Modelling the Effect of Macro-economic Variables on Pension Contribution in Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In recent years, the performance of pension contribution funds administrators in Nigeria has been rated as unsatisfactory, negatively impacting the ambitions of retirees. The broad view is that changes in a few macroeconomic variables, such as the foreign exchange rate, annual inflation rate, savings deposit rate, and GDP (income), must have played a role in this issue. As a result, the purpose of this study is to look at the impact of these variables on the pension contribution funds. The research was conducted in Nigeria, and annual data sets on pension contributions and other macroeconomic factors were acquired for the years 2004 through 2020.
The long and short run dynamics of some macroeconomic variables and pension contribution were analyzed using the Auto-regressive Distributed Lag method. The analysis demonstrates a positive and significant association between exchange rate and pension contributions in both the long and short run. Similarly, inflation rate demonstrates a negative and statistically significant link with pension contributions in both the long and short run. The results also show that the Error Correction Model (ECM) coefficient has the correct sign: negative, less than one, and statistically significant which means that, the system will correct itself at a rate of 38 percent from the short to the long run. The study concludes that there should be concerted efforts by the government to curve the excessive inflation rate down, deposit rate should be monitored and always relate it to pensioners fund in order to maintain its financial sustainability.

Keywords: Inflation rate; exchange rate; deposit rate; GDP; pension contributions.

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1. INTRODUCTION

Pension is a payout made to retired personnel after they have been released from active duty to help them maintain their lifestyle. Employees receive their monthly emolument for services done at the conclusion of each month while on the job. Pension is a mechanism that ensures that when an employee retires, he or she will be able to maintain a steady source of income. Pensions have traditionally been paid through a Defined Benefit (DB) pension plan. Financial sustainability and pension fund performance are important variables of providing a safe and reliable pension for retirees since it is the criterion that translates into revenue estimates and measures the success of pension funds [1]. However, because of the many dimensions the idea takes when evaluated from both short- and long-term perspectives, there has been little understanding of the importance of macroeconomic variables on pension contributions. As a result, the financial viability of pension payments is a crucial requirement for future pension provision to be adequate and effective. However, macroeconomic variables including inflation, exchange rate, deposit rate, and Gross Domestic Product (GDP) appear to have a major impact on the units used to measure pension contributions in Nigeria. For example, the rate of inflation appears to skew the size, age, and net income of pension plans, lowering their financial sustainability and performance [2].

However, in order to ensure the future of retirees, it is critical to assess the impact of macroeconomic factors on the Nigerian pension contributions fund, because the financial sustainability of the pension contributions fund is what will ensure that employees' future lives after retirement are secure. As a result, if future retirees are to be protected, the effect of inflation must be taken into account while assessing the financial viability of the pension contributions fund. This is to ensure fair value of the true position of their financial sustainability of their funds. Therefore, the questions begging for answer is will inflation, exchange rate or devaluation of naira, deposit rate and GDP not erode the value of the pension contributions? There is also growing pressure on the government to explore raising the retirement age, decreasing benefits, and hiking contribution rates in order to make the Nigerian pension system more feasible and sustainable. Each of the three decisions, however, has unintended repercussions. In recent times, the performance of the pension contribution funds administrators in Nigeria is being recorded as suboptimal and this has adversely affected the aspirations of the pensioners. The general consensus is that the changes in some selected macroeconomic variables namely foreign exchange rate, annual inflation rate, savings deposit rate and GDP (income) must have contributed to this problem.

Scholars such as Christen [3] Woller and Schreiner [4] and Karam et al. [5] used big and well-developed pension funds in several nations to determine the factors affecting financial sustainability of pension fund managers. Their conclusions were limited by a lack of inclusion of the incidence of inflation rate impacts in their research, as well as a small sample size. In Nigeria for instance, the study of Ije, [6] Arun [7] Gbitse [8] Sulaiman [9] Farayibi [10], Zubair and Mathew [11] failed to captured the aspect of macro-economic variables on pension contributions fund thereby leaving a gap to be filled. The study therefore sets out to investigate the effect of these variables on the pension contribution fundsAs a result, the goal of this study is to look into the effect of macroeconomic variables on pension contributions in Nigeria utilizing the Autoregressive Distributed Lag (ARDL) technique to cointegration to fill in the gaps in the literature. This is owing to the fact that the approach produces consistent and dependable results regardless of the order in which the components are combined.

