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By Abiodun Sunday Olayiwola & Kazeem Fasoye
Obafemi Awolowo University

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Abiodun Sunday Olayiwola[α] & Kazeem Fasoye[σ]

Abstract- This study examines the impact of China's currency swap agreements with Nigeria on U.S. dollar's exchange rate with naira between 1999 and 2017 using Robust Least Squares (ROBUSTLS) technique. The results of the finding reveal that China's currency swap agreement with Nigeria tends to have a reasonable impact on the exchange rate (value) of U.S. dollar. Since the existing works on bilateral currencies swap agreements between China and other countries(excluding Nigeria) reveal that the U.S. dollar dominates all other international currencies in trade settlement and with the aim of bypassing the U.S. dollar in international trades, this study therefore provides fresh empirical evidence on the impact of China's currency swap agreements with Nigeria on the U.S. dollar's exchange rate and concludes that China's currency swap agreement with Nigeria will raise the exchange rate of naira and lower the value of the U.S. dollar with respect to Nigerian naira.

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I. Introduction

The evolution of the foreign exchange market in Nigeria has been under the influence of some factors; changing patterns of international trade, political changes in the economy and structural shifts in production. Nigeria has adopted two main exchange regimes since the era of the oil boom in the 1970s: Direct administrative control exchange rate before 1986 and market regulated system introduced during Structural Adjustment Programme in 1986. Since then, the country is still experimenting various market arrangements (Auction System, Dutch Auction System, Wholesale Dutch Auction System, and Rental Dutch Auction System) in determining the exchange rate of naira to US dollar (CBN, 2011; Umar and Soliu, 2009; Mojekwu, Okpala and Adeleke, 2011). Over the past 20 years, the Central Bank of Nigeria (CBN) has been intervening in the foreign exchange market because Nigerian naira- US dollar exchange rate has considerable influence on other socio – economic variables in Nigeria and part of this intervention has led to the recent bilateral currency swap agreement between the Peoples Bank of China (PBC) and the Central Bank of Nigeria (CBN).

Author α σ: Department of Economics, Faculty of Social Sciences, Obafemi Awolowo University, Ile-Ife, Nigeria.
e-mails: abiodunolayiwola37@gmail.com, qosimfasoye@yahoo.com

By definition, currency swap deal consists of an agreement between at least one or two international central banks to swap their currencies, to ease trade transactions between both countries and this is devoid of exchange rate challenges. The central bank's party to the swap transaction can lend the proceeds of the swap, against collaterals they deem adequate, to the commercial banks within their jurisdiction, to provide them with temporary liquidity in a foreign currency. Basically, this implies that a particular country would set aside certain amount of its currency(say Yuan) from which People or importers from the other country could directly exchange their currency (say Naira) at pre-determined exchange rates, without first procuring any standard or vehicle currency(dollars/ pounds) to complete the transaction. Therefore, currency swap is designed to assist both countries in their foreign exchange reserves management, enhance financial stability, and protect business people from the harsh effects of vehicle/standard currency fluctuations.

For instance, the People's Bank of China (PBOC) signing of a RMB16-billion (amounting to nearly $2.4 billion or N720 billion) swap agreement with the Central Bank of Nigeria (CBN) on April 27, 2018 in Beijing, China implies that China will exchange RMB16 billion and receive Nigeria naira at a specified exchange rate (N720 billion). Subsequently, CBN will inject RMB16 billion, and PBOC will inject N720 billion into their financial systems, which will be borrowed by domestic traders to pay for their imports from each other country. And when the agreement expires, PBOC and CBN will exchange the other nation's currency at the same exchange rate. This currency swap deal between Nigeria and China (Naira and Yuan swap deal) has implications. According to Banwo and Ighodalo (2018), this will ease trade transactions between both countries, prevent exchange rate challenges with the United State dollar and significantly reduce the increasing pressure on the U.S. dollar, which has gone haywire in the foreign exchange market. Beyond this, the move by the Nigerian government will make trade between Nigeria - China less reliant on the US dollar and will ultimately strengthen our reserves (CBN, 2018).

