

T.C.
ISTANBUL AYDIN UNIVERSITY
INSTITUTE OF GRADUATE STUDIES



FACTORS DETERMINING EXCHANGE RATE VOLATILITY IN NIGERIA

MASTER'S THESIS

IWUAGWU UCHECHUKWU ANTHONY

Department of Business
Business Administration Program

February – 2022

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(Y1812.1300057)

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Thesis Advisor: Associate Professor Salvatore Joseph Terregrossa

February, 2022

ONAY FORMU



DECLARATION

I hereby declare with respect that the study “Factors Determining Exchange Rate Volatility In Nigeria”, which I submitted as a Master thesis, is written without any assistance in violation of scientific ethics and traditions in all the processes from the Project phase to the conclusion of the thesis and that the works I have benefited are from those shown in the Bibliography. (.../.../20...)

IWUAGWU UCHECHUKWU ANTHONY

FOREWORD

This thesis was submitted in partial fulfillment of the Requirements for the Master's degree Program in Business Administration at Istanbul Aydin University. The research is focused on "Factors determining Exchange rate volatility in Nigeria" between 1986 to 2020.

First, thanking God for the mental strength and knowledge in making this thesis a success. I must acknowledge my thesis supervisor, Associate Professor (Doçent Dr) Salvatore Joseph Terregrossa, who inspired and motivated me all through the process. Special thanks to my wife and my family for standing by me all through when it got tough. And also, to my friend and brother Naheem, who was supportive all through. May God grant you all your heart desires

February , 2022

IWUAGWU UCHECHUKWU ANTHONY

FACTORS DETERMINING EXCHANGE RATE VOLATILITY IN NIGERIA

ABSTRACT

The price and quantity of every nation are affected by the volatility of the exchange rate, but the degree of effectiveness and the effect are dependent on the current economic situation. However, this study investigated the factors affecting the volatility of the Nigerian exchange rate between 1986 and 2020, and source from the CBN Statistical Bulletin, World Development Indicators, and National Bureau of Statistics. Hence, several estimation techniques were employed ranging from the unit root testing for stationarity, descriptive analysis, regression analysis, covariance and correlation, ARCH model to Granger causality analysis. The study reported that $RESID(-1)^2$ which is also known as the ARCH effect has the coefficient value of 0.686699, with the p-value of 0.00551, representing that the exchange rate was volatile since the GARCH(-1) being the internal cause of the volatility of exchange rate has the coefficient value of 0.405101 with the p-value of 0.0499 representing that exchange rate during the period has GARCH affect. It was concluded that GDP was positively insignificant to influence the exchange rate movement, the consumer price index was negatively insignificant to influence exchange rate variation, the money supply was positively significant to influence exchange rate variation, and monetary policy rate was positively significant to influence exchange rate variation during the study period.

Keywords: *Volatility, Exchange Rate, Money Supply, and GDP*

NİJERYA'DA DÖVİZ KURU OYNAKLIĞINI BELİRLEYEN FAKTÖRLER

ÖZET

Her ulusun fiyatı ve miktarı döviz kurunun oynaklığından etkilenir, ancak etkinliğin derecesi ve etkisi mevcut ekonomik duruma bağlıdır. Ancak, bu çalışma 1986 ve 2020 yılları arasında Nijerya döviz kurunun oynaklığını etkileyen faktörleri ve Nijerya Merkez Bankası İstatistik Bülteni, Dünya Kalkınma Göstergeleri, Ulusal İstatistik Bürosu'ndan kaynak araştırmıştır. Bu nedenle durağanlık için birim kök testi, betimsel analiz, regresyon analizi, kovaryans ve korelasyon, ARCH modelinden Granger nedensellik analizine kadar çeşitli tahmin teknikleri kullanılmıştır. Çalışma, ARCH etkisi olarak da bilinen $RESID(-1)^2$ 'nin 0.686699 katsayı değerine sahip olduğunu ve p değeri 0.00551 olduğunu ve GARCH(-1)'in döviz kurunun oynak olduğunu ifade etmektedir. döviz kurundaki oynaklığın içsel nedeni 0.405101 katsayı değerine sahiptir ve p değeri 0.0499 olan dönem boyunca döviz kurunun GARCH etkisine sahip olduğunu temsil etmektedir. GSYİH'nın döviz kuru hareketini etkilemede pozitif önemsiz, tüketici fiyat endeksinin döviz kuru değişimini etkilemede negatif önemsiz, para arzının döviz kuru değişimini etkilemede pozitif ve para politikası faizinin döviz kurunu etkilemede pozitif anlamlı olduğu sonucuna varılmıştır. çalışma süresi boyunca oran değişimi.

Anahtar kelimeler: *Oynaklık, Döviz Kuru, Para Arzı ve GSYİH*

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I. INTRODUCTION

A. Study Background

The foreign currency rate, as well as its volatility, are important elements influencing economic activity. As a result, variations in the foreign currency market have long captured the imagination in literature. Foreign currency rates in Nigeria have been volatile during the previous two decades, creating instability in the country; as a result, potential foreign enterprises are inherently subjected to exchange risks if they invest in Nigeria. As a result, recognizing the economic dynamics influencing the country exchange policy is critical for international corporations and investors. Most economies throughout the globe have seen substantial volatility of the foreign exchange rate, which turns into an elevated level of ambiguity in achieving key macroeconomic objectives like economic growth and stability of price. Hence, regarding the effect on growth, exchange rate has attracted a great attention. Policymakers are frequently faced with the dilemma of choosing an acceptable exchange rate system to link the domestic economy to the international economy. Currency movement is as crucial as economic expansion and improvement stability. This exchange rate is among the key indicators of the macroeconomic, in which its movement could significantly influence positive or negative on the economic well-being. The relative price of a country's currency in relation to fiat exchange defines its worth. (Ezike, 2009; Pandey, 2008; Unuafe, 2005). The exchange rate is a method of transforming the monetary system of one home nation into the monetary system of another. (Esezobor, 2009).

Volatility in exchange rates has been revealed to significantly influence the growth of the economy. The term volatility refers to the unpredicted invasions on the exchange rate. The currency value has an impact on the economic development, and its significance in achieving a country's overall economic objectives cannot be emphasized. As demonstrated by Rahmatsyah et al (2002), Numerous scientific studies have now confirmed the negative effects from exchange rate fluctuations on varying sectors of the market. (2002). Meanwhile, the Nigerian exchange mechanism

had passed through numerous regimes. In the 1960s, a fixed exchange system was created, wherein the currency was set at parallel with the British pound. When the British pound was devalued in 1967, the authorities consented to peg the currency to the US dollar and tight regulatory limits on foreign exchange and enforced import restrictions. Nigeria had to leave the dollar peg after the financial crisis though returned to the British pound and remained loyal to it until 1973, when the Nigerian naira was once again fixed to the US dollar.

B. Problem Identified

In recent times, the Nigerian naira exchange rate has continuously experienced depreciation and volatility which is known to be a part of the extensive macroeconomic instability that have continued to unravel itself in the Nigerian economy and so, it is as a result of this that the researcher investigates the factors determining volatility of exchange rates in Nigeria with particular reference to the publication of CBN Statistical Bulletin and World Development Indicator from 1990 to 2019 for analysis.

While there has been records of available literature studying the outcome of the volatility of exchange rate on different forms of indicators of macroeconomic as well as the causes and determinants of the volatility, this study pursues to further assess the causes and the factors that influence the uncertainty of the exchange system but in the light of the recent troubling continuous depreciation of the Naira. As a result of the early 1980s global economic downturn, Nigeria's economy began to experience crises, which had a negative impact on global commodity prices. The decline of oil prices caused structural imbalances, which resulted in a decrease in the country's revenue. As a result, there was a significant budget deficit, a large external trade deficit, rising unemployment, and a high inflation rate despite diminishing domestic investment intake.

Volatile foreign exchange rates are related with unpredictability in the economy's relative pricing. Foreign currency trading is become a highly popular way to make money in Nigeria. Foreign exchange rates are an essential issue to research since they affect not just the government but also all businesses, merchants, and individuals in an economy. However, money supply, trade flows, interest rates, balance of payment, foreign reserve, levels of output, income, CPI, and unforeseen

situations are all elements that influence exchange rate fluctuations. The degree to which each of these elements has an influence varies and is dependent on the economic situation of a certain nation. In the recent time, Nigeria exchange rate has experienced a sporadic uprising movement due to several crises ranging from the financial crisis, economy recession to pandemic.

C. Research Questions

The below questions are aimed to be answered in the study:

- i. How does money supply influence the volatility of exchange rate in Nigeria?
- ii. What is the effect of monetary policy rate on the volatility of exchange rate in Nigeria?
- iii. How does the level of output impact the volatility of exchange rate in Nigeria?
- iv. How does consumer price index affect the volatility of exchange rate in Nigeria?

D. Study Sub-aims

The detailed sub-aims of this study are to:

- v. measure the influence of money supply on the volatility of exchange rate in Nigeria.
- vi. assess the influence of monetary policy rate on the volatility of exchange rate in Nigeria
- vii. evaluate the effect of level of output on the volatility of exchange rate # in Nigeria
- viii. measure the effect of consumer price index on the volatility of exchange rate in Nigeria

E. Purpose/Importance

The motive behind this investigation is to discover the variety that influences

the uncertainty in the Nigeria exchange system. Meanwhile, this investigation may prove useful to organizations in Nigeria because it will help discover new variety that contribute to the exchange system uncertainty.

Secondly, various authorities, for instance, the government, financial institutions, investors, and academia who undertake research works in understanding how exchange rate is being managed for sound economic growth and development, will have more information's from this investigation in identifying new ways of managing the volatility with the Nigeria Exchange rate.

This investigation may also prove useful to the future researchers/students in providing an insight on how exchange rate volatility and fluctuations are being managed, implemented, and controlled to impact on economic growth.

F. Methods of Achieving the Stated Objectives

Quantitative method shall be conducted in this study where the data shall be subjected to different estimation techniques and structured according to the study objectives. To confirm the stationarity of the variables, the collected data must first be subjected to unit root testing. Nonetheless, regression method was used to capture the impact of each objective, the cointegration technique was used to evaluate if the variables are connected within a short or long run, while ARCH effect analysis will also be conducted to examine whether there is a volatility among the variables during the study period. Additionally, granger causality may also be conducted to examine the causality of the variables.

G. Study Similarity and Gap Findings

Various studies, for instance, (Odusola and Akinlo 2001; Gidigbi, Babarinde, and Lawan, 2018; Mokoma and Moroke 2015; Adelowokan, Adesoye and Balogun 2015; Yinpreye, and Moses 2015; Ikechi and Nwadiubu 2020) in the developed and developing countries that have been shown on exchange rate and some other macroeconomic variables, indicating a similarity exist between this study and previous studies.

From the findings of the previous studies, it was discovered that their reports were inconsistent, and this may be because of the study scope, methodology, and

geographical area. In a study conducted by Lee-Lee (2007), on the macroeconomic factors of exchange volatility among ASEAN countries using E-GARCH as the estimation technique, and reported that that among the macroeconomic factors, stock market is a great influenced of exchange rate turbulence across countries. While in South Africa, Mokoma and Moroke (2015) showed a survey on the turbulence of exchange rate using ARCH technique, and reported that soon, the country's currency would depreciate, the exchange rate will not be extremely volatile.



II. STUDY REVIEW

A. Exchange Rate Concept

Emerging-market exchange rate policies are frequently delicate and contentious, because of the restructuring that must be made, for instance, minimizing imports or intensifying non-oil exports, inevitably, this will result in a decline in the nominal exchange rate. The real exchange rate is a benchmark for showcasing local industries' competitiveness in the global market, and it shows the currency's strength or weakness in relation to foreign money (Razazadehkarsalari, Haghiri & Behrooznia, 2011). Because of their short-term impact on pricing and demand, domestic adjustments are considered harmful to the economy. Interestingly, in emerging countries that rely on imports for consumption and production, the inefficiencies inherent in an inflated exchange rate system are rarely discussed (Obadan, 2006). Nigeria's currency rate policy has seen significant changes in recent years. Despite these many techniques of computing exchange rates, a reasonable exchange rate for the naira has yet to be established, since existing exchange rate systems have rapidly increased the imbalance between the official and unofficial markets and have been unable to avoid market inequity. It has also failed to preserve currency rate stabilization as well as attractive external reserve levels and, as a result, external balances. Furthermore, the multiple currency rate mechanisms in use in Nigeria have been ineffective in preventing or mitigating capital emigration, and the ability to stabilize the Naira's rapidly rising exchange rate has been lacking.

