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Gold Demand Determinants and Reserve Building Capacity of the Nigerian Economy: Inputs from a Panel Analysis of Selected Countries

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Abstract: Over the years, gold has showed some promises in performing the role of value preservation for the holders and as a result helping countries in stabilizing their reserves. For this reason, several countries still maintain part of their reserves in gold, even though gold was officially de-pegged from countries' currencies after the collapse of the Bretton woods system. In this study, we employed panel data regression model to examine the determinants of demand for gold by countries. The result showed a positive relationship between the demand for gold and the price of gold, exchange rate, foreign direct investment, and private credit to GDP. It revealed that trade openness and inflation rate had a negative relationship with the demand for gold. Also, it was revealed that the price of gold had a positive relationship with Nigeria's total reserves both in the short run and in the long run. On the other hand, while exchange rate had a positive relationship with Nigeria's total reserves in the short run it exerts a negative relationship in the long run. Also trade openness and GDP growth rate had a negative relationship with Nigeria's total reserves both in the short-run and in the long run. But inflation rate had a negative relationship with Nigeria's total reserves in the long run. Based on these findings, the study recommends that Nigerian government should adopt a pro-active measure in strengthening and enhancing the total reserve base of the economy by including gold as a safe and hedging asset in the reserve portfolio, thereby enhancing the performance and resilience of our total reserves in the face of economic and financial downturns.

Keywords: Gold Reserves, Demand for Gold, External Reserves, Price, Exchange Rate

1. Introduction

Gold has contributed immensely to the socio-economic evolution of the human society with diversified roles, which cannot be overemphasized. In time past, gold played several roles ranging from acting as a legal tender locally and internationally, value storing asset, to prestige conveying material. These distinguishing features are the promoters of the general acceptability of gold around the world over other precious metals and currencies.

In a study by World Gold Council-WGC [38], it was asserted that gold is the third most liquid asset in the securities market beside United States (U.S) treasury bills and Japanese government bonds. Although fiat currencies top the liquidity list, it is highly disadvantaged in value preservation, especially during the season of rising inflation. This weakness is what gives gold an edge. Hence, the conceived embedded quality of value preservation of gold during an economic downturn.

Since the collapse of the Bretton Woods system in the early 1970s, which lead to gold being gradually replaced by variety of currencies, its share in international reserves has gradually declined [20]. This is owed to the fact that almost all the central banks effectively de-pegged their currencies from gold against the Bretton Woods Agreement of 1944. Consequently, gold has accounted for a relatively small percentage of the overall international reserves of central banks, with a decline from 16.5% in 1990 to 6.01% in 2015 [20].

However, in the face of all these odds, since gold is considered as one of the better hedges against inflation and as

a "safe haven" during periods of economic meltdowns, it remains an important component of the portfolio of Central bank assets in some countries. Another reason is premised on the fact that since the issuance of gold is not controlled or monitored by any one government or Central bank, its value cannot be influenced by political decisions or by the insolvency of any individual institution [32].

Consequently, over the last two decades, Central banks have opted for a diversification of the assets in their reserve portfolio. This diversification was partly influenced by an attempt to reduce the net financial costs of holding larger reserves in fiat currencies, especially after the Stock Exchange Crisis in 1987, the Asian Crisis in 1997, and the Global Financial Crisis of 2008 to 2009 [24]. This is with a view to improve the reserve management practices of Central banks. From this standpoint, Central banks continue to accumulate gold in their reserve portfolio despite the decreased role of gold in International Financial System. This has positioned a few Central Banks since 2010 as net buyers of gold in order to expand their reserves as a means of diversification and safety. To this end, gold mine production has increased by an average of 1.4% per year for the past 20 years; with consumers, investors, and Central banks contributing to higher demand for gold; with diversity of demand being a key strength. [28, 29]

The argument remains that gold has a strong history of resilience during periods of elevated systematic risks, having outperformed equities as well as other alternatives when markets have undergone a major correction. It is upon this background that it is considered important for countries to begin a modification of their foreign reserves management policy, especially on building gold reserves. The Federal government of Nigeria thinking in this direction issued its first gold refining license on 23rd October 2018 to Kian Smith Limited – a company that operates in mineral commodities and marine services. The Company, which was expected to have started production by the end of the first half of 2019 will be refining gold bars for the Central Bank of Nigeria (CBN) under the Federal Gold Reserve Scheme and the Local Jewelry Industry. The Honorable Minister of States for Mines and Steel Development, Abubakar Bwari, who performed the groundbreaking ceremony of the Kian Smith gold refinery plant in Ogun State on 13th December 2018 maintained that the Federal government had proposed a Gold Purchase Scheme aimed at developing gold value chain, thereby leading to the production of gold products [9].

In the Five-year plan of the Central Bank of Nigeria (CBN) to grow the Economy of Nigeria, the Governor of the Central Bank of Nigeria pointed out that on key macroeconomic concerns, building and maintaining a strong external reserve was one of the policy thrusts of the framework [22]. So, in view of the macroeconomic issues confronting the Nigerian economy and the turnaround motive of the CBN to build resilient reserves, this study seeks to analyze the determinants of the demand for gold in order to explore the potentials of diversifying the reserve base to including gold among other precious metals.

This study therefore seeks to determine the relationship between demand for gold and some macroeconomic variables with focus on selected countries of the world on the one hand; and connect how this could be of assistance to Nigeria in the quest towards building reliable reserves.

2. Literature Review

Central banks across the world hold a fraction of their foreign exchange reserves in gold for a variety of reasons. Most of these reasons can be captured under the umbrella of "Self-insurance" against financial shocks and sudden stops in the access to international capital markets and enhancing the credibility of monetary policy [25]. This is evident in United States of America reserve portfolio. In 2015, the Federal Reserve kept almost 72% of its total monetary holdings as gold reserves. This percentage rose to 74.5% as at July 2019 while France held 59.9%, Ghana 6.5%, South Africa 10.8%, and Malaysia 1.6% [14].

2.1. Nigerian Gold Industry

Abundant gold deposits exist in Northern Nigeria in Anka, Maru, Malele, Tsohon, Birnin, Gwari-Kwaga, Bin Yauri, and Gurmana. Though it's not dominant in the country, other states with smaller deposits include Abia, Abuja, Bauchi, Edo, Cross River, Niger, Sokoto, Osun, Oyo, Kebbi, Kaduna, Kogi, and Zamfara [11].

Mining for gold in these areas began in 1913 with all activities from exploration to production, mining and refining recording its highest in the early 1930s. Unfortunately, few years after the promising mineral exploration and production, the production of gold in Nigeria declined due to the Second World War in 1939 which resulted in abandonment of mines by the colonial companies that was then at the head of the Nigerian gold production. The companies left the mines, and as a result, the extraction of gold ceased. There was however a resurgence of interest to mining again in the 1960's, but the Nigerian Civil War thwarted those efforts.

The search for gold resumed during the 1980's, by the Nigerian Mining Corporation (NMC). Although the search was not successful partly because of poor funding, the major reason may be traceable to the fact that a lot of revenue is being generated from oil since its discovery in 1956. Till date oil remains the most valuable commodity in Nigeria. But in 2015, the government issued gold mining licenses to two companies. Segilola Nigeria Limited got a license to mine gold in Osun State, and Geotechniques Nigeria Limited got a license to mine gold in Kebbi State [27].

Although there are no large-scale gold mining operations in Nigeria currently, there are some small-scale gold mining done by artists. The leading gold miners in the country are a family from Anka called Alye [18].

As a way of further developing the gold industry in Nigeria, the first license to refine gold was granted to Kian Smith in 2018. The company, which participated in the Economic Recovery Growth Plan (ERGP) focus labs had submitted some proposals to the Nigerian government, which

led to the establishment of the Nigerian Gold Council to be in charge of the country's gold policy and the establishment of the Federal Gold Reserve Scheme in Nigeria. The Company which was expected to have started production by the end of the first half of 2019 will be refining gold bars for the Central Bank of Nigeria (CBN) under the Federal Gold Reserve Scheme and the Local Jewelry Industry. The Honourable Minister of States for Mines and Steel Development, Abubakar Bwari, who performed the groundbreaking ceremony of the Kian Smith gold refinery plant in Ogun State on 13th December 2018 maintained that the Federal government had proposed a Gold Purchase Scheme aimed at developing gold value chain, thereby leading to the production of gold products [9].

From the submission of The Minister of State for Mines and Steel Development at the ground-breaking ceremony in Mowe on Thursday 13th December 2018, the government and promoters of the refinery identified gold as a strategic commodity. He further said that in fulfillment of the Federal Government's mandate, a roadmap for the development of the mining industry, focusing on seven minerals, with gold positioned to get the utmost priority. It was emphasized that during the focus labs of the Economic Recovery and Growth Plan of government, it was discovered that a well-organized gold value chain could trigger an economic revolution like it did in India, South Africa, Switzerland, and other countries. It is based on this premise that the ministry approved the first Gold Refinery license to Kian Smith Nigeria Limited to commence construction activities for gold refining plant. The firm (Kian Smith) is working with small and medium scale miners to source gold for its refinery. It is also working with artisanal miners, whose activities were going to be an important part of formalizing operations in the sector [2].

In the words of Nere Teriba, the Vice Chairman of Kian Smith, the company will also be sourcing gold for its refinery from other parts of Africa, including Ghana, Sierra Leone, and Tanzania. One supplier working across Ghana and Sierra Leone has already committed to supplying Kian Smith 100Kg of gold per month. In all, the company has signed Memoranda of Understanding with about 200 suppliers. It was added that, the refinery will start production by the end of the first half of 2019 with a production capacity of three tonnes per month of 99.99% gold and one tonne per month production of 99.99% silver. The company will also be supplying (in addition to the Central Bank, and the Jewelry firms) the Electronic Industry once it fully commences production. Upon completion, the refinery will provide more than 500,000 jobs in two years as it continues to support its suppliers in their bid to become registered business entities in the mining sector [8].

2.2. Theoretical Underpinnings

Two theories emerged as relevant in examining the determinant of the demand for gold by countries. They include the theory of Asset Demand postulated by Mishkin [19] and the Modern Portfolio Theory (MPT) pioneered by Markowitz [17]. These theories anchored the underlying factors regarding why a firm, or an individual would allocate their wealth amongst assets.