Likewise, China has actively implemented measures of promoting the cross-border use of its currency (Renminbi RMB) in order to reduce its reliance

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on the US dollar and to prevent dollar squeeze, and the danger of operating a US-centric global financial system (Chen and Cheung, 2011). Some economists have considered this aggressive policy move as a clear signal of China's efforts to internationalize RMB (Cheung, Ma, and McCauley, 2011). Therefore, Nigeria- China currency swap decision has the capacity of bringing double investment to the country from China and the U.S. because it is expected that the pressure on the US-dollar and the value of the dollar to naira will come down, and as such, American investors will be willing to invest in the Nigerian economy. A lot of studies have considered the dangers and benefits as well as evaluating the impact of China's currency swap agreements with other nations on the U.S. dollar's exchange rate, but none of these studies on currency swap agreements, so far, have looked into the impact of such swap deal on the Dollar – Naira exchange rates (Adhikari, 2016). For example, Ibrahim Yelwa and other bureau de change operators in 2016 explain that the currency swap agreement will eliminate the challenges arising from dollar exchange transaction and promote business flexibility between Nigeria and China. According to them, the impact of the currency swap agreement between Nigerian and China will reduce trade imbalances and thereby boost the Nigerian economy, but their views lack empirical findings of the impact of the swap deal on US- dollar exchange rate in Nigeria. Likewise, Atkins (2016) concludes on both the costs and benefits of Nigeria's currency swap agreement with China that increase in trade with China is a benefit to Nigeria, but a possible political turmoil is a danger that may arise from the swap agreement. Against this background, this study seeks to evaluate the impact of China's currency swap agreements with Nigeria on the U.S. dollar's exchange rate with naira.

This study is organized into five sections: Section one is the Introduction, Section 2 focuses the literature review; section 3 deals with Methodology, variable measurement and sources of data. Section 4 discusses the results with their detailed analysis. Finally, Section 5 attempts to bring together the main findings for concluding remarks.

II. Literature Review

Since 2009, the People Bank's of China (PBoC) has signed Bilateral Currency Swap Agreements (BCS) with many central banks, including both emerging and some other industrialized countries. The objective of these Bilateral Currency Swap Agreements (BCS) according to the PBoC is to promote the use of the Chinese currency in trade and investment around the globe (PBoC, 2012). Many authors (such as Aizenman, Jinjarak, and Park, 2011; Liao and McDowell (2015); Zhitao, Wenjie and Cheung, 2016; Garcia-Herrero and Xia,2013) have concluded that the predominant reason for the choice of swap agreements are to insulate the trading nations from international liquidity shocks and reduced transaction costs of cross-border exchange rate for local firms, trade intensity, economic size, strategic partnership, free trade agreement, corruption, and stability. Others opine swap agreements by China will only have limited effect in terms of establishing Renminbi (RMB) as a substitute to other reserve currencies (Liao and McDowell, 2015).

However, there have been several studies on swap agreements, but none of these studies has empirically examined the impact of such currency swap agreement on the value of U.S. dollar in Nigeria but the only related empirical analysis we are aware of recently is that of Adhikari (2016), who examines the impact of Indonesia - China's swap agreements on the value of the U.S. dollar and conclude that the currency swap agreement turned out to be insignificant, meaning that China's swap agreement with Indonesia has no effect on the exchange rate (value) of the U.S. dollar and It should be noted that Adhikari (2016) conclusion cannot be directly extended to the Nigeria economy or other countries, given the differences in the objectives of the respective central banks currency swap agreements with China and socio – economic factors in these countries. While considering the impact of Nigeria's currency swap agreement with China on Nigerian economy, Yelwa's opinion in 2016 and other newspaper articles conclude that currency swap agreement will boost the Nigerian economy but failed to state by how much the swap agreement will affect the economy empirically since imports from China account for some percent of Nigeria's annual imports, meaning that the swap deal will have effects on remaining percent of Nigeria's total import which may definitely require dollar exchange rate. Atkins (2016) analyzes both the benefits and dangers of Nigeria's swap agreement with China. To him, while increased trade with China is a benefit to Nigeria, a possible political turmoil is the danger of the swap agreement.

VanNess (2014), argues that the impact of China's currency swap agreements with other countries on U.S. economy will have significant impact on dollar because international community will rely less and less on the dollar, thereby eliminating the dollar's reserve currency status resulting in higher interest rates, a rise in prices, and a difficulty servicing the debts for the United States. In the same vein, Durden (2014) opines that China's currency swap agreement may endanger U.S dollar and argues that as many countries, through currency swap agreements, begin to reject the dollar due to the exported inflation that is growing in nations that are relegated to having to hold them for global oil purchases, alternatives such as the Chinese Yuan will become a more viable option. On the contrary, authors like Murphy and Yuan (2009) conclude that China's currency swap agreements pose no danger to US-

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dollar since the United States still remains number one destination for Chinese exports and, as such the US will continue to build its dollar reserves because all transactions are still denominated in US-dollars.