The process of exchanging local currencies for international currencies in a forex market at various exchange rates is known as foreign exchange. Foreign exchange is the most common item that is utilized daily for the payment of foreign trades and obligations. A price of one currency to another is often known as an exchange rate. Madura (2006) characterized real exchange rate as the difference between two nations' actual exchange rates after accounting for inflation impacts. The RER is calculated in the forex market, which is accessible to a wide volume of trade and where currency trading takes place on a regular basis. The current

exchange rate is regarded as the spot exchange value, one of numerous forms of exchange system while a forward exchange value is quoted and exchanged today but is intended for future payment. Economic, political, and psychological factors can influence exchange rates, which can be a short-term or long-term dynamic.

The decision of exchange rate system is possibly the most divisive component of macroeconomic management in the developing countries (Adeoye & Saibu, 2014). Since the liberalization of the economy with the introduction of SAP, the Nigerian government has gone through a variety of currency rate regimes, including depreciation and appreciation. According to Aliyu (2011), increased imports trigger a declines in exports, whereas a depreciation results in a rise in exports and a fall in imports. Furthermore, currency depreciation results in a movement away from imported goods and toward domestic goods. Revenue is shifted from importing countries to exporting countries because of the change in trade conditions, influencing both exporting and importing countries' economic trade balances and growth. Even though successive administrations have implemented a variety of exchange rate modifications, the effectiveness of these policies in increasing export remains uncertain. This is due to the fact that, despite government efforts, Nigeria's economy has grown at a sluggish pace.

Even though Nigeria's exchange rate was restructured, and the hypothetical assumed that it contributes to a country's growth exertion, the country's economy has been associated with a low industrial output utilization, rampant inflation, massive debt burden, high rate of unemployment, high income disparity, and poverty, to name a few (Uniamikogbo & Ewanehi, 1998).

Table 1 CBN Official Rate of some key currencies to Naira

Year	US Dollar	Pound Sterling	Japanese Yen	CFA Franc	Swiss Franc	Euro
1995	84.58	130.14	0.83	0.17	73.20	
1996	79.60	131.98	0.70	0.15	60.15	
1997	74.63	124.34	0.58	0.13	52.03	
1998	84.37	140.21	0.65	0.14	58.50	
1999	92.53	146.51	0.76	0.15	60.76	97.21
2000	109.55	163.03	0.95	0.16	66.96	101.88
2001	113.45	164.32	0.86	0.15	67.84	100.39
2002	126.90	204.55	1.07	0.18	91.57	133.11
2003	137.00	244.01	1.28	0.17	110.87	172.77
2004	132.85	256.71	1.30	0.27	117.50	181.46
2005	129.00	222.49	1.10	0.23	98.18	152.72
2006	127.00	249.39	1.07	0.26	104.14	167.42

Table 1 (more) CBN Official Rate of some key currencies to Naira

Year	US	Pound	Japanese	CFA	Swiss	
	Dollar	Sterling	Yen	Franc	Franc	Euro
2007	116.80	234.02	1.04	0.26	103.76	171.89
2008	131.25	191.21	1.45	0.28	123.40	183.51
2009	148.10	239.94	1.60	0.32	145.14	213.41
2010	148.81	230.09	1.70	0.30	142.99	197.59
2011	156.70	242.34	2.03	0.31	166.65	202.72
2012	155.76	250.99	1.88	0.31	168.61	203.50
2013	155.74	245.51	1.58	0.31	168.83	206.97
2014	168.00	262.25	1.41	0.31	169.75	204.15
2015	197.00	291.93	1.64	0.33	198.23	214.65
2016	305.00	375.18	2.61	0.49	299.64	322.11
2017	306.00	413.65	2.72	0.56	313.75	366.86
2018	307.00	392.01	2.79	0.53	311.74	351.33
2019						
Q1	306.95	402.35	2.77	0.52	308.21	344.80
Q2	306.90	389.64	2.79	0.52	314.51	349.19
Q3	307.00	377.86	2.85	0.51	307.95	334.63
Q4	307.00	405.24	2.83	0.52	317.48	344.82
2020						
Q1	361.00	445.94	3.33	0.52	373.63	395.62
Q2	361.00	442.84	3.35	0.52	379.28	404.28
Q3	381.00	489.55	3.60	0.68	413.10	446.49
Q4	381.00	520.07	3.70	0.70	432.56	467.72

Source: CBN Statistical Bulletin (2021)

B. Exchange Rate Volatility

The exchange rate, as well as its volatility, has an important impact on Nigerian economic activity. That is why swings in the foreign currency market have long attracted the attentions of economists and statisticians alike. The term "exchange rate volatility" coined by Azeez, et al., (2012) described when a rate deviates from the baseline or equilibria over time. It also suggests that there has been a mismatch of currency rates if there are several markets running concurrently with the official market. Since the 1970s, Since the 1970s, when global economic management began to embrace the regime of floating exchange system, the uncertainty of exchange value and sustainable growth have become critical policy issues. As a result, there has been a lot of interest in experiments on the uncertainty of exchange value.

A rise within the real exchange value, also known as a real appreciation, is expected to reduce competitiveness by raising imports and lowering exports. If there is an increase within the real exchange value, the trade deficit is prone to exacerbate, but if the rate decreases, it is expected to increase. However, if the economy is

substantially dependent on imports, actual import elasticity is low in the short run, and the impacts may be asymmetric. Currency depreciation raises the domestic value of the trade balance by lowering export prices while lowering import prices. When real imports have a lower elasticity than real exports, the nominal value of imports grows faster than the nominal export value, aggravating the trade balance.

Variations in the exchange rate have far-reaching implications for pricing, salaries, interest rates, production levels, and job possibilities. With the failure of Bretton Woods approach, many nations have experiencing continual and ever-increasing variability in their exchange rates, with variability in the short term at an all-time high because of the switch from static to malleable exchange system in the 1970s and afterwards. One of the challenges to macroprudential efficiency is high fluctuation and unpredicted alter in the exchange value.

According to Martins (2015), volatility is a sequence of movements and swings that allow a currency to depreciate or appreciate. Morina et al (2020) claim that when foreign trade transaction costs get too high, investors' earnings become too low, limiting their choices to extend their investment perspectives. They claim that most economists believe that a fluctuating exchange rate can harm the economy because all nations use currency in procurement of goods and services in international trade; thus, when the value of the currency fluctuates, these people have difficulty making decisions about agreements with other nations. The concerns with exchange rate risk are not limited to politicians; they also affect scholars. More so er words, this hazard tied to the difficulty in making judgments as it pertains unanticipated movements on the exchange is deemed volatility. Shocks, according to Clarida and Gali (1994), are a primary cause of the unpredictability of changes in the cost of products, interest rates, inflation, investments, loans, and savings.

C. Interest Rate and Economic Growth

The original idea behind financial liberalisation, which the Breton Woods Institution supported, was widely believed to have been marketed to many developing nations. These nations did not accept the preconditions for their execution and the implications of the concept as part of the deal for their performance. The correlation between interest rate reform, and market expansion, has been a heated dispute since the early 70s, both theoretically and analytically.

According to Keynesians and Neoclassical ideas (as cited by Odhiambo, 2008), low interest rates would encourage investment expenditure in both established and emerging nations.

Financial liberalization affects economic growth by affecting savings, financial depths, and investment decisions.

According to Calderon and Kubota (2009), countries with more established economies are more stable than their counterparts in emerging countries and developing markets. This is due to the advanced nations' industrialisation, which has made their financial institutions and systems efficient and dependable. All these characteristics are certain to boost their economies' growth while also protecting them from foreign influences, which can lead to instability in main macroeconomic indicators, notably the currency rate. According to Sanusi (2004), when there is a high productivity and efficiency, there is also a high level of economic expansion, which leads to a low level of exchange rate volatility.

D. Study Empirical Review

Odusola and Akinlo (2001) studied output, Nigeria's exchange rate and inflation rate between 1970Q1 and 1995Q4. They employed cointegration test and vector autoregressive analysis and found that the variables such as GDP, M1, CPI, official exchange rate and parallel exchange rate including export were cointegrated, this indicates variables have a long-term relationship.

Aghion, et al., (2006) wrote, there is a correlation between exchange value uncertainty and productivity growth in the United States from 1960 to 2000. GMM analysis was employed and indicted, exchange value uncertainty has a minor and minimal impact on real activity, according to the findings.

Lee-Lee (2007) studied macroeconomic factors of exchange rate volatility. The E-GARCH discovered that among macroeconomic variables, the stock exchange is a great influenced of exchange system uncertainty globally.

The study of Ihnatov and Capraru (2012) on the correlation around exchange rate regimes and economic development in the Europe utilizing ordinary least square and generalized method of moments reported that most of the chosen countries employed hard pegs regime and revealed that flexible regime inspires growth.

Khonder, Bidisha and Razzaque (2012) wrote on the connection between exchange system and economic development in Bangladesh from 1980 to 2012. The cointegration and ECM used found that exchange rate fluctuations affect overall output.

Obansa, Okoroafor, Aluko, and Eze (2013) conducted a survey on the connection between, interest rate, exchange rate and the Nigerian economy between 1970 and 2010. They employed VAR analysis and during the study period, it was discovered that exchange value had a greater influence on economic advancement than interest rate.

Syarifuddin, Achsani, Hakim and Bakhiar (2014) examined the effect of exchange value fluctuation on monetary policy in Indonesia using TGARCH and found that exchange rate volatility is persistent in Indonesia.

Adeoye and Saibu (2014) studied the affiliation between monetary policy and the uncertainty of exchange system in Nigeria from 1980 to 2009. Regression analysis, cointegration testing, and granger causality were employed and there exist a causal affiliation between the exchange system and monetary policy, according to the report.

Mokoma and Moroke (2015) focused on South African economy's exchange system volatility using ARCH technique. According to the study, exchange rates will become less volatile in the near future, despite currency depreciation.

Adelowokan et al., (2015) employed co-integration and VECM. According to their findings, currency volatility has a detrimental effect on investment and growth though exhibited a favorable effect on inflation and interest rate.

Oyinpreye, and Moses (2015) wrote on the Nigerian economy, focusing on impact of exchange value and share price uncertainty. They used ARCH LM test and it was discovered that exchange value uncertainty had a detrimental effect on share price movement.

Osigwe (2015) wrote on exchange rate and economic growth including oil price in Nigeria between 1960 and 2005 using OLS and two stage OLS analyses. According to the study, both price of oil and exchange value maintained positive contribution on Nigeria's economic expansion.

Ubah (2015) did an investigation on the correlation between the volatility of exchange rate and economic growth between 1980 and 2012 in Nigeria using cointegration and GARCH methods. It was reported that exchange value has an adverse effect on economic growth, in both short and long run.

Amassoma and Odeniyi (2016) Performed a study to determine the affiliation in both exchange rate fluctuations and economic expansion in Nigeria. They used cointegration and ECM techniques, and it was discovered there is a positive but insignificant affiliation in both exchange rate and economic expansion in Nigerian's economy.

Jelilov, Jibrin and Isik (2016) did a survey on exchange rate and expansion of Nigeria's economy between 1990 and 2014 using vector autoregressive model and granger causality test. They discovered that GDP and inflation have a one-way relationship though a bidirectional connection was found between exchange rate and inflation.

Ismaila (2016) wrote on the correlation between exchange rate depreciation and the Nigerian economy performance, a post-SAP study from 1986 to 2012. The study employed cointegration test and ECM techniques and reported that exchange value exhibits an insignificant effect on Nigeria's economic advancement.

Okorontah (2016) Between 1986 and 2012, conducted research on effects of exchange rates towards economic growth in Nigeria. The study used cointegration and ECM, and discovered there is a weak link between economic growth and exchange rate fluctuations.