Mishkin opined that facing the question of whether to buy and hold or not to buy and hold an asset, an individual must consider the following factors:

i. Wealth: This represents the total resources owned by the individual, including all assets. Holding everything else constant, an increase in wealth raises the quantity demanded of an asset.
ii. Expected return: The expected return over the next period on one asset relative to alternative assets influences the demand for the asset. An increase in an asset's expected return relative to that of an alternative asset, holding everything else constant, raises the quantity demanded of the asset.
iii. Risk: The degree of uncertainty associated with the return on one asset relative to alternative assets also influences the holding of that asset. Holding everything else constant, if an asset's risk relative to that of alternative assets is high, its quantity demanded will fall.
iv. Liquidity: This concerns the ease and speed with which an asset can be turned into cash relative to alternative assets. An asset is liquid if the market in which it is traded has depth and breadth. That is, if the market has many buyers and sellers. The more liquid an asset is relative to alternative assets, holding everything else constant, the more desirable it is, and the greater the quantity demanded of it will be.

Another theoretical footing attached to this work is the Modern Portfolio Theory (MPT), pioneered by Markowitz [17]. The MPT is a mathematical framework for assembling a portfolio of assets such that the expected return is maximized for a given level of risk. It is formalization and extension of diversification in investing, the idea that owning different kinds of financial assets is less risky than owing only one type. The focal point of this idea is that an asset's risk and return should not be assessed by itself, but by how it contributes to the overall risk and return of a portfolio [36].

Markowitz uses the variance of asset prices as a proxy of risks in relation to other assets in constructing portfolio. Decisions with regards to this construction are based on the concept of "Efficient Portfolio", which are those portfolios that yield the highest return for the level of risk accepted or alternatively, the smallest portfolio risk for a specified level of expected return. To build an efficient portfolio, an expected return level is chosen, and the assets are substituted until the portfolio combination with the smallest variance at the return level is found. As the process is repeated for other expected return, a set of efficient portfolios is generated. [17]. Thus, the selection is guided by two criteria:

i. The investor would go for the portfolio with lower risk among two portfolios with same returns.
ii. The investor would go for the portfolio with higher returns among two portfolios with same risk.

Markowitz made the following assumptions while developing the Harry Markowitz (HM) model: [33, 17]

i. Risk of a portfolio is based on the variability of returns from the said portfolio.
ii. An investor is risk averse.
iii. An investor prefers to increase consumption.
iv. The investor's utility function is concave and increasing, due to their risk aversion and consumption preference.
v. Analysis is based on single period model of investment.
vi. An investor either maximizes their portfolio return for a given level of risk or maximizes their return for the minimum risk.
vii. An investor is rational in nature.

MPT assumes that investors are risk averse, meaning that given two portfolios that offer the same expected return, investors will prefer the less risky one. Thus, an investor will take on increased risk only if compensated by higher expected returns. Conversely, an investor who wants higher expected returns must accept more risk. The exact trade-off will be the same for all investors, but different investors will evaluate the trade-off differently based on individual risk aversion characteristics. The implication is that a rational investor will not invest in a portfolio if a second portfolio exists with a more favorable risk-expected return profile – i.e., if for that level of risk an alternative portfolio exists that has better expected returns. (Markowitz, 1952). Portfolios return and Portfolio risk can be calculated as presented in equations 1 to 4.

i. Portfolio Expected Return: This is presented as:

$$E(R_P) = \sum_{i=1}^{n} w_i \, E(R_I) \quad (1)$$

ii. Portfolio Risk: Portfolio risk, which involves assessing portfolios with more than two assets/securities may be presented in terms of portfolio return variance as:

$$\sigma_p^2 = \sum_{i=1}^{n} w_i^2 \, \sigma_i^2 + \sum_i \sum_{j \neq 1} w_i w_j \sigma_i \sigma_j p_{ij} \quad (2)$$

Alternatively, equation (2) may be written as:

$$\sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} w_i w_j \sigma_{ij} \, \rho_{ij} \quad (3)$$

Where $\rho = 1$, for i = j

From these presentations, the Portfolio Standard deviation is given as

$$\sigma_p = \sqrt{\sigma_p^2} \quad (4)$$

Where:

W_i = Proportion of funds invested in asset i; Wj = Proportion of funds invested in asset j; σ_{ij} = The Covariance between the pairs of Assets i & j; ρ_{ij} = The correlation coefficient between the returns on assets i and j; n = Total number of assets/securities in portfolio; $E(R_1)$, $E(R_2)$, $E(R_n)$ = Expected return on asset 1 & asset 2 and so on.

An investor can reduce portfolio risk simply by holding combinations of instruments that are not perfectly positively correlated (i.e., $-1 < \rho_{ij} < 1$). In other words, investors can reduce their exposure to individual asset risk by holding a diversified portfolio of assets. In other words, diversification may allow for the same portfolio expected return with reduced risk.

2.3. Empirical Review

Oktay, Oztunç, and Serìn [21] investigated the determinants of gold reserves for G-7 countries using a panel regression based on combination of time series and cross-sectional data, revealing the link between gold reserves and economic indicators. They used macro-economic variables, trade related variables, and financial related variables to represent the independent factors of the reserves. The macro-economic variables included GDP (in current USD) and population. The trade related variables included imports of goods and services and export of goods and services, and the financial related variables included net foreign direct investment (FDI) liabilities, financial openness index, current account balance and private capital flows. From their findings, the variables explained approximately 65% of variations in the total reserves of the selected seven major industrial countries. Reserves were a buffer shock or a hedge to the crisis' effects and besides that, gold has the power to stabilize the economies. Also, both increase in GDP and exports of goods and services affected an increase in gold reserves while population, net foreign liabilities, and current account balance have negative effects on it. There was also a strong relationship between gold reserves and the state power. The G-7 countries are the suppliers of key currencies in the global market and were also the net buyers of gold since 2010. According to their findings, that is why gold is accepted as a haven and strategic asset by the countries during the financial crisis. They submitted that high economic growth and rising exports of goods and services of the G-7 countries are mostly likely to lead to an increase in their gold reserves which contributed to about 64% of net global wealth.

Haugom [13] analyzed World Gold Council data on physical gold imports of developed and developing countries, respectively. He found the gold demand of developed countries to be positively related to past demand and negatively related to the gold price, making the gold price seemed less important than other economic and political factors in physical demand. For the developing countries their gold demand was found to have somewhat different determinants: It was positively affected by U.S. economic growth (taken as a proxy for the strength of the world economy) and was significantly influenced by various measures of international economic and financial conditions. A shortcoming of Haugom's study is that, because the data were for country groups rather than individual countries, it was not possible to investigate how national economic and financial conditions influenced demand for gold.

In his own study, Pulvermacher [26] argues that adding gold to investment portfolio may earn significant diversification benefits given the negative correlation of gold

with financial assets. So, he sees gold as a versatile risk management tool. From the perspective of safety, Fiscor [10] noted that gold has negative relationship with USD. Furthermore, the supply of gold has lagged behind the supply of USD amid increasing demand for both local as well as international liquidity. On the other hand, Rogoff [31] attributed the gold price to many other factors, yet he supported the argument that gold can serve as a protection from recessions.

In an early study of gold demand in India in 1901-1913, Rao and Nagabhushanam [30] found demand to rise strongly with income and to decline with price. Using cross-country data, Balassa [3] found investment in gold to be higher in places where real interest rates were negative. Also, Kutan and Tansu [16] studied the market for gold in Istanbul. In their results, gold prices did not react much to consumer price index (CPI) releases, suggesting it is not a good hedge against inflation; however, prices did react significantly to real-side news. This implies that gold prices are not determined by the general price level prevailing in a single country, but they are determined by global market demand for gold. This is because no government or central bank controls the value of gold. However, the market prices prevailing in a country has tendencies to respond to changes in the value of gold. This further puts the gold in an advantageous position over the fiat currency.

Cai, Cheung, and Wong [5] studied the behavior of the gold future market. They found that gold future prices were significantly affected by news about sales of gold reserves by central banks, political tensions in South Africa, and key U.S. macroeconomic indicators like inflation, unemployment, interest rates, and oil prices. However, reactions of gold prices to news about economic fundamentals were relatively small, compared to their effects on markets for Treasury bonds and foreign exchange.

Capie, Mills, and Wood [6] examined whether the hedging roles of gold had changed after the breakdown of the Bretton Woods, distinguishing between its role as an internal hedge against the domestic purchasing power of the dollar and as an external hedge against changes in its external purchasing power. They found that gold was a good external hedge against exchange-rate fluctuations, although its value in this respect varied over time.

From the empirical review, it is clear on what previous scholars have done to investigate the determinant of the demand for gold by countries. However, most of this works have been either concentrating on countries of interest such as India, Pakistan, UK, and China individually or a group of selected countries in panel data analysis. But not much work has been done investigating this same situation in Nigeria alongside what is happening in the economies of the world. For instance, Olokoyo, Osabuohien and Salami [23] who analyzed foreign reserve and some macroeconomic variables in Nigeria in the period of 1970 and 2007 with annual data did not consider gold as one of the reserve assets. That is a gap which this study intends to fill, thus establishing the significance of the research.

This study intends to analyze the total foreign reserve and some macroeconomic variables in Nigeria from the period 1980 to 2018 which will update the available literature. This will be done alongside investigating the determinants of the demand for gold with a case study of selected countries. This way, there will be a proper understanding of the situation at hand and the study will be able to mete out appropriate recommendations based on the findings from these two extremes.

3. Methodology

The study analyses annual data on gold holdings for ten (10) countries over the period 1999-2018 published by the International Monetary Fund (IMF), International Financial Statistics (IFS) and World Gold Council (WGC) while macroeconomic variables data were obtained from World Development Indicators (WDI) and IMF IFS. A panel regression analysis is therefore employed to reveal the link between the gold reserves and some macroeconomic indicators. Specifically, an unbalanced panel of 200 observations from 10 countries over the 1999–2018 periods (20 years) was used in this study. The ten countries chosen were made up of high-income countries and emerging-market countries who had fractions of their total reserves kept in gold.

There are several estimation techniques in panel data regression, however the two most remarkable are fixed and random effects panel regression. The study adopted the Fixed Effect model in estimating the parameters of the model.