2. LITERATURE REVIEW

This section contains an empirical review of prior studies that have looked into the topic. For instance, the study of Karam et al. [12] Beredugo [13] Ahmed, Abayomi and Nureni [14] Farayibi [15 Zubair Agbata, Ekwueme and Jeroh [16] Ameh, Ajie and Duhu [17] Ojiya, Ajie, and Isiwu [18] Mathew [19] Nwawolo and Nwogwugwu [19] Saheed [20] and Uwakwe and Louis [21] are some of the reviews done in this study. The goal is to incorporate their viewpoint while also connecting it to the current research. Karam et al. [22] examined the macroeconomic effects of three public pension reforms which include; an increase in retirement age, a reduction in benefits and an increase in contribution rates. A five-region form of the IMF's Global Integrated Monetary and Fiscal Model was used to assess the study (GIMF). They discovered that public pension reforms can promote economy in the short and long run by increasing consumption

and pushing out higher investment through reducing government debt. They also discovered that a reform action undertaken in collaboration by all areas resulted in higher output, indicating more capital accumulation due to increased global savings. A rise in the retirement age has the most impact in the short term, due to the demand effects of higher labor income, and in the long run, due to supply effects.

Beredugo [23] conducted research on pension fund accounting and the well-being of retirees, as well as their long-term viability and life expectancy. The study used a judgemental sampling technique and a sample of 400 retirees from the states of Oyo, Rivers, and Kano. The Ordinary Least Square (OLS) method was employed for the hypotheses tests, and it was found that pension fund accounting has a major impact on pensioners' well-being, and that pensioners' long-term viability is based on collective bargaining between pensioners and their administrators.

In Nigeria, Christian and Wobiaraeri [24] looked into the connection between pension fund administration and infrastructure financing. A correlation research design was adopted in this study. The study's 108 participants were chosen using a basic random sampling method. The data was analyzed using descriptive statistics, and the hypotheses were tested using the Pearson correlation coefficient. They discovered that the factors under investigation have a substantial link. Zubair also looked into the impact of pension fund investments on the Nigerian capital market. The study employed time series analysis and the Autoregressive Integrated Moving Average (ARIMA) regression technique to look at data from 2009Q3 to 2016Q1. According to the findings, there is a considerable positive association between pension fund investments and capital market performance in Nigeria following the major industry reform in 2004.

Farayibi [25] investigated Nigeria's funded pension program and economic growth. The data set was analyzed using error correcting mechanisms (ECM) and Ordinary Least Square (OLS) methodologies. According to the study, pension fund contributions from both the private and public sectors in Nigeria expanded significantly, resulting in a large investment fund in the capital and money markets. Using primary sources of information and personal interviews, Ahmed et al. [26] investigated some of the

justifications for the contributory pension scheme as part of its values and determined their implications for public officials' productivity and retirees' wellbeing in Lagos State. The studies' findings revealed that there is a correlation between a strong retirement package and employee productivity, as well as a favorable impact on the efficiency of the firm. Agbata et al. [27] studied how the administration of the Pension Scheme could be perked up in Nigeria. Multiple Regression Analysis models was used. The findings showed that despite the provisions of the Act (the Pension Reform Act - PRA), intents for committing Pension Fraud have not reduced to a significant extent .

The impact of Nigeria's contributory pension policy on economic growth was investigated by Ameh et al. [28] The data was analyzed using the Statistical Package for Social Sciences (SPSS). According to the data, pension fund assets and pension contribution/savings mobilized over time have a positive but minor impact on economic growth. Ojiya et al. [29] evaluated the impact of a contributing pension program on Nigerian economic growth. According to the study, pension fund assets and pension contribution/savings mobilized over time have a positive but minor impact on economic growth. This means that the authorities in issue were unable to use the pension fund's assets and savings to help Nigeria's economy thrive.