Guzman, Ocampo, and Stiglitz (2016) investigated the policies of exchange rate (real) on market development in Columbia. The empirical survey reported that stable and competitive exchange rate strategies are helpful for economic development.

Diala, Kalu, and Igwe-Kalu (2016) wrote on exchange value fluctuation effects on the returns of commercial property in Nigeria between 2000 and 2010. EGARcH was employed and discovered that exchange value fluctuation is linked to commercial property returns in a positive way.

The study of Gidigbi, Babarinde, and Lawan (2018) between 1981 and 2015, using VECM and discovered that inflation and exchange value uncertainty revealed a

short-run relationship.

Kilicarslan (2018) wrote on determinants of exchange rate uncertainty in Turkey using GARCH and FMOLS. And discovered that the variables have a long-term relationship.

Simtowe and Yi (2018) did a study between 1980 and 2014 on real exchange effects on the Malawian economy using OLS and VECM as the estimation techniques. Within duration for research, exchange rate had a negative impact on economic growth.

Nwafor (2018) did a survey on Naira impact, on growth of Nigerian economy from 2006 to 2016 using OLS. It was demonstrated that the Naira had no impact on Nigeria's economic growth within research duration.

Idris, Ashemi and Musa (2019) used autoregressive distributed lag to evaluate the correlation between Nigeria's GDP and exchange value between 1981 and 2017. A long-run correlation was discovered between both variables.

Adjei (2019) used ARCH and GARCH as the estimation techniques and exchange uncertainty has substantial, detrimental effect on economic growth, according to findings.

Uzoma-Nwosu and Orekoya (2019) discussed on affiliation between the uncertainty of exchange value and Nigeria's FDI within 1980 to 2017. They used VECM, descriptive analysis, cointegration and granger causality analysis. It was reported, no significant connection between both variables during study period.

Ikechi and Nwadiubu (2020) focused on affiliation between exchange value uncertainty and international trade in Nigeria. They used vector autoregressive, ARCH, and GARCH methods. It was discovered, in every unit increment in export and import, results in 0.9% and 0.4% decrement in real exchange value, respectively.

Morina, et al., (2020). Discussed on exchange rate fluctuation effects on CEE nations' growth between 2002 and 2018. They used panel data analysis of effects and exchange rate uncertainty was reported to have a negative repercussion on market development.

Abdi, Muturi and Olweeny (2020) discussed factors influencing the volatility exchange rate in Kenya between 2004 and 2019 using descriptive analysis, charts,

correlation, and covariance analyses. It was reported that interest and inflation have significant influence on uncertainty of exchange value.

Nor, Masron, and Alabdullah (2020) examined the affiliation between the macroeconomics indicators and the uncertainty of exchange value in Somalia. EGARCH was used and found that macroeconomic indicators influence exchange rate volatility and its own shocks.

Anifowose (2021) investigated the connection between development of the Nigerian economy and uncertainty of exchange value between 1981 and 2020. The study used non-linear autoregressive distributed lag analysis, and reported that economic growth exhibits an influence on exchange rate in long-run.

E. Summary of Empirical Review

Table 2 Summary of Empirical Review

Name & Year	Country	Method	Findings
Odusola and Akinlo (2001)	Nigeria	Cointegration test and autoregressive analysis	Found that the variables such as GDP, M1, CPI, official exchange rate and parallel exchange rate including export were cointegrated.
Aghion, et al., (2006)	USA	GNN	Exchange rate fluctuations appear to have a minor and minimal impact on real activity, according to the findings.
Lee-Lee (2007).	ASEAN	E-GARCH	Found that among the macroeconomic factors, stock market is a great influenced of exchange rate volatility across countries.
Ihnatov and Capraru (2012)	Europe	OLS and GMM	Reported that most of the chosen countries employed hard pegs regime and revealed that flexible regime inspires growth.
Khonder, Bidisha and Razzaque (2012)	Bangladesh	Cointegration and ECM	Found that exchange rate fluctuations affect overall output.
Obansa, Okoroafor, Aluko, and Eze (2013)	Nigeria	VAR	During study period, it was discovered that exchange value had greater influence on economic development than interest rate.
Syarifuddin, Achsani, Hakim and Bakhjar (2014)	Indonesia	TGARCH	Found that exchange value uncertainty is persistent in Indonesia.
Adeoye and Saibu (2014)	Nigeria	Regression analysis, cointegration testing, and granger causality	Reported that a causality connection between exchange rate and monetary policy.

Table 2 (more) Summary of Empirical Review

Name & Year	Country	Method	Findings
Amassoma and Odeniyi (2016)	Nigeria	Cointegration and ECM techniques	The exchange value and growth of Nigerian's economy has a positive but insignificant correlation, according to the study.
Jelilov, Jibrin and Isik (2016)	Nigeria	Vector autoregressive model and granger causality test	They discovered that GDP and inflation have a one-way relationship though a bidirectional connection was found between exchange rate and inflation.
Ismaila (2016)	Nigeria	Cointegration test and ECM	Reported that exchange rate exhibits an insignificant effect on economic growth.
Okorontah (2016)	Nigeria	Cointegration and ECM	It was resulted that a weak connection exist exists between economic growth and exchange rate fluctuation.
Guzman, Ocampo, and Stiglitz (2016)	Columbia	Empirical Review	Reported that stable and competitive exchange rate strategies are helpful for economic development.
Diala, Kalu, and Igwe-Kalu (2016)	Nigeria	EGARCH	Discovered that exchange value uncertainty is linked to commercial property returns in a positive way.
Gidigbi, Babarinde, and Lawan (2018)	Nigeria	VECM	Found that inflation and exchange rate volatility revealed a short-run relationship.
Mokoma and Moroke (2015)	South Africa	ARCH	According to the study, exchange rates will become less volatile in the near future, despite currency depreciation.
Adelowokan, Adesoye and Balogun (2015)	Nigeria	Cointegration and VECM	Researchers discovered that exchange value uncertainty has a detrimental effect on investment and growth though exhibited a positive impact on inflation and interest rate.
Oyinpreye, and Moses (2015)	Nigeria	ARCH-LM	They used ARCH LM test and it was discovered that exchange value fluctuation had a detrimental effect on share price movement.
Osigwe (2015)	Nigeria	OLS & 2 stage OLS	According to the study, both price of oil and exchange value maintained positive contribution on Nigeria's economic expansion.
Ubah (2015)	Nigeria	Cointegration and GARCH	It was reported that exchange rates have negative impact on economic growth in both short and long run.
Kilicarslan (2018)	Turkey	GARCH and FMOLS	The researchers discovered that the variables have a long-term relationship.

Table 2 (more) Summary of Empirical Review

Name & Year	Country	Method	Findings
Nwafor (2018)	Nigeria	OLS	It was demonstrated that the Naira had no impact on Nigeria's economic growth within research duration.
Simtowe and Yi (2018)	Malawi	OLS and VECM	Within research duration, it was discovered that exchange value had negative impact on economic growth.
Idris, Ashemi and Musa (2019)	Nigeria	ARDL	They discovered a long-run relationship between GDP and the exchange rate.
Adjei (2019)	Ghana	ARCH and GARCH	Exchange uncertainty has substantial, detrimental effect on economic growth, according to findings.
Uzoma-Nwosu and Orekoya (2019)	Nigeria	VECM, descriptive analysis, cointegration and granger causality analysis.	It was reported that no significant connection between FDI and exchange rate volatility during the study period.
Ikechi and Nwadiubu (2020)	Nigeria	Vector autoregressive, ARCH, and GARCH methods and	It was discovered, in every unit increment in export and import, results in 0.9% and 0.4% decrement in real exchange value, respectively.
Morina, Hysa, Ergiin, Panait, and Voica (2020).	Central and Eastern European countries	Panel data analysis of effect effects	Exchange rate uncertainty was reported to have a negative repercussion on market development.
Abdi, Muturi and Olweeny (2020)	Kenya	Descriptive analysis, charts, correlation, and covariance analyses	It was reported that interest and inflation have significant influence on uncertainty of exchange value.
Nor, Masron, and Alabdullah (2020)	Somalia	EGARCH	Found that macroeconomic indicators influence exchange rate volatility and its own shocks.
Anifowose (2021)	Nigeria	Non-linear autoregressive distributed lag analysis	Reported that economic growth exhibits an influence on exchange rate in long-run.

Source: Author's compilation

F. Theories

While economic theories suggest that the kind of exchange rate system matters for growth, it's uncertain which system is most likely to support growth. It doesn't say how the exchange-rate regime, namely the exchange-rate peg, affects economic growth. Rather, the focus is frequently on the impact of foreign investment and trade. According to Babatolu (2015), there is a lot of discussion about how the

exchange-rate regime affects growth, although it has minimal impact in the short run. Theoretical work on the subject is scarce, and much of it is based on topics that are only tangentially connected to development, such as export growth or currency crises.

G. The PPP

The notion of purchasing power may be traced back to Spain's Salamanca School in the 16th century. Classical economists like Ricardo, Mill, Goshen, and Marshall embraced and advanced qualified PPP theories during the nineteenth century. Gustav Cassel, a Swedish economist, is credited with developing and popularizing the idea in its contemporary form in the 1920s (Rogoff, 1996). The PPP's core principle is the final exchange value in proportion to the national currencies', essential purchasing power parity, implying that exchange rate changes destabilize a country's buying power and hence have a substantial influence on trade and investments (Aghevli, 1991). When evaluating the exchange rate, macroeconomic (real) theory focuses on macroeconomic variables. The Balassa-Samuelson technique and Nurkse's payment balance approach are two different approaches to this problem. The Balassa-Samuelson method emphasizes the balance of trade between tradable and non-tradable sectors, whereas Nurkse emphasizes the balance of payments (Hassan *et.al.*, 2017). An acceptable payment balance causes the exchange rate to appreciate excessively, whereas an imbalance in payments causes the country's exchange rate to depreciate.

H. The Hypothesis of Export-led Growth

Self-sufficiency is a big part of export-led growth. Import substitution, on the other hand, is the opposite. It is an endeavour by nations to become self-sufficient and lessen their dependency on developed economies. They accomplish this by building their own industries to compete with nations that rely heavily on exports. Continue reading to understand more about the history of export-led growth.

Export expansion, according to hypothesis, is a significant component in supporting long-term economic growth. The hypothesis proposes that export increase is one of the key drivers of development, according to Medina-Smith (2001).

According to this viewpoint, countries grow not just through growing the quantity of labour and capital in their economy, but also by boosting exports. Proponents of the theory say that exports might act as a "growth engine.

According to Garnaut et al. (1995), numerous industrial economies have realised that relying on global markets, an approach described as outward looking, provides far more room for economic growth than relying on home markets. Instead of depending just on domestic markets, outward-looking countries may benefit from expanded international markets, which helps boost trade balance and, eventually, exports. According to James et al. (1989), the East Asian countries' success in the 1970s was due to their adoption of export-led development. The spectacular expansion and industrialization of Japan, Hong Kong, Singapore, and Korea, according to James, et al. (1989), addressed the negative perceptions about the applicability of export-led growth strategies to other less developed nations.

Exports, as a proportion of total demand, according to Agosin (1999), can act as an accelerator for income expansion. This logic is based on the fact that in a small open economy, product demand in local markets is insufficient to support economic development. On the other hand, export markets are virtually limitless, and as a result, demand growth is unrestricted. Export-led strategy, according to Palley (2011), is a win-win situation for both emerging and developed nations. The universal implementation of the comparative advantage concept benefits both the exporter and the importer. The theory of export-led strategy is not without its critics. As per Palley (2011), trade can diminish domestic demand in a Keynesian world of demand scarcity, resulting in lower production, employment, and national welfare. Export subsidies, in the Keynesian paradigm, are not a gift, but rather a means of stealing demands and job opportunities.

i. Fisher's Theory

The Fisher effect is an economic hypothesis presented by economist Irving Fisher that explains how inflation affects both real and nominal interest rates. The real interest rate may be considered by subtracting predicted inflation rate from nominal interest rate, according to Fisher effect equation. All of the specified rates are compounded in this calculation (Neiman, 2010). The Fisher Effect theory claims that a country's nominal interest rate is determined by its real interest rate and the

expected inflation rate, thereby connecting the dots between inflation and interest rates. Because, this incorporates interest and inflation rates, which both impact exchange rates, the real interest rate is used to measure exchange rate fluctuations. Given constant other factors, real interest rate differentials and currency exchange rates have a strong inverse relationship. To measure the influence of relative changes in nominal interest rates among nations on their foreign exchange values, the Fisher Effect combines the PPP with the Fisher effect. The PPP theory predicts that to compensate for changes in inflation rate differentials, exchange rates will fluctuate. As a result, when a country's inflation rate rises relative to other countries, the value of its currency falls. (Vigfusson, et al. 2009).