III. Methodology

a) Model Specification

This study adopts a modification approach of Irving Fisher's equation as used by Adhikari (2016), given as

$$MV = PQ \quad ---------- (1)$$

Here M is the quantity of money supply in the economy, V is the velocity of domestic currency, P is the general price level, and Q is the real domestic output (GDP).

Dividing both sides of the equation (1) by Q yields

$$P = \frac{MQ}{Q} \quad ---------- (2)$$

Since the relationship shown in equation (2) is universal for any country of the world, thus, the specific equation for U.S. can be rewritten as

$$P^* = \frac{M^*V^*}{Q^*} \quad ---------- (3)$$

Where, P^*, M^*, V^* an d Q^* represent U.S.price level, money supply, the velocity of money, and real domestic output respectively.

By substituting equations (2) and (3) in Absolute Purchasing Power Parity equation, $R = \frac{P}{P^*}$, and it becomes

$$R = \frac{MVQ^*}{M^*V^*Q} \quad ----------(4)$$

Where, R is the exchange rate between the U.S. dollar and Nigerian naira, which is defined as number of the U.S. dollar needed to purchase one naira.

By taking the natural logarithm of both sides of equation (4), it becomes

$$lnR = lnM + lnV + lnQ^* - lnM^* - lnV^* - lnQ \quad --- (5)$$

Irving Fisher assumes that velocities of money are constant over time, then, $lnV + lnV^* = \alpha_0$. Therefore, equation (5) becomes

$$lnR = \alpha_0 + lnM + lnQ^* - lnM^* - lnQ \quad ------(6)$$

Stochastically, equation (6) takes an estimable form as:

$$e_t = \alpha_0 + \beta m_t + \delta q_t^* - \theta m_t^* - \rho q_t + \varepsilon_t \quad ------(7)$$

The a priori expectation is that, β will to be positive, because when domestic money supply (m_t) rises, the domestic interest rate falls, causing a capital outflow and thereby forcing a surge in the exchange rate of domestic currency (e_t). Also, δ is expected to be positive, because when the foreign real GDP (q_t^*) rises, the demand for money in the foreign country also rises, causing the interest rate in the foreign country to rise, which, in turn, causes a capital inflow into the foreign country and out of the domestic country, thereby forcing the exchange rate of domestic currency (e_t) to rise. On the contrary, the sign of θ is expected to be negative, because when foreign money supply (m_t^*) soars up, the interest rate there falls, causing a capital outflow from the foreign country and into the domestic country, and thereby forcing the exchange rate of domestic currency (e_t) to fall. Similarly, the sign of ρ is expected to be negative, because when domestic real GDP (q_t) rises, the transaction demand for money rises causing the interest rate at home to rise, which in turn, causes a capital inflow and forcing the exchange rate of domestic currency (e_t) to fall.

To capture the effect of previous value of the dependent variable on its current value, we include a one-period lagged value of the dependent variable, e_{t-1}, as an additional explanatory variable of interest. Also, since the purpose of this study is to examine the effect China's swap agreements on the value (exchange rate) of U.S. dollar with Nigerian naira, we include a swap dummy in equation (7). The swap dummy takes a value of 1 for the years since 2008 – the year in which China's Bilateral Swap Agreements with Other Countries (Nigeria inclusive) began – and zero otherwise (see Appendix B). With the inclusion of the lagged value of the dependent variable and the swap dummy, equation (7) is re-specified as follows:

$$e_t = \alpha_0 + \vartheta e_{t-1} + \beta m_t + \delta q_t^* - \theta m_t^* - \rho q_t + \pi \text{Ð} + \varepsilon_t \quad ---------- (8)$$

If π turns out to be negative and significant, we will conclude that China's swap agreements will raise the exchange rate (lower the value) of the U.S. dollar concerning Nigerian naira.

b) Estimation Techniques

This study practically employs both descriptive and econometric techniques to achieve the stated objective. Descriptive statistics which involves the use of graph and tables and the econometric technique employed is Robust Least Squares (ROBUSTLS). The choice of this technique is as a result of the fact that Ordinary least squares estimators are sensitive to the presence of observations that lie outside the norm for the regression model of interest. The sensitivity of conventional regression methods to these outlier observations can result in coefficient estimates that do not accurately reflect the underlying statistical relationship. Thus, Robust Least Squares (ROBUSTLS) is designed to be robust, or less sensitive, to outliers. It is also designed to overcome some limitations of traditional parametric and non-parametric methods. There are three different methods for robust least squares: M-estimation (Huber, 1973), S-estimation

