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GLOBAL ECONOMIC UNCERTAINTY AND EXCHANGE RATE IN NIGERIA: A TODA-YAMAMOTO APPROACH

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Abstract

The rise in global economic uncertainty (GEU) has made individuals, firms and governments take reserved positions, as near-accurate forecasting becomes difficult. This study examines GEU and the exchange rate in Nigeria, following a Toda-Yamamoto approach. The research employs a multivariate model to analyse the monthly data on the exchange rate and uncertainty. Findings reveal that there is no causal relationship between Nigeria's exchange rate and GEU. The result also shows that the response of exchange rate to shocks to economic policy uncertainty is asymmetry while the variance decomposition reveals that the movement of exchange rate as a result of shock to GEU is small but increasing at a steady rate. The finding is of great significance to policymakers, investors, and every individual whose economic activity is directly and indirectly influenced by the exchange rate movement. The result will get them informed, save them from risk and reduce their exposure to it.

Keywords: Global economic uncertainty, Exchange rate, Toda-Yamamoto, Policy Trilemma, Monetary Policy, Impulse Responses Functions, and Variance Decomposition

JEL Classification Code: C32, E39, E52

1. Introduction

The impact of the global economic disruption amplified by the effect of the pandemic has been significant in all economies of the world. This has attracted the attention of various researchers to examine the effect of global economic uncertainty (GEU) on various macroeconomic variables and activities such as growth (Cepni, Guney & Swanson, 2020), prices (Bakas & Triantafyllou, 2020), trade and capital flight (Bobasu et al., 2020; Uche & Effiom 2021), market volatility (Fang et al., 2019; Liang et al., 2020; Lyu et al., 2021), the stock market (Hoque & Azlan Shah Zaidi, 2020), tourism (Wu et al., 2022; Sharma & Khanna, 2021), globalization (Fang, Gozgor, & Nolt, 2022). At the domestic and international levels, economic policies have played a significant role in the proper functioning of the economy as well as stabilizing it. However, considering the complexity of the economy's working system which is rising daily with globalization, coupled with the COVID-19 pandemic that impacted every economy in the globe, the uncertainty associated with economic policy has risen more (Ma et al., 2022; Kumar & Prabheesh, 2023). This has adversely affected consumer and investor confidence. It also pushes up the cost of finance as the spending associated with precautionary motives is changing with high risk. More so, in the financial scene, the foreign exchange market in which the foreign exchange rate is determined is not spared from the impulses of uncertainty. These changes in the exchange rate slow down economic activities making the economy operates at its sub-optimal level, influencing the design of economic policy and increasing GEU (Balcilar et al., 2016; Yin et al., 2017).

Exchange rate fluctuations have been identified as one of the key drivers of stability in the economy and it has short-run and long-run effect on the economy. Research has shown that the fluctuation in the exchange rate, in the long run, is needed to stabilize the economy at the aggregate level. However, theoretically, the variation in the exchange rate as a result of exogenous shock will have a negative impact on the economy (Chang, 2011; Abid, 2020). A recent study identified economic policy uncertainty as one of the transitory shocks that affect the exchange rate in the short run. This adversely impacts the financial markets and economic activities, making the fluctuation in the exchange rate to be classified as risky (Arouri et al., 2016; Abid & Rault, 2020). GEU has been suggested to align with the volatility of the exchange rate and the level of the changes is high for the domestic economic policy uncertainty when compared to the GEU. The level of uncertainty impact on exchange rate experienced by the developing economies is higher compared to the developed economy and the former suffers more from the spillover of a global shock. The exchange rate volatility is very high when the developing economy adopts a floating exchange regime. This is so because foreign exchange market pressure is depicted by the fluctuation of the exchange rate.

Nigeria's exchange rate currently follows a flexible control after the fixed exchange rate in 2015. This was accompanied by land border closure to import which weakens the recovery of the country since the country depends on other economies for its major consumption and trade. The level of dependence on the outside economy by a country is a pointer to the adverse effect a global shock will have on it. More impactful when the main source of the economy's revenue is exogenously determined and Nigeria is not an exception. Since the economic impact of various macroeconomic shocks hinges on oil prices, the vulnerability of the Nigerian economy becomes very high

(Asaleye, 2019). The economic scenario in this pandemic era with recurring waves is challenging with growth dropping below projection as real GDP contracted in 2020 by 1.92%, rise in unemployment, increased debt burden, and weakening currency.