3.1. Model Specification

The model was specified based on the intuitions from the research of Oktay, Öztunç, and Serin [21] whose empirical results revealed a significant relationship between macroeconomic variables, trade-related variables, and financial variables and gold reserves. Also, the intuitions from Starr and Tran [34] contributed to the formulation of the model of this research, given the discovery from their work that exchange rate volatility, inflation rate volatility, and the gold price turn out not to be systematic determinants of physical demand for gold. According to their study, "financial-hedging variables play little role in physical demand for gold; rather, physical demand reflects an interest in actually acquiring the gold with keen interest in expected price changes". Their result vividly pointed out that determinants of physical demand for gold are indeed different from determinants of demand for gold claims. However, these variables were adopted to be systematic determinants of the demand for gold as was further strengthened by other works reviewed.

3.1.1. The Gold Reserve Model

The model shows the relationship between the demand for gold by countries as the dependent variable and selected macroeconomic variables as independent variables. The model is specified as equation 5:

$$LNDEG = \beta_0 + \beta_1 INFLR + \beta_2 EXCR + \beta_3 FDIG + \beta_4 TRO + \beta_5 PRG + \beta_6 PVCDGDP + \mu \quad (5)$$

Where: DEG = Demand for Gold represented by annual amount of gold reserves; INFLR = Inflation Rate; EXCR = Exchange Rate; FDIG = Foreign Direct Investment growth rate; TRO = Trade openness; PRG = Price of Gold; PVCDGDP = Private Credit to GDP ratio (proxy for level of financial development).

3.1.2. The Reserve Without Gold Model

This model shows the relationship between the total reserve without gold in Nigeria and some selected macroeconomic variables. The model is specified as equation 6:

$$TRG = \beta_0 + \beta_1 INFLR + \beta_2 EXCR + \beta_3 PRG + \beta_4 TRO + \beta_5 GDPGR + \mu \quad (6)$$

Where: TRG = Total reserves without gold; INFLR = Inflation Rate; EXCR = Exchange Rate; PRG = Price of Gold; TRO = Trade openness; GDPGR = GDP growth rate.

3.1.3. The Panel Model Specification

The econometric specification used to analyze the demand for gold with panel data is presented as equation 7:

$$G_{it} = \alpha G_{it-1} + \beta X_{it} + \delta D_{it} + \mu_i + \varepsilon_{it} \quad (7)$$

Where: G_{it} is gold reserves as a share of overall international reserves, G_{it-1} captures the fact that Current-period demand is modeled as a function of lagged demand, which seems appropriate given that gold's perceived value may depend in part on how highly others seem to value it, so that recent strong demand presently would bolster demand in future periods also, X_{it} is the vector of macroeconomic variables expected to cause variations in the gold reserves across countries and overtime, D_{it} is the vector of year dummies intended to capture effects of changes in global conditions or geo-political factors that are common across countries, μ_i is a country-specific intercept, and ε_{it} is the error term.

There are three types of models used in panel data regression: the pooled model, the fixed effects model, and the random effects model. However, the two most remarkable are fixed and random effects model. We use fixed effects (FE) whenever we are only interested in analyzing the impact of variables that vary over time. FE explore the relationship between predictor and outcome variables within an entity (country, person, company, etc.).

When using FE, we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. This is the rationale behind the assumption of the correlation between an entity's error term and predictor variables. FE remove the effect of those time-invariant characteristics from the predictor variables so we can assess the predictors' net effect [15]. In sum, the FE model is used when there are suspected correlations between the individual, or cross-section specific, error component u_i and the x regressor. Additionally, if the T (the number of time series data) is large and N (the number of cross-sectional units) is small, the FE model maybe preferable.

The fixed effects model for some variable y_{it} may be written as equation 8:

$$Y_{it} = \alpha_i + \beta_1 X_{it} + \mu_i + v_{it} \quad (8)$$

Where: Y_{it} is the dependent variable with i = entity and t = time; α_i is the unknown intercept for each entity; X_{it} represents one independent variable; β_1 is the coefficient for the independent variable; v_{it} is the error term; we can think of μ_i as summarizing all of the variables that affect y_{it} cross-sectionally but do not vary over time.

Thus, we would capture the heterogeneity that is encapsulated in μ_i by a method that allows for different intercepts for each cross-sectional unit.

This model could be estimated using dummy variables, which would be termed the least squares dummy variable (LSDV) approach [4].

On the other hand, the rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor or independent variables included in the model. Random effects assume that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables. In Random-Effects, we specify those individual characteristics that may or may not influence the predictor variables. The problem with this is that some variables may not be available therefore leading to omitted variable bias in the model [35].

The random effects model for some variable y_{it} may be written as equation 9:

$$Y_{it} = \alpha + \beta X_{it} + u_{it} + \varepsilon_{it} \quad (9)$$

Where: The error term (u_{it}) is the between entity error summarizing all the variables that affect y_{it} cross-sectionally and vary over time while ε_{it} is the within entity error term.

To decide between fixed or random effects, there is need to run a Hausman test where the null hypothesis is that the preferred model is random effects vs. the alternative that the fixed effects is appropriate [12]. This basically tests whether the unique errors (u_i) are correlated with the regressors, the null hypothesis is they are not. The fixed effects model was adopted after the Hausman test was conducted to choose between the random effects and the fixed effects. The test result can be found in the appendix section of the paper.

3.2. Sources of Data

The data used for this study are extracted from: CBN statistical Bulletin [7], World Bank's World Development Indicators [37], World Gold Council [38, 39], IMF International Financial Statistics [14], IMF Balance of Payments Statistics, and World Bank Classification.

4. Data Analysis and Result

The descriptive statistics for all the variables used in the study for the sampled countries are presented in Table 1, showing the summary of descriptive statistics of the data used for the panel regression which presents the descriptive property, or the nature of data set used in the study, collected across the sampled countries. The total observation for the dependent variable and explanatory variables is 198 (panel data for ten countries for 20 years). It shows the means, standard deviations, maximum values, minimum values and how skewed the variables for the sample countries are.

The mean of Gold Reserves which was taken in the log-linear form (LNDEG) was found to be 7.4 for the ten countries. The maximum value of LNDEG is 11.78426 indicating the highest amount of Gold reserves kept by one of the countries. While the minimum value is 3.806662 indicating the lowest value of gold reserves kept among the countries. The deviation from the mean of LNDEG among the countries is given by the value of 1.978306 while the skewness value of 0.201444 indicated that the distribution of gold reserve among the ten countries is normal while the kurtosis value of 2.167783 showed that the distribution of gold reserves is platykurtic since 2.16 is less than 3 as the threshold for a normal distribution.

Table 1. *Descriptive Statistics for the Variables in Model 1.*

	LNDEG	TRO	PRG	EXCR	INFLR	FDIG	PVCDGDP
Mean	7.398069	97.75888	874.9622	101.7534	7.261753	113.6249	98.1616
Median	7.430945	58.6135	871.96	97.27052	3.735347	1.593196	105.6536
Maximum	11.78426	437.3267	1668.98	740.5999	45.94327	9393.453	206.6707
Minimum	3.806662	22.15427	271.04	54.58111	-5.9921	-1505.88	8.771811
Std. Dev.	1.978306	99.57594	469.6643	57.75208	9.264864	751.174	59.16558
Skewness	0.201444	2.082339	0.055081	8.297216	1.908258	9.964981	-0.08346
Kurtosis	2.167783	6.139857	1.5364	83.1898	6.249478	120.139	1.805058
Jarque-Bera	7.052954	224.4268	17.77264	55322.68	207.2804	116479.6	12.00995
Probability	0.029408	0	0.000138	0	0	0	0.002466
Sum	1464.818	19356.26	173242.5	20147.18	1437.827	22497.74	19436
Sum Sq. Dev.	770.9979	1953327	43455151	657054.5	16910.03	1.11E+08	689611.4
Observations	198	198	198	198	198	198	198

Trade openness (TRO) which provides the information about how open a country is to trade has a mean value of 97.6 for the ten countries. The maximum value of TRO is 437.3267 for the ten countries while the minimum value is 22.15427. The deviation from the mean of TRO among the countries is given by the value of 99.57594 while the skewness value of 2.082339 indicated that the distribution of trade openness among the ten countries is slightly positively skewed while the kurtosis value of 6.139857 showed that the distribution of trade openness is leptokurtic since 6.14 was greater than 3 as the threshold for a normal distribution.

Price of gold (PRG) as a determinant of the demand for gold has a mean value of 874.9622 with a standard deviation, maximum and minimum value of 469.6643, 1668.98 and 271.04, respectively. The skewness value of 0.055081 indicates that the price of gold is normally distributed among the ten countries while the kurtosis value of 1.5364 shows that the distribution of price of gold is platykurtic since 1.53 is less than 3 as the threshold for a normal distribution.

Real Effective Exchange rate (EXCR) of the ten countries has a mean value of 101.7534 while the maximum value, minimum value and standard deviation is 740.5999, 54.58111, and 57.75208, respectively. The skewness value of 8.297216 indicates that the distribution of exchange rate among the ten countries is positively skewed while the kurtosis value of 83.1898 showed that the distribution of exchange rate is leptokurtic since 83.2 is greater than 3 as the threshold for a normal distribution.

Inflation rate (INFLR) which provides information about the purchasing power of the dollar among the countries has a mean value of 7.261753 while maximum inflation rate, minimum inflation rate, and standard deviation is 45.94327, -5.9921, and 9.264864, respectively. The skewness value of 1.908258 indicates that the distribution of inflation rate among the ten countries is slightly positively skewed while the kurtosis value of 6.249478 showed that the distribution of inflation rate is leptokurtic since 6.2 is greater than 3 as the threshold for a normal distribution.

Foreign Direct Investment growth rate (FDIG), which provides information concerning the inflow of investment by non-residents of the reporting country has a mean value of 113.6249 with the standard deviation of 751.174 while the maximum values and minimum values are 9393.453 and -1505.88 respectively. The skewness value of 9.964981 indicates that the distribution of foreign direct investment among the ten countries is positively skewed while the kurtosis value of 120.139 showed that the distribution of foreign direct investment is leptokurtic since 120.1 is greater than 3 as the threshold for a normal distribution.

Private credit to GDP ratio (PVCDGDP) which provides information about the development of the financial system in a reporting country has a mean value of 98.1616 with a standard deviation of 59.16558 while the maximum value and minimum value is 206.6707 and 8.771811, respectively. The skewness value of -0.08346 indicates that the private credit to GDP ratio is normally distributed among the ten countries while the kurtosis value of 1.805058 shows that the distribution of private credit to GDP ratio is platykurtic since 1.81 is less than 3 as the threshold for a normal distribution.

