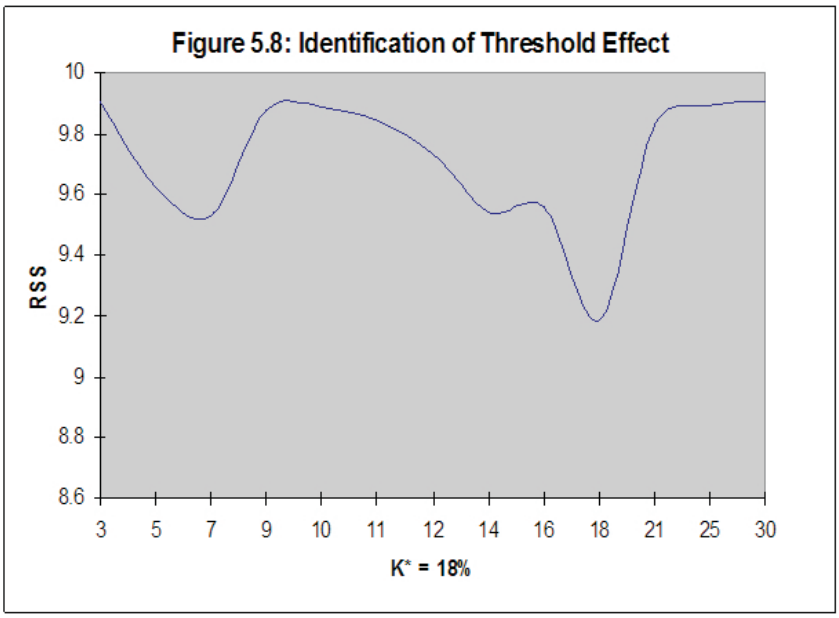

Figure 2: Identification of threshold effect

The threshold inflation is the one that minimizes the RSS and that is identified at 18 percent as depicted in Figure 2 above. Further examination of Table 6 reveals that, in tandem with the empirical literature, the growth of real investment has a powerful positive effect on growth. The coefficients of this variable are found to be statistically significant at 1 percent level in all the regressions regardless of the value of the inflation threshold (K). The ratio of money stock to GDP, a measure of financial depth, maintains consistently negative signs and statistically significant. This suggests that the growth in money stock, which transmits into high inflation, is detrimental to economic growth in Nigeria.

Going by the history of inflation in Nigeria and the empirical evidence from Nigeria and other developing countries, the location of inflation threshold for Nigeria at 18 percent looks both plausible and factual. Over the period covered by the study (1970-2006), Nigeria recorded average inflation of 21.1 percent, with the highest and the lowest rates of 72.9 percent and 3.2 percent respectively in 1995 and 1972. In a study of 90 developing countries, using panel data, Li (2005) found inflation threshold at 14 percent. The possibility of two threshold levels of inflation for developing countries was also detected in the study. Also, in a country specific study, Seleteng (2005) found inflation threshold for Lesotho (a low inflation country) at 10 percent.

V.3 Test for the Significance of Threshold Effects

Having identified the threshold level for inflation in Nigeria, it is important to determine whether the threshold effect is statistically significant. To do this, the study tests the null hypothesis of no threshold against the alternative hypothesis of one threshold. As earlier explained, under the null hypothesis, that is, Ho: $B_1 = B_2$, the threshold level of inflation K* is not identified. Thus, the classical tests have non-standard distributions and cannot be applied. To overcome this problem, the Bootstrap method as suggested by Hansen (1999) is adopted to simulate the asymptotic distribution of the following likelihood ratio test of Ho: $B_1 = B_2$; given as:

$$LR_1 = \frac{(S_0 - S_{IK^*})}{\sigma^2_{K^*}} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

where S_0 = Residual sum of squares under Ho

$S_{1\,(K^*)}$ = Residual sum of squares under H_1

σ^2 = residual variance under H_1

The residual variance, $\sigma^2_{K^*}$ is expressed as: $\frac{1}{T}(S_{IK^*})$,

where T is the sample size.

To determine the critical value, the study uses the confidence interval given by Hansen (1999) as

$C(a) = -2 \ln (1 - 1\ a)$..... (11)

where "a" is the critical level of significance. The "no rejection region" of confidence level 1-a is a set of values of K, such that $LR_{K^*} \leq C(a)$, where:

LR_{K^*} is the computed likelihood ratio under H_1, C(a) is the constructed asymptotic confidence interval and K* is the threshold level of inflation. Thus, if $LR_{K^*} > C(a)$, we reject Ho and conclude that the threshold is statistically significant.

Using equation 10 to compute the likelihood ratio under H_1 (that is, $_{12}$), the following results were obtained

So = 10.1840

$S_{1(K^*)}$ = 9.1906

$^{2}_{K^*}$ = 0.2454

Therefore, $LR_{(K^*)}$ = 3.9992

Using the procedure proposed by Hanson (1999), the critical values at 1%, 5% and 10% levels of significance are given as 10.5916, 7.3523 and 5.9395 respectively. Since in this case, the computed likelihood ratio $LR_{(K^*)} < C(a)$, we accept Ho, and conclude that the threshold level of inflation for Nigeria is not statistically significant.

The rejection of the threshold level of inflation at 10 percent confidence level suggests that the threshold may not be very stable. The rejection of the threshold level may be blamed on the small size of sample used in this study. Most threshold studies are based on cross country panel data that have large sample sizes. A large sample size may lead to a lower value of the residual variance which may improve the likelihood ratio statistic. Since a time series study in Nigeria is constrained by sample size, it may be of interest for further research to test this hypothesis again for example, by extrapolating annual data into quarterly data to increase the sample size.

VI Summary and Conclusions

The focus of this study has been to determine whether inflation has any adverse consequences on economic growth and whether there is an inflation threshold for Nigeria. Empirical evidence from the study strongly supports the inverse relationship between inflation and economic growth in Nigeria. Further evidence showed that there is an inflation threshold for Nigeria at 18 percent. Beyond this level inflation inhibits growth. The obvious policy implication is that the Central Bank should endeavour to keep the inflation rate below 18 percent as this would be growth inducing. **The major findings of this study are:** there is a strong and significant inverse

relationship between inflation and economic growth in Nigeria. Specifically, a 10 percent increase in inflation will reduce real output growth by 3.8 percent, other thing being equal; there is an inflation threshold for Nigeria at 18 percent. Beyond this level, inflation is detrimental to economic growth; the inflation threshold is found to be statistically insignificant; and while real investment growth exerts a positive and significant influence on growth, financial depth and government expenditure influence growth negatively and significantly. Population growth, openness and index of human capital exert negative but insignificant influences on growth.

In conclusion it is desirable for policy makers to strive to reduce corruption to the barest minimum and to embrace fiscal and monetary discipline in order to achieve a sustainable rate of economic growth for Nigeria.

