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# Investigating The Relationship Between Taxation and Price Fluctuations In Nigeria

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**ABSTRACT:**
This study examined the relationship between taxation and price fluctuations in Nigeria using quarterly data from 2015 Q1 to 2021 Q4. The study used company income tax, petroleum profit tax, and value-added tax as independent variables, while the consumer price index was used to measure price fluctuation. The data analysis used the autoregressive distributed lag (ARDL) technique with structural breaks. It was found that there was a long-run relationship between taxation and consumer price index. In the long run, company income tax had a negative but insignificant impact on the consumer price index, while petroleum profit tax and value-added tax were found to have caused an upward trend in the consumer price index. Also, the dummy for the structural break was statistically significant, implying that the break period between 2012 and 2019 had a significant impact on price fluctuation, meaning that the state of the economy in these years triggered a considerable impact on price fluctuations in Nigeria. It was then concluded that taxation caused a significant impact on price fluctuation in Nigeria; that is, the higher the tax collected by the government, the greater the increase in price fluctuation. Hence, it was advocated that the tax authorities encourage businesses to pay taxes and reinvest the amount collected into productive sectors to increase domestic productivity towards effective price control.

**KEYWORDS:** *Tax, price fluctuations, consumer price index*

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## INTRODUCTION

Since the advent of civilization, governments have relied on taxes to generate the funds necessary to pay for their rising expenditure on infrastructure and social services and reduce income and wealth disparities. Additionally, taxes are employed to discourage the purchase of specific goods and manage inflation (Eze & Atagboro, 2020; Kamasa *et al.,*2022). Likewise, tax policies are intended to achieve the challenging balance between achieving the fewest possible disincentives to engage in productive activities and the greatest possible societal fairness, according to public sector economics (Dom *et al.,* 2022). The relationship between prospective modifications to the tax code and the macroeconomic space has long interested policymakers and researchers.

Accordingly, taxation is one of the tools that governments may employ to combat the severe consequences of inflation on the poor, particularly the impact of consumer prices. To control inflation and its unfavorable trends, the government might employ taxation as a fiscal instrument (Cebreiro-Gómez *et al.,* 2022; Chen *et al.,* 2020). In this regard, Vylkova (2019) showed that taxation is a potent tool for economic stabilization. However, the excessive burden of taxes on the producers is often shifted to the consumers, who then pay higher prices for goods and services. Thus, the macroeconomic target of price stabilization is undermined.

Along with simplicity and clarity, stability is one of the foundations that policymakers should consider while attempting to create and administer a fair and favorable tax system. These foundations comprise the three guiding principles that policymakers should consider when considering altering the tax system (Olaoye,

2016). They are also the three major metrics taxpayers can use to