Mathew [11] analyzed the effect of funded pension on the economic growth in Nigeria. Due to data availability, the study used secondary data on the gross domestic product and pension funds from both the public and private sectors for a ten-year period. The data was also analyzed using ordinary least square. According to the report, there is empirical evidence that the implementation of the new pension fund has a considerable favorable impact on Nigeria's economic growth. Nwawolo and Nwogwugwu [30] examines the contributors' involvement in pension fund investments decision making and retirees standard of living in University of Lagos, Nigeria. The study used a convergent parallel research design with a sample size of 100 respondents drawn using Yaro Yamane's [31] formula and a population of non-academic personnel at the University of Lagos. The data was also analyzed using descriptive and inferential statistics (linear regression). The study discovered that contributors' investing decisions on pension funds had a positive significant impact on retirees' standard of living.

Saheed explored the determinants of defined benefits pension fund performance in Nigeria using correlational research design. The VCE Robust Regression Technique was used for the analysis. The study discovered that the number of pensioners on the payroll and the quantity of pensions paid had a positive and substantial impact on defined benefit pension fund performance in Nigeria, whereas GDP had a negative and significant impact. Uwakwe and Louis using an ex-post facto study approach, researchers investigated the effects of the post-2014 Pension Reform Act on Nigerian economic growth in order to determine the implications of post-2014 Retirement Savings Account (RSA) portfolio performance. For the years 2011 through 2019, secondary data was gathered quarterly from the National Pension Commission. Ordinary Least Squares was used to estimate the hypotheses, as described in the study's model specification. Retirement savings account portfolio performance, closed pension fund administrators' portfolio performance, and contributory pension scheme portfolio performance all have a positive and significant impact on Nigeria's economic growth, according to the study. This means that the Nigerian pension business makes a major contribution to the country's economic growth.

3. THEORETICAL REVIEW

This study examines a variety of ideas, all of which, strangely, tend to explain the study's topic. Stakeholder theory, fund theory, financial intermediation theory, and immunisation theory are some examples of such theories.

3.1 The Stakeholder Theory

Edward Freeman proposed this theory in 1984. Stakeholders are individuals and groups who gain from or are hurt by an organization's decisions and activities. They include shareholders and other financers of the business, suppliers and creditors, the workers, consumers and the community [32]. The stakeholder theory's primary notion is that an organization should be viewed as a collection of stakeholders with the goal of managing their demands and interests. The pensioners and contributors to retirement savings accounts are the key stakeholders in the case of a Pension Fund Administrator.

3.2 The Fund Theory

In his 1947 book "The Fund Theory of Accounting and Its Implications for Financial Reports," economist William Joseph Vatter created fund accounting theory for the first time. Fund theory, according to the Dictionary of Accounting Terms, is a system used by government agencies as well as non-profit organizations like charities and hospitals. The fund contains a set of assets that are subject to restrictions since they are designated for specified uses. Each fund has its assets restricted for concrete purposes and liabilities determine restrictions against those assets [32].

3.3 The Theory of Financial Intermediation

The current theory of financial intermediation is based on the idea that intermediaries minimize transaction costs and informational asymmetry. Financial intermediation theory will come to the conclusion that intermediation is useless as improvements in information technology, deregulation, and the depth of financial markets, among other things, tend to minimize transaction costs and informational asymmetries. This is in contrast to the notion of financial intermediation as a value-creating economic process held by practitioners. It also contradicts the financial intermediaries' continuous and growing economic relevance. We argue that current financial intermediation theory fails to provide an acceptable explanation for the presence of financial intermediaries as a result of this dilemma. Bert and Dick [12] propose the foundations for a financial intermediation theory that tries to comprehend and explain the presence and behavior of real-world financial intermediaries. When information asymmetries aren't the driving force behind intermediation, and eliminating them isn't a business motivation for financial intermediaries, the question becomes which paradigm, as a substitute, could better reflect the essence of the intermediation process. The concept of value creation in the framework of the value chain, in our opinion, could be useful for this. This wealth creation, in our perspective, is driven by risk and risk management. The central role of both banking and insurance is risk absorption. Because savers are on average more risk averse than real investors, the risk function bridges a gap between the supply of savings and the demand for investments. The financial industry's fundamental business is risk, which includes maturity risk, counterparty risk, market risk (interest rates and stock prices), life expectancy, income expectancy risk, and so on. Financial intermediaries can absorb risk at the market's

scale because their size allows for a sufficiently diverse portfolio of investments to provide the security that depositors and policyholders want. Agents who examine and monitor on behalf of savers are not financial middlemen. They are active counterparts themselves offering a specific product that cannot be offered by individual investors to savers, namely cover for risk.