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MONETARY POLICY AND STOCK PRICES IN AN ESTIMATED DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM (DSGE) MODEL FOR THE NIGERIAN ECONOMY

By **Adebiyi, Michael Adebayo and Charles N.O. Mordi**

ABSTRACT

In this paper, an attempt is made to estimate a DSGE model in which stock price fluctuations exert a direct impact on the demand side of the economy via the financial wealth effect arising when agents' effective decision horizon is finite. Using Bayesian techniques to estimate standard New-Keynesian model of the Nigerian economy with data covering 1985Q1-2008Q4, the following empirical results are obtained. First, stock price gap significantly influence aggregate demand in the IS curve. Second, we find a significant reaction of monetary policy to the stock price fluctuations in standard Taylor rule. The result underscores the importance of taking into consideration financial fluctuations when describing inflation, the business cycle, and the monetary policy stance. Lastly, from the stock price gap equation, the empirical results show that economic agents in Nigeria tend to be relatively forward-looking in forming their expectations on stock prices.

JEL Classifications: *E32, C22, C51*

Keywords: Bayesian Estimation, DSGE Models, Monetary Policy, Nigeria, Stock Prices

1 INTRODUCTION

In the literature, the importance of stock prices in monetary policy making has been identified (Bernanke and Gertler, 1999, 2001; Cecchetti, et al, 2002). More importantly, fluctuations in financial wealth may affect macroeconomic environment through their impact on consumption and, consequently, inflation. It is, therefore, not surprising that debates are ongoing on the optimal reaction by monetary authorities to fluctuations in the stock market (e.g. Bernanke and Gertler, 1999, 2001; Cecchetti et al, 2002). For instance, while Bernanke and Gertler (2001) link macroeconomic importance of stock market fluctuations to their impact on inflation and recommend that a central bank should react to oscillations in the inflation rate only; Cecchetti, et al (2002) are of the opinion that financial bubbles may induce inefficient fluctuations in the output gap and inflation. They are all of the

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The views expressed in this paper are those of the authors. No responsibility for them should be attributed to the Central Bank of Nigeria or its Management.

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view that a central bank should react to stock price misalignments. It is glaring from these submissions, therefore, that a central bank's ability to identify fundamental movements vis-a-vis bubbles in the stock market is imperative.

While these discussions are exciting from a normative point of view, it is also of interest to empirically assess the relationship between monetary policy and asset prices in the Nigerian economy. The pertinent questions to investigate include: Are stock market fluctuations a relevant driver of Nigeria's business cycle? Are they vital to understanding Nigeria's inflation oscillations? Have they triggered any movements in the financial market rates? Have shock market fluctuations actually been considered as a policy variable to react to by the Central Bank of Nigeria? What is the causal link between monetary policy and stock market behaviour? It is the expectation that providing answers to these questions could contribute to the knowledge of monetary authorities in the understanding of inflation dynamics, given that price stability is one of the core mandates of the Bank.

Some empirical studies have already sought to address these questions by explaining the links between monetary policy, stock prices, business cycle, and inflation in multi-equation VAR models. Their findings have shown that the interactions between monetary policy and stock market fluctuations are small and insignificant (see e.g. Lee, 1992; Patelis, 1997; Thorbecke, 1997; Neri, 2004; Bernanke and Kuttner, 2005; Nistico, 2006).

Although, VAR studies have a great advantage over single-equation contributions- they model the dynamic interconnections existing between all the macroeconomic variables of interest- an option to VARs is the employment of micro-founded macroeconomic frameworks that explicitly give room for expectations (Nason and Cogley, 1994; Schorfheide, 2000; Kydland and Prescott, 1982; Smets and Wouters, 2003; Bergeoing and Soto, 2002; and Alege, 2008, 2009). Peiris and Saxegaard (2007) identify some features that make Dynamic Stochastic General Equilibrium (DSGE) models unique. First, DSGE model is *structural and has the characteristics of a general equilibrium model. Apart from the fact that the equations are* interpreted based on economic theory, the main variables of interest are also endogenous and depend on each other. In addition, the model is

[3] For examples Benhabib, Rogerson and Wright (1991) conduct the study for USA; Bergoeing and Soto (2002), for Chile; Kose (1999) and Hofmaiser and Roldos (1997), for Asia; Maussner and Spatz (2005), for Germany and Christodulakis, Dimelis and Kollintzas (1999), for the European countries.

stochastic since random shocks affect each endogenous variable. DSGE also incorporates rational expectations, which assume that all economic agents utilize all available information at their disposal to determine the expectations of some crucial macroeconomic variables such as stock prices and interest rates.

While there is a large volume of literature on DSGE in developed and emerging economies, few of these studies are based on the African economies and, in particular, Nigeria (Alege, 2009). In Nigeria, with the pioneering work of Olekah and Oyaromade (2007) in this area, other attempts were made by Olayeni (2009), Alege (2009) and Garcia (2010). From available information, there are no DSGE models that tested the role of stock prices in consumers' decisions so far in Nigeria. This paper, therefore, aims at filling this gap by adopting Bayesian techniques to estimate a DSGE model based on Nigeria's data in which financial wealth matters for the business cycle, in the sample.

The structure of the paper is organized as follows. Following the introduction in section 1, section 2 provides the theoretical framework, and describes the log-linearized DSGE model of the Nigerian economy. Model set-up and description are discussed in section 3, while model estimation including choice of priors and viability of the estimation are discussed in Sections 4. This is followed with the discussion of measuring policy effects, including posterior estimation results and evaluation of policy response, in Section 5. Section 6 summarizes and concludes the paper.

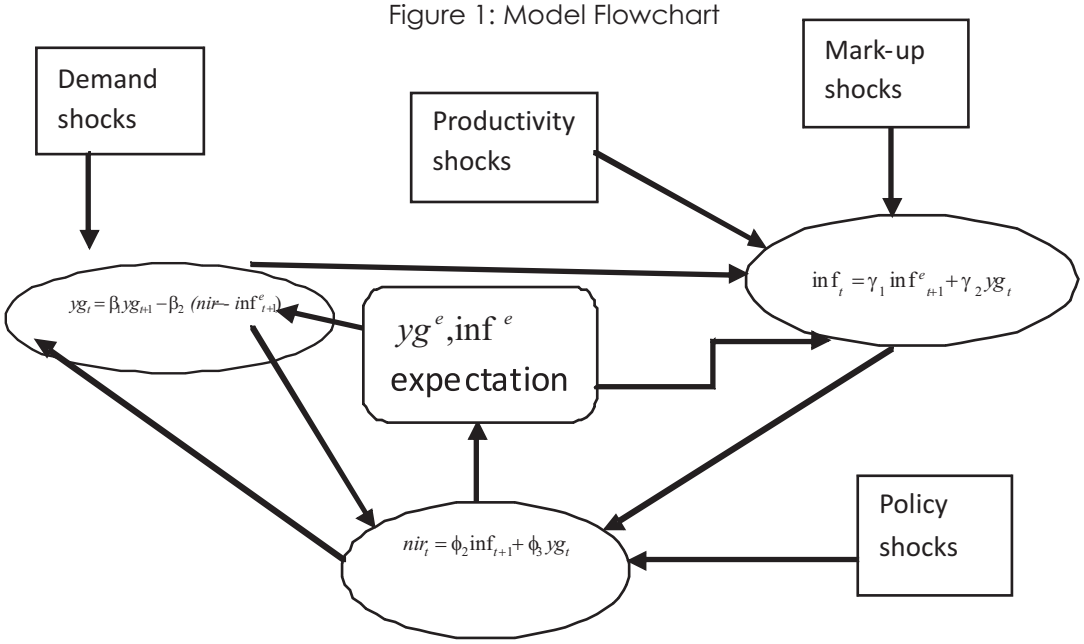
This paper has benefited immensely from the works of Sbordone, et al, based on DSGE model (2010).