It would also be linked to an increase in the country's interest rate in comparison to international rates. The IFE, which argues that interest rate differentials induce exchange rate fluctuations, is a mixture of these two requirements. Any variance in nominal interest rates, might be ascribed to differences in predicted inflation, if real interest rates are the same across the country. Because high nominal interest rates indicate predicted inflation, foreign currencies with comparatively high interest rates devalue. According to the IFE, the variation between interest rates of two countries, is a fair indicator of future alteration in the current exchange value. (Neiman, 2010).

In Fisher effect, the nominal interest rate is equal to supplied actual interest rate, which implies currency intervention, padded to a specific amount of money or currency over time, as a result of a financial lender. The real interest rate is the figure, that reflects increasing purchasing power of borrowed money over time. The Fisher effect is more than an equation: It portrays how money supply affects both nominal interest rate and inflation rate concurrently. (Vigfusson, 2009).

III. METHODOLOGY

A. Study Design

The study design applies to the comprehensive plan to be adopted to combine the many aspects of the study in a cohesive and logical manner, assuring that effectively solution will be achieved. It serves as the blueprint for data collecting, measurement, and analysis. The kind of study (empirical, descriptive, correlational, survey research and review) as well as its sub-types are explained by the design of a research topic. Though, the techniques and processes used in the design of a study are determined by the researcher's ideas about the nature of knowledge and reality.

This research employed the descriptive research design, which is, simply concerned with describing the situation under review. It involves data collection, interpretation, and presentation procedure.

B. Source of Data

A source of data is the place from which data is derived. A data source can be the original site where data is created or where tangible material is first processed, that even the most refined data can be used as a source if it is accessed and used by another process. As a result, this study relied on secondary data sources such as the CBN Statistical Bulletin, the National Bureau of Statistics, and the World Development Indicators. Between 1986 and 2020 was the time frame.

C. Model Specification

This study employed a singleton functional equation modeling where some of the macroeconomic variables were used to regress the volatility of the exchange during 1986 to 2020. The functional model was further expressed in mathematical equation model, econometric equation model and time series form. The models are presented as:

$$EXRV = f(MPR, M2, GDP, CPI) \dots \dots \dots \text{Equation 1}$$

Where

EXR = Exchange Rate Volatility

MPR = Monetary Policy Rate

M2 = Money Supply

GDP = Gross Domestic Product

CPI = Consumer Price Index

The above model was presented mathematically as:

$$EXRV = \vartheta_0 + \vartheta_1MPR + \vartheta_2M2 + \vartheta_3GDP + \vartheta_4CPI) \dots \text{Equation 2}$$

Where

ϑ_0 = Constant

$\vartheta_1 - \vartheta_4$ = the coefficient

The model is presented in econometric form as

$$EXRV = \vartheta_0 + \vartheta_1MPR + \vartheta_2M2 + \vartheta_3GDP + \vartheta_4CPI + \varepsilon_t \text{ Equation 3}$$

Where

ε_t = Error Term

While the time series form is presented as

$$EXRV_t = \vartheta_0 + \vartheta_1MPR_t + \vartheta_2M2_t + \vartheta_3GDP_t + \vartheta_4CPI_t + \varepsilon_t \text{ Equation 4}$$

D. A priori Expectation

Table 3 Expected Sign

Variables	Description	Expected Sign
MPR → EXRV	MPR is expected not to affect exchange rate positively	-
M2 → EXRV	M2 is projected to be positive or negative to exchange rate volatility	+/-
GDP → EXRV	GDP is expected to be positive or negative to exchange rate volatility	+/-
CPI → EXRV	The increase in CPI is expected to be positive to exchange rate volatility	+

Source: Writer's compilation

E. Measurement of Variables

Table 4 Variable Measurement

Variable	Measurement
EXR	is the conversion rate between two currencies. This is employed as the controlled variable
MPR	is the rate that a monetary authority uses to indicate or execute its monetary policy stance. This is employed as the controlling variable
MS	alludes to all a country's cash and currency in circulation. This is employed as the controlling variable
GDP	is the market worth of all finished products and services produced within a nation's boundaries in a given year. This is employed as the controlling variable
CPI	is a price index that evaluates at the weighted sum of a range of consumer goods and services. This is employed as the controlling variable

Source: Writer's compilation

F. Estimation Techniques

This study employed several estimation techniques ranging from the descriptive analysis, regression analysis, ARCH-M model to granger causality. Some of the techniques used were explained below:

G. Descriptive Analysis

Descriptive analysis is a sort of research methodology that explains, illustrate, or aggregate sets of data in a rational way so that trends can develop that satisfy all the data's conditions. It is one of the most crucial procedures in statistical data analysis. There may be several metrics in a research study. Descriptive statistics assist in rationally simplifying enormous volumes of data. Each descriptive statistic distils a large amount of data into a concise summary.

Descriptive statistics give easy-to-understand descriptions of the sample and the observations obtained. These summaries might be quantitative, such as summary statistics, or pictorial, such as simple graphics. These summaries may serve as the foundation for an initial analysis of the data collected as part of a larger statistical study, or they may be adequate for specific research on their own.

H. Regression Analysis

In the social sciences, regression analysis is the oldest and most extensively used multivariate approach. Regression is a type of dependency analysis in which the factors are not treated symmetrically, unlike the previous approaches. The goal of regression analysis is to find a forecast for one variable based on the values of the others. Different vocabulary and notation are employed to reflect this shift in perspective. The predicted variable is normally indicated by y , while the predictor variables are usually denoted by x , with notation appended to differentiate one from the other. In practice, least squares estimation is used to estimate regression models using suitable software. Multiple regression may also be used to estimate the model's overall fit and the relative contributions of each predictor to the total variance explained. The optimal selection of the best regressor variables, verifying the significance of their parameters, and determining confidence bounds for the forecasts are all significant practical considerations.

I. Arch-M Model

ARCH (autoregressive conditional heteroskedasticity) is a quantitative technique for studying time series volatility and forecasting future volatility. ARCH modelling is used in financial sector, to quantify risk, by giving a model of volatility

that closely reflects real markets. Times of high volatility are followed by more high volatility, while intervals of low volatility are accompanied by more low volatility, according to ARCH modelling. The ARCH model was created to enhance econometric models, by substituting constant volatility assumptions with conditional volatility. Past financial data affects future data, as Engle and others, working on ARCH models observed. The ARCH simply refers to the observable reality that financial market volatility is non-constant—all financial variables, whether oil price, exchange rate, stock market value, or GDP, experience periods of high and low volatility. ARCH established a model for volatility that economists might use instead of a constant or average. ARCH models might also spot and anticipate volatility clusters in the market during financial crises or other black swan occurrences.

J. Granger Causality

A statistical approach for studying the flow of information between time series is Granger causality analysis. Because of its capacity to define oscillatory and multidimensional data, Granger causality has become increasingly commonly used. A time series Y , is shown to Granger-cause X , if it can be shown by a series of t -tests or F -tests on lagged values of Y (along with lagged values of X), that those Y values transmit statistically valid projections of future values of X .

IV. ANALYSIS DISCUSSION

A. Unit Root Testing

Table 5 Unit @ Level

Variables	ADF Test		Remark	Philip Peron Test		Remark
	T-stat	Crit. Val		T-stat	Crit. Val	
MPR	-3.2527	-2.951125	Stationary	-3.3129	-2.951125	Stationary
M2	-1.9654	-2.954021	-	-2.4006	-2.951125	-
GDP	-0.1762	-2.951125	-	-0.2463	-2.951125	-
EXR	1.72283	-2.951125	-	1.91971	-2.951125	-
CPI	-4.5071	-2.976263	Stationary	-2.8655	-2.951125	-

Source: Writer's compilation

This table reveals the unit root report of ADF test and PP test of the variables. The report shows that monetary policy rate (MPR) has absolute t-stat value of 3.2527 with the critical absolute value of 2.951125, signifying in the remark that MPR was stationary at level. Money supply (M2) has the absolute ADT t-stat value of 1.9654 and the critical value in absolute term was 2.954021, indicating that M2 was not stationary at level. Gross domestic product (GDP) has the ADF t-stat absolute value of 0.1762 and the critical value of 2.951125, connoting that GDP was not stationary at level. Exchange rate shows that ADF t-stat value of 1.72283 with the critical absolute value of 2.951125, indicating that EXR was not stationary at level. While consumer price index (CPI) has the absolute ADF value of 4.5071 and the absolute critical value of 2.976263, implying that CPI was stationary at level.

The Philip Peron test was further used as a retest estimation technique to measure the root unit testing of the variables. It was reported that MPR has the absolute t-stat value of 3.3129 and the critical value of 2.951125, indicating that MPR was stationary at level. This result is similar to the report of the ADF unit root testing. The money supply showed that PP unit root indicates an absolute value of 2.4006 and the absolute critical value of 2.95119, indicating that M2 was not stationary, which the same as prediction of ADF unit root was. PP unit root showed that GDP has the absolute t-stat value of 0.2463 and the critical value of 2.95119,

indicating that GDP was not stationary. More so, EXR has the t-stat value of 1.91971 with the absolute critical value of 2.951125, connoting that EXR was not stationary. While CPI has the absolute value of 2.8655 and the absolute critical value of 2.95119, signifying that CPI was not stationary at level. The two unit root testing reports are similar with a little different in CPI, ADF unit testing predicted CPI was stationary at level while PP testing predict CPI was not stationary at level. Since some of the variables are not stationary at level, first differencing was implemented to measure if they will become stationary.

Table 6 Unit @ First Difference

Variables	ADF Test		Remark	Philip Peron Test		Remark
	T-stat	Crit. Val		T-stat	Crit. Val	
M2	-3.2015	-2.954021	Stationary	-3.0445	-2.954021	Stationary
GDP	-4.627	-2.954021	Stationary	-4.6233	-2.954021	Stationary
EXR	-3.944	-2.954021	Stationary	-3.8911	-2.954021	Stationary
CPI				-7.0407	-2.954021	Stationary

Source: Writer's compilation

The unit root of the first difference of ADF shows that money supply (M2) has the t-stat value in the absolute term of 3.2015 and the critical value of 2.954921, remarking that M2 was stationary after first difference. GDP reveals the t-stat value 4.627 and the critical value of 2.954021, connoting that GDP became stationary after first difference. While, exchange rate (EXR) has the absolute value of 3.944 with the critical value of 2.954021, remarking that EXR also became stationary after first difference. The PP testing equally shows that M2 has the t-stat value of 3.0445 with critical value of 2.954021, revealing that M2 was stationary after first difference. GDP shows the t-stat value of 4.6233 and the critical value of 2.954021, indicating stationary after converting to first difference. Exchange rate also shows the t-stat value of 3.8911 with critical value of 2.954021, connoting stationarity after first difference. CPI which was stationary at level in ADF testing became stationary at first difference in PP unit root testing, since the t-stat value was 7.0407 with critical value of 2954021.

Table 7 Unit Root Break Point

	Break Date
MPR	2004
M2	2012
GDP	2014
EXR	2014
CPI	2000

Source: Writer's compilation

The variable's breaking point was examined to measure the exact period in time of the break between 1986 and 2020. The monetary policy rate had a significant break in 2004, the breaking point of money supply was in 2012, the gross domestic product and exchange had their break point in 2014, while consumer price index had its own break point in 2000.