With few buffers as well as policy instruments to tackle the aforementioned, the level of global economic and trade policy uncertainty has increased more rapidly. This makes the task of forecasting or predicting future outcomes become very difficult if not impossible. The management of the exchange rate has always demanded extra caution because of its volatility and the extent to which this is been amplified by the GEU has been a major concern. The combination of the level of policy uncertainty and its impact on the exchange rate adversely affects price via expectations (Bartsh, 2019) and the whole economy as it erodes investors' business confidence. Against this backdrop, the study will examine global economic uncertainty and exchange rate management with a keen focus on the Nigerian economy.

Research Objectives

The broad objective of this study is to examine the effect of global economic uncertainty on the exchange rate. The specific objectives are to:

(i) Explore the global economic uncertainty and exchange rate management
(ii) Examine the effect of shocks from global economic uncertainties on the exchange rate in Nigeria
(iii) Quantify the contribution of the shocks to the changes in the exchange rate in Nigeria
(iv) Investigate the existence of a causal relationship between economic uncertainties and exchange rate in Nigeria

Research Hypothesis

Based on the research objectives, the following hypothesis will be tested:

H_1: There is an effect of shocks from global economic uncertainties on the exchange rate in Nigeria
H_2: There exists a causal relationship between economic uncertainties and exchange rate in Nigeria

2. Literature review

Overview of Exchange Rate Policy in Nigeria

The basis for focusing on the exchange rate policy in Nigeria is driven by the concern that the policy adopted provides information about the relationship between the exchange rate and the GEU. The exchange rate policy is set up to preserve the value of the Nigerian currency as well as having a favourable external balance and external reserve (Omojimite & Akpokodje, 2010). All these must be achieved without lagging in the pursuit of the macroeconomic stability goal. Right from time, Nigeria has implemented fixed, flexible and a combination of exchange rate regimes

(CBN, 2017). Table 1 shows the different exchange rate policies that the countries have operated with and the average value of naira to US dollar in each regime.

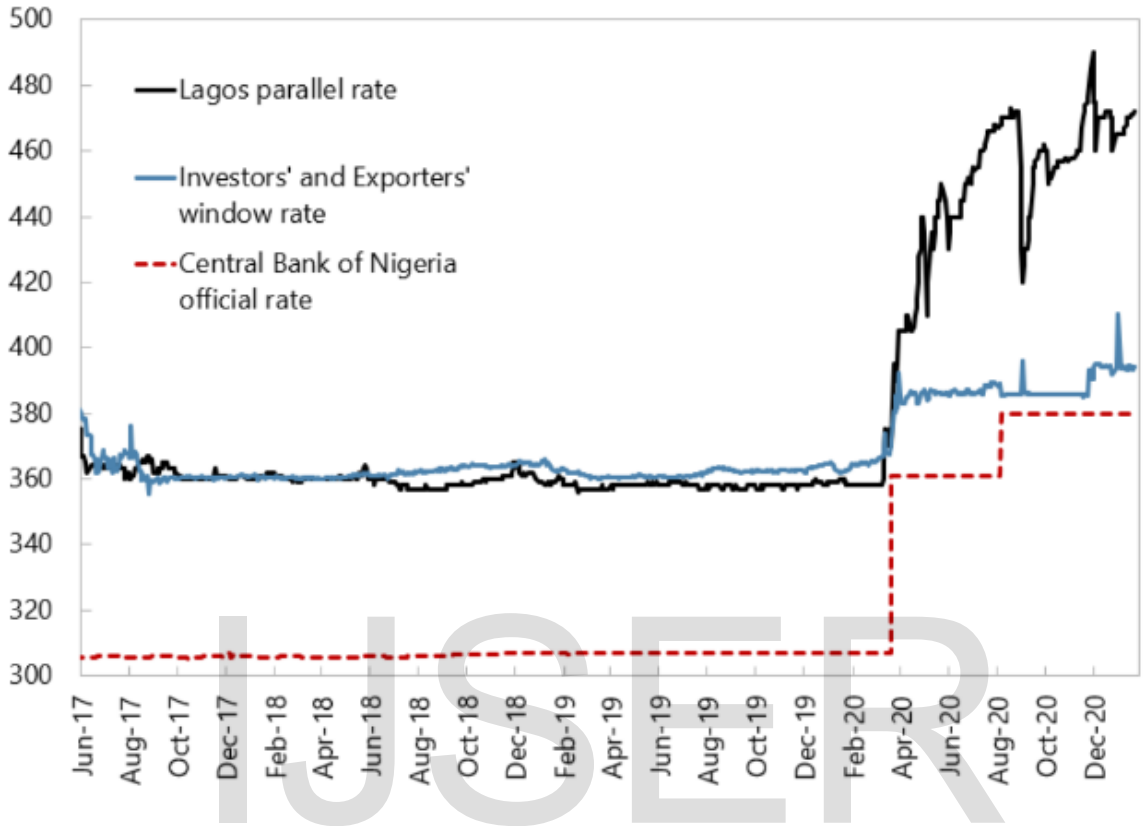
Table 1. Nigeria's Exchange Rate Policy (1973 – till date)