2.0 BASIC FRAMEWORK OF DSGE MODELS

In the literature, there have been pragmatic efforts to explain how the traditional Keynesian interest rate channel operates within the context of dynamic stochastic general equilibrium models, which is based on the assumption that all economic agents have rational expectations coupled with nominal price or wage rigidity (Fischer, 1977; Phelps and Taylor, 1977). This assumption makes it possible to reverse the policy ineffectiveness syndrome associated with Lucas (1972) and Sargent and Wallace (1975).

The version of DSGE models that is useful for policy analysis is built on three interrelated blocks: a demand block, a supply block, and a monetary policy equation. The equations emanating from these blocks are derived from the principle of micro-foundation based on explicit assumptions about the behavior of the households, firms, and the government, which are the main economic agents in the economy. The interaction of these agents in the markets gives room for market

Figure 1: Model Flowchart



Source: Sbordone, Tambalotti, et. al. (2010)

The demand block, which is the IS curve, links output today to its expected future value and to the ex-ante real interest rate. This block captures the idea that, when real interest rates are temporarily high, people and firms would rather save than consume or invest. At the same time, people are willing to spend more when future prospects are promising, regardless of the level of interest rates.

The line connecting the demand block to the supply block shows that the level of activity (*yg*) emerging from the demand block is a key input in the determination of inflation (*inf*), together with expectations of future inflation (*infe*). The inflation block is similar to a log-linearized version of the Euler equation that connects an optimizing household's intertemporal marginal rate of substitution to the inflation-adjusted return on bonds, which is the real interest rate (Ireland, 2008). It describes the optimal behavior of monopolistically competitive firms. These firms are confronted with the decision to either explicitly adjust the costs of nominal price or set their nominal prices in randomly staggered way (Calvo, 1983; Rotemberg, 1982). The supply block shows that when the level of activity is high, firms tend to raise wages to motivate employees to work longer hours. With higher wages, marginal costs increase, thereby putting pressure on prices and generating inflation. Moreover, the higher the expected inflation rate, the greater the increase in current prices.

The determination of output and inflation from the demand and supply blocks feeds into the monetary policy block. The block is an interest rate rule for monetary policy that is similar to the type suggested by Taylor (1993). The supply block shows that central bank systematically adjusts the short-term nominal interest in reaction to movements in inflation and output. This description of monetary policy in terms of interest rates shows that most central banks today conduct monetary policy using targets for the interest rate rather than for any of the monetary aggregates.

From this standard New Keynesian model, monetary policy works through the conventional Keynesian interest rate channel. For example, a monetary easing in the form of a shock to the Taylor rule, which reduces the short-term nominal interest rate, translates into a decrease in the real interest rate due to costly or staggered price setting (Ireland, 2008). This fall in the real interest rate motivates households to raise their spending thereby causing output and price to increase with gradual adjustment after the shock. The policy rule, therefore, closes the circle, thereby giving a complete model of the relationship between output, inflation, and the nominal interest rate.

The diagram in Figure 1 highlights the role of expectations and the dynamic connections between the blocks that they create. The influence of expectations on the economy is represented by the arrows, which flow from monetary policy to the demand and then the supply block, where output and inflation are determined. This is to emphasize that the conduct of monetary policy has a large influence on the formation of expectations. In fact, in DSGE models, expectations are the main channel through which policy influences the economy. This is a feature that is consistent with the perception of the financial markets and the public on the pronouncements of central banks and their likely course of action.

The last component of DSGE models that is captured in the diagram is their stochastic nature. Every period, random exogenous events perturb the equilibrium conditions in each block, injecting uncertainty in the evolution of the economy and, thus, generating economic fluctuations. Without these shocks, the economy would evolve along a perfectly predictable path, with neither booms nor recessions.

In summary, the new Keynesian model follows the earlier rational expectations models of Lucas (1972) and Sargent and Wallace (1975) in which the role of expectations in the monetary transmission mechanism is underscored. The model also takes advantage of the powerful microeconomic foundations by building expectations into the optimizing behavior of households and firms through the real business cycle model (Kimball, 1995; Kydland and Prescott, 1982). While the policy implications of the New Keynesian model were traced out by Clarida, Gali, and

Gertler (1999) and Woodford (2003), the open-economy extension, in which the exchange rate channel operates together with the interest rate channel of monetary transmission, was developed by Obstfeld and Rogoff (1995). Bernanke, Gertler, and Gilchrist (1999) extend the New Keynesian model to account for the balance sheet channel of monetary transmission.

3.0 MODEL SET UP AND DESCRIPTION

Most DSGE models available in the literature have a basic structure that incorporates elements of the new-Keynesian paradigm and the real business cycle approach. The benchmark DSGE model is an open or a closed economy fully micro-founded model with real and nominal rigidities (see for instance Christiano, et al, 2005; and Smets and Wouters, 2003). As anticipated in the introduction, a model was considered in which stock price fluctuations are germane to the determination of current consumption. In this model, it is assumed that consumers may buy equities issued by intermediate firms operating in the wholesale sector and having monopolistic power in addition to standard state-contingent securities. These firms are assumed to supply production inputs to the final goods sector, which is populated by an infinite number of perfectly competitive firms. Intermediate firms maximize the expected stream of future dividends (i.e. the real value of the outstanding shares) at time *t* by taking into account that the chosen price will remain unchanged up to period *t + k*.

From policy standpoint, fiscal authorities balance the fiscal budget each period via lump-sum taxes. Monetary authorities follow a Taylor rule, i.e. the central bank sets the nominal interest rate (nirt) by systematically reacting to fluctuations of the inflation rate *inf*t, the output gap *yg*t, and possibly the stock price gap sgt, where the latter two gaps are defined as percentage deviations of the real GDP and real stock price from their potentials.

In line with Nisticò (2006) and Airaudo, et al (2006), the dynamic evolution of the endogenous variables of interest in the Nigerian economy is explained in nine (9) equations expressed in difference form as specified in equations 1 to 9 below:

$$yg_t = \beta_1 yg_{t+1} + (1-\beta_1) yg_{t-1} + \beta_2 (mlr_{t+1} - phi_{t+1}) + \beta_3 (ner_t - pf_t + phi_t) + \beta_4 ygf_{t-1} + \beta_5 sg_t + \varepsilon_{1t} \quad (1)$$

$$sg_t = \delta_1 sg_{t+1} + (1-\delta_1) sg_{t-1} - \delta_2 yg_{t+1} - \delta_3 (mlr_{t+1} - phi_{t+1}) + \varepsilon_{2t} \quad (2)$$

$$phi_t = \gamma_1 phi_{t+1} + (1-\gamma_1) phi_{t-1} + \gamma_2 yg_{t-1} + \gamma_3 (ner_t - ner_{t-1}) + \gamma_4 (po_t - po_{t-1}) + \varepsilon_{3t} \quad (3)$$