B. Descriptive Analysis

Table 8 Report of the Descriptive

	EXR	GDP	CPI	M2	MPR
Mean.	115.0494	11.12563	19.58532	12.21445	13.75714
Median,	120.5782	11.02082	12.55496	12.24699	13.50000
Maximum	358.8108	11.73773	72.83550	13.58689	26.00000
Minimum	1.754523	10.44330	5.388008	10.37301	6.000000
Std Deviatio	99.78363	0.436613	17.80517	1.034331	3.779534
Skewness	0.761910	0.078543	1.697801	-0.271343	0.738400
Kurtosis	2.857484	1.334184	4.540513	1.771281	5.045795
Jarque-Bera	3.415908	4.082775	20.27564	2.631209	9.284064
Prob	0.181236	0.129848	0.000040	0.268312	0.009638

Source: Writer's compilation

The descriptive analysis conducted on the variables indicates that exchange rate has an average value of 115.0494, gross domestic product has an average value of 11.12563, consumer price index was 19.58532, the money supply has an average value of 12.21445 and the monetary policy rate has an average value of 13.75714. the median and maximum values of EXR was 120.5782 and 358.8108 with the minimum value of 1.754523, the GDP has a median and maximum values of 11.02082 and 11.73773 with the minimum value of 10.44330, CPI has a median and maximum values of 12.55496 and 72.83550 with the minimum value of 5.388008, money supply's median and maximum values were 12.24699 and 13.58689 with the minimum value of 10.37301, while monetary policy rate has the median and maximum values of 13.50000 and 26.00000 with the minimum value of 6.000000.

The standard deviation reveals that EXR has the value of 99.78363, GDP has the value of 0.436613 SD, CPI has the standard deviation value of 17.80517, M2 has the deviation of 1.034331 and the MPR has the standard deviation value of 3.779534, indicating that exchange rate the highest deviation of its mean, followed by consumer price index, monetary policy rate, money supply, and gross domestic product. The skewness statistic showed that exchange rate was positively skewed with the value of 0.761910, GDP was positively skewed with the value of 0.078543, CPI was positively skewed with the value of 1.697801, M2 was negatively skewed with the value of -0.271343, while MPR was positively skewed with the value of 0.738400. The Kurtosis statistic reveals that EXR, GDP and M2 have the values below 3 and the two remaining variables (CPI and MPR) are more 3. Based on the rule of thumb, when the values are more than 3, it is referred as leptokurtic and if otherwise platykurtic. That is, EXR, GDP and M2 are platykurtic while CPI and MPR are leptokurtic during the study period.

C. Covariance and Correlation Tests

Table 9 Covariance Analysis: Ordinary

Covariance Correlation t-Statistic	EXR	GDP	CPI	M2	MPR
Probability					
EXR	9672.294 1.000000				
GDP	35.60153 0.841204 8.936923 0.0000	0.185185 1.000000 ----- -----			
CPI	-688.5225 -0.398935 -2.499191 0.0176	-4.020637 -0.532403 -3.613064 0.0010	307.9661 1.000000 ----- -----		
M2	89.58070 0.893480 11.42867 0.0000	0.406245 0.926020 14.09259 0.0000	-7.816049 -0.436889 -2.790096 0.0087	1.039273 1.000000 ----- -----	
MPR	-88.77154 -0.242307 -1.434700 0.1608	-0.870202 -0.542843 -3.713105 0.0008	24.62736 0.376724 2.336232 0.0257	-1.485356 -0.391131 -2.441367 0.0202	13.87673 1.000000 ----- -----

Source: Writer's compilation

The above analysis shows the covariance and correlation including t-statistics and probabilities between the variables. Exchange rate and gross domestic product has the covariance value of 35.60153 with the correlation value of 0.841204, t-stat value of 8.93923 with the prob value of 0.0000, implying that positive connection exist between exchange rate and GDP significantly. The connection between exchange rate and consumer price index reveals the covariance value of -688.5225, correlation value of -0.398935, t-statistic value of -2.499191 and the probability value of 0.0176, indicating that negative connection exists between EXR and CPI significantly. Exchange rate and money supply has the covariance value of 89.58070, correlation value of 0.893480, t-statistic value of 11.42867 and the probability of 0.0000, meaning that exchange rate and money supply has strong connection. While the connection between (exchange rate) and monetary policy rate shows the covariance value of -88.77154, correlation value of -0.242307, t-statistic value of -1.434700 with the probability of 0.1608, implying that exchange rate and MPR are negatively connected.

D. Regression Analysis

Table 10 Report of the Regression

DV - EXR				
Variable	Coeff.	Std. Error	t-Statistic	Prob.
C	-1603.556	432.5177	-3.707492	0.0008
GDP	79.29499	56.75354	1.397181	0.1726
CPI	-0.040631	0.515020	-0.078892	0.9376
M2	62.52657	21.07749	2.966510	0.0059
MPR	5.340303	2.571925	2.076384	0.0465
R-squared	0.824841	F-statistic		35.31827
Adjusted R-squared	0.801487	Prob(F-statistic)		0.000000
		Durbin-Watson stat		0.405783

Source: Writer's compilation

The above table shows the relationship between the dependent and independents variable and presented that, at constant, exchange rate has the value of the coefficient of -1603.556, t-statistic value of -3.707492 with the probability value of 0.0008, representing that exchange rate will be negatively significant when the control variables are held constant. The GDP has the coefficient value of 79.29499 with t-stat value of 1.397181 and p-value of 0.1726, representing that GDP was positively insignificant to influence the exchange rate movement. Hence, consumer

price index has the coefficient value of -0.040631 , the t-statistic value of -0.078892 with p-value of 0.9376 , representing that CPI was negatively insignificant to influence exchange rate variation. Money supply during the period has the coefficient value of 62.52657 with the t-statistic value of 2.966510 and p-value of 0.0059 , representing that money supply was positively significant to influence exchange rate variation. The monetary policy rate has the coefficient value of 5.340303 , the t-statistic value of 2.076384 and p-value 0.0465 , representing that MPR was positively significant to influence exchange rate variation during the study period. The report of the R-square and its adjusted showed 82% and 80% respectively while the F-statistic and its p-values revealed 35.31827 and 0.000000 , representing that the control variables can predict the dependent variable.

E. Precondition for ARCH Testing

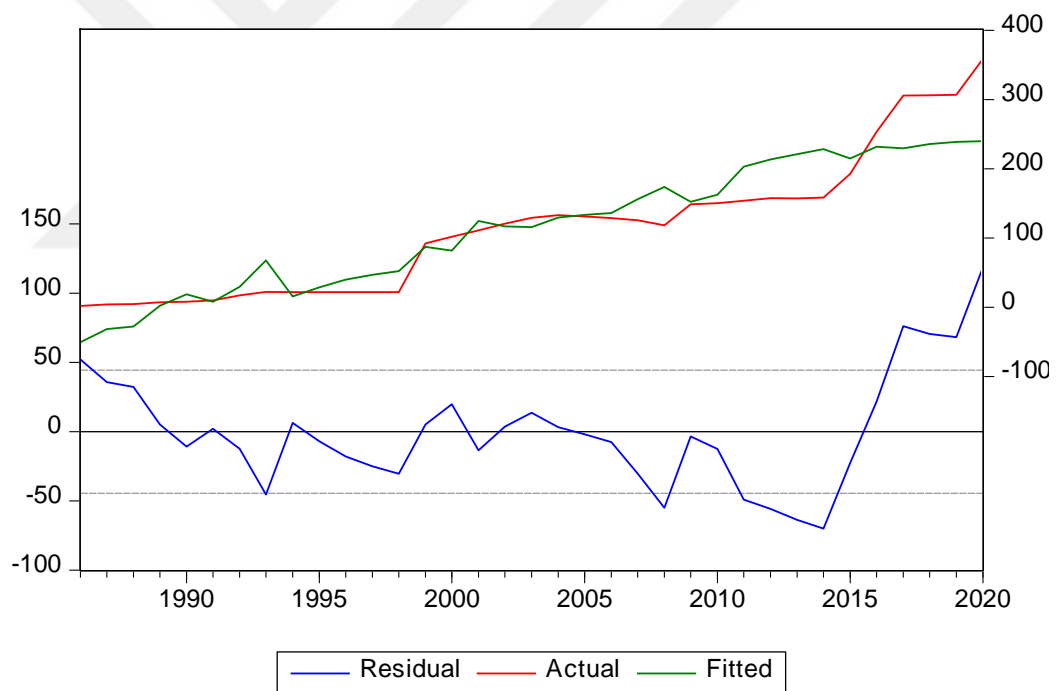


Figure 1 Clustering Volatility

Clustering volatility graph was examined to measure whether the variable moves in a clustering direction. The report of the above graph had indicated that the variable moves in a clustering direction from the low volatility to high volatility between 1986 and 2020.

- **ARCH Effect**

Table 11 Heteroscedasticity Test: ARCH

F-stat	17.62508	Prob. F (1,32)	0.0002
Obs. R-squared	12.07560	Prob. Chi-Square (1)	0.0005

Source: Writer's compilation

The heteroscedasticity ARCH affect presented in the above table shows that the variables has ARCH affect since the probability of the Chi-square is less than 5% alpha level. However, null hypothesis is stated as, there is no ARCH affect and since the p-value has predicted less than 5%, this implies that there is ARCH affect.

F. ARCH Analysis

Table 12 ARCH Report

DV: EXR				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	131.1507	5.448947	24.06901	0.0000
Variance Equation				
C	423.3903	15463.02	0.027381	0.9782
RESID(-1)^2	0.686699	0.385844	1.779731	0.0551
GARCH(-1)	0.405101	0.206577	1.961019	0.0499
GDP	-11.79861	1206.958	-0.009775	0.9922
M2	-5.196718	24.67553	-0.210602	0.8332
CPI	-2.286019	81.74221	-0.027966	0.9777
MPR	-18.78499	107.1214	-0.175362	0.8608

Source: Writer's compilation

$$\text{GARCH} = C(2) + C(3)*\text{RESID}(-1)^2 + C(4)*\text{GARCH}(-1) + C(5)*\text{GDP} + C(6)*\text{M2} + C(7)*\text{CPI} + C(8)*\text{MPR}$$

The report shows that RESID(-1)^2 which is also known as the ARCH effect has the coefficient value of 0.686699, std error value of 0.385844, t-statistic value of 1.779731 with the p-value of 0.00551, representing that the exchange rate has ARCH effect that is exchange rate is volatile since the p-value is less than 5% significant level. The GARCH(-1) being internal cause of the volatility of exchange rate has the coefficient value of 0.405101 with the p-value of 0.0499, representing that exchange rate during the period has GARCH affect. Meanwhile, the external variables employed that could cause volatility on exchange rate reveal that GDP has the coefficient value of -11.79861, t-stat value of -0.009775 with 0.9922, representing that GDP was insignificantly negative to cause the volatility in exchange rate. Money

supply shows the value of the coefficient of -5.196718, t-stat value of -0.210602 with p-value of 0.83322, indicating that money supply does not cause the volatility of exchange rate. The consumer price index has the value of -2.286019, t-stat value of -0.027966 with p-value of 0.9777, representing that consumer price index does not cause the volatility of the exchange rate. Monetary policy rate revealed the value of -18.78499, with t-stat value of -0.175362 and p-value of 0.8608, representing the MPR was insignificantly negative to influence the volatility of the exchange rate during the study period.

G. Causality Testing

Table 13 Pairwise Causality Tests

	Obs	F-Stat	Prob.
GDP *** EXR	33	0.77565	0.4700
EXR *** GDP		0.96339	0.3939
CPI *** EXR	33	0.71160	0.4995
EXR *** CPI		2.08170	0.0436
M2 *** EXR	33	0.81219	0.4541
EXR *** M2		0.04242	0.9585
MPR *** EXR	33	0.02637	0.9740
EXR *** MPR		0.76823	0.4734

*** (does not granger cause)

Source: Writer's compilation

The causality test reported that the causality from GDP to EXR has the values of 0.77565 with p-value of 0.4700 while the causality from EXR to GDP has the values of 0.96339 with p-value of 0.3939, representing that GDP and exchange rate does not cause each other in any way. The consumer price index and exchange rate has the values of 0.71160 with p-value of 0.4995 while that of causal effect from exchange rate and CPI has the values of 2.08170 with p-value of 0.1436, indicating that consumer price index has no causality with exchange rate though exchange rate could granger cause consumer price index. The causality from money supply to exchange rate has the values of 0.81219 with p-value of 0.4541 while that of exchange rate to money supply was 0.04242 with p-value of 0.9585, representing that the two variables do not cause one another. More so, the causality from monetary policy rate to exchange rate has the values of 0.02637 with p-value of 0.9740 while the causality from exchange rate to monetary policy rate has the value

of 0.4734, representing that no causality exists between monetary policy rate and exchange rate during the study period.