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(Rousseeuw and Leroy, 1987), and MM-estimation (Yohai 1987). The three methods differ in their emphases:

- M-estimation addresses dependent variable outliers where the value of the dependent variable differs markedly from the regression model norm (large residuals).
- S-estimation is a computationally intensive procedure that focuses on outliers in the regressor variables (high leverages).
- MM-estimation is a combination of S-estimation and M-estimation. It addresses outliers in both the dependent and independent variables.

The study, therefore, made use of MM-estimation method of Robust Least Squares (ROBUSTLS) technique so as to account for the outliers that exist in both the exogeneous and endogenous variables.

c) Data: Measurement of Variable and Sources

We made use of annual secondary data on the U.S. and Nigeria's real gross domestic product (GDP). Also, data on the average exchange rate of the U.S. dollar with Nigerian naira as well as U.S. and Nigerian money supply. The information on China's swap agreements with other countries is obtained from the data base of the People's Bank of China (see Appendix A). Thus, the data sources are tabulated below:

Variables	Source(s)
Nigeria's real gross domestic product (GDP)	World Development Indicators (WDI, 2018)
U. S. real gross domestic product	World Development Indicators (WDI, 2018)
Exchange rate of U.S. dollar with Nigerian naira	International Financial Statistics (IFS, 2018)
Nigerian money supply	Central Bank of Nigeria (CBN) Statistical Bulletin (2018)
U. S. money supply	Federal Reserve Bank of St. Louis (2018)

IV. Data Analysis and Discussion of Results

a) Descriptive analysis

The relative interactions existing among the variables are displayed by the graphical illustration in Figure 1 below:

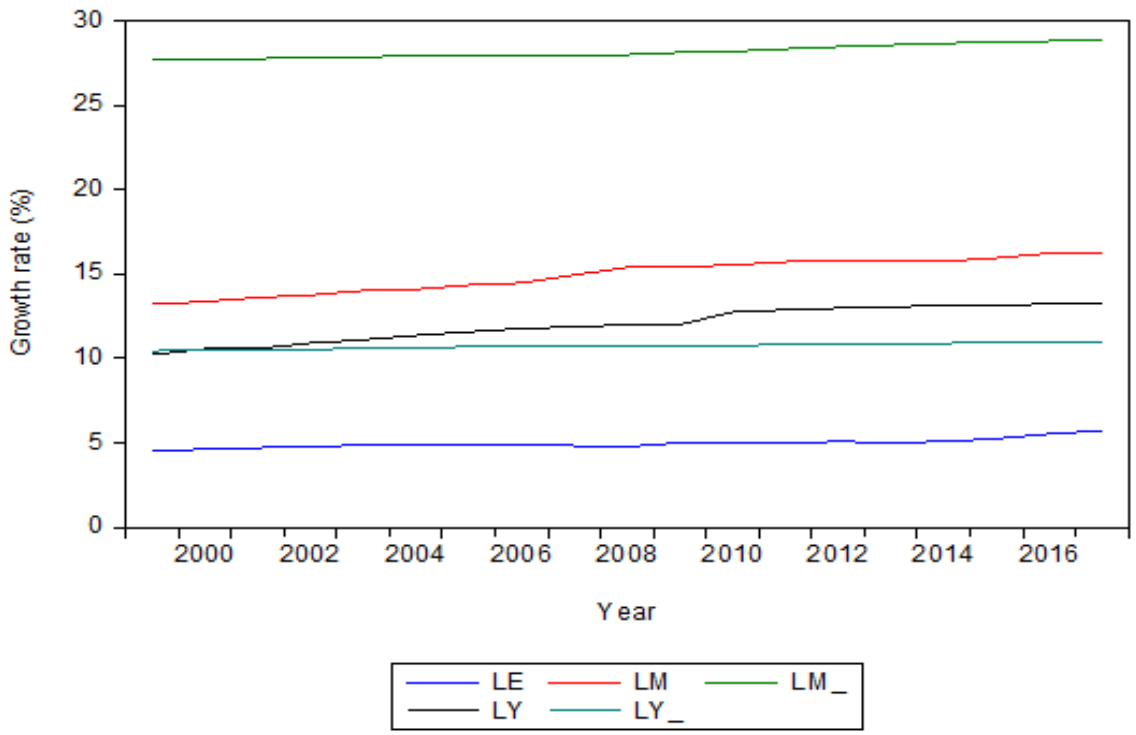


Figure 1: The interactions among Nigeria - U.S. exchange rate, money supply and outputs (1999-2017)