3.4 Theory of Immunization

The term "immunisation" is used by Redington to describe the investment of assets in such a way that the present firm will be immune to a general change in the rate of interest [22]. According to Tijjani [23] adherents of this theory Lucas and Zeldes [24] think that a pension fund should have enough assets to sustain obligations in such a way that financial factors that affect the value of liabilities influence the assets in an identical manner. According to this approach, finances should be "immunized" against loss. This simply implies that the liabilities are backed up in such a way that the fund is protected in the event of a loss.

4. METHODOLOGY

The longitudinal technique was used in this study since there was enough data for analysis on one hand, and given the time series data, the important variables over the years 2004-2020 on the other. The information was gathered mostly from secondary sources and was comprised of pension contributions funds generated during the time period under consideration (2004 – 2020), inflation rate, exchange rate, deposit rate and GDP which were collected from the National Pension Commission (PENCOM), National Bureau of Statistics, World Bank, and other relevant sources. Descriptive and Inferential statistics would be tested in section four of this paper in order to summarize the characteristics of data set and to ascertain whether the data is generalizable to the broader population.

4.1 Model Specification

Functionally, the model to this is specified thus;

PCT=f(INF+EXR+DPR+GDP+ e)

In econometric terms, the model is specified as;

$PCT = \beta_0 + \beta_1 INF_{it} + \beta_2 EXR_{it} + \beta_3 DPR_{it} + GDP_{it} + e$

Where;
PCT= pension contribution funds as provided by PENCOM.
INF = inflation rates as provided by Nigeria Bureau of Statistics
EXR=exchange rate as provided by CBN
DPR=deposit rate as provided by CBN, and
GDP= gross domestic product
e= error term

4.2 Data Presentation and Analysis

Table 1 shows the descriptive features of the variables estimated in the model. It indicated that the means of all the variables are positive, meaning that it will bring more of increase than decrease in the changes in all of the variables. The standard deviation of pension contributions is higher among the variables, while GDP is having lower which suggest that the degree of variability of pension contributions is higher than that of the inflation rate, exchange rate, deposit rate and GDP, which means that the dispersion of the data point of GDP is closer to its mean.

However, the returns of the pension contributions, inflation rate , deposit rate and GDP are negatively skewed which suggests that the majority of the distribution is concentrated to the right, meaning to say that the low values in the distribution are relatively few, whereas the returns of the exchange rate is positively skewed which suggests that the majority of the distribution will be to the left, and the high values in this distribution are relatively few. The pension contributions have a higher excess kurtosis than inflation rate, exchange rate, deposit interest rate and GDP, which suggests that more of the pension contributions variance might be as a result of infrequent high deviations. The Jarque-Bera suggests the pension contributions departure from normality is high and that the variable is not normally distributed.

Pre-estimation tests were conducted using Augmented Dickey-Fuller and Phillips-Perron testing methodologies to determine if the variables are stationary or not, and the results are reported in Table 2. After first difference (I(1)), the ADF test revealed that the inflation rate, deposit rate, and GDP are stationary. As a result of the P-P test, the inflation rate, deposit rate, and GDP are all stationary after the first difference, however the pension contribution is stable at the level value. We may extrapolate from the data that the series have distinct integration

orders, with some being stationary at the level value and others being stationary after the first difference. This also demonstrates that the ARDL strategy is the optimum method for dealing with results of this nature. The researchers also used a bound test to see if there was any cointegration between the variables. The outcome of the bound test is displayed in Table 3.