Exchange Rate Policy/Regime in Nigeria	Period	Average Exchange Rate (₦/US$)
Managed Float	1973 – 1978	0.63
Basket of Currencies Approach	1978	0.78
Introduction of Second Tier FEM (Dual Exchange Rate System)	September 1986	3.87
Dutch Auction System of Bidding	1987	3.90
Single enlarged Foreign Exchanged Market with various pricing methods	July 1987	4.40
Creation of Interbank Foreign Exchange Market	January 1989	12.98
Pegged Exchange Rate system	1994	22.00
Autonomous Foreign Exchange Market (AFEM)	1995	81.93
Reintroduction of Interbank Foreign Exchange Market	October 1999	102.81
Retail Dutch Auction System (RDAS) of foreign exchange management	July 2002	129.14
Wholesale Dutch Auction System (WDAS)	2006 – 2013	142.66
Retail Dutch Auction System (RDAS) of foreign exchange management	October 2013	159.43
Interbank Foreign Exchange Market (Closure of Official Window)	February 2015	197.25
Tightly Managed Floating	February 2016	197.00
Tightly Managed Floating	June 2016 – till date	460.02

Source: Central Bank of Nigeria

The policy that allows for multiple exchange rates and allocation of foreign exchange under the non-transparent rule will engender uncertainty, especially for the private sector of the economy. Only a few exceptions have a successful experience with multiple exchange rates as we see in Thailand from 1947 to 1955 (Nidhiprabha, 2018). Figure 1 shows Nigeria has a fragmented exchange rate leading to a serious loss of value in naira relation to the US dollar starting from the second quarter of 2020. One of the main steps in building credibility for the exchange rate policy requires maintaining a unifying rate which will lead to just a single market-clearing rate either through the big bang or gradual devaluation (Geiger, Nguyen & Nguyen, 2018). As the CBN has made the move to adopt the NAFEX, we expect the gap between investors and exporters window rate and the CBN official rate to close. A clear policy and appropriate exchange rate have been seen as important instruments that can drive the recovery from the contribution of the private sector and generally boost confidence. Beyond these, it can also trigger a large inflow of capital which has been following a downward trend in recent years.