V. DISCUSSION OF FINDINGS AND CONCLUSION

A. Findings

The analysis revealed M2 was stationary after first difference, GDP became stationary after first difference, exchange rate also became stationary after first difference. Meanwhile, the PP testing equally revealed that M2 was stationary after first difference, GDP was stationary after converting to first difference, exchange rate was stationary after first difference, CPI which was stationary at level in ADF testing became stationary at first difference in PP unit root testing. The Philip Peron test reported that MPR was stationary at level. This result is similar to the report of the ADF unit root testing. Because some variables are not stationary at the level, first differencing was implemented to measure if they will become stationary. The variables breaking point was examined to measure the exact period in time of the break between 1986 and 2020. The monetary policy rate had a significant break in 2004, the breaking point of money supply was in 2012, and the gross domestic product and exchange had their break point in 2014, while consumer price index had its own break point in 2000.

The descriptive analysis conducted on the variables indicated that exchange rate has the average value of 115.0494, gross domestic product has the average value of 11.12563, consumer price index was 19.58532, the money supply has the average value of 12.21445 and the monetary policy rate has the average value of 13.75714. the median and maximum values of EXR was 120.5782 and 358.8108 with the minimum value of 1.754523, the GDP has the median and maximum values of 11.02082 and 11.73773 with the minimum value of 10.44330, CPI has the median and maximum values of 12.55496 and 72.83550 with the minimum value of 5.388008, money supply's median and maximum values were 12.24699 and 13.58689 with the minimum value of 10.37301, while monetary policy rate has the median and maximum values of 13.50000 and 26.00000 with the minimum value of 6.000000. The standard deviation reveals that EXR has the value of 99.78363, GDP has the value of 0.436613 SD, CPI has the standard deviation value of 17.80517, M2

has the deviation of 1.034331 and the MPR has the standard deviation value of 3.779534, indicating that exchange rate the highest deviation of its mean, followed by consumer price index, monetary policy rate, money supply, and gross domestic product. The skewness statistic showed that exchange rate was positively skewed with the value of 0.761910, GDP was positively skewed with the value of 0.078543, CPI was positively skewed with the value of 1.697801, M2 was negatively skewed with the value of -0.271343, while MPR was positively skewed with the value of 0.738400. The Kurtosis statistic reveals that EXR, GDP and M2 have the values below 3 and the two remaining variables (CPI and MPR) are more 3. Based on the rule of thumb, when the values are more than 3, it is referred as leptokurtic and if otherwise platykurtic. That is, EXR, GDP and M2 are platykurtic while CPI and MPR are leptokurtic during the study period.

The analysis revealed there is a significant positive relationship between exchange rate and gross domestic product, the connection between exchange rate and consumer price index revealed a negative connection exists between EXR and CPI significantly. Exchange rate and money supply has the covariance value of 89.58070, correlation value of 0.893480, t-statistic value of 11.42867 and the probability of 0.0000, meaning that exchange rate and money supply has strong connection. While the connection between exchange rate and monetary policy rate showed the covariance value of -88.77154, correlation value of -0.242307, t-statistic value of -1.434700 with the probability of 0.1608, implying that exchange rate and MPR are negatively connected.

The regression analysis revealed that, at constant, exchange rate has a value coefficient of -1603.556, t-statistic value of -3.707492 with the probability value of 0.0008, representing that exchange rate will be negatively significant when the control variables are held constant. The GDP has a coefficient value of 79.29499 with t-stat value of 1.397181 and p-value of 0.1726, representing that GDP was positively insignificant to influence the exchange rate movement. Hence, consumer price index has the coefficient value of -0.040631, the t-statistic value of -0.078892 with p-value of 0.9376, representing that CPI was negatively insignificant to influence exchange rate variation. Money supply, during the period has the coefficient value of 62.52657 with the t-statistic value of 2.966510 and p-value of 0.0059, representing that money supply was positively significant to influence

exchange rate variation. The monetary policy rate has the coefficient value of 5.340303, the t-statistic value of 2.076384 and p-value 0.0465, representing that MPR was positively significant to influence exchange rate variation during the study period. The report of the R-square and its adjusted showed 82% and 80% respectively while the F-statistic and its p-values revealed 35.31827 and 0.000000, representing that the control variables can predict the dependent variable.

Clustering volatility graph was examined to measure whether the variable moves in a clustering direction. The report of the above graph had indicated that the variable moves in a clustering direction from the low volatility to high volatility between 1986 and 2020. The heteroscedasticity ARCH affect presented that the variables has ARCH affect since the probability of the Chi-square is less than 5% alpha level. However, null hypothesis is stated as, there is no ARCH affect and since the p-value has predicted less than 5%, this implies that there is ARCH affect.

The report showed that $RESID(-1)^2$ which is also known as the ARCH effect has the coefficient value of 0.686699, std error value of 0.385844, t-statistic value of 1.779731 with the p-value of 0.00551, representing that exchange rate has ARCH effect, that is exchange rate is volatile since the p-value is less than 5% significant level. The GARCH(-1) being internal cause of the volatility of exchange rate has the coefficient value of 0.405101, with the p-value of 0.0499, representing that exchange rate during the period has GARCH affect. Meanwhile, the external variables employed that could cause volatility on exchange rate, reveal that GDP has the coefficient value of -11.79861, t-stat value of -0.009775 with 0.9922, representing that GDP was insignificantly negative to cause the volatility in exchange rate. Money supply shows the value of the coefficient of -5.196718, t-stat value of -0.210602 with p-value of 0.83322, indicating that money supply does not cause the volatility of exchange rate. The consumer price index has the value of -2.286019, t-stat value of -0.027966 with p-value of 0.9777, representing that consumer price index does not cause the fluctuations of exchange rate. Monetary policy rate revealed a value of -18.78499, with t-stat value of -0.175362 and p-value of 0.8608, representing the MPR was insignificantly negative to influence the uncertainty of the exchange value during study period.

The causality test reported that GDP and exchange rate does not cause each other in any way, consumer price index has no causality with exchange rate though

exchange rate could granger cause consumer price index, and money supply and exchange rate do not cause one another. More so, the causality from monetary policy rate to exchange rate revealed that no causality exists between monetary policy rate and exchange rate during the study period.

B. Conclusion

The overall price and quantity of every market are affected by exchange value uncertainty, but degree of effectiveness and repercussions are dependent on current economic situation. However, this study had examined the factors affecting the volatility of the Nigerian exchange rate between 1986 and 2020. Several estimation techniques were employed ranging from the unit root testing for stationarity, descriptive analysis, regression analysis, covariance and correlation, ARCH model to granger causality analysis.

It was concluded that GDP was positively insignificant to influence the exchange rate movement, consumer price index was negatively insignificant to influence exchange rate variation, money supply was positively significant to influence exchange rate variation, and monetary policy rate was positively significant to influence exchange rate variation during study period.

It was concluded that exchange value moves in a clustering direction from the low volatility to high volatility between 1986 and 2020 and that there exist ARCH affect.

More so, it was concluded that exchange rate volatility was caused by the internal factors and not the external factors. Meanwhile, the external variables employed that could cause volatility on exchange rate reveal that GDP was insignificantly negative to cause the volatility in exchange rate, money supply does not cause the volatility of exchange rate, consumer price index does not cause volatility of the exchange value, and monetary policy rate was insignificantly negative to influence the fluctuation of exchange value during study period.

Additionally, GDP and exchange rate has no uni or bi-directional connection, consumer price index has no causality with exchange rate though exchange rate could granger cause consumer price index, and money supply and exchange rate do not cause one another, and no causality relationship exists between monetary policy

rate and exchange value during study period.

C. Recommendations

This is recommended that the policy makers and the regulators should be proactive to the sensitive movement of exchange rate and employed appropriate regime to curb its volatility. Since the volatility of exchange value is mostly caused by internal factors, the regulatory authorities should implement policy that will suppress the internal factors. The external factors in one way or the other could affect exchange rate volatility, particularly the macroeconomic factors should be kept under watch and introduce measures will cushion the volatility of exchange rate.

D. Suggestion for Further Research

There are several factors that could affect exchange rate uncertainty both internally and externally. This study had measured the volatility using some of the key external macroeconomic variables. However, further researchers in this area should investigate the own internal factors affecting exchange rate volatility in a comparative perspective. Hence, further researchers should include balance of trade – import and export measurement in the model formation to examine whether there is a balance in the trading system of the chosen country or countries.

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APPENDIX

Appendix 1: Analysis



Appendix 1: Analysis

ADF Unit Root Testing

MPR @Level

Null Hypothesis: MPR has a unit root

	t-Statistic	Prob.*
ADF test Stat	-3.252693	0.0254
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MPR(-1)	-0.481580	0.148056	-3.252693	0.0027
C	6.731755	2.113366	3.185324	0.0032
R-squared	0.248474	Mean dependent var		0.102941
Adjusted R-squared	0.224988	S.D. dependent var		3.706116

M2 @Level

Null Hypothesis: M2 has a unit root

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-1.965426	0.2999
Test critical values:		
1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.019229	0.009784	-1.965426	0.0587
D(M2(-1))	0.382442	0.161705	2.365057	0.0247
C	0.293143	0.126166	2.323466	0.0271
R-squared	0.324099	Mean dependent var		0.094729
Adjusted R-squared	0.279039	S.D. dependent var		0.060294
F-statistic	7.192611	Durbin-Watson stat		1.810955
Prob(F-statistic)	0.002807			

M2@First Difference

Null Hypothesis: D(M2) has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=8)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.201478	0.0289
Test critical values:		
1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Sample (adjusted): 1988 2020

Included observations: 33 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-0.507757	0.158601	-3.201478	0.0032
C	0.047456	0.017854	2.658043	0.0123
R-squared	0.248475	Mean dependent var		-0.001307
Adjusted R-squared	0.224232	S.D. dependent var		0.060750
F-statistic	10.24946	Durbin-Watson stat		1.804597
Prob(F-statistic)	0.003153			

GDP @Level

Null Hypothesis: GDP has a unit root

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-0.176228	0.9323
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.005295	0.030048	-0.176228	0.8612
C	0.085216	0.334104	0.255058	0.8003

GDP @First Difference

Null Hypothesis: D(GDP) has a unit root

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.626987	0.0008
Test critical values:		
	1% level	-3.646342
	5% level	-2.954021
	10% level	-2.615817

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-0.816601	0.176487	-4.626987	0.0001
C	0.022630	0.013846	1.634403	0.1123

R-squared 0.408499 Mean dependent var 4.84E-05
 Null Hypothesis: D(EXR) has a unit root

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-3.944028	0.0047
Test critical values:		
1% level	3.646342	
5% level	2.954021	
10% level	2.615817	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.7367600	0.1868043	-3.944028	0.0004
C	8.3170493	8.534172	1.58357	0.0388

R-squared 0.334126 Mean dependent var 1.503889
 Adjusted R-squared 0.312646 S.D. dependent var 23.86685
 F-statistic 15.55536 Durbin-Watson statistic 1.790438
 Prob(F-statistic) 0.000427

Adjusted R-squared	0.389418	S.D. dependent var	0.095260
F-statistic	21.40901	Durbin-Watson stat	2.045160
Prob(F-statistic)	0.000062		

EXR @Level

Null Hypothesis: EXR has a unit root

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	1.722831	0.9995
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	0.063038	0.036590	1.722831	0.0946
C	3.701095	5.148113	0.718923	0.4774
R-squared	0.084881	Mean dependent var		10.50166
Adjusted R-squared	0.056284	S.D. dependent var		19.83649
F-statistic	2.968146	Durbin-Watson stat		1.627794
Prob(F-statistic)	0.094572			