Table 1. Summary Statistics of Variables under Study

	LPCT	LINF	LEXR	LDPR	LGDP
Mean	5.581501	2.420140	5.186322	2.151178	31.66431
Median	6.135045	2.449372	5.058229	2.160749	31.72443
Maximum	6.811343	2.882759	5.729314	2.589329	31.90899
Minimum	2.747271	1.684176	4.775475	1.548626	31.22645
Std. Dev.	1.146751	0.306518	0.354299	0.305827	0.236306
Skewness	-1.247526	-0.611684	0.645623	-0.449408	-0.577446
Kurtosis	3.526826	3.103672	1.808209	2.214902	1.883596
Jarque-Bera	4.606169	1.067724	2.187110	1.008843	1.827595
Probability	0.099950	0.586336	0.335023	0.603855	0.400999
Sum	94.88552	41.14238	88.16748	36.57002	538.2933
Sum Sq. Dev.	21.04060	1.503255	2.008445	1.496478	0.893450
Observations	17	17	17	17	17

Source: Author's computations using Eviews 9.

Table 2. Unit Root Tests (Augmented Dickey-Fuller and Phillips-Perron)

Variables	Augmented Dickey-Fuller		Phillips-Perron	
	Level	1st Diff.	Level	1st Diff.
LPCT	-3.778093**	-2.874227	-1.367457*	-6.345414
LINF	--2.809484	-3.674328***	-3.210963	-3.867247**
LDPR	-2.809743	-4.118191**	-2.719853	-8.523906*
LGDP	0.792766	-3.846440**	0.355052	-2.297618**

Source: Author's computations using Eviews 9.)
*Note: *, ** and *** indicates significant at 1%, 5% and 10% respectively (the coefficients without asterisks signified evidence of non-stationary)*

Table 3. ARDL Bounds Test

Test Statistics		
F-statistics	5.78	
Critical Value Bounds		
Significance Level	I(0)	I(1)
10%	2.2	3.09
5%	2.56	3.49
1%	3.29	4.37

Source: Author's computations using Eviews 9.

Table 4. Long Run Coefficients of the ARDL

Dependent Variable: Pension Contributions			
Variables	Coefficient	Std. Error	t-Statistics	Prob.
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LINF	-1.378123	0.546349	-2.522421	0.0397
LEXR	3.320959	1.488988	2.230347	0.0609
LDPR	-1.507185	0.685610	-2.198311	0.0639
LGDP	-0.907354	2.468518	-0.367570	0.7241
C	23.429216	73.479264	0.318855	0.7591

Source: Author's computations using Eviews 9.

Table 3 shows that there is a long term association between pension contributions, inflation rate, and other factors at a 5% level of significance (deposit rate and GDP). This is due to the fact that the F-statistic (5.78) is higher than the lower and upper critical value boundaries of 5% and 10%, respectively. As a result, the null hypothesis of no long-term link (cointegration) is ruled out. The alternative hypothesis of the presence of a long-term connection, on the other hand, can be accepted. Because of the long-run link, the study was able to create both long-run and short-run associations between the variables. Table 4 summarizes and tabulates the results of long run relationships.

Table 4 illustrates that the association between inflation and pension contributions is negative and statistically significant. In the long run, an increase in the rate of inflation reduces the value of pension payments. This means that a 1% increase in inflation in Nigeria will result in a 1.37 decline in pension contribution money. Furthermore, there is a positive and statistically significant association between exchange rate and pension contributions in Nigeria, implying that an increase in the exchange rate will result in an increase in pension contributions over time. In the long run, a 1% increase in the exchange rate will result in a 3.3 increase in pension contributions. This rule of ARDL outcomes is consistent with the findings of Sani and Idris [25] and Idris and Sani [26].

In the case of deposit rate, there is negative but statistically significant relationship between deposit rate and pension contributions. This means that an increase in deposit rate will lead to significant decrease in pension contributions in the long run, meaning to say that a 1% increase in deposit rate will lead to 1.5% decrease in pension contributions in the long run. Moreover, GDP has negative but statistically significant relationship with pension contributions. This means that an increase in GDP will lead to significant decrease in pension contributions in

the long run, this means that a 1% increase in GDP will lead to 0,9% decrease in pension contributions in the long run. This rule of ARDL results is in line with the findings of Sani and Idris [25] and Idris and Sani [26].