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Figure 1 above reveals that the rate of growth of exchange rate (LE) over the sampled period remains minimally low and falls below 8 percent. Also, the growth rate of domestic output in Nigeria (LQ) began to rear above that U.S. economy in 2001 and maintained the pace throughout the study period. Nigeria's money supply growth rate was between 13 and 15 percent between 2000 and 2016. But U. S. money supply growth rate maintained a higher 27 to 29 percent than that of Nigeria. Thus, this noticeable greater growth rate of money supply in the U.S. economy portrays the variable as an outlier among variables of interest in the study and this necessitates the use of an appropriate econometric technique to achieve the objective of the study.

b) Correlation Analysis

The correlation analysis coefficient measures the strength of the linear relationship between variables and bounds between -1 and +1 inclusive. Thus, correlations close to zero indicate no linear association between the variables, whereas correlations close to -1 or +1 indicate strong negative or positive relationship respectively between the variables. For a negative perfect correlation, the coefficient is -1 while for positive perfect correlation, the coefficient is +1. The results in Table 1 indicate that all the variables have a strong positive relationship with each other.

Table 1: Correlation matrix of the log of the variables in the model of the equation (7)

Variables	*e*	*m*	*m**	*q*	*q**
e	1.000000				
m	0.823292	1.000000			
*m**	0.909562	0.902364	1.000000		
q	0.829241	0.977828	0.930758	1.000000	
*q**	0.861633	0.971310	0.924016	0.972935	1.000000

In summary, the results of the correlation analysis above imply that there is no multicollinearity among the variables; therefore, the research can proceed with the estimations procedure.

c) Robust Least Squares (ROBUSTLS) results

Table 2 below reports the Robust Least Squares results using MM-estimation method which accounted for the outliers that existing in the study variables.

Table 2: Dependent Variable: Exchange rate (e)

Method: Robust Least Squares (ROBUSTLS)				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
m	0.576554	0.187066	3.082081	0.0021
*m**	0.647420	0.193268	3.349852	0.0008
q	-0.072166	0.117737	-0.612940	0.5399
*q**	-1.932966	0.619578	-3.119810	0.0018
Ɗ	-0.491099	0.149244	-3.290574	0.0010
R-squared = 0.634387			Adjusted R-squared = 0.529926	

The results reveal that all the variables but except of U. S. real output (q) are significant at 5 percent level. Also, Nigeria and U.S. money supplies (*m* and *m**) have a positive relationship with the Nigeria-U.S. exchange rate (*e*) which implies that an increase (decrease) in Nigeria and U.S. money supplies raises (lowers) the U.S. dollar's exchange rate. On the other hand, the negative signs associated with the variable, q and q* *indicate* that an increase (decrease) in Nigeria's and U.S.real output lowers (raises) the U.S. dollar's exchange rate. Also, the variation of the dependent variable {exchange rate (*e*)} is accounted for by 63 percent of the changes of the independent variables.

However, our interest is in swap dummy which turned out to be significant at 5 percent, indicating that China's swap agreement with Nigeria (in April 2018) tends to have a significant impact on the exchange rate (value of) U.S. dollar.

V. Conclusion

China began signing bilateral swap agreements with other countries of the world in December 2008. As at today, the Asian country has signed Currency Swap Agreements with 35 countries, Nigeria inclusive. In this spectacular bilateral swap agreement, two trading partners agree to exchange a stipulated amount of domestic currency for a foreign currency in the amount determined by a specified exchange rate within a specified period. And when the swap agreement expires, the two nations would make a reverse exchange of the remaining amount of the foreign currency at the same exchange rate. Initially aimed at bypassing the

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U.S. dollar in international trades and thereby keeping bilateral trades unaffected by the fluctuations in the value of the dollar, China's bilateral swap agreements (BSAs) are also seen as China's attempt to establish its domestic currency (Yuan) as an international currency.

From the findings of this study, the swap dummy appeared significant; indicating that China's swap agreement with Nigeria tends to have a reasonable effect on the exchange rate (value) of the U.S. dollar. The results of the findings are indeed contrary to the findings of Adhikari (2016) which reveal that China's swap agreement with Indonesia does not affect the exchange rate (value) of the U.S. dollar.