EXR @First Difference

CPI @Level

Null Hypothesis: CPI has a unit root

Exogenous: Constant

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.507131	0.0014
Test critical values:		
1% level	-3.699871	
5% level	-2.976263	
10% level	-2.627420	

*MacKinnon (1996) one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI(-1)	-0.477540	0.105952	-4.507131	0.0003
D(CPI(-1))	-0.031123	0.144536	-0.215330	0.8319
D(CPI(-2))	0.225301	0.136776	1.647224	0.1169
D(CPI(-3))	0.219892	0.121156	1.814946	0.0862
D(CPI(-4))	-0.047117	0.109647	-0.429713	0.6725
D(CPI(-5))	-0.259972	0.109261	-2.379370	0.0286
D(CPI(-6))	0.171446	0.089176	1.922549	0.0705
D(CPI(-7))	0.193692	0.096344	2.010430	0.0596
C	6.401742	2.358396	2.714447	0.0142
R-squared	0.791772	Mean dependent var		-1.533787
Adjusted R-squared	0.699226	S.D. dependent var		10.68468
F-statistic	8.555452	Durbin-Watson stat		1.970205
Prob(F-statistic)	0.000087			

Philip Peron Unit Root Testing

MPR @Level

Null Hypothesis: MPR has a unit root

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.312927	0.0221
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	10.01883
HAC corrected variance (Bartlett kernel)	10.75942

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MPR(-1)	-0.481580	0.148056	-3.252693	0.0027
C	6.731755	2.113366	3.185324	0.0032
R-squared	0.248474	Mean dependent var		0.102941
Adjusted R-squared	0.224988	S.D. dependent var		3.706116
F-statistic	10.58001	Durbin-Watson stat		2.155342
Prob(F-statistic)	0.002696			

M2 @Level

Null Hypothesis: M2 has a unit root

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-2.400567	0.1491
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002829
HAC corrected variance (Bartlett kernel)	0.003375

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2(-1)	-0.024219	0.009342	-2.592395	0.0142
C	0.389374	0.114124	3.411860	0.0018
R-squared	0.173565	Mean dependent var		0.094526
Adjusted R-squared	0.147739	S.D. dependent var		0.059385
F-statistic	6.720514	Durbin-Watson stat		1.199838
Prob(F-statistic)	0.014247			

M2@First Difference

Null Hypothesis: D(M2) has a unit root

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.044469	0.0411
Test critical values:		
1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.002689
HAC corrected variance (Bartlett kernel)	0.002243

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-0.507757	0.158601	-3.201478	0.0032
C	0.047456	0.017854	2.658043	0.0123
R-squared	0.248475	Mean dependent var		-0.001307
Adjusted R-squared	0.224232	S.D. dependent var		0.060750
F-statistic	10.24946	Durbin-Watson stat		1.804597
Prob(F-statistic)	0.003153			

GDP @ Level

Null Hypothesis: GDP has a unit root

Exogenous: Constant

Bandwidth: 1 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-0.246279	0.9227
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.005280
HAC corrected variance (Bartlett kernel)	0.006260

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP(-1)	-0.005295	0.030048	-0.176228	0.8612
C	0.085216	0.334104	0.255058	0.8003
R-squared	0.000970	Mean dependent var		0.026381
Adjusted R-squared	-0.030250	S.D. dependent var		0.073794
F-statistic	0.031056	Durbin-Watson stat		1.608936
Prob(F-statistic)	0.861226			

GDP @First Difference

Null Hypothesis: D(GDP) has a unit root

Exogenous: Constant

Bandwidth: 3 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-4.623294	0.0008
Test critical values:		
1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.005205
HAC corrected variance (Bartlett kernel)	0.005167

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	-0.816601	0.176487	-4.626987	0.0001
C	0.022630	0.013846	1.634403	0.1123

EXR @Level

Null Hypothesis: EXR has a unit root

Exogenous: Constant

Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	1.919713	0.9997
Test critical values:		
1% level	-3.639407	
5% level	-2.951125	
10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	349.4959
HAC corrected variance (Bartlett kernel)	306.3530

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	0.063038	0.036590	1.722831	0.0946
C	3.701095	5.148113	0.718923	0.4774
R-squared	0.084881	Mean dependent var		10.50166
Adjusted R-squared	0.056284	S.D. dependent var		19.83649
F-statistic	2.968146	Durbin-Watson stat		1.627794
Prob(F-statistic)	0.094572			

EXR @First Difference

Null Hypothesis: D(EXR) has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.891102	0.0054
Test critical values:	1% level	-3.646342	
	5% level	-2.954021	
	10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	367.8057
HAC corrected variance (Bartlett kernel)	348.6424

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.736760	0.186804	-3.944028	0.0004
C	8.317049	3.853417	2.158357	0.0388

CPI @ Level

Null Hypothesis: CPI has a unit root

Exogenous: Constant

Bandwidth: 2 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-2.865484	0.0600
Test critical values:	1% level	-3.639407	
	5% level	-2.951125	
	10% level	-2.614300	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	189.3605
HAC corrected variance (Bartlett kernel)	208.9733

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI(-1)	-0.379625	0.136719	-2.776682	0.0091
C	7.773036	3.629087	2.141871	0.0399
R-squared	0.194157	Mean dependent var		0.295172
Adjusted R-squared	0.168974	S.D. dependent var		15.55973
F-statistic	7.709963	Durbin-Watson stat		1.585493
Prob(F-statistic)	0.009103			

CPI @ First Difference

Null Hypothesis: D(CPI) has a unit root

Exogenous: Constant

Bandwidth: 20 (Newey-West automatic) using Bartlett kernel

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-7.040653	0.0000
Test critical values:		
1% level	-3.646342	
5% level	-2.954021	
10% level	-2.615817	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	239.5699
HAC corrected variance (Bartlett kernel)	34.75448

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(CPI(-1))	-0.916971	0.178853	-5.126960	0.0000
C	0.120942	2.780110	0.043503	0.9656

Unit Root Break Testing

MPR

Break Date: 2004

Break Selection: Minimize Dickey-Fuller t-statistic

Lag Length: 0 (Automatic - based on Schwarz information criterion, maxlag=8)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.465420	0.0474
Test critical values:		
1% level	-4.949133	
5% level	-4.443649	
10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MPR(-1)	0.269808	0.163521	1.649986	0.1094
C	11.80538	2.679145	4.406397	0.0001
INCPTBREAK	-3.456284	1.253113	-2.758158	0.0098
BREAKDUM	2.603785	3.151634	0.826170	0.4152

M2

Break Date: 2012

Break Selection: Minimize Dickey-Fuller t-statistic

Lag Length: 2 (Automatic - based on Schwarz information criterion,
maxlag=8)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.094578	< 0.01
Test critical values:		
1% level	-4.949133	
5% level	-4.443649	
10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(M2(-1))	-0.284758	0.252181	-1.129180	0.2695
D(M2(-1), 2)	0.605653	0.200558	3.019847	0.0058
D(M2(-2), 2)	0.415186	0.178283	2.328807	0.0282
C	0.149588	0.030814	4.854490	0.0001
INCPTBREAK	-0.091636	0.024924	-3.676666	0.0011
BREAKDUM	0.049160	0.049392	0.995305	0.3291
Prob(F-statistic)	0.000915			

GDP

Break Date: 2014

Break Selection: Minimize Dickey-Fuller t-statistic

Lag Length: 0 (Automatic - based on Schwarz information criterion,
maxlag=8)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.828693	0.0163
Test critical values:		
1% level	-4.949133	
5% level	-4.443649	
10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GDP(-1))	0.122971	0.181629	0.677048	0.5037
C	0.033529	0.015942	2.103121	0.0442
INCPTBREAK	-0.049392	0.034654	-1.425318	0.1647
BREAKDUM	0.041240	0.081026	0.508964	0.6146

EXR

Break Date: 2014

Break Selection: Minimize Dickey-Fuller t-statistic

Lag Length: 1 (Automatic - based on Schwarz information criterion,
maxlag=8)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-5.356400	< 0.01
Test critical values:		
1% level	-4.949133	
5% level	-4.443649	
10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Included observations: 32 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.250144	0.233393	-1.071772	0.2933
D(EXR(-1), 2)	0.338573	0.180356	1.877247	0.0713
C	7.628074	3.736397	2.041559	0.0511
INCPTBREAK	31.92771	8.985658	3.553186	0.0014
BREAKDUM	-37.06660	19.42386	-1.908302	0.0670

CPI

Break Date: 2000

Break Selection: Minimize Dickey-Fuller t-statistic

Lag Length: 5 (Automatic - based on Schwarz information criterion,
maxlag=8)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-6.725601	< 0.01
Test critical values:		
1% level	-4.949133	
5% level	-4.443649	
10% level	-4.193627	

*Vogelsang (1993) asymptotic one-sided p-values.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CPI(-1)	-1.696898	0.400990	-4.231772	0.0004
D(CPI(-1))	1.790813	0.279519	6.406768	0.0000
D(CPI(-2))	1.435535	0.293780	4.886423	0.0001
D(CPI(-3))	1.136647	0.226550	5.017191	0.0001
D(CPI(-4))	0.395943	0.145328	2.724476	0.0131
D(CPI(-5))	0.021681	0.102014	0.212528	0.8338
C	105.1182	15.85074	6.631756	0.0000
INCPTBREAK	-72.82794	11.20286	-6.500837	0.0000
BREAKDUM	30.29763	10.52817	2.877769	0.0093

Descriptive Analysis

	EXR	GDP	CPI	M2	MPR
Mean	115.0494	11.12563	19.58532	12.21445	13.75714
Median	120.5782	11.02082	12.55496	12.24699	13.50000
Maximum	358.8108	11.73773	72.83550	13.58689	26.00000
Minimum	1.754523	10.44330	5.388008	10.37301	6.000000
Std. Dev.	99.78363	0.436613	17.80517	1.034331	3.779534
Skewness	0.761910	0.078543	1.697801	-0.271343	0.738400
Kurtosis	2.857484	1.334184	4.540513	1.771281	5.045795
Jarque-Bera Probability	3.415908 0.181236	4.082775 0.129848	20.27564 0.000040	2.631209 0.268312	9.284064 0.009638
Sum	4026.730	389.3969	685.4862	427.5057	481.5000
Sum Sq. Dev.	338530.3	6.481462	10778.81	36.37457	485.6857
Observations	35	35	35	35	35

Covariance and Correlation Tests

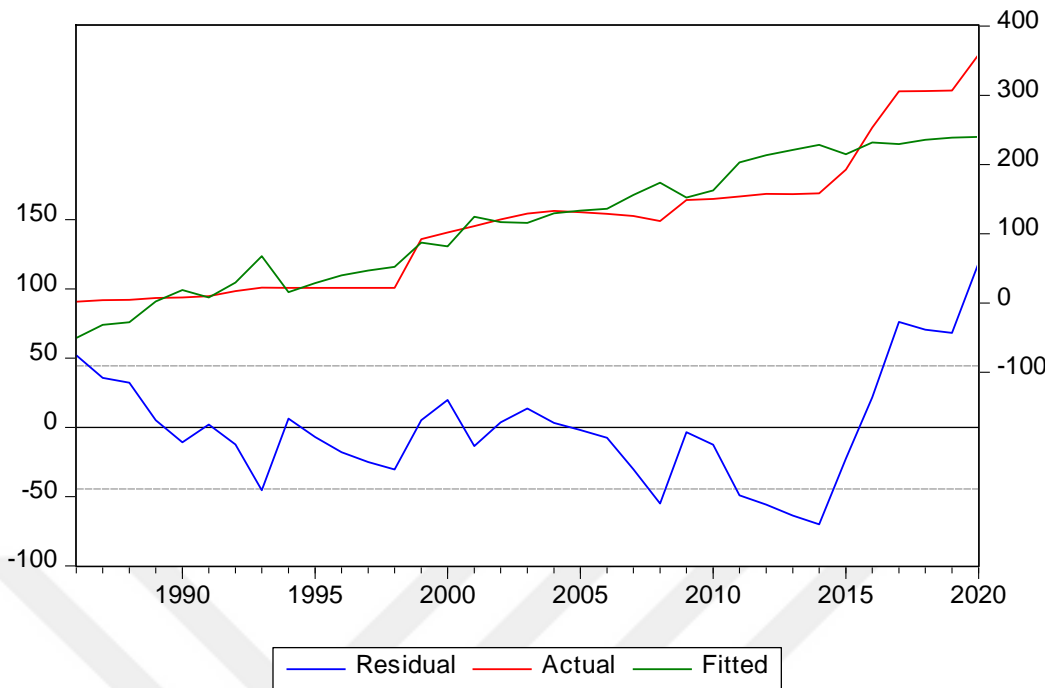
Covariance Correlation t-Statistic Probability	EXR	GDP	CPI	M2	MPR
EXR	9672.294 1.000000 ----- -----				
GDP	35.60153 0.841204 8.936923 0.0000	0.185185 1.000000 ----- -----			
CPI	-688.5225 -0.398935 -2.499191 0.0176	-4.020637 -0.532403 -3.613064 0.0010	307.9661 1.000000 ----- -----		
M2	89.58070 0.893480 11.42867 0.0000	0.406245 0.926020 14.09259 0.0000	-7.816049 -0.436889 -2.790096 0.0087	1.039273 1.000000 ----- -----	
MPR	-88.77154 -0.242307 -1.434700 0.1608	-0.870202 -0.542843 -3.713105 0.0008	24.62736 0.376724 2.336232 0.0257	-1.485356 -0.391131 -2.441367 0.0202	13.87673 1.000000 ----- -----