4.1. Gold Demand and Macroeconomic Variables Relationship

The Fixed-Effect model was analyzed to determine the relationship between demand for gold and some macroeconomic variables by countries of the world since the Hausman test (Appendix 4) favors the Fixed-Effect model. The result is presented in Table 2.

Table 2. *Results of the Fixed-effects Model for Determinants of the Demand for Gold.*

Independent Variables	Coefficients	Prob. Value
LNDEG(-1)	0.686456	0.0000
TRO	-0.000326	0.7539
PRG	0.000222	0.0001
EXCR	-0.000569	0.0499
INFLR	-0.003487	0.3390
FDIG	1.90E-05	0.3747
PVCDGDP	0.000208	0.8765
Constant	2.258025	0.0000
F-statistic	985.9781	0.000000
Obs	188	
Adjusted R-squared	0.988273	
Durbin-Watson stat	1.643145	

A close examination of the results showed that the model explained about 98.9% systematic variation in Demand for Gold (LNDEG), which measures the amount of gold held by central banks as reserve while about 1.1% is left unexplained by the model but is attributed to the error term or stochastic disturbances. This showed that the model gives a very good fit, meaning that there exists a significant linear relationship between the explanatory variables combined and the explained variable.

The F-statistic value of 985.9781 is very high and the Prob (F-statistic) of 0.000000 shows that the model is highly significant at 1%. This is because a comparison of the calculated value with the table value at the 5% level of significance show that F calculated value of 985.9781 is greater than the critical value of (0.05) = 2.61 shows that there exists a linear relationship between the explanatory variables and the explained variable combined. Thus, we accept the hypothesis that all the slope coefficients are simultaneously significant. The overall model is significant in explaining the changes in demand for Gold over the sample period in the short run.

The Durbin Watson statistics value of approximately 1.643 for Demand for gold (LNDEG) shows the absence of first order positive autocorrelation, as confirmed by the Breusch-Godfrey Serial Correlation LM Test, thus, the parameter estimates can be relied upon.

The co-efficient of Price of gold (PRG) and Exchange rate (EXCR) were significant in the model, implying that the variables are strong determinants of the demand for Gold by countries. This is because the prob-value of 0.0001 for Price of gold and 0.0499 for Exchange rate is lower than 0.05. This indicates that there is a significant relationship between the demand for Gold with Price of gold and Exchange rate combined.

The co-efficient of Trade openness (TRO), Inflation rate (INFLR), Foreign direct investment growth rate (FDIG), and Private credit to GDP ratio (PVCCDGDP) representing the financial development of a country were not significant at 5% level. The prob-value of 0.7539, 0.3390, 0.3747, and 0.8765 for each of the variables respectively are higher than 0.05, indicating that trade openness, inflation rate, foreign direct investment growth rate, and private credit to GDP ratio are weak determinants of the demand for Gold, which implies that there is no significant relationship between trade openness, inflation rate, foreign direct investment growth rate, and private credit to GDP ratio and demand for gold by countries.

Furthermore, the results showed that the one period lag of the dependent variable Demand for gold LNDEG (-1) was positively related to the demand for gold, implying that increased demand for gold in the previous period or year will lead to an increase in the current demand for gold in the current period, and this relationship conformed to a priori expectation and was very significant. The coefficient of demand for gold LNDEG (-1) indicates that a percentage increase in previous year demand for gold will lead to a 68.6 percent increase in the current period demand for gold.

The coefficient of trade openness (TRO) was negatively related to demand for gold (LNDEG) implying that a unit increase in trade openness will lead to 0.000326 unit decrease in demand for gold. This relationship does not conform to a priori expectation and was not statistically significant. Trade openness gives us information on how open an economy is to trade, and by theory, an increase in trade openness ensures better flow of foreign investments into a country which in turns triggers an increase in the national output. However, a country may be opened to trade but lack the potential economic environment necessary for foreign investments to thrive and at such an inverse relationship may surface which might have contributed to the coefficients of trade openness not conforming to a priori expectation and not being statistically significant.

The result also showed a positive relationship between the price of gold (PRG) and the demand for gold (LNDEG) as presumed by the a priori expectation and this relationship was significant. This implies that the price of gold is a key determinant of the demand for gold. The coefficient of price of gold indicated that a unit increase in the price of gold will lead to 0.000222 unit increase in the demand for gold.

The result also showed that exchange rate (EXCR) had a negative relationship with demand for gold (LNDEG). The coefficient of exchange rate indicated that a percentage increase in exchange rate (i.e., an appreciation of the dollar relative to domestic currencies) will bring about a 0.000569% decrease in the demand for gold. This relationship was also significant for the demand for gold and exchange rate, and it conformed to a priori expectation. This implies that exchange rate is a strong determinant of demand for gold (LNDEG).

Inflation rate (INFLR) was negatively related to demand for gold (LNDEG) implying that a 1% increase in inflation

will lead to a 0.003487% decrease in the demand for gold. This relationship was not statistically significant and did not conformed to a priori expectation. Inflation reveals the nature of prices prevailing in the countries under study. The differences among the countries' economy can be directly studied with the kind of prices obtainable in these countries. From our study, Venezuela and Ghana displayed high inflation rates compared to other countries hence, giving occasion to a rightly skewed inflation rate distribution across our cross-section as observed in table 2 containing the descriptive statistics. Also, given the fact that rates are not meant to be normalized by taking the log of the inflation rate, this again may be the reason why inflation rate does not conform to a priori expectation and is not statistically significance.

Furthermore, the result showed that foreign direct investment growth rate (FDIG) was positively related to the demand for gold (LNDEG). This implies that a percentage increase in foreign direct investment growth rate will lead to a 1.90% increase in the demand for gold. However, the relationship was not statistically significant. This could be since foreign direct investment is a very volatile form of investment. Foreign direct investment which is an aspect of international capital flows comprising transfer of financial assets such as cash, stock, or bonds across international borders in want of profit is a volatile form of foreign capital inflow. According to Adeola (2017), it is often easier to sell off the securities and pull out the foreign portfolio investment in a country. Therefore, it is said to be a volatile form of foreign capital inflow. From the data set in appendix 1, we can rightly observe that FDI records a consistently negative and positive growth rate across our cross-section. This contributes to the insignificant nature of foreign direct investment (FDI).

The results also displayed a positive relationship between private credits to GDP ratio (PVCDGDP) implying that a 1% increase in the ratio will lead to a 0.000208% increase in the demand for gold (LNDEG). This did not conform to a priori expectation and was not also significant. This result could be due to the fact that an increase in domestic credit to private sector, which acted as a proxy for financial development was crowded-out by the effect of certain economic variables such as inflation which has the capacity of reducing the value of the credit available to the private sector, hence leading to a corresponding increase in the demand for gold (LNDEG) as a safe asset to preserve the value of these funds. However, the positive relationship was not also significant implying that private credits to GDP ratio is a weak determinant of the demand for gold (LNDEG).

4.2. Macroeconomic Variables and Total Reserves Without Gold in Nigeria

The study examined the effect of macroeconomic variables on the total reserves without gold in Nigeria. To avoid spurious regressions, which may arise as with time series data, we first subjected the data to stationarity test by employing the Augmented Dickey Fuller (ADF) test. The rule is that if the ADF test statistic is greater than the 5 percent critical value we accept the null hypothesis i.e., the variable is stationary but if the ADF test statistic is less than the 5 percent critical value i.e., the variable is non-stationary we reject the null hypothesis and go ahead to difference once. If the variable does not become stationary at first difference, we difference twice. However, it is expected that the variable becomes stationary at first difference. The general form of this test is estimated in the form presented in equation 10:

$$\Delta Y_t = b_0 + \beta Y_{t-1} + \mu_1 \Delta Y_{t-1} + \mu_2 \Delta Y_{t-2} + \ldots + \mu_\rho \Delta Y_{t-\rho} + \varepsilon_t \quad (10)$$

Where: Y_t represents time series to be tested, b_0 is the intercept term, β is the coefficient of interest in the unit root test, μ is the parameter of the augmented lagged first difference of Y_t to represent the pth order autoregressive process, and ε_t is the white noise error term.

The results of the unit root test presented in Table 3 showed that total reserves without gold (TRG), exchange rate (EXCR), price of gold (PRG), trade openness (TRO), and gross domestic product growth rate (GDPGR) were found to be stationary at first difference. This implies that they are I(1) series. While inflation rate (INFLR) was found to be stationary at level, implying that it is an I(0) series. Given that the variables were integrated of order I(1) and I(0), we move into co-integrating the variables using the Auto Regressive Distributed Lag (ARDL) model for both its short-run and long-run relationship since the result of the unit root test depicts that some variables are following a trend.

Table 3. *Unit Root Test Results.*

Variable	Unit Root Test	Series: Level	Series: First Difference	Order of Integration	Prob.*
TRG	ADF	-1.663194	-4.017797	I(1)	0.0083
INFLR	ADF	-3.228229**	_____	I(0)	0.0349
EXCR	ADF	-1.476485	-3.110436**	I(1)	0.0449
DLNPRG	ADF	-2.212393	-4.922544*	I(1)	0.0013
TRO	ADF	-1.924667	-5.097483	I(1)	0.0009
GDPGR	ADF	-2.094567	-4.884274*	I(1)	0.0014

Note: * indicates significance level at 1%, ** indicates 5% and *** 10%.

(i). ARDL Bounds and Long Run Tests

The Co-integration test using total reserve without gold (TRG) as the dependent variable shows that the F-statistic is higher than the upper bound critical value at the 5% level of significance using restricted intercept and linear trend in specification for the model as presented in Table 4 and Table 5. This indeed implies that all the independent variables in model 2 and total reserve without gold are bound by a long

run relationship in Nigeria. This means that the variables included in the model shared long-run relationships among themselves.

Table 4. *ARDL Bounds Test for Co-integration for TRG Model.*

Model		**F-Statistic = 8.051546**
f (TRG, INFLR, EXCR, PRG, TRO, GDPGR)		K = 5
Critical Values	Lower Bound	Upper Bound
10%	2.08	3
5%	2.39	3.38
1%	3.06	4.15

Note: Restricted intercept and no trend, *level of significance at 5%.