Figure 1. Nigeria Multiple Exchange Rate Chart



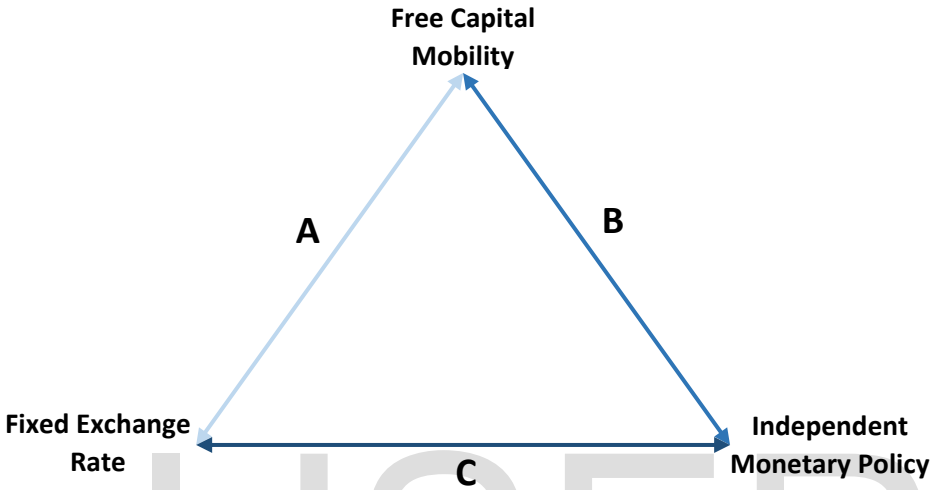
Source: IMF and Central Bank of Nigeria

Nigeria's Exchange Rate: Current Stand and Policy Trilemma

There have been a series of exchange rate adjustments by the CBN but the adjusted rate still falls below the prevailing market rates. As the CBN has initiated an adjustment of about 17.61% to the exchange rate from N379/US$ to N460.02/US$, the official rate is yet to closely align with market rates. Achieving a close rate between the CBN rate and the market prevailing rate is a long-awaited move that has once been recommended by both the Federal Government's Economic Sustainability Plan (ESP) and International Monetary Fund (IMF) in its Article IV which are internal and external bodies respectively. The current move on the exchange rate by the CBN has been projected to be a very positive move as it serves as a booster to market confidence in the economy amidst the uncertainty that clouds the global economy. It is also projected that the unification of the exchange rate will increase funding opportunities from the multilateral organization as well as making the exchange rate in the medium-term steady (Maria, 2019; Eregha, 2021). Beyond this unification, the supply of forex from other sources besides CBN must be strongly pursued to maintain stability.

In the economic decision-making theory, the trilemma presents policymakers with three solutions to a complex phenomenon and it is synonymous with the impossible trinity. This economic theory is also referred to as the Mundell-Fleming trilemma model. It posits that when economies are making their international monetary policy agreement, they may choose one of the three mutually exclusive options. Figure 2 presents the foreign exchange and monetary choice of Nigeria.

Figure 2. The Policy Trilemma



Source: Rieber (2017)

The government faces a trade-off in making monetary policy decisions. With the current pandemic scenario before May 2021, Nigeria operates at point C on the trilemma in which it pursued the two objectives of a fixed official exchange rate and independent monetary policy. This policy choice leaves the economy to sacrifice the free movement of capital. The adoption of the I & E market rate as the official rate by the CBN positioned the country to point B. This will bring flexibility to the exchange rate as the monetary authority maintains monetary autonomy as well as the free movement of capital. The appreciation and depreciation of the Naira now depend on the external reserve position, the inflows and outflows of capital, and involvement in market by the apex bank. The stability of the exchange rate is now a function of the level of capital that is attracted to the economy and forex market intervention. As the exchange rate becomes flexible at this point B maintained, it is expected that round-tripping and arbitrage would decline and Naira will possess its fair value. This will also make the market fairly predictable making investors participate more as market confidence rises.

Exchange Rate and Policy Uncertainty

Economic policy uncertainty and the exchange rate have attracted the attention of a few researchers. One of such is the work of Chen, DU and Hu (2020) who examined the impact that economic policy uncertainty (EPU) plays on exchange rate volatility using China as the case study.

In exploring the correlation between economic policy uncertainty and exchange rate volatility, they found the correlation to be asymmetric. Using quantile regression, it was revealed that the exchange rate volatility is positively impacted by the EPU at all quantiles. This relationship was found to be significant and also exhibit an inverted-U. As the quantiles increase. they also found that the volatility of the rate rises due to the impact of US EPU on the exchange rate.