$$ner_t = \mu_1 ner_{t+1} + (1-\mu_1) ner_{t-1} - \mu_2 (mlr_t - nirf_t) + \mu_3 (phi_t - pf_t) + \mu_4 yg_t + \mu_5 (po_t - po_{t-1}) + \varepsilon_{4t} \quad (4)$$

$$mlr_t = \phi_1 mlr_{t-1} + (1-\phi_1)[\phi_2 phi_{t+1} + \phi_3 yg_{t+1} + \phi_4 sg_{t+1}] + \varepsilon_{5t} \quad (5)$$

$$pf_t = \tau_{11} pf_{t-1} + \varepsilon_{6t} \quad (6)$$

$$nirf_t = \tau_{21} nirf_{t-1} + \varepsilon_{7t} \quad (7)$$

$$ygf_t = \tau_{31} ygf_{t-1} + \varepsilon_{8t} \quad (8)$$

$$po_t = \tau_{51} po_{t-1} + \varepsilon_{12t} \quad (9)$$

Where ygt is the output gap in period t; ygft is the foreign output gap in period t; nert is the nominal exchange rate in period t; phit represents inflation rate in period t; sgt is the stock prices gap (proxied by all share index) in period t pft captures foreign price level in period t; is the domestic maximum lending rate in period t; nirft is the foreign short-term interest rate in period t; pot represents crude oil price (bonny light) in period t; t-i represents the lagged of relevant variables; t+i stands for the lead of relevant variables; and are all parameters to be estimated.

Equation 1 is an enriched version of the standard new-Keynesian Euler equation for consumption, which is theoretically linked to household utility optimization. According to the theory, household maximizes discounted stream of utility (consumption and labor supply) subjected to budget constraints (consumption expenditure and wages). In calculating the present value of spending and wages, interest/ policy rate is incorporated. Thus, a forward-looking proportion of the IS relationship (yg_{t+1}) is included in addition to real interest rate. Also this model suggests a role for the stock price gap to affect demand as long as >0. Stock prices affect the business cycle (via consumption) because of the finite horizon a consumer takes into account when maximizing her inter-temporal utility. This creates a role for the financial wealth itself as a driver of the business cycle.

The lag of output gap (yg_{t-1}) is included to give room for some degree of habit persistence in consumption or adjustment costs of investment (Pongsaparn, 2008). Nigeria is a small open economy and, consequently, nominal exchange rate (ner) is included as a variable that influences economic activities through the prices of imports and exports. Also, foreign output gap (*ygf*) is added as a determinant of export demand. The influence of other explanatory variables such as oil prices, fiscal policy and other demand shocks are captured by the residual term.

Equation 2 is the Euler equation displaying the dynamics of the stock price gap. This gap is negatively influenced by the discounted sum of future output gaps (given the

inverse relationship existing in this model between production and dividends, as pointed out by Nisticò, 2006) and by the real ex-ante interest rate (that takes into account both variations in the real value of the assets and the substitution between assets and risk-free bonds triggered by movements in the real interest rate). We interpret the as a shock to the equilibrium real stock price value, shock that may be interpreted as non-fundamental fluctuation in the stock market, or shock to the equity premium. Such shock is assumed to follow an AR(1) process. It should be observed that the expected limited horizon of interest influences the discount factor in equation (2) by attributing a higher relative weight to the current value of expected output gap and ex-ante real interest rate with respect to their future realizations.

Equation 3 is the hybrid Phillips curve with backward-looking and forward-looking elements (Romer, 2012). From the equation, output gap captures the behavior of firms' real marginal cost. When output gap is above normal, marginal costs are high, which increases desired relative prices. The equation shows that inflation rate is influenced not only by past inflation but also by inflation expectations, demand pressures, and external supply shocks captured by real interest rate. From this equation, inflation depends on its expected future value and its own lagged value. The inclusion of the lagged term shows the existence of a short-run trade-off between output and inflation. In the specification of inflation equation, exchange rate effect on domestic prices is considered. The inclusion of the exchange rate attempts to capture the exchange rate pass-through to domestic prices due to the openness of the economy. T**he inclusion of oil price and foreign price reflects** the peculiarities of the Nigerian economy as an oil-exporting and import-dependent economy.

Equation 4 is the uncovered interest rate parity (UIP) equation for an open economy, such as Nigeria. In the literature, many models that assume interest rate parity condition do not provide enough persistence to generate a hump-shaped response of the real exchange rate after a shock to monetary policy, which is commonly found in estimated VARs (Eichenbaum and Evans, 1995; Faust and Rogers, 2003). Given the degree of openness of the Nigerian economy, it is plausible to assume that interest rate parity condition holds in Nigeria. Thus, nominal exchange rate depends on its own lag and lead values. Oil price and output gap are included in the equation to measure the effect of the country risk premium on the exchange rate. These variables measure the foreign investors' perception about the Nigerian economy (Garcia, 2010).

Equation 5 is the modified Taylor's rule, which explains the interest rate path for the monetary authority. Apart from inflation and output gaps, monetary authorities

react immediately to the changes in the stock price gap by altering its monetary policy rate to stabilize both the nominal and real exchange rates. The exchange rate plays an important role in aggregate demand through its effects on net export and also on inflation through the pass-through effect. The UIP shows the link between exchange rate and interest rates. In reaction to a depreciation of the exchange rate, for example, the monetary authority is expected to raise interest rates subsequently.

Equations 6, 7, 8 and 9 are foreign price (US CPI), foreign interest rate (US short term deposit rate), foreign output gap and oil price, respectively. These variables are exogenously determined but are assumed to be generated by an autoregressive process of order 1 (AR,1).

4.0 BAYESIAN ESTIMATION

Recalling the objective of the paper, an attempt is made to examine whether or not fluctuations in the stock prices significantly influence the consumers' decisions with respect to current consumption, which consequently affect output gap, inflation, and the policy rate. In the final analysis, it translates into understanding if the parameter in the IS curve (1) assumes a value which is strictly positive in a statistical sense. This issue is investigated by estimating equations 1- 9 with Bayesian techniques (for technical discussion see Appendix A.7).

Bayesian estimation has been widely adopted for estimating small and medium-scale DSGE models in the last few years (see An and Schorfheide, 2007). In such an analysis, it is possible for a researcher to exploit a-priori information regarding the parameters' values (coming for example from previous micro or macroeconometric studies). In addition, it is system-based that fits the solved DSGE model to the data, thereby allowing a researcher to exploit all the cross-equation restrictions coming from the theoretical model under consideration. The possibility of computing the marginal likelihood for each estimated model offers a way to perform meaningful comparisons across competing set ups. It is demonstrated by Férnandez-Villaverde and Rubio-Ramírez (2004) that Bayesian estimations and model comparisons are consistent even in the case of models' misspecification.

Technically put, Bayesian estimation is a mix between calibration and maximum likelihood, which are connected by Bayes' rule. The calibration part is the specification of priors and the maximum likelihood approach enters through standard econometrics based on adjusting the model with data. Combining the prior density and the likelihood function gives the posterior density as follows:

$$p\left(\lambda_B \middle| K_T, B\right) = \frac{p\left(K_T \middle| \lambda_B, B\right) p\left(\lambda_B \middle| B\right)}{p\left(K_T \middle| B\right)}$$

where is the marginal density of the data condition on the model, the priors density function and is the likelihood function.