Table 5. *Estimated ARDL Long Run Coefficients. Dependent Variable: TRG ARDL (1, 0, 1, 1, 1, 1).*

Regressors	**Coefficient**	**t-Statistic**	**P-Value**	**Remarks**
INFLR	-1.72E+09	-2.103730	0.0735	Significant
EXCR	-23456133	-0.059958	0.9539	Not Significant
DLNPRG	1.17E+11	4.345451	0.0034	Significant
TRO	-8.62E+08	-2.328722	0.0527	Significant
GDPGR	-2.74E+09	-1.819778	0.1116	Not Significant

(ii). Discussion of Results

The estimated ARDL long run coefficients revealed that trade openness (TRO) has a negative relationship with total reserves excluding gold. This does not conform to a priori expectation. Trade openness gives us information on how open an economy is to trade, and by theory, an increase in trade openness ensures better flow of foreign investments into a country which in turn should trigger an increase in the national output and by extension an increase in the total reserves of a country. However, although Nigeria is quite open to trade, it lacks the productive capacity in which foreign investments can thrive to bring about an increase in the total reserves. The result indicates that a 1 unit increase in trade openness (TRO) will lead to 8.62 unit decrease in total reserves without gold in the long run. Moreover, price of gold (PRG) has a positive relationship with total reserves without gold (TRG). This conforms to a priori expectations. This means that a 1 unit increase in the price of gold will lead to a 1.17 unit increase in the total reserves without gold in the long run. Also, inflation rate (INFLR) has a negative relationship with total reserves without gold as presumed by a priori expectation. This means that a 1 unit increase in inflation rate will lead to a 1.72 unit decrease in total reserves without gold in the long run.

Exchange rate (EXCR) has a negative relationship with total reserves without gold (TRG). This does not conform to a priori expectations. The result showed that a 1 unit increase in exchange rate will lead to a 23456133 unit decrease in total reserves without gold in the long run. At the same time, GDP growth rate (GDPGR) has a negative relationship with total reserves without gold (TRG). This does not conform to a priori expectation since a 1 unit increase in GDP growth rate (GDPGR) will lead to a 2.74 unit decrease in the total reserves without gold. This may be due to the fact that Nigeria, in this empirical analysis, is a dominant importing economy and lacks the productive capacity to trigger the manufacture of exportable products needed by the global market which would in turn increase the total reserves with an increase in the exchange rate.

Furthermore, inflation rate (INFLR), trade openness (TRO), and price of gold (DLNPRG) were statistically significant at conventional level. While exchange rate (EXCHR) and GDP growth rate (GDPGR) were statistically insignificant at conventional level. Therefore, it can be deduced from the result that in the long run, exchange rate and GDP growth rate will impact on Nigeria's total reserves without gold but not significantly (i.e., meaningfully).

(iii). Error Correction Analysis

The result of the short-run dynamic coefficients associated with the long-run relationships obtained from the error correction model (ECM) is presented in Table 6. The ECM equation indicates that only four variables have tendencies of adjusting to long-run equilibrium. The error correction term in the model has the wright sign (i.e., negative) and is statistically significant. This implies that deviations from the short run, in total reserves without gold, will adjust quickly to long run equilibrium. Furthermore, the result indicates that the dynamic model is a good fit. This is because the R^2 value of 0.895269 indicates that over 89 percent variations in total reserves without gold is explained by price of gold, exchange rate, trade openness, and GDP growth rate. Meanwhile, the remaining 11 percent is captured by the error term.

Table 6. *Error Correction Representation for the Selected ARDL Model: TRG ARDL (1, 0,1,1,1,1).*

Regressors	**Coefficients**	**t-statistic**	**P-Value**	**Remarks**
D(DLNPRG)	8.35E+09	0.000000	0.0000	Significant
D(EXCR)	5.74E+08	0.000000	0.0000	Significant
D(TRO)	-2.08E+08	0.000000	0.0000	Significant
D(GDPGR)	-5.26E+08	0.000000	0.0000	Significant
ECM (-1)	-0.544537	-10.23084	0.0000	Significant
R-squared = 0.895269	Akaike info criterion =	Schwarz criterion =	Durbin-Watson stat =	
Adjusted R-squared = 0.863045	46.65780	46.90513	2.048776	

In addition, the reason why the coefficient of determination (R^2) is 89% and the error term captures 11% is because there are other variables that determine total reserves without gold which were omitted in the model for purpose of parsimony. This happened because the variables that determine total reserves without gold are too numerous to be captured in a single model. In this study, variables were selected in line with the topical, conceptual, empirical, and theoretical literatures reviewed. Therefore, the overall fit is satisfactory given the R^2 of 89%. The Durbin Watson (DW) value of 2.048776 suggests that the model is free from autocorrelation and implies that there is no first level serial correlation.

Moreover, coefficients of exchange rate (EXCR) and price of gold (PRG) have positive relationship with total reserves without gold in the short run. This conforms to a priori expectations, implying that, in the short run, a 1 unit increase in exchange rate and price of gold will lead to 5.75 units and 8.35 units increase in the total reserves without gold respectively. Also, the coefficient of trade openness (TRO) has a negative relationship with total reserves without gold. This does not conform to a priori expectation implying that a 1 unit increase in trade openness will lead to a 2.08 unit decrease in total reserves without gold.

The coefficient of GDP growth rate (GDPGR) has a negative relationship with total reserves without gold (TRG). This also does not conform to a priori expectation and implies that a 1 unit increase in GDP growth rate will bring about a 5.26 unit decrease in total reserves without gold. This means that an increase in GDP growth rate will be accompanied by a decrease in total reserves. This further implies that, for there to be growth in the GDP, total reserves must decline. If such a relationship exists, it indicates that the economy lacks a robust productive base to grow its output without tampering with her total reserves. It also implies that the Nigerian economy's national income is not adequate to trigger sustainable growth. Therefore, the Nigerian government continually may have to deplete its total reserves to finance its capital-intensive projects. Consequently, if the total reserve is depleting as the national output of the country is growing, it is a clear indication that the Nigerian economy has a weak total reserve base.

Furthermore, price of gold, exchange rate, trade openness, and GDP growth rate were statistically significant. This means that, if policies regarding price of gold, exchange rate, trade openness, and GDP growth rate in Nigeria are well managed, the variables can meaningfully influence the country's total reserves.

(iv). Diagnostics Tests

The diagnosis tests were employed to examine the reliability of the estimated model for prediction purposes. Specifically, Breusch-Godfrey Serial Correlation LM Test, Breusch-Pagan-Godfrey Heteroskedasticity Test and normality tests were employed. Specifically, the Breusch-Godfrey F-Statistics p-value of 0.2986 indicates that the residuals are serially uncorrelated since the p-value is greater than 0.05. Similarly, the Breusch-Pagan-Godfrey F-Statistics p-value of 0.2700 indicates that the residuals are homoscedastic since the p-value is greater than 0.05. The Jarque-Bera statistic revealed that the error term is normally distributed at the conventional level of significance (i.e., 0.05). This is because the probability value of the Jarque-Bera statistic p-value of 0.668922 is greater than the 0.05 conventional level. The results of these tests are reported in Table 7.

Table 7. *Serial Correlation LM Test, Heteroskedasticity and Normality Test Results.*

Test	F-Statistic	t-Statistic	Obs R-Square	Prob. Value
Breusch-Godfrey Serial Correlation LM Test	1.294775	_____	3.194883	0.2986
Heteroskedasticity Test: Breusch-Pagan – Godfrey	1.613481	_____	12.55366	0.2700
Normality Test	Jarque-Bera Statistic = 0.804176	_____	_____	0.668922

5. Conclusion and Recommendations

The result from the Panel OLS method revealed that exchange rate (EXCR) and price of gold (PRG) were key determinants of the demand for gold. Also, the ARDL long-run results revealed that inflation rate (INFLR), price of gold (PRG), and trade openness (TRO) had a significant relationship with total reserves without gold in Nigeria. While the short-run dynamics coefficients revealed that the price of gold (PRG), exchange rate (EXCR), trade openness (TRO), and GDP growth rate (GDPGR) had significant relationships with total reserves without gold in Nigeria.

The following recommendations were made based on the findings in the study: First, importing and exporting countries that are opened to international trade and hence, bound to be affected by exchange rate volatility should take pro-active measures towards the management of their external reserves to accommodate assets such as gold which have the capacity of strengthening the reserve portfolio of the central banks in these countries to hedge their reserves against exchange rate volatility. Second, since the value of gold has displayed strong resilience towards financial market shocks with its value following an exponential trend over the years, it is a clear indication that the value of gold will maintain a steady upward trend, hence, for central banks to reap from the net returns of future gold value, it is necessary that this safety asset be added to its reserve portfolio.

Third, since this study was conducted with the aim of proposing policy options to the Central Bank of Nigeria (CBN), given the inverse relationship between inflation rate and total reserves without gold in Nigeria in the long-run, it is necessary for the monetary authority responsible for managing Nigeria's external reserves (specifically CBN), to adequately broaden the reserve base to include assets capable of maintaining value and strengthening Nigeria's total reserves in the face of a severe financial downturns and shocks of which gold poses as the best possible and most reliable alternative. This is because inflation reduces the value of the Naira and a reduction in the value of the Naira in turn depletes the value of the total reserves since it is kept in terms of fiat currency. Therefore, to create a hedging mechanism to the reserve base, it is crucial that gold be included in the external reserves of the country.

Lastly, it is recommended that given the negative relationship between GDP growth rate and Nigeria's total reserves, a necessary and pro-active measure must be taken by the Central Bank of Nigeria (CBN) to include this "safe asset" in the reserve structure of the country. This will enhance the performance of the reserve base and maintain its value even in the face of a deficit financing.