In assessing exchange rate shocks and global economic uncertainties, Ndou, Gumata and Ncube (2018) examined the transmission channels of policy and uncertainty. They found that exchange rate volatility has an asymmetric effect on exports in the period of appreciation and depreciation. Olanipekun, Olasehinde-Williams and Gungor (2019) examined how exchange market pressure is impacted by economic policy uncertainty. Using a panel of 20 countries, the study revealed a long-run relationship between economic policy uncertainty and exchange rate pressure. An increase in policy uncertainty makes the severity of the exchange rate pressure rise. However, they identified that gross domestic product growth, foreign direct investment inflow and domestic credit can suppress the pressure. They conclude that irrespective of the exchange rate regime that a country follows, economic uncertainty significantly affects its foreign exchange market.

In the case of Nigeria, the impact that economic uncertainty has on the exchange rate resulted in liquidity challenges in the forex market. The oil price drop during the COVID-19 inception affected the reserves of the nation but after gaining a moment back, the high crude oil price of about 36 per cent plus in the first five months of 2021 could not move the external reserve of Nigeria to its level prior pre-COVID-19. More so, the pressure on the Naira has been intensified by the increasing need and demand for foreign currency to settle service payments and imports. Another policy that pressured the Naira, is the output cap placed on crude oil by OPEC (Nwosa, 2021). This is a signal that to get the reserve back to its pre-pandemic level, private sources have an important role to play in achieving this. Based on the aforementioned discussion in this section, this study will examine the Nigeria exchange rate and global economic uncertainty.

3. Methodology

To assess the global economic uncertainties and exchange rate relationship, a bi-variate model will be specified and we follow the identified measure of global economic uncertainty (GEU) as well as the exchange rate (EXR) variable. The variables and the sources are highlighted under the data section. We adapt the Toda-Yamamoto (1995) model which is specified as:

$$GEU_t = \propto_0 + \sum_{i=1}^{k} \propto_{1i} GEU_{t-i} + \sum_{j=k+1}^{k+d_{max}} \propto_{2j} GEU_{t-j} + \sum_{i=1}^{k} \emptyset_{1i} EXR_{t-i} + \sum_{j=k+1}^{k+d_{max}} \emptyset_{2j} EXR_{i-j} + \mu_{1t}$$

$$EXR_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} GEU_{t-i} + \sum_{j=k+1}^{k+d_{max}} \beta_{2j} GEU_{t-j} + \sum_{i=1}^{k} \emptyset_{1i} EXR_{t-i} + \sum_{j=k+1}^{k+d_{max}} \emptyset_{2j} EXR_{i-j} + \mu_{1t}$$

Where the variables are as defined above and k represents the optimal lag length; d_{max} denotes the maximum order of integration; μ represents the error term.

A serial correlation test will be carried out as a post-estimation test for the multivariate model using the LM test. In addition to the post-estimation test, we will examine if the errors are homoscedastic. To provide answers to the research questions, we will be testing for Granger non-causality with the assumption of causality if $\emptyset_{1i} \neq 0$ and $\beta_{1i} \neq 0$. Impulse response functions (IRFs) and the forecast error variance decomposition (FEVDs) were also estimated to examine the effect of various shocks on the adjustment path of the two variables and to quantify the contribution of the shock.

The monthly data set employed in this study covers the period from January 2008 to December 2022. The global economic uncertainties (GEU) are proxied by the global economic policy uncertainty index. The data was sourced from the work of Ahir, Bloom, and Furceri (2022). The exchange rate (EXR) data was collected from the database of the Central Bank of Nigeria.

4. Empirical Analysis

The empirical analysis starts with the stationarity test of the series (EXR and GEU) which was estimated with trend and intercept using the augmented Dickey-Fuller (ADF) test. As presented in Table 2, the result revealed that EXR is stationarity at the first difference while the GEU is stationary at level. This combination of stationarity of the variables which are I(0) and I(1) justify the Toda-Yamamoto method employed as it adequately caters for the different order of integration observed in the two series.

Table 2. Augmented Dickey-Fuller Unit Root Test

Variables	At Level		At First Difference		Comments
	tau Statistic	Prob.	tau Statistic	Prob.	
EXR	0.689001	0.9916	-9.365464	0.0000	I(1)
GEU	-3.150409	0.0248	NA	NA	1(0)

Source: Author's computation using EVIEWS

The optimal lag length (k) for the estimation was first determined. Based on the output in Table 3, we will observe that the maximum lag length of 4 was suggested by the various information criteria which are used as the basis of evaluating the test.