For our econometric exercise we consider Nigerian quarterly data between 1995-2009 on logarithm of consumer price index (inf), real exchange rate (rer), short term real interest rate (rir), monetary policy rate (mpr), logarithm of real gross domestic output gap (gy), logarithm of US CPI (Pf), potential inflation (phie), US three-month deposit rate (rsf), stock price gap (sg), which is proxied by all-share index, foreign output gap (ygf), and oil price (po).

The observable variables used to estimate the model for Nigeria is plotted as shown in Figure A.7 (in the Appendix). The plot shows the trend and de-trended measures of logarithm of consumer price index (inf), real exchange rate (rer), short term real interest rate (rir), maximum lending rate (mlr), logarithm of real gross domestic output gap (gy), logarithm of US CPI (Pf), US three-month deposit rate (nirf), stock price gap (sg), which is proxied by all-share index, foreign output gap (ygf), and oil price (po). Equilibrium values of these variables are exogenous and are derived using a variant of the Hodrick-Prescott (1997) filter that allows for additional constraints to be added to the minimization problem to prevent the resulting equilibrium value from converging to the actual observed data at the end of the sample period (Honjo and Hunt, 2006). The sample period for the estimation is 1985Q1 -2009Q4.

4.1 Choice of Priors and Posterior Estimation Technique

In the literature, two main methods for evaluating DSGE models are calibration and econometric estimation. The calibration part is the specification of priors, while the maximum likelihood approach involves using standard econometrics to complement the model.

According to Schorfiede (2000), prior values can emanate from the following: personal introspection to reflect strongly held beliefs about the validity of economic theories; researcher confidence about the likely location of structural parameters of the model and observation, facts and existing empirical literature. Against this background, the prior values were obtained from the DSGE model for the Nigerian economy by Adebiyi and Mordi (2010a, 2010b) and expert judgement (JVI/IMF, 2010).

The model's parameter values are estimated from the data using a Bayesian estimation technique. The Bayesian approach starts with prior distributions for the model parameters that are then combined with the data using the likelihood function to estimate the posterior distributions for the parameters. This approach has two important strengths. First, starting with prior distributions for the parameters allows other empirical evidence from a range of sources to enter into the estimation. Second, use of prior distributions makes the highly nonlinear optimization algorithm considerably more stable, making it feasible to apply the technique when sample

periods are short. In addition, the estimation procedure also allows for measurement errors in the data (Honjo and Hunt, 2006). Lastly, on the basis of this approach, the state of 'general equilibrium' is ensured and the whole system of the model is consistent, particularly at the steady state.

4.2 Viability of the Estimation

A set of visual diagnostic tests was utilized to examine the statistical integrity of the maximum likelihood and the Bayesian estimation procedures and results. The diagnostic tests shown in Figure A.1 illustrate the historical and smoothed variables and shocks for each model. The horizontal axis in each plot denotes the length of the sample period. Visual inspection supports the consistency of the expected path of the shocks with the realized estimates of the innovations indicated by the clustering of the smoothed shocks estimates around zero. The multivariate MCMC diagnostic tests demonstrated in Figure A.2 are similar to the univariate analogue. The multivariate tests represent an aggregate measure of stability and convergence based on the eigenvalues of the variance covariance matrix of the coefficients (Juillard 2008; Griffoli 2007). The charts in Figure A.5 seem not to support the stability and convergence of the MH solver for all the models.

5.0 MEASURING POLICY EFFECTS

The estimated posterior moments of the distribution of the coefficients and the marginal likelihood for the models are depicted in Table 1-5. We use the estimates to measure the policy response of output and inflation to interest rate shocks. Bayesian response functions are employed in the analysis. We also examines how the models fit the data, evaluate and analyzes their consistency with the realities of the Nigerian economy.

5.1 Posterior Estimation Results

Tables 1-5 and Figure A.2 (in the Appendix) display the posterior distributions. To give deeper insight into the relative importance of priors vs. data in shaping the posteriors, the paper ensures that the table and figure also displays the prior distributions. It is evident that the priors, while influencing the posteriors, are far from fully determining them. Tables 1-5 contain the prior and the posterior mean values.

In Table 1, the parameters estimated for the aggregate demand (IS) curve equation 1 is indicated. The parameter, appears to be (almost) entirely pinned down by the data as indicated by the posterior mean of **0.**35. This strongly supports the presence of the stock price gap in the IS equation.

Also, lags in monetary policy transmission mechanism imply relatively higher inertia than forward-looking components in aggregate demand equation; therefore, $\beta 1$ is 0.04, which implies that $(1-\beta 1)$ is 0.96, while the sum of $\beta 2$ and $\beta 3$ is less than $1-\beta 1$. This

confirms the findings that the parameter on the lagged output gap would be in the neighbourhood of 0.50 and 0.90 and a small coefficient on the lead of the output gap ranging between 0.05 and 0.15 is expected (Berg, Karam and Laxton, 2006). The coefficients of real interest rate and real exchange rate are 0.06 and 0.0003, respectively. This confirms that though the Nigerian economy is open, the degree of openness is very low. The parameter of foreign output gap () is 0.08, which implies that a one percent increase in foreign output gap would lead to 0.08 percent increase in the domestic output gap the following period.

Table1: Model Parameters Estimation Results of the Aggregate Demand (IS) Curve

Parameter	Prior Mean	Posterior Mean	Distribution
β_1 (coefficient of lead of output gap in gy)	0.100	0.04	Beta
β_2 (coefficient of the deviation of real interest rate from it potential in gy)	0.100	0.06	Gamma
β_3 (coefficient of deviation of real exchange rate from its potential in gy)	0.10	0.0003	Gamma
β_4 coefficient of foreign output gap in gy)	0.10	0.08	Beta
β_5 coefficient of stock price gap in gy)	0.30	0.35	Beta

In the literature, it is shown that a stable inflation rate requires a positive 2, and how monetary authorities should react is dependent on the other features of the economy (Berg, Karam and Laxton, 2006). Monetary policy rule in Table 2 shows that the posterior value (2 = 1.62) is in line with the literature. The posterior estimate for output gap is totally pinned down by the data while that of expected inflation is very close to the data. This suggests a strong reaction of the policy rate to inflation oscillations, as well as a less aggressive but still high reaction to the fluctuations in the business cycle (Clarida, et al, 2000). However, the original Taylor rule imposed a zero weight on interest rate smoothing (1 = 0) and implying 2 of 0.5 and a value of 3 of 0.5, which tallies with the posterior value estimated in Table 2 (3 =0.50). The posterior value (1 = 0.51) explains the possibility that the central bank can moderate interest rates and adjust them fairly rapidly to the desired value based on the deviation of

This section benefitted from the work of Adebiyi and Mordi (2010b)

the inflation and output from equilibrium. This implies that the best Taylor-type policy rule for Nigeria is a monetary policy rule that attaches a higher weight to inflation than output gap.