The findings of our study are not unconnected with the fact that Nigeria is an import-dependent economy and the country imports heavily from China. So, if the U.S. dollar is by-passed and the China domestic currency (Yuan) takes center stage, Nigerian economy stands a better chance due to the fact that Nigeria's real output and the value of swap dummy variables are both negative in Table 2. Since the coefficient of swap dummy variable turns out to be negative and significant, we will conclude that China's swap agreements will raise the exchange rate of naira and lower the value of the U.S. dollar with respect to Nigerian naira.

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Appendix A

China's Bilateral Swap Agreements with Other Countries							
S. No.	Country	Swap Agreement Date	Swap Amount (Billions of RMB)	S. No.	Country	Swap Agreement Date	Swap Amount (Billions of RMB)
1	South Korea	12 December 2008	360	19	Ukraine	26 June 2012	15
2	Hong Kong	20 January 2009	400	20	Brazil	26 March 2013	190
3	Malaysia	8 February 2009	180	21	United Kingdom	22 June 2013	200
4	Belarus	11 March 2009	7	22	Hungary	9 September 2013	10
5	Indonesia	23 March 2009	100	23	Albania	12 September 2013	2
6	Argentina	29 March 2009	70	24	European Union	9 October 2013	350
7	Iceland	9 June 2010	3.5	25	Switzerland	21 July 2014	150
8	Singapore	23 July 2010	300	26	Sri Lanka	16 September 2014	10
9	New Zealand	18 April 2011	25	27	Qatar	3 November 2014	35
10	Uzbekistan	19 April 2011	0.7	28	Canada	8 November 2014	200
11	Mongolia	6 May 2011	15	29	Nepal	23 December 2014	0.6
12	Kazakhstan	13 June 2011	7	30	Suriname	18 March 2015	1
13	Russian Federation	23 June 2011	150	31	South Africa	10 April 2015	30
14	Thailand	22 December 2011	70	32	Chile	25 May 2015	22
15	Pakistan	23 December 2011	10	33	Tajikistan	5 September 2015	3.2
16	United Arab Emirates	17 January 2012	35	34	Belarus	May 2016	7
17	Turkey	21 February 2012	10	35	Nigeria	27 April, 2018	2.5
18	Australia	22 March 2012	200				

Source: People's Bank of China data base (2019).

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Appendix B

Real GDP, Money Supply, and Exchange Rate with Naira						
Year	Exchange rate (₦/ $)	Nigeria's GDP($)	U.S. GDP($)	U.S. Money Supply (M1) ($ Millions)	Nigeria Money Supply (M1) (₦ Millions)	Swap Dummy
1999	92.3381	27757.66	34620.93	1102275000000.00000	547436.9	0
2000	101.6973	38555.41	36449.86	1103600000000.00000	637731.1	0
2001	111.2313	39131.13	37273.62	1140300000000.00000	816707.6	0
2002	120.5782	55400.52	38166.04	1196700000000.00000	946253.4	0
2003	129.2224	66245.96	39677.2	1274041666666.67000	1225559	0
2004	132.888	86219.74	41921.81	1344591666666.67000	1330658	0
2005	131.2743	106055.7	44307.92	1371950000000.00000	1725396	0
2006	128.6517	131,192	46,437	1375000000000.00000	1935005	0
2007	125.8081	143,022	48,062	1373008333333.33000	3116272	0
2008	118.546	164,055	48,401	1435200000000.00000	4857545	1
2009	148.9017	163,444	47,002	1638058333333.33000	5017116	1
2010	150.298	349,792	48,374	1742691666666.67000	5571270	1
2011	153.8616	391,175	49,791	2010508333333.33000	6771581	1
2012	157.4994	433,956	51,450	2315500000000.00000	7420946	1
2013	157.3112	471,456	52,787	2549725000000.00000	7032839	1
2014	158.5526	510,805	54,599	2815158333333.33000	6919549	1
2015	192.4403	525,316	56,469	3021900000000.00000	8571701	1
2016	253.492	551,511	57,638	3250708333333.33000	11271507	1
2017	305.7901	600,411	59,792	3512025000000.00000	11175574	1

Source: i. International Monetary Fund, "International Financial Statistics." (IFS, 2018)
ii. World Bank, "World Development Indicators" (WDI, 2018)
Note: Gross Domestic Product (GDP) is measured as GDP, PPP (Current international $)

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