In the short run, the link between inflation and pension contributions is negative and statistically insignificant, as shown in Table 5. This indicates that an increase in inflation in Nigeria will result in a short-term loss in pension contributions funds, e.g., a 1% increase in inflation will result in a 0.24 percent decrease in pension contributions funds. Furthermore, the exchange rate and the pension contributions fund have a positive and statistically significant link. This illustrates that in the short run, an increase in the exchange rate will result in an increase in pension contributions in Nigeria, i.e., a 1% increase in the interest rate will result in a 1.3 percent increase in the pension contributions fund. Furthermore, in the short run, there is a negative but statistically significant association between deposit rate and pension contributions.

This illustrates that in the short run, an increase in the inflation rate will result in a considerable fall in pension contributions in Nigeria, i.e., a 1% increase in the deposit rate will result in a 0.19 percent decrease in pension contributions in Nigeria. Finally, the GDP shows a statistically significant positive correlation with pension contributions. In the short run, a rise in GDP will result in a considerable increase in pension contributions; for example, a 1% increase in GDP will result in a 6% increase in pension contributions in the short run. The findings of Sani and Idris and Idris and Sani support this norm of ARDL outcomes [32].

The result reveals that the Error Correction Model (ECM) coefficient has the correct sign: negative, less than one, and statistically significant. This explains why, when the economy is distorted, the system will correct itself at a rate of 38 percent from the short to the long run.

Table 5. Short Run Coefficients of the ARDL

Dependent Variable: D (Pension Contributions)				
Variables	**Coefficient**	**Std. Error**	**t-Statistics**	**Prob.**
D(LINF)	-0.244962	0.070302	-3.484449	0.0102
D(LEXR)	1.359224	0.269892	5.036188	0.0015
D(LDPR)	-0.195520	0.074282	-2.632150	0.0338
D(LGDP)	6.488243	0.484948	13.379252	0.0000
ECM(-1)	-0.997315	0.227112	-4.391299	0.0004

Source: Author's computations using Eviews 9

Table 6. Post Estimation Tests

Tests	F-statistics	Prob.
Autocorrelation Test	7.429789	0.2318
Heteroscedasticity	0.402051	0.8874
Normality	1.2001	0.5487