Table 2: Model Parameters Estimation Results of the Monetary Policy Rules

Parameter	Prior mean	Posterior Mean	Distribution
ϕ_1 (coefficient of lag of monetary policy rate in mlr equation)	0.50	0.51	Beta
ϕ_2 (coefficient of the expected inflation rate in mlr equation)	1.50	1.62	Gamma
ϕ_3 (coefficient of output gap in mlr equation)	0.50	0.50	Gamma
ϕ_4 (coefficient of stock price gap in mlr equation)	0.50	0.56	Gamma

The posterior value of stock price gap in mlr equation is 0.56, which is very close to the prior, suggesting the importance of stock price in the monetary policy rule. A significant reaction of monetary policy to the stock price oscillations in the short-run is also an important finding from the results.

Table 3 displays the coefficients of the Euler equation 2, which shows the dynamics of the stock price gap. The posterior estimates for all the coefficients, when compared with the priors, indicate that the estimates almost entirely pinned down the data, except the coefficient on the real interest rate in the stock price gap equation. For instance, a 1 per cent increase in the output gap reduces the stock price gap by 0.89 per cent. The real interest rate effect on the stock price gap is 0.04, which implies that when the interest rate is raised by one percentage point, the real stock price would reduce by 0.04 percent. Such a relatively low coefficient is expected from an emerging economy like Nigeria.

Table 3: Model Parameters Estimation Results of the Stock Price Gap Equation

Parameter	Prior mean	Posterior Mean	Distribution
δ 1 (coefficient of the lead of stock price gap in stock price gap equation)	0.30	0.34	Gamma
δ 2 (coefficient of the expected output gap in stock price gap equation)	0.90	0.89	Gamma
δ 3 (coefficient of real interest rate in stock price gap equation)	0.30	0.04	Gamma

In addition, the equation explicitly considers the role of expectations in the form of model-consistent expectations. The finding shows that the posterior estimate of the expected stock price changes is 0.34. This implies that economic agents in Nigeria tend to be relatively forward-looking in forming their expectations on stock prices.
Table 4 shows the coefficients of inflation dynamics in the Phillips equation. The Calvo-probability value is in line with several estimates in the literature (e.g. Christiano, et al, 2005; Smets and Wouters, 2006; Rabanal, 2007; and Pongsaparn, 2008). The behavior of the economy depends critically on the value of. From the empirical results, inflation expectation in Nigeria is more backward looking ([1-] = 0.76) than forward-looking (= 0.24), which is closer to the value of 0.38 obtained by Adebiyi and Mordi (2010b). This estimate is also consistent with the assertion that, for most countries, the values of forward- looking inflation expectation significantly below 0.50 produced results that were usually considered to be more consistent with data (Berg, Karam and Laxton, 2006).

Moreover, from the inflation equation, the coefficient of lead term in the equation () is 0.24. This implies a weight on the lagged inflation term (1-) of 0.76, which indicates a significant intrinsic inertia in the inflation process. These parameters, combined with the coefficient on the output gap (=0.23), are the principal determinants of the output costs of disinflation. With the posterior mean of the output gaps of 0.23, the sacrifice ratio in Nigeria is 1.23. This compares well with a sacrifice ratio of 1.306 obtained by Adebiyi and Mordi (2010b).

Table 4: Model Parameters Estimation Results of the Phillip Curve

Parameter	Prior Mean	Posterior Mean	Distribution
γ_1 (coefficient of the lead of inflation rate inf equation)	0.20	0.24	Gamma
γ_2 (coefficient of output gap in inf equation)	0.30	0.23	Gamma
γ_3 (coefficient of real exchange rate in inf equation	0.25	0.30	Gamma
γ_4 (coefficient of oil price in inf equation)	0.20	0.06	Gamma

Sacrifice ratio is defined as the cumulative output losses associated with a permanent one percentage point decline in inflation.

Monetary policy influences inflation through its effects on output and the exchange rate. The posterior estimate of the output gap (=0.23) is not too far from the prior (0.30), which provides an important tool for monetary authorities (particularly the Central Bank of Nigeria) to control inflation through output gap. Also, the impact of the exchange rate on prices (= 0.30) is very close to the prior value (0.25), indicating a high exchange rate pass-through into prices (that is 30 per cent). For monetary policy to have an impact on inflation, the coefficients on the output and exchange rate gaps must be greater than zero. This assertion is established with the coefficients of output (= 0.23) and exchange rate (= 0.30). Change in oil price has insignificant impact on inflation with a posterior value of 0.06 (that is =0.06), which is lower than the prior values of 0.20. This implies that a 1 percent increase in oil price would raise prices by only 0.06 the following period. The reason for the low impact is due to the existence of subsidies of pump price of petroleum product in Nigeria, notwithstanding that the country is an importer of refined petroleum products.

Table 5 shows the estimated parameters of the interest rate parity condition. In the literature, it is argued that more robust policies should assume a much smaller value of 1 (below 0.5), because it might be imprudent to rely so heavily on these forward-looking linkages in the face of uncertainty (Isard and Laxton, 1998; Berg, Karam and Laxton, 2006).

Table 5: Model Parameters Estimation Results of the Uncovered Interest Parity (UIP)

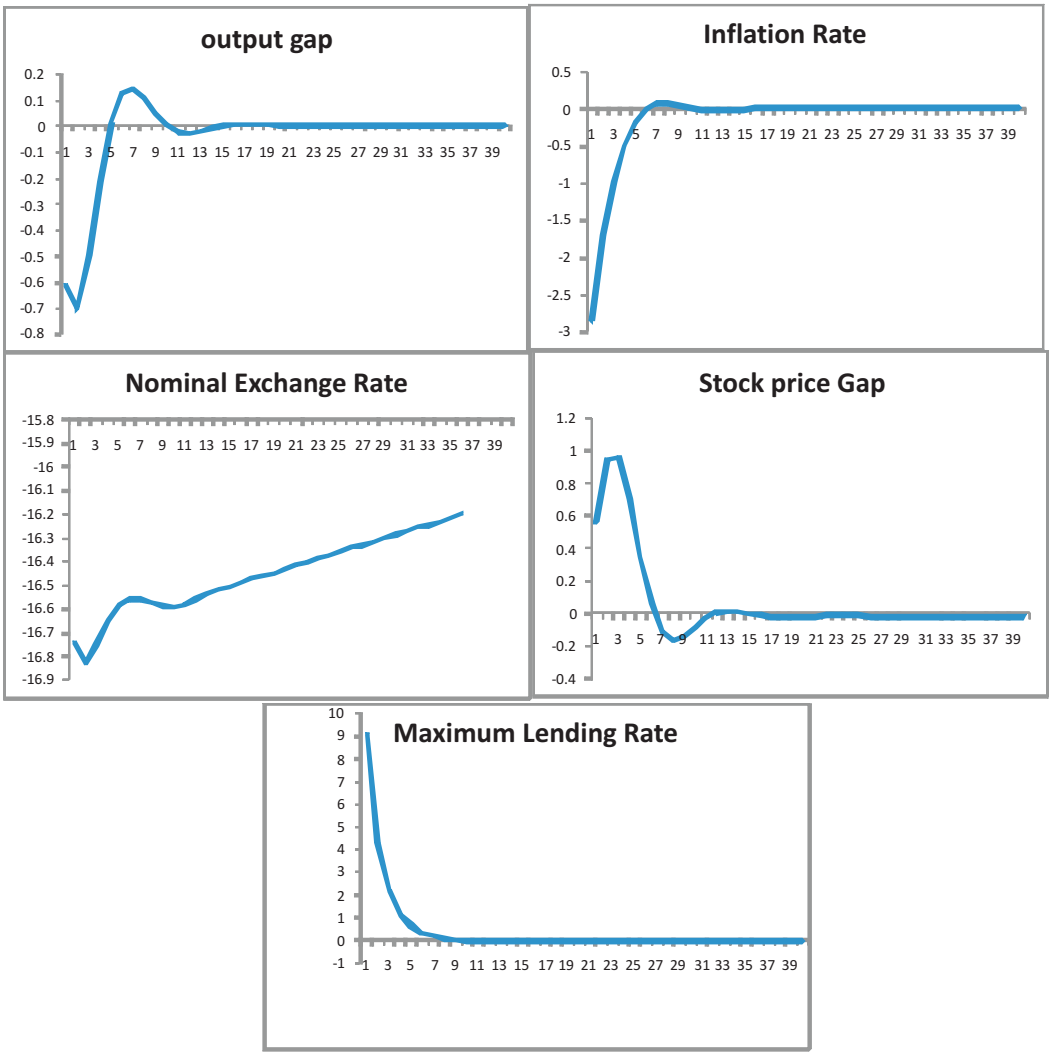
Parameter	Prior Mean	Posterior mean	Distribution
μ_1(coefficient of the lead of nominal exchange rate in ner equation)	0.30	0.26	Gamma
μ_2 (coefficient of interest rate differential in ner equation)	0.50	0.39	Gamma
μ_3 (coefficient of the change in relative prices in ner equation)	0.50	0.43	Beta
μ_4 (coefficient of oil price changes in ner equation)	0.25	0.15	Beta
μ_5 (coefficient of output gap in ner equation)	0.40	0.47	Beta