Table 3. Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1019.758	NA	495.2932	11.88090	11.91750	11.89575
1	-543.5237	935.8553	2.042272	6.389810	6.499606	6.434357
2	-515.4458	54.52324	1.543595	6.109835	6.292829	6.184081
3	-501.1565	27.41551	1.369613	5.990192	6.246384*	6.094136
4	-494.3634	12.87527*	1.325980*	5.957714*	6.287103	6.091356*
5	-492.9288	2.685863	1.366345	5.987544	6.390130	6.150884
6	-491.5386	2.570271	1.408765	6.017890	6.493674	6.210928

7	-487.9910	6.476406	1.416636	6.023151	6.572132	6.245887
8	-487.2461	1.342489	1.471882	6.061001	6.683180	6.313435

Source: Author's computation using EVIEWS

The Toda-Yamamoto (TY) model was estimated with a maximum order lag of 4 and the post-estimation test was conducted as a diagnostic check. The serial correlation test uses the LM test with the hypothesis of no serial correlation. The result obtained showed that the p-value exceeds the 5 per cent level of significance and we will therefore not reject the null hypothesis of no evidence of serial correlation. Also using the White heteroskedasticity tests, the result showed that the residuals are homoscedastic. (The result of the tests are presented in the appendix section).

Granger Causality Test

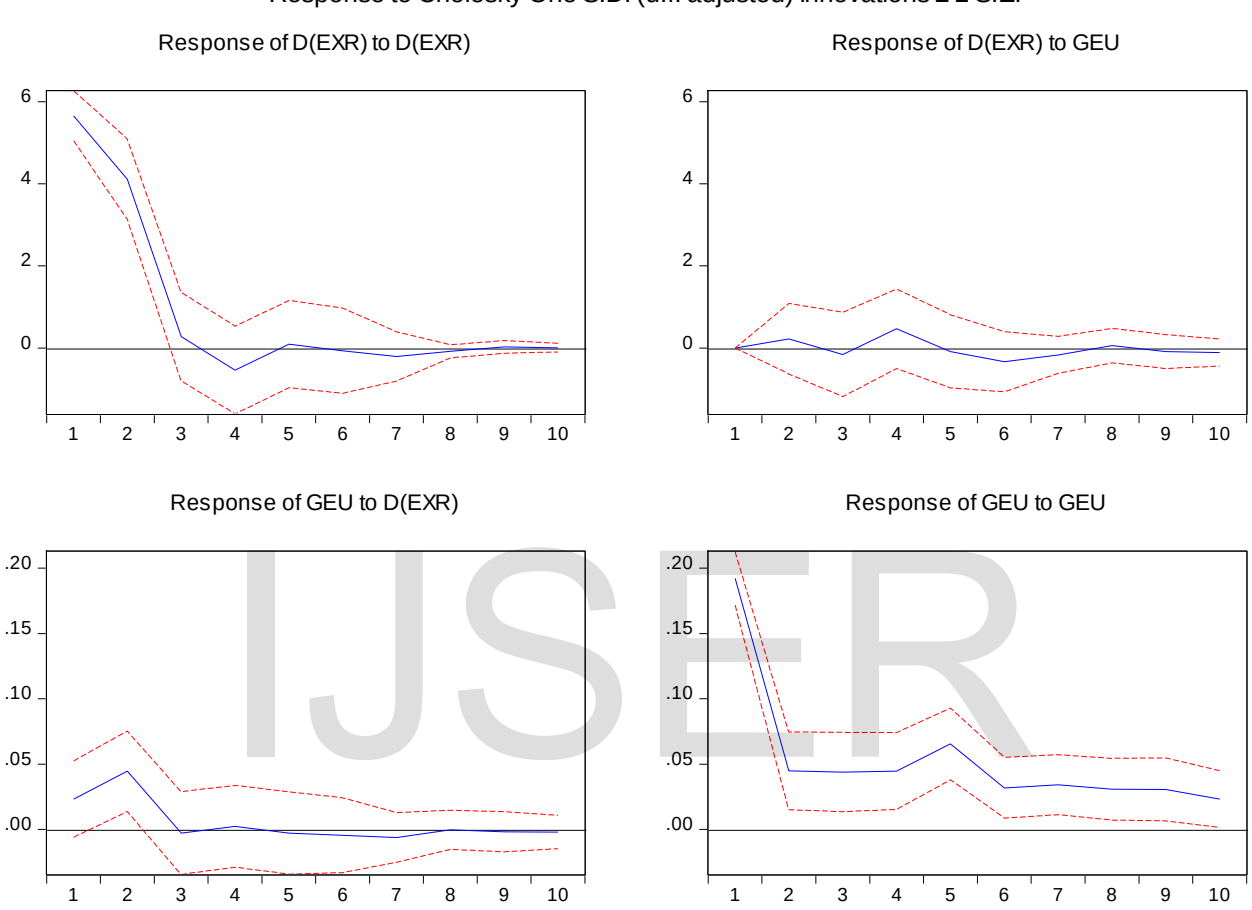
With the confirmation of no serial correlations in the residuals, we estimate the Granger non-causality using the Wald test and it has the null hypothesis of no causal relationship. The result of the Wald test with p-values of 0.2820 and 0.0460 for GEU and EXR respectively shows that there is a form of unidirectional causal relationship among the series running from exchange rate to economic uncertainty in the country. We will therefore reject the hypothesis and conclude that there exists a form of unidirectional causal relationship between global economic uncertainties and exchange rate in Nigeria. To further check the result, we examine if there is cointegration among the series using the autoregressive distributive lag (ARDL) Bounds test. The result showed that there is no cointegration among the variables when EXR serve as the dependent variable and when otherwise there is the existence of a cointegration relationship which supports the Wald test findings. This result is in agreement with the findings of Olanipekun, Olasehinde-Williams and Gungor (2019) who using panel analysis found a causal relationship between exchange rate market pressure and economic policy uncertainty.