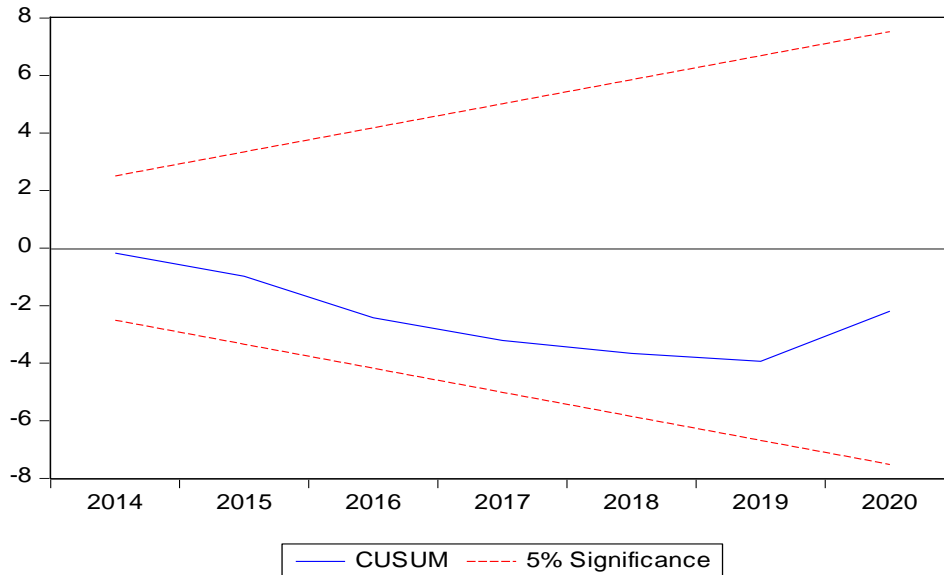*Source: Author's computations using Eviews 9.*
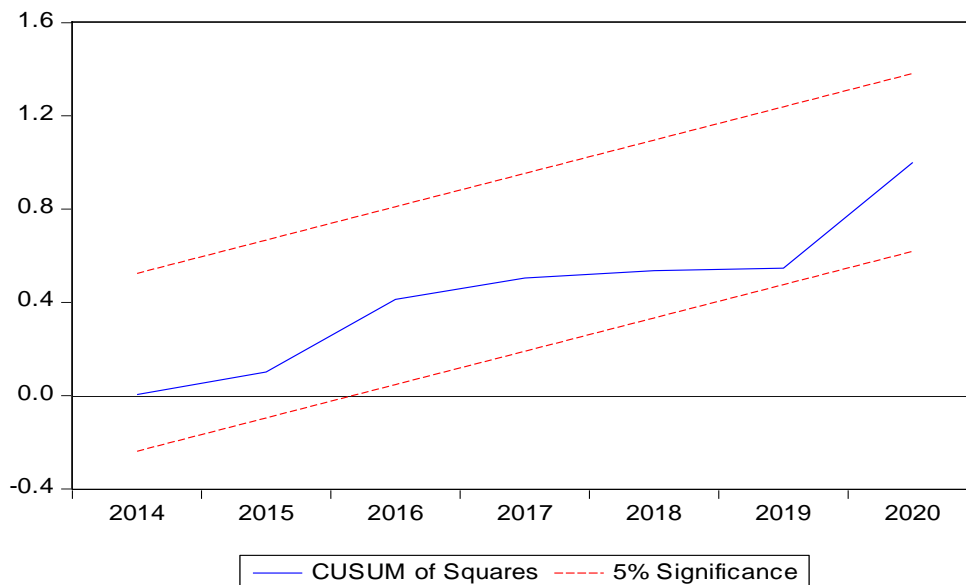

Fig. 1. Statbility model

Fig. 2. Recursive errors within the CUSUM

To determine the consistency of the results, post-estimation tests were conducted using three approaches: Breusch Godfrey Serial Correlation LM test, Breusch Pegan Godfrey Heteroscedasticity test, and Jarque Bera Normality test. The autocorrelation test result in Table 6 reveals that the series or model is devoid of serial correlation or autocorrelation issues. This is because, even at 10%, the p-value of f-statistics is not statistically significant. Similarly,

because the variables in the models are normally distributed, the normality test result suggests that the p-value of f-statistics is not statistically significant.

Stability tests using the cumulative sum of recursive residual and cumulative sum of square of recursive residual were also used to demonstrate the model's stability.

Because the recursive mistakes lie below the CUSUM test's 5 percent critical lines, the result of the test in Fig. 1 indicates that the model is stable.

The results of the test in Figure 2 show that the model is stable, as the recursive errors are within the CUSUM of Squares test's 5 percent critical lines.

5. CONCLUSION AND RECOMMENDA-TIONS

For a period of 17 years, this study evaluates the influence of macroeconomic variables on the Nigerian pension contributions fund. Pension contributions, inflation rate, exchange rate, deposit rate, and GDP were the variables of interest in the study that we utilized as a unit of measurement. The study's findings show that in the long run, inflation, deposit rate, and GDP have a negative and statistically insignificant link on pension contributions in Nigeria, however exchange rate has a positive and statistically significant association on pension contributions. Similarly, inflation and deposit rates have negative and significant relationship on pension contributions in the short run, while exchange rate and GDP have positive and significant relationship on pension contributions fund in the short run.

5.1 Recommendations

The following recommendations are made based on the findings of this study in the hopes that they would be considered by all stakeholders. There should be concerted efforts by the government to curve the excessive inflation rate down, deposit rate should be monitored and always relate it to pensioners fund in order to financially sustain the pension contributions fund.

In order to fulfill their duties under the Act, the Pension Funds Administrators (PFAs) should enhance their administration of contributions and invest in a way that ensures safe and acceptable returns on investment.

.However, the inflation rates which have cast worry on the financial sustainability and pension fund performance should be keenly watched by the management in order not to erode completely the gain made from trading activities.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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