The estimated coefficient in Table 5 (1= 0.26) satisfies this requirement. The condition for uncovered interest rate parity is held, the posterior value for 2 indicates that a one percentage point increase in interest rate differential between the domestic and foreign interest rates (nir-nirf) would lead to an appreciation of the naira by 0.39 percent. The posterior value of output gap (5) is 0.47, which indicate that the estimates almost pinned down the data.

5.2 Evaluation of Policy Response: Monetary Policy and the Stock Market Nexus

In this section, Bayesian impulse response functions are estimated to shed light on the possible interaction existing between monetary policy and the stock market. Figure 2 displays the impulse responses to a monetary policy shocks. An increase in the nominal interest rate reduces output gap, and the inflation rate immediately but stock price gap does not reduce until quarter 7.

Figure 2: Impulse Response Function to a Transitory Interest Rate Shocks



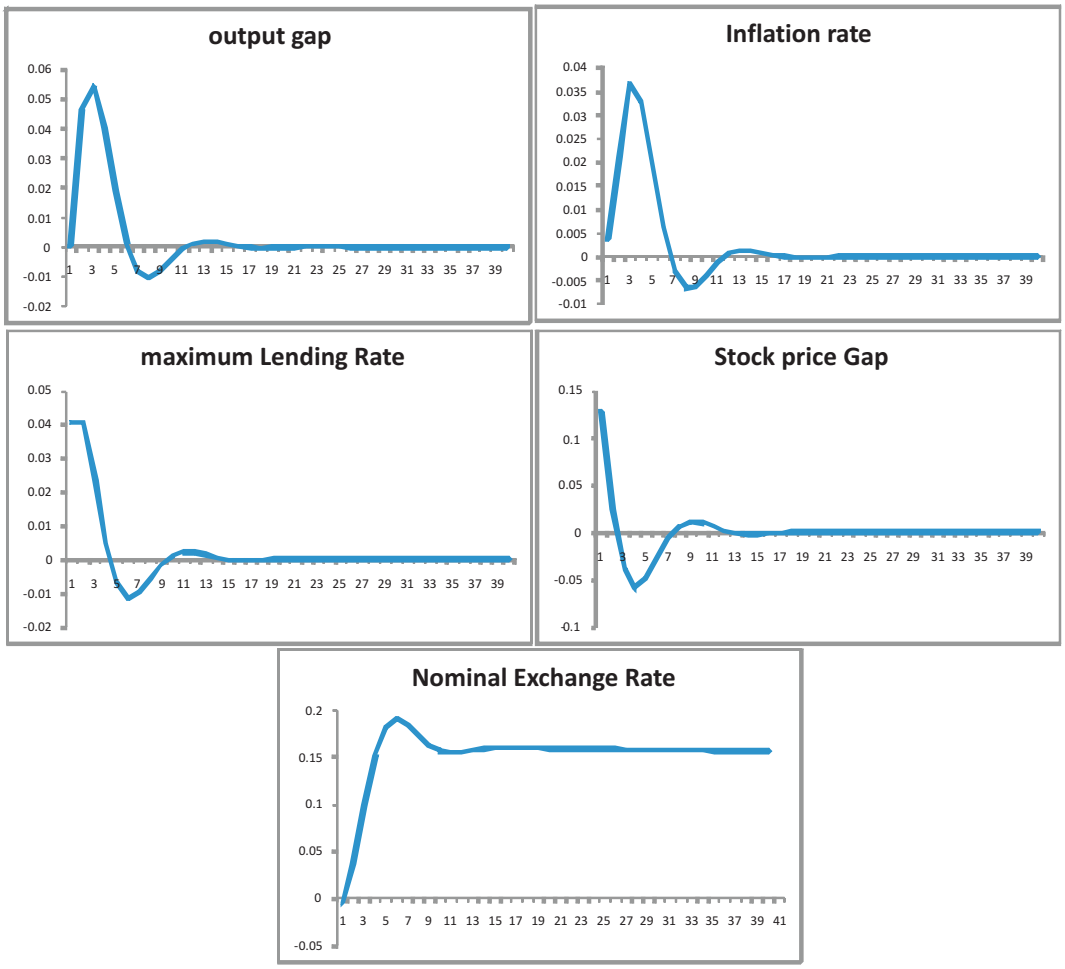
This reaction is statistically significant at a 1% level of significance. For instance, the stock price gap drops by about 0.16 per cent in quarter 8 in reaction to an increase in the nominal interest rate of 10-basis points. This is comparable with the findings suggested by other studies in the literature. For example, Rigobon and Sack (2004) estimate a 1.7 percent negative reaction of the S&P 500 index to an unexpected interest rate hike equal to 25 basis points, and Bernanke and Kuttner (2005) estimate a negative reaction of about 1 per cent to the same shock.

However, it is necessary to interpret these results with caution for two reasons. One, this study employs quarterly data and it is expected to capture, on the average, quarterly reaction in the market after a monetary policy shock. Two, the stock price gap is proxied by all-share index in which fluctuations are due both to the all share index movements and its long-run trend fluctuations. Consequently, the behavior of this gap may not necessarily reflect the movement in the stock price index per se. The movement of inflation and the output gap are as expected and return to their steady state values after 12- 13 quarters.