Appendix

Table 8. *Pooled data of countries.*

C_ID	COUNTRY NAME	YEAR	LOG (GDR)	INFR (%)	EXCR	FDIGR (%)	TRO (%)	PRG (USD)	PVCDGDP (% of GDP)
1	U.S.A	1999	9.310039	1.443803	115.5613	NA	23.27347	278.57	171.6233
1	U.S.A	2000	9.309800	2.235474	119.4654	20.94471	25.04364	279.10	162.5981
1	U.S.A	2001	9.309733	2.193425	126.2270	-51.01752	22.84296	271.04	170.8512
1	U.S.A	2002	9.309552	1.581763	125.9170	-36.16063	22.15427	309.68	162.2958
1	U.S.A	2003	9.309558	1.857095	117.9955	6.979336	22.47710	363.32	177.3723
1	U.S.A	2004	9.309710	2.692212	112.4003	82.43386	24.35241	409.17	184.8580
1	U.S.A	2005	9.309574	3.114942	110.8426	-33.37234	25.55599	444.45	188.6701
1	U.S.A	2006	9.309376	3.026205	109.9252	109.6773	26.90015	603.77	198.2978
1	U.S.A	2007	9.309376	2.686279	104.8933	16.13265	27.95580	695.39	206.6707
1	U.S.A	2008	9.309376	1.945132	100.4471	-1.592843	29.88680	871.96	188.0974
1	U.S.A	2009	9.309376	0.762350	104.6986	-52.77432	24.64156	972.35	193.6556
1	U.S.A	2010	9.309376	1.165251	100.0000	63.91488	28.05795	1224.52	188.4476
1	U.S.A	2011	9.309376	2.088904	95.01137	-0.205273	30.78929	1571.52	179.7554
1	U.S.A	2012	9.309376	1.917849	97.37236	-4.991328	30.56818	1668.98	180.6789
1	U.S.A	2013	9.309376	1.754916	97.53458	15.09357	30.01301	1411.23	192.8353
1	U.S.A	2014	9.309376	1.891891	99.16757	-12.58976	29.96454	1266.40	193.9488
1	U.S.A	2015	9.309376	1.069342	109.8549	102.1342	27.72614	1160.06	188.3943
1	U.S.A	2016	9.309376	1.093525	114.3235	-2.877308	26.49100	1250.80	191.4594
1	U.S.A	2017	9.309376	1.900778	114.0503	-28.27245	27.09091	1257.15	198.8601
1	U.S.A	2018	9.309376	2.255308	112.9630	-27.14205	NA	1268.49	186.0253
2	Malaysia	1999	4.037504	0.045765	97.23956	NA	217.5695	278.57	149.1520
2	Malaysia	2000	5.684939	8.854493	98.49870	-2.763140	220.4074	279.10	134.9999
2	Malaysia	2001	5.685958	-1.581874	103.3325	-85.37483	203.3646	271.04	129.1014
2	Malaysia	2002	5.687653	3.128614	103.4618	476.3895	199.3565	309.68	121.8277
2	Malaysia	2003	5.685279	3.299202	97.87613	0.815956	194.1949	363.32	118.9741
2	Malaysia	2004	5.685279	6.009506	93.47408	35.94670	210.3738	409.17	111.9374
2	Malaysia	2005	5.685279	8.862357	93.30068	-10.31217	203.8545	444.45	106.5244
2	Malaysia	2006	5.681878	3.980757	96.28709	95.95285	202.5777	603.77	103.6640
2	Malaysia	2007	5.681878	4.881499	98.07713	17.95198	192.4661	695.39	101.5801
2	Malaysia	2008	5.937536	10.38876	97.78945	-16.52294	176.6686	871.96	96.74838
2	Malaysia	2009	7.155318	-5.992098	94.94143	-98.48578	162.5590	972.35	111.6069
2	Malaysia	2010	7.403179	7.266867	100.0000	9393.453	157.9448	1224.52	107.1228
2	Malaysia	2011	7.516184	5.412408	99.82912	38.89314	154.9377	1571.52	108.4259
2	Malaysia	2012	7.570443	0.999932	99.51367	-41.16307	147.8418	1668.98	114.1245
2	Malaysia	2013	7.251045	0.174474	98.98532	26.98478	142.7210	1411.23	119.8997
2	Malaysia	2014	7.219192	2.467467	97.94030	-5.991777	138.3122	1266.40	120.5787
2	Malaysia	2015	7.176969	-0.366770	89.58410	-7.178063	133.4597	1160.06	125.0618
2	Malaysia	2016	7.264842	1.952744	86.52849	36.65282	128.8244	1250.80	123.8306
2	Malaysia	2017	7.357829	3.817592	85.12324	-30.44983	135.8375	1257.15	118.8064
2	Malaysia	2018	7.373567	0.884302	88.63673	-8.521942	132.2554	1268.49	121.8312
3	Italy	1999	10.03802	1.600000	98.00000	NA	44.70000	278.57	NA
3	Italy	2000	9.982050	2.000000	93.20000	2373.518	50.50000	279.10	NA
3	Italy	2001	9.989492	3.000000	94.40000	152.1470	50.20000	271.04	60.60000
3	Italy	2002	10.20428	3.400000	96.70000	-29.71900	48.20000	309.68	62.30000
3	Italy	2003	10.40097	3.200000	102.9000	-81.36044	46.30000	363.32	65.50000
3	Italy	2004	10.44950	2.500000	104.6000	567.4575	47.50000	409.17	67.90000
3	Italy	2005	10.60756	1.900000	102.8000	265.3786	49.40000	444.45	71.00000
3	Italy	2006	10.82201	1.900000	102.4000	12.74294	53.30000	603.77	76.00000
3	Italy	2007	11.09650	2.400000	103.1000	103.5131	55.20000	695.39	82.10000
3	Italy	2008	11.13001	2.500000	103.9000	-43.57713	54.70000	871.96	84.00000
3	Italy	2009	11.37398	2.000000	105.1000	-72.86827	45.60000	972.35	87.80000
3	Italy	2010	11.61880	0.300000	100.0000	67.27958	52.30000	1224.52	93.40000
3	Italy	2011	11.72897	1.500000	99.90000	68.81310	55.60000	1571.52	94.70000
3	Italy	2012	11.78426	1.400000	97.80000	-86.89725	56.20000	1668.98	94.40000
3	Italy	2013	11.45861	1.200000	99.50000	198.3143	55.50000	1411.23	91.30000
3	Italy	2014	11.45673	1.000000	99.30000	0.695060	55.80000	1266.40	88.90000
3	Italy	2015	11.33288	0.900000	93.90000	-21.14730	56.90000	1160.06	87.50000
3	Italy	2016	11.42126	1.100000	94.60000	-5.328885	56.00000	1250.80	85.20000
3	Italy	2017	11.53548	0.500000	95.30000	-14.61374	59.40000	1257.15	81.20000
3	Italy	2018	11.52463	NA	96.80000	112.3827	61.00000	1268.49	77.40000
4	Canada	1999	6.261492	1.906295	75.25689	NA	80.31486	278.57	97.03840

C_ID	COUNTRY NAME	YEAR	LOG (GDR)	INFR (%)	EXCR	FDIGR (%)	TRO (%)	PRG (USD)	PVCDGDP (% of GDP)
4	Canada	2000	5.777652	4.345246	75.62683	175.5417	82.97479	279.10	93.43513
4	Canada	2001	5.673323	1.639734	73.40494	-58.43381	78.51487	271.04	173.2319
4	Canada	2002	5.323010	1.237473	72.76328	-13.75316	75.84232	309.68	167.8561
4	Canada	2003	3.806662	3.257503	80.95191	-71.36457	69.95226	363.32	162.0693
4	Canada	2004	3.871201	3.278838	85.44202	-79.28609	70.28581	409.17	164.8739
4	Canada	2005	4.025352	3.145439	90.53886	1659.291	69.80885	444.45	172.7459
4	Canada	2006	4.234107	2.602275	95.53401	151.6505	68.07145	603.77	188.7536
4	Canada	2007	4.510860	3.308587	98.59499	87.32064	66.27301	695.39	123.8577
4	Canada	2008	4.553877	3.997513	95.98701	-41.78601	67.00112	871.96	124.4069
4	Canada	2009	4.779123	-2.315573	91.57587	-70.12093	58.42640	972.35	NA
4	Canada	2010	5.030438	2.868094	100.0000	41.82911	60.13413	1224.52	NA
4	Canada	2011	5.117994	3.236382	101.5641	29.02124	62.40337	1571.52	NA
4	Canada	2012	5.198497	1.204536	101.0746	28.77187	62.47932	1668.98	NA
4	Canada	2013	4.744932	1.728928	97.47752	35.76918	62.06198	1411.23	NA
4	Canada	2014	4.753590	1.957936	91.48466	-4.256828	64.14239	1266.40	NA
4	Canada	2015	4.060443	-0.902405	83.12167	-6.526565	65.83846	1160.06	NA
4	Canada	2016	NA	0.797481	81.51783	-43.21459	64.90653	1250.80	NA
4	Canada	2017	NA	2.563358	82.73953	-18.35155	64.52294	1257.15	NA
4	Canada	2018	NA	1.900101	82.28783	63.29600	65.75020	1268.49	NA
5	Venezuela	1999	7.967973	26.19271	76.96824	NA	42.07023	278.57	13.61787
5	Venezuela	2000	7.935230	29.45283	79.95879	62.73356	47.85722	279.10	12.46922
5	Venezuela	2001	8.024862	7.996904	85.04231	-21.24176	42.14127	271.04	12.18510
5	Venezuela	2002	8.164795	33.02288	66.49298	-79.45464	48.57571	309.68	9.979473
5	Venezuela	2003	8.440744	34.93376	57.73698	106.7017	50.57701	363.32	8.771811
5	Venezuela	2004	8.541300	33.95372	55.75639	-5.340114	55.36746	409.17	10.98098
5	Venezuela	2005	8.651374	29.60406	54.58111	64.53996	60.12733	444.45	13.12917
5	Venezuela	2006	8.889446	17.90432	57.80386	-91.91837	58.66559	603.77	17.00356
5	Venezuela	2007	9.135725	15.44848	63.34244	2101.010	56.19910	695.39	23.44811
5	Venezuela	2008	9.127067	30.13245	75.96215	-52.20285	51.82901	871.96	21.43585
5	Venezuela	2009	9.495294	7.831666	99.06831	-154.5847	38.52093	972.35	23.58697
5	Venezuela	2010	9.702778	45.94327	100.0000	-239.2260	46.13689	1224.52	18.83101
5	Venezuela	2011	9.901435	28.14919	70.80226	269.8673	49.63812	1571.52	20.47423
5	Venezuela	2012	9.902837	14.05943	84.98671	-14.84202	50.40357	1668.98	25.30375
5	Venezuela	2013	9.644717	35.50267	83.22710	-56.97954	54.27776	1411.23	29.89615
5	Venezuela	2014	9.590214	40.44049	128.9564	-47.08625	48.09081	1266.40	NA
5	Venezuela	2015	9.214532	NA	310.0365	160.4405	NA	1160.06	NA
5	Venezuela	2016	8.952476	NA	740.5999	-46.31258	NA	1250.80	NA
5	Venezuela	2017	8.798907	NA	NA	-104.2848	NA	1257.15	NA
5	Venezuela	2018	NA	NA	NA	-1505.882	NA	1268.49	NA
6	Indonesia	1999	6.700069	14.16120	102.5063	NA	62.94391	278.57	20.59284
6	Indonesia	2000	6.641113	20.44746	97.07070	143.9057	71.43688	279.10	19.90854
6	Indonesia	2001	6.649178	14.29572	96.75931	-34.56793	69.79321	271.04	20.29053
6	Indonesia	2002	6.981626	5.896052	98.36337	-104.8729	59.07946	309.68	21.27670
6	Indonesia	2003	7.163131	5.487429	103.7466	-511.4289	53.61649	363.32	22.94974
6	Indonesia	2004	7.208449	8.550727	105.5383	-417.6423	59.76129	409.17	26.39253
6	Indonesia	2005	7.371678	14.33179	104.0271	339.6568	63.98794	444.45	26.42785
6	Indonesia	2006	7.303305	14.08742	103.3545	-41.05027	56.65713	603.77	24.60603
6	Indonesia	2007	7.574635	11.25858	103.8761	40.98893	54.82925	695.39	25.45599
6	Indonesia	2008	7.622621	18.14975	104.4936	34.49492	58.56140	871.96	26.55348
6	Indonesia	2009	7.846052	8.274752	104.5384	-47.65903	45.51212	972.35	27.65871
6	Indonesia	2010	8.102564	15.26429	100.0000	213.5299	46.70127	1224.52	27.25304
6	Indonesia	2011	8.188092	7.465943	99.21431	34.48160	50.18001	1571.52	30.08220
6	Indonesia	2012	8.278959	3.753879	96.01535	3.091866	49.58290	1668.98	33.43417
6	Indonesia	2013	8.014103	4.965990	97.30148	9.815506	48.63737	1411.23	36.05814
6	Indonesia	2014	8.015347	5.443175	97.32860	7.898849	48.08018	1266.40	36.42355
6	Indonesia	2015	7.886307	3.980243	92.02884	-21.26373	41.93764	1160.06	39.11880
6	Indonesia	2016	7.964228	2.438924	92.91205	-77.03785	37.42134	1250.80	39.40242
6	Indonesia	2017	8.115380	4.274986	93.36433	351.5985	39.36275	1257.15	38.73980
6	Indonesia	2018	8.080126	3.831486	NA	-2.450163	43.02166	1268.49	38.80911
7	South Africa	1999	6.927364	7.028155	103.2045	NA	46.86189	278.57	131.0482
7	South Africa	2000	7.280012	8.796302	100.0688	-35.55442	51.43777	279.10	130.3122
7	South Africa	2001	7.263192	7.641860	88.35777	650.4242	54.80163	271.04	138.7925
7	South Africa	2002	7.458711	12.20528	75.73347	-79.64602	59.76464	309.68	110.7184
7	South Africa	2003	7.296897	5.793571	98.34416	-47.07841	51.40183	363.32	115.8622
7	South Africa	2004	7.364189	6.527026	104.2468	-10.43421	51.07803	409.17	126.9323
7	South Africa	2005	7.625887	5.449103	104.1232	829.8394	53.14912	444.45	138.1594