Regression Analysis

Dependent Variable: EXR

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1603.556	432.5177	-3.707492	0.0008
GDP	79.29499	56.75354	1.397181	0.1726
CPI	-0.040631	0.515020	-0.078892	0.9376
M2	62.52657	21.07749	2.966510	0.0059
MPR	5.340303	2.571925	2.076384	0.0465
R-squared	0.824841	Mean dependent var		115.0494
Adjusted R-squared	0.801487	S.D. dependent var		99.78363
F-statistic	35.31827	Durbin-Watson stat		0.405783
Prob(F-statistic)	0.000000			

Clustering Volatility



ARCH Effect

Heteroskedasticity Test: ARCH

F-statistic	17.62508	Prob. F(1,32)	0.0002
Obs*R-squared	12.07560	Prob. Chi-Square(1)	0.0005

Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	402.5705	494.1104	0.814738	0.4212
RESID^2(-1)	0.949108	0.226074	4.198223	0.0002

R-squared	0.355165	Mean dependent var	1664.438
Adjusted R-squared	0.335014	S.D. dependent var	2804.230
F-statistic	17.62508	Durbin-Watson stat	1.639162
Prob(F-statistic)	0.000200		

ARCH Analysis

Dependent Variable: EXR

Method: ML ARCH - Student's t distribution (BFGS / Marquardt steps)

Date: 12/28/21 Time: 07:23

Sample: 1986 2020

Included observations: 35

GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1) + C(5)*GDP + C(6)
*M2 + C(7)*CPI + C(8)*MPR

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	131.1507	5.448947	24.06901	0.0000

Variance Equation

	Coefficient	Std. Error	z-Statistic	Prob.
C	423.3903	15463.02	0.027381	0.9782
RESID(-1)^2	0.686699	0.385844	1.779731	0.0551
GARCH(-1)	0.405101	0.206577	1.961019	0.0499
GDP	-11.79861	1206.958	-0.009775	0.9922
M2	-5.196718	24.67553	-0.210602	0.8332
CPI	-2.286019	81.74221	-0.027966	0.9777
MPR	-18.78499	107.1214	-0.175362	0.8608

R-squared	-0.026804	Mean dependent var	115.0494
Adjusted R-squared	-0.026804	S.D. dependent var	99.78363
Durbin-Watson stat	0.048143		

Granger Causality Test

Pairwise Tests

Sample: 1986 2020

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP **** EXR EXR **** GDP	33	0.77565 0.96339	0.4700 0.3939
CPI **** EXR EXR **** CPI	33	0.71160 2.08170	0.4995 0.0436
M2 **** EXR EXR **** M2	33	0.81219 0.04242	0.4541 0.9585
MPR **** EXR EXR **** MPR	33	0.02637 0.76823	0.9740 0.4734
CPI **** GDP GDP **** CPI	33	0.63121 3.75193	0.5393 0.0360
M2 **** GDP	33	3.01954	0.0649

GDP **** M2		0.59091	0.5606
MPR **** GDP GDP **** MPR	33	0.09674 1.37343	0.9081 0.2698
M2 **** CPI CPI **** M2	33	4.56957 1.94362	0.0192 0.1620
MPR **** CPI CPI **** MPR	33	4.15354 1.76876	0.0263 0.1891
MPR **** M2 M2 **** MPR	33	0.09885 1.76524	0.9062 0.1897

**** does not Granger

APPENDICES

Computed Relative PPP exchange rate with Percentage Overvaluation and Undervaluation between 2001 to 2020

Period	Exchange Rates	RPPP	Overvaluation/Undervaluation (%)
Jan 2011	151.55	165.78	9.39
Feb 2011	151.94	167.13	10.00
Mar 2011	152.51	165.32	8.40
Apr 2011	153.97	167.51	8.79
May 2011	154.80	166.10	7.30
Jun 2011	154.50	167.93	8.69
Jul 2011	151.86	164.45	8.29
Aug 2011	152.72	160.31	4.97
Sep 2011	155.26	160.86	3.61
Oct 2011	153.26	164.93	7.62
Nov 2011	155.77	163.65	5.06
Dec 2011	158.21	166.54	5.26
Jan 2012	158.39	169.46	6.99
Feb 2012	157.87	173.32	9.79
Mar 2012	157.59	171.67	8.94
Apr 2012	157.33	172.11	9.40
May 2012	157.28	173.57	10.36
Jun 2012	157.44	174.27	10.69
Jul 2012	157.43	174.83	11.05
Aug 2012	157.38	175.11	11.27
Sep 2012	157.34	172.85	9.86
Oct 2012	157.32	171.63	9.09
Nov 2012	157.31	172.00	9.34
Dec 2012	157.32	173.63	10.37
Jan 2013	157.30	173.15	10.08
Feb 2013	157.30	168.81	7.32
Mar 2013	157.31	168.97	7.41
Apr 2013	157.31	168.35	7.02

May 2013	157.30	169.74	7.91
Jun 2013	157.31	169.10	7.49
Jul 2013	157.32	167.51	6.48
Aug 2013	157.31	167.69	6.60
Sep 2013	157.32	167.71	6.61
Oct 2013	157.42	167.84	6.62
Nov 2013	157.27	168.09	6.88
Dec 2013	157.27	167.67	6.61
Jan 2014	157.29	167.27	6.35
Feb 2014	157.31	167.20	6.28
Mar 2014	157.30	167.55	6.51
Apr 2014	157.29	167.02	6.18
May 2014	157.29	166.39	5.79
Jun 2014	157.29	166.28	5.72
Jul 2014	157.29	166.68	5.97
Aug 2014	157.29	166.99	6.17
Sep 2014	157.30	167.86	6.71
Oct 2014	157.31	167.60	6.54
Nov 2014	160.00	167.21	4.50
Dec 2014	169.68	170.43	0.44
Jan 2015	169.68	181.84	7.17
Feb 2015	194.48	183.69	-5.55
Mar 2015	197.07	210.79	6.96
Apr 2015	197.00	213.97	8.61
May 2015	197.00	214.48	8.87
Jun 2015	196.92	214.82	9.09
Jul 2015	196.97	214.71	9.01
Aug 2015	197.00	214.76	9.02
Sep 2015	197.00	214.97	9.12
Oct 2015	196.99	215.58	9.44
Nov 2015	196.99	214.94	9.11
Dec 2015	196.99	214.37	8.82
Jan 2016	197.00	214.25	8.75
Feb 2016	197.00	213.02	8.13
Mar 2016	197.00	217.21	10.26
Apr 2016	197.00	220.29	11.82
May 2016	197.00	221.54	12.46
Jun 2016	231.76	225.39	-2.75
Jul 2016	294.57	267.29	-9.26
Aug 2016	309.73	342.19	10.48
Sep 2016	305.23	360.44	18.09
Oct 2016	305.21	354.53	16.16
Nov 2016	305.18	355.34	16.44
Dec 2016	305.22	355.55	16.49
Jan 2017	305.20	354.48	16.14
Feb 2017	305.31	353.50	15.78
Mar 2017	306.40	350.02	14.23
Apr 2017	306.05	350.93	14.66

Source: CBN statistical Bulletin (2021)

Period	Nominal Rates		RPPP	Overvaluation/Undervaluation (%)	
	BDC	I & E		BDC	I & E
*May 2017	384.48	381.86	433.75	12.81	13.59
June 2017.	366.25	370.46	435.77	18.98	17.63
July 2017.	365.38	364.75	423.20	15.82	16.03
August 2017	365.57	362.73	416.10	13.82	14.72
Sept 2017	365.55	359.99	412.80	12.92	14.67
Oct 2017.	362.21	360.43	408.39	12.75	13.31
November 207	362.41	360.30	409.40	12.97	13.63
December 2017	362.83	360.68	408.60	12.61	13.29
January 2018	363.20	360.53	407.53	12.20	13.03
Febry 2018.	362.48	360.36	406.65	12.19	12.85
March 2018	362.07	360.21	403.09	11.33	11.90
April 2018	362.25	360.27	398.84	10.10	10.71
May. 2018	362.86	361.19	395.50	9.00	9.50
June 2018	360.66	361.06	392.13	8.73	8.61
July 2018	359.36	361.81	390.40	8.64	7.90
August 2018	359.00	362.39	390.60	8.80	7.78
Sept 2018.	359.25	364.22	392.49	9.25	7.76
Oct 2018.	360.81	363.98	396.29	9.83	8.88
Nov 2018.	362.82	363.91	394.99	8.87	8.54
December 2018.	363.46	364.76	396.34	9.05	8.66
January 2019.	360.94	363.76	398.87	10.51	9.65
Feb 2019.	359.76	361.94	398.95	10.89	10.22
Mar. 2019	359.24	360.49	396.83	10.46	10.08
Apr. 2019	359.00	360.44	393.71	9.67	9.23
May 2019	359.75	360.70	393.57	9.40	9.11
Jun. 2019	359.94	360.63	394.74	9.67	9.46
Jul 2019	359.43	361.26	394.58	9.78	9.22
Aug 2019	359.00	363.00	394.16	9.79	8.59
Sep 2019	359.00	362.27	396.05	10.32	9.33
Oct 2019	359.00	362.35	396.22	10.37	9.35
Nov 2019	359.00	362.66	397.40	10.70	9.58
Dec 2019	360.25	363.57	397.49	10.34	9.33
Jan 2020	361.00	363.20	398.02	10.25	9.59
Feb 2020	359.00	364.79	397.37	10.69	8.93
Mar 2020	376.89	373.04	399.97	6.12	7.22
Apr 2020	420.15	384.99	412.41	-1.84	7.12

May 2020	443.89	386.24	431.09	-2.88	11.61
Jun 2020	447.71	386.39	433.64	-3.14	12.23
Jul 2020	464.71	387.48	432.13	-7.01	11.52
Aug 2020	473.48	386.26	432.89	-8.57	12.07
Sep 2020	453.68	386.01	431.67	-4.85	11.83
Oct 2020	459.50	385.90	432.99	-5.77	12.20
Nov 2020	472.74	386.91	435.67	-7.84	12.60
Dec 2020	471.62	394.92	439.35	-6.84	11.25

Source: CBN statistical Bulletin (2021)



RESUME

Name Surname:

Education:

2001-2007 Anadolu University-English Language and Teaching Department

2012-2018 İstanbul Aydın University-Doctorate, English Language and Literature Department

Work Experience:

2005-2007 Polat Renaissance Hotel Erzurum-General Manager Asisstant

2009-2013-Bayburt University-Faculty of Education-Lecturer

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Languages:

-Turkish: Native Language

-English: Advanced

-German: Intermediate

Skills:

-Communication, Teamwork, Problem Solving, Flexibility, Creativity

- Computer skills (Microsoft Office) and others