Impulse Response Function to a Transitory Stock price Shocks

Dynamic responses to a stock price shock are displayed in Figure 3. A standard deviation increase in the equity premium raises the stock price gap by 0.1 per cent in quarter 1.

Figure 3: Impulse Response Function to a Transitory Stock price Shocks



An increase in stock price gap raises current consumption and output gap by about 5-basis points in quarter 3 and return back to the steady state in quarter 15. With the demand pressure emanating from this impact, inflation and interest rates increase by about 3.5 and 2.0 basis points, respectively, in quarter 3. However, both variables return to their steady state in quarter 15. This is in line with the findings by Rigobon and Sack (2003) and Bjørnland and Leitemo (2007).

6 SUMMARY AND CONCLUDING REMARKS

In this paper, an attempt has been made to estimate with Bayesian techniques a DSGE model, using data for Nigeria in which financial wealth matters for the business cycle over the period 1985 through 2008. The paper is in synch with the works of Nisticò (2006) and Airaudo, et al (2006) in which agents participating in the markets face a constant probability of dying (i.e. exiting the market) each period. As a result, their horizon of interest is finite, and current or expected stock price fluctuations generate variations in aggregate consumption via wealth effects. This leads to changes in the inflation rate through the demand channel. With the inclusion of a Taylor rule in the model, monetary policy responds to inflation, output and stock price fluctuations. Thus, monetary policy shocks produce a monetary policy reaction that influences stock prices through its impact on the business cycle.

The empirical results arising from this study can be summarized as follow. First, stock price gap significantly influence aggregate demand in the IS curve, which corroborates the findings by Nisticò (2006), Airaudo, et al (2006) and Woodford (2003). The parameter, appears to be (almost) entirely pinned down by the data as indicated by the posterior mean of 0.35. This strongly supports the presence of the stock price gap in the IS equation.

Second, there is evidence to support the importance of stock price fluctuations in a standard Taylor rule. A shock to the stock price gap leads to a statistically significant reaction of the short-term interest rate. In particular, a 1% unexpected rise in the stock price gap raises maximum lending rate by 0.02 percentage point. This shows that stock prices affect the aggregate demand and, as a result, influence inflation and the monetary policy rate. From the reverse causal link, a shock to monetary policy rate leads to a negative impact on stock price gap by about 0.16 per cent in quarter 8.

Third, the posterior value of stock price gap in mlr equation is 0.56, which is very close to the prior of 0.5, suggesting the importance of stock price in the monetary policy rule. There is evidence to suggest that monetary authority in Nigeria (i.e. Central Bank of Nigeria) reacts to stock price oscillations in the short-run.

Lastly, from the stock price gap equation, the posterior estimate of the expected stock price changes is 0.34, which implies that economic agents in Nigeria tend to be relatively forward-looking in forming their expectations on stock prices.

It need hardly be emphasized that the findings in this study are tentative, being subject to limitations of the database and DSGE model used. Even so, the limitations are not such as to nullify the findings given the robustness of the estimates and their corroboration with those of studies on other countries as revealed in extant literature. Nevertheless, the updating of the database for fullness of time coverage is in progress to permit a revisit to the study and confirmation of the findings for policy.

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APPENDIX

Figure A.1:Historical and Smoothed Variables and Shocks

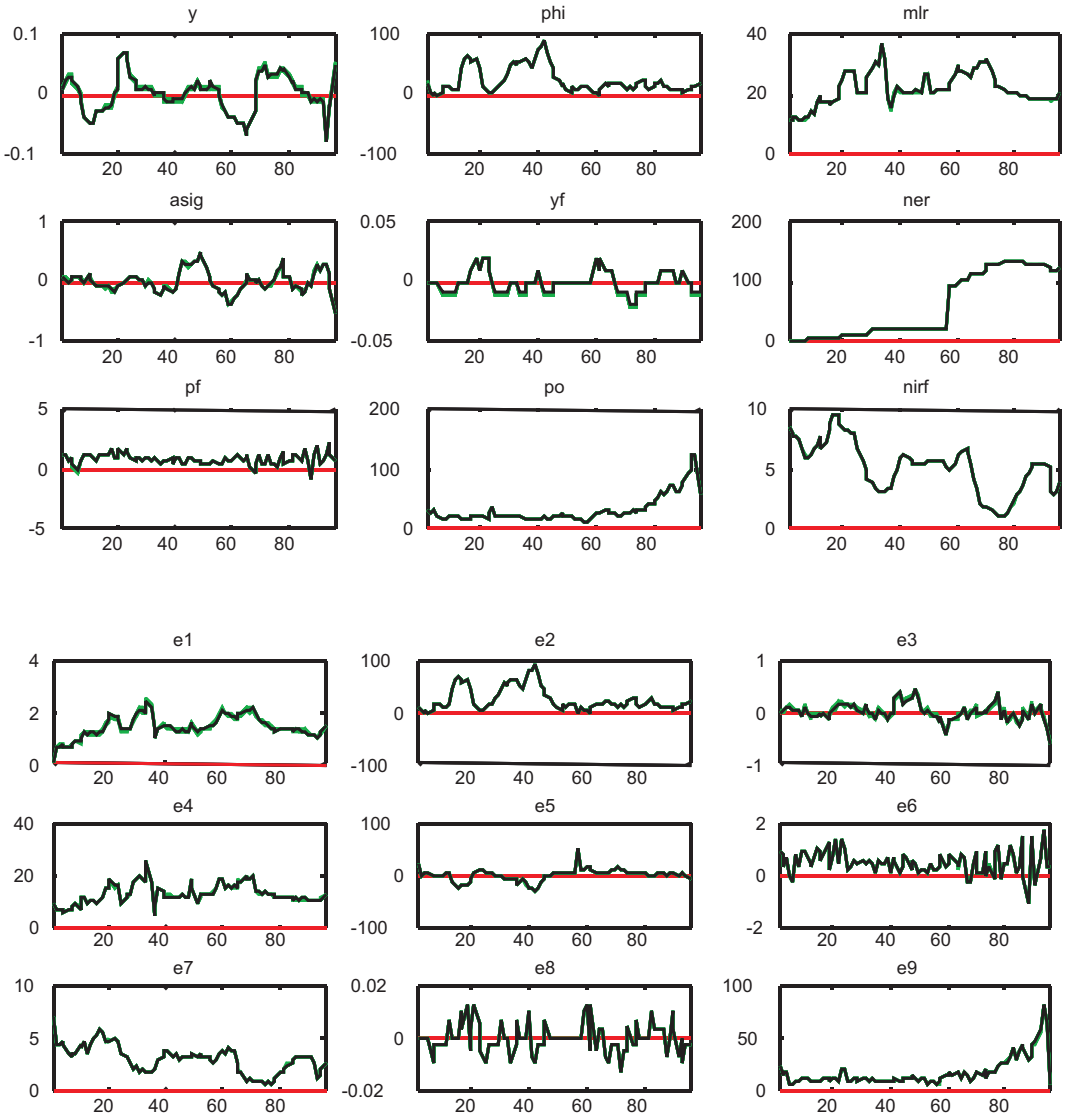

Figure A.2: Multivariate Diagnostics