C_ID	COUNTRY NAME	YEAR	LOG (GDR)	INFR (%)	EXCR	FDIGR (%)	TRO (%)	PRG (USD)	PVCDGDP (% of GDP)
7	South Africa	2006	7.835992	6.255249	98.19019	-90.44339	60.27726	603.77	156.9762
7	South Africa	2007	8.118008	8.849399	91.70039	956.7751	63.68309	695.39	160.1248
7	South Africa	2008	8.156166	8.831509	80.09221	50.07307	72.86539	871.96	140.3499
7	South Africa	2009	8.397968	7.504521	87.24286	-22.86809	55.41826	972.35	145.9412
7	South Africa	2010	8.640049	6.351038	100.0000	-51.56041	55.98899	1224.52	148.9814
7	South Africa	2011	8.743920	6.532231	98.27432	12.07649	60.11263	1571.52	139.6023
7	South Africa	2012	8.810297	5.282771	92.38279	11.75902	60.89970	1668.98	146.4798
7	South Africa	2013	8.481709	6.155257	82.02077	77.96081	64.24176	1411.23	149.2337
7	South Africa	2014	8.481722	5.547005	77.01895	-29.64900	64.43450	1266.40	150.9740
7	South Africa	2015	8.364104	5.170614	75.07243	-73.73568	61.61707	1160.06	147.5125
7	South Africa	2016	8.447459	7.206346	70.35425	45.63466	60.63819	1250.80	143.8161
7	South Africa	2017	8.560827	5.267458	79.38383	-7.016779	57.97389	1257.15	147.4725
7	South Africa	2018	8.550628	3.916540	80.75602	165.4321	59.47033	1268.49	NA
8	Singapore	1999	NA	-3.582965	98.67760	NA	336.4848	278.57	102.7073
8	Singapore	2000	5.344724	3.862640	98.51867	-6.410027	364.3645	279.10	96.05246
8	Singapore	2001	5.345678	-1.816175	99.03310	9.613607	349.2921	271.04	115.0240
8	Singapore	2002	5.355170	-0.888632	96.45792	-63.79552	349.7460	309.68	102.0242
8	Singapore	2003	5.355170	-1.787355	93.07235	176.9324	377.2186	363.32	104.7828
8	Singapore	2004	5.355170	4.073556	92.02906	43.03978	401.5237	409.17	95.72897
8	Singapore	2005	5.355170	1.907434	90.60466	-25.82986	420.4305	444.45	89.22336
8	Singapore	2006	5.355170	1.845657	91.82318	104.1084	425.3634	603.77	84.28706
8	Singapore	2007	5.355170	5.916244	92.24490	29.27460	394.2885	695.39	85.35176
8	Singapore	2008	5.355170	-1.386134	96.99645	-74.43980	437.3267	871.96	97.86436
8	Singapore	2009	5.355170	2.961071	97.03152	95.24453	358.1928	972.35	96.86138
8	Singapore	2010	5.355170	1.102603	100.0000	131.2052	369.6856	1224.52	94.85840
8	Singapore	2011	5.355170	1.125733	105.1743	-10.74919	379.0986	1571.52	104.7037
8	Singapore	2012	5.355170	0.482051	110.0231	12.52175	369.2130	1668.98	112.9735
8	Singapore	2013	5.355170	-0.428603	112.0021	16.41398	367.0418	1411.23	124.0660
8	Singapore	2014	5.355170	-0.233706	111.2866	6.692018	360.4673	1266.40	128.1298
8	Singapore	2015	5.355170	3.156402	108.2824	1.566382	329.4714	1160.06	122.4214
8	Singapore	2016	5.355170	0.785274	108.0662	5.414724	304.4785	1250.80	124.0998
8	Singapore	2017	5.355170	2.553747	106.7784	28.90243	317.8327	1257.15	122.7186
8	Singapore	2018	5.355170	1.908415	106.1706	-13.47055	326.1947	1268.49	121.9005
9	Australia	1999	6.611195	0.356985	73.50242	NA	39.13465	278.57	84.28029
9	Australia	2000	6.549070	2.579736	70.44027	349.7978	41.02901	279.10	87.73576
9	Australia	2001	6.563450	4.620877	67.56447	-28.03902	44.36521	271.04	88.65183
9	Australia	2002	6.777847	2.860341	70.85305	36.75599	41.55728	309.68	91.48292
9	Australia	2003	6.974947	3.113555	79.36526	-38.69372	40.29614	363.32	99.40057
9	Australia	2004	7.024042	3.311089	85.41557	377.5348	37.12073	409.17	102.9750
9	Australia	2005	7.181990	3.797155	87.96121	-158.4817	39.27118	444.45	108.7941
9	Australia	2006	7.396868	5.092362	87.23438	-221.7508	41.60423	603.77	113.9612
9	Australia	2007	7.668394	5.011640	92.32910	45.46150	42.05144	695.39	120.7813
9	Australia	2008	7.711054	4.525547	90.36905	1.620011	42.87033	871.96	121.9529
9	Australia	2009	7.934525	5.001895	87.59626	-36.48527	45.79790	972.35	122.6334
9	Australia	2010	8.191036	1.167180	100.0000	22.75706	40.64967	1224.52	125.4957
9	Australia	2011	8.304581	6.252793	106.9661	86.17871	41.90673	1571.52	122.3348
9	Australia	2012	8.361887	1.873450	109.0223	-12.21032	43.21035	1668.98	121.2837
9	Australia	2013	8.024895	-0.154201	103.4513	-6.173938	41.20843	1411.23	124.7823
9	Australia	2014	8.032339	1.444359	98.32287	17.03453	42.50649	1266.40	128.5068
9	Australia	2015	7.885705	-0.701819	89.83034	-28.71102	41.49971	1160.06	136.3349
9	Australia	2016	7.906179	-0.496665	90.90182	-12.93123	40.73885	1250.80	142.2841
9	Australia	2017	8.014005	3.716816	93.67540	10.62853	41.74690	1257.15	140.1224
9	Australia	2018	7.946971	1.826363	89.92952	40.45697	43.00226	1268.49	139.5927
10	Ghana	1999	4.368181	12.40867	145.1165	NA	81.70510	278.57	12.56208
10	Ghana	2000	4.373112	25.19322	95.30918	-31.92450	116.0484	279.10	13.97149
10	Ghana	2001	4.367674	32.90541	96.39164	-46.16034	110.0459	271.04	11.88439
10	Ghana	2002	4.569854	14.81624	95.97219	-34.02373	97.48924	309.68	12.14954
10	Ghana	2003	4.754021	26.67495	96.39606	132.0567	97.28715	363.32	12.49305
10	Ghana	2004	4.808560	12.62457	95.13852	1.842034	99.67033	409.17	13.17249
10	Ghana	2005	4.973375	15.11819	104.1772	4.092769	98.17151	444.45	15.54407
10	Ghana	2006	5.180969	10.91517	109.9112	338.7184	65.92144	603.77	11.09359
10	Ghana	2007	5.179976	10.73273	109.1151	117.4774	65.35432	695.39	14.48843
10	Ghana	2008	5.489831	16.52214	103.8220	96.28106	69.51423	871.96	15.88200
10	Ghana	2009	5.469578	19.25071	94.83567	-12.86509	71.59474	972.35	15.65806
10	Ghana	2010	5.715098	10.70757	100.0000	6.835782	75.37782	1224.52	15.28970
10	Ghana	2011	5.773619	8.726837	95.21364	27.49493	86.29545	1571.52	15.05014