Impulse Responses Functions (IRFs)

To see the effect of shocks on the adjustment path of exchange rate and global economic uncertainty, the IRFs graphically present the effects these shocks have on the current and future path of EXR and GEU in Figure 3. The result of the IRFs in the figure shows that the exchange rate responds to a one standard deviation shock to the global economic policy positively in period 1 to period 2 with a slight increase. The response gradually declines and reaches its minimum in the negative region at period 3 to later pick up in period 4, returning to the positive region. It declined back to negative in period 6. The response hit its steady state at the initial point of period 8. This reveals that the shocks to GEU will have an asymmetric impact on EXR. This result is in agreement with the findings of Chen, Du and Hu (2020) which revealed an asymmetric correlation between economic policy uncertainty and exchange rate volatility in China. The asymmetric impact can be reflecting the response of importers and exporters to the appreciation and depreciation of the exchange rate (Ndou, Gumata & Hcube, 2018).
The response of global economic uncertainty was positive at the start to the shocks to the exchange rate in Nigeria in the first period and later remained negative all through starting from period 8.

The response hit steady-state at the initial point of period 8. Considering the innovation within the two series, GEU responds positively to its shock while EXR response to the shock to itself is asymmetry.

Figure 3. IRFs: Responses to Innovations



Source: Author's computation using EVIEWS

Variance Decomposition

The variance decomposition gives insight into other to infer over certain parts of the movements that is due to exchange rate shock versus shocks to global economic uncertainty as we have in the system. As presented in the result in Table 4, the level of shocks accounted for by the global economic uncertainty in the exchange rate innovation was minute but conversely, the effect of the shock from the exchange rate on global economic uncertainty increased largely. A look at the exchange rate in the 10-month horizon reveals that about 99.06 per cent of innovations in its value is explained by its value in the past while it is only 0.93 per cent of the innovation is a result of global economic uncertainty. Considering the shock of global economic uncertainty, exchange rate only explains about 4.79 per cent of the innovation in it over the same period while about 95.20 per cent of innovation in the global economic uncertainty can be attributed to shock due to itself.

Table 4. Variance Decomposition

Variance Decomposition of D(EXR):			
Period	S.E.	D(EXR)	GEU
1	5.656943	100.0000	0.000000
2	6.996361	99.89897	0.101025
3	7.003504	99.84806	0.151939
4	7.039512	99.40944	0.590562
5	7.040621	99.39554	0.604462
6	7.048973	99.16916	0.830844
7	7.054063	99.11393	0.886074
8	7.054747	99.10758	0.892416
9	7.055355	99.09185	0.908149
10	7.056264	99.06641	0.933591

Variance Decomposition of GEU:			
Period	S.E.	D(EXR)	GEU
1	0.193675	1.432464	98.56754
2	0.203706	6.070502	93.92950
3	0.208387	5.818891	94.18111
4	0.213118	5.574401	94.42560
5	0.222948	5.109883	94.89012
6	0.225239	5.047450	94.95255
7	0.227902	5.006528	94.99347
8	0.229964	4.917473	95.08253
9	0.231988	4.838928	95.16107
10	0.233142	4.799061	95.20094

Cholesky Ordering: D(EXR) GEU

Source: Author's computation using EVIEWS

5. Conclusion

This paper examined the global economic uncertainty (GEU) and exchange rate (EXR) in Nigeria using the Toda-Yamamoto approach. Though the country has experienced different regimes of exchange rate, the study data covers from 2008 in which the country follows the Wholesale Dutch Auction System till the current tightly managed floating exchange rate policy. The result obtained suggests that there is no form of causal relationship between the EXR and GEU. However, it also showed that the EXR is sensitive to GEU and the volatility in the exchange rate is slightly influenced by global economic uncertainty. As noted by Olanipekun, Olasehinde-Williams and Gungor (2019), the foreign exchange markets of countries are significantly affected by economic policy uncertainty irrespective of their exchange rate regime. As the exchange rate responds to the shock to GEU and the shock to itself, the risk premium of the investors is raised by this as well

as prices in the economy. The response of exchange rate in Nigeria is asymmetric to the shocks to GEU and this shows that special attention is needed when handling or responding to policy relating to Nigeria's exchange rate. However, it is interesting to see that the global economic policy uncertainty is more responsive to the effect of shocks to exchange rate management in Nigeria but it is difficult to conclude that it is the aftermath effect of what the global uncertainty caused since there is no form of causal relationship between the two. Future research can pay more attention to this phenomenon.

The finding is of significance to the decision-makers and investors alike in Nigeria as it highlights germane issues that affect their activity. Setting policies such as the diaspora remittance rule and ease of business reforms that will shield the exchange rate as well as reduce its exposure to the fluctuations in global policies are of crucial importance for policymakers to pursue. Also, there is a need to align the foreign exchange management policies with the fiscal and industrial policies to improve the forex market liquidity. The performance of the real sector cannot be underestimated in achieving stability of the exchange rate amidst the rising uncertainty. The movement of the exchange rate will be an influence on the recovery of imports, exports, and other economic activities. Therefore, it is also essential that investors and every other economic agent whose activity is influenced by the exchange rate takes into consideration the internal policy in Nigeria as well as the global policy to optimize their portfolio allocation and manage their exposure to policy uncertainty.

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Appendix

Post-Estimation Test

VAR Residual Serial Correlation LM Tests
Date: 02/15/23 Time: 02:32
Sample: 2008M01 2022M12
Included observations: 175

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	2.360782	4	0.6697	0.590524	(4, 322.0)	0.6697
2	3.104109	4	0.5406	0.777354	(4, 322.0)	0.5406
3	6.238627	4	0.1820	1.569941	(4, 322.0)	0.1820
4	5.258436	4	0.2618	1.321265	(4, 322.0)	0.2618
5	4.402602	4	0.3543	1.104755	(4, 322.0)	0.3543

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	2.360782	4	0.6697	0.590524	(4, 322.0)	0.6697
2	5.524969	8	0.7003	0.690088	(8, 318.0)	0.7003
3	11.52844	12	0.4843	0.962940	(12, 314.0)	0.4844
4	11.75074	16	0.7610	0.731681	(16, 310.0)	0.7611
5	15.50132	20	0.7470	0.771755	(20, 306.0)	0.7473

*Edgeworth expansion corrected likelihood ratio statistic.