C_ID	COUNTRY NAME	YEAR	LOG (GDR)	INFR (%)	EXCR	FDIGR (%)	TRO (%)	PRG (USD)	PVCDGDP (% of GDP)
10	Ghana	2012	5.820582	7.126350	86.46748	2.209237	93.16804	1668.98	15.64476
10	Ghana	2013	5.299026	11.66619	86.24932	-2.037390	61.68722	1411.23	12.89697
10	Ghana	2014	5.465428	15.48962	66.37534	4.049785	65.17055	1266.40	14.51647
10	Ghana	2015	5.293932	17.14997	64.66527	-11.50125	75.58639	1160.06	15.72443
10	Ghana	2016	5.469253	17.45463	74.22170	16.82237	69.35767	1250.80	15.36759
10	Ghana	2017	5.591254	12.37192	73.62330	-6.672731	73.64820	1257.15	13.85757
10	Ghana	2018	5.535561	9.836993	73.79900	NA	NA	1268.49	11.67806

Source: IMF International Financial Statistics and WDI 2018.

Table 9. *Time series data for nigeria.*

YEAR	TRG (USD)	INFLR (%)	EXCHR ($/₦)	TRO (%)	GDPGR (%)	DLNPRG (Log)
1999	5.45E+09	6.6	69.8	34.50	0.521844	NA
2000	9.91E+09	6.9	70.8	49.00	5.518500	0.001901
2001	1.05E+10	18.9	78.8	49.70	6.666848	-0.029304
2002	7.33E+09	12.9	79.1	40.00	14.60438	0.133273
2003	7.13E+09	14.0	74.3	49.30	9.502606	0.159744
2004	1.70E+10	15.0	76.0	31.90	10.44200	0.118847
2005	2.83E+10	17.9	87.0	33.10	7.008457	0.082707
2006	4.23E+10	8.2	92.3	42.60	6.725974	0.306356
2007	5.13E+10	5.4	91.4	39.30	7.318081	0.141280
2008	5.30E+10	11.6	100.5	40.80	7.199287	0.226271
2009	4.48E+10	11.5	92.6	36.10	8.353344	0.108972
2010	3.49E+10	13.7	100.0	43.30	9.539786	0.230588
2011	3.52E+10	10.8	100.5	53.30	5.307924	0.249494
2012	4.64E+10	12.2	110.5	44.50	4.205890	0.060169
2013	4.54E+10	8.5	117.4	31.00	5.487793	-0.167751
2014	3.67E+10	8.1	124.5	30.90	6.222942	-0.108283
2015	2.83E+10	9.0	119.0	21.40	2.786398	-0.087707
2016	2.72E+10	15.7	110.2	20.70	-1.583065	0.075312
2017	3.96E+10	16.5	100.8	26.30	0.823987	0.005064
2018	4.28E+10	12.1	109.1	26.06	1.930000	0.008980

Source: CBN statistical Bulletin and WDI 2018.

Table 10. *World Official Gold Holdings.*

S/N	WORLD OFFICIAL GOLD HOLDINGS International Financial Statistics, July 2019						
		Tonnes	% of reserves	S/N		Tonnes	% of reserves
1	United States	8,133.5	74.5%	51	Bulgaria	40.5	6.1%
2	Germany	3,367.9	70.0%	52	Malaysia	38.9	1.6%
3	IMF	2,814.0		53	Peru	34.7	2.3%
4	Italy	2,451.8	65.4%	54	Slovak Republic	31.7	21.4%
5	France	2,436.0	59.9%	55	Hungary	31.5	4.4%
6	Russian Federation	2,190.1	18.4%	56	Qatar	31.3	3.5%
7	China, P.R.: Mainland	1,916.3	2.5%	57	Syrian Arab Republic	25.8	6.1%
8	Switzerland	1,040.0	5.4%	58	Ukraine	24.6	5.3%
9	Japan	765.2	2.4%	59	Morocco	22.1	3.8%
10	India	618.2	6.1%	60	Afghanistan, Islamic Republic of	21.9	11.1%
11	Netherlands	612.5	64.9%	61	Nigeria	21.5	2.1%
12	ECB	504.8	26.4%	62	Serbia, Republic of	20.9	6.7%
13	Taiwan Province of China	423.6	3.7%	63	Tajikistan	20.4	71.4%
14	Portugal	382.5	59.8%	64	Sri Lanka	19.9	9.6%
15	Kazakhstan	370.9	55.1%	65	Colombia	18.9	1.5%
16	Uzbekistan	363.9	55.8%	66	Ecuador	16.9	24.0%
17	Saudi Arabia	323.1	2.6%	67	Mongolia	15.8	18.0%
18	United Kingdom	310.3	8.3%	68	Bangladesh	14.0	1.9%
19	Turkey[6)]	302.8	14.4%	69	Cyprus	13.9	62.0%
20	Lebanon	286.8	23.2%	70	Curaçao and Sint Maarten	13.1	27.9%
21	Spain	281.6	16.3%	71	Kyrgyz Republic	12.8	24.5%
22	Austria	280.0	49.8%	72	Mauritius	12.4	7.6%
23	Belgium	227.4	34.7%	73	Cambodia	12.4	3.6%
24	Philippines	197.9	9.8%	74	Ghana	8.7	6.5%
25	Algeria	173.6	8.7%	75	Paraguay	8.2	4.5%
26	Venezuela, Republica Bolivariana de	161.2	77.7%	76	Czech Republic	8.2	0.2%

S/N	WORLD OFFICIAL GOLD HOLDINGS International Financial Statistics, July 2019						
		Tonnes	% of reserves	S/N		Tonnes	% of reserves
27	Thailand	154.0	3.1%	77	United Arab Emirates	7.5	0.3%
28	Poland	128.6	4.6%	78	Myanmar	7.3	5.3%
29	Singapore	127.4	1.8%	79	North Macedonia, Republic of	6.9	8.9%
30	Sweden	125.7	8.8%	80	Guatemala	6.9	2.0%
31	South Africa	125.3	10.8%	81	Tunisia	6.8	4.8%
32	Mexico	120.2	2.7%	82	Latvia	6.6	6.3%
33	Libya	116.6	6.2%	83	Nepal	6.4	3.2%
34	Greece	113.2	66.0%	84	Ireland	6.0	4.7%
35	Korea, Republic of	104.4	1.1%	85	Lithuania	5.8	5.6%
36	Romania	103.7	10.6%	86	Bahrain, Kingdom of	4.7	6.7%
37	BIS[2)]	102.0	[1)]	87	Brunei Darussalam	4.5	4.9%
38	Iraq	96.3	6.2%	88	Mozambique	4.4	5.5%
39	Kuwait	79.0	7.7%	89	Slovenia	3.2	13.2%
40	Egypt	78.8	7.5%	90	Aruba	3.1	12.1%
41	Indonesia	78.5	2.6%	91	Bosnia and Herzegovina	3.0	1.8%
42	Australia	68.7	5.2%	92	Luxembourg	2.2	9.6%
43	Brazil	67.4	0.7%	93	Hong Kong SAR	2.1	0.0%
44	Denmark	66.5	4.0%	94	Iceland	2.0	1.3%
45	Pakistan	64.6	21.6%	95	Papua New Guinea	2.0	4.0%
46	Argentina	61.7	3.6%	96	Trinidad and Tobago	1.9	1.1%
47	Finland	49.1	18.7%	97	Haiti	1.8	3.2%
48	Belarus[4)]	47.1	25.8%	98	Yemen, Republic of	1.6	1.3%
49	Jordan	43.5	12.3%	99	Albania	1.6	1.8%
50	Bolivia	42.5	21.0%	100	Guinea	1.5	5.6%

Source: IMF International Financial Statistics 2019.

Table 11. *World Bank Classification of Countries.*

High-income countries	Developing countries
Australia	Albania
Austria	Argentina
Belgium	Burundi
Bahrain, Kingdom of	Bangladesh
Canada	Bulgaria
Switzerland	Belarus
Chile	Bolivia
Cyprus	Brazil
Czech Republic	China, P.R.: Mainland
Germany	Cameroon
Denmark	Congo, Republic of
Spain	Colombia
Estonia	Costa Rica
Finland	Ecuador
France	Egypt
United Kingdom	Fiji
Greece	Ghana
China, P.R.: Hong Kong	Guatemala
Hungary	Honduras
Ireland	Indonesia
Iceland	India
Israel	Iraq
Italy	Jordan
Japan	Kazakhstan
Korea, Republic of	Kenya
Kuwait	Kyrgyz Republic
Norway	Cambodia
Oman	Lao People's Democratic Republic
Poland	Libya
Portugal	Sri Lanka
Saudi Arabia	Morocco
Singapore	Mexico
Slovak Republic	Macedonia, FYR
Slovenia	Mongolia
Sweden	Mozambique
Trinidad and Tobago	Mauritius

Table 12. *Correlated Random Effects - Hausman Test.*

Correlated Random Effects - Hausman Test				
Equation: Untitled				
Test cross-section random effects				
Test Summary		**Chi-Sq. Statistic**	**Chi-Sq. d f.**	**Prob.**
Cross-section random		74.243625	7	0.0000
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
LNDEG(-1)	0.686456	0.988707	0.001423	0.0000
TRO	-0.000326	-0.000139	0.000001	0.8542
PRG	0.000222	-0.000034	0.000000	0.0000
EXCR	-0.000569	-0.000430	0.000000	0.0021
INFLR	-0.003487	-0.001147	0.000007	0.3704
FDIG	0.000019	0.000017	0.000000	0.6635
PVCDGDP	0.000208	-0.000421	0.000002	0.6225

Source: E-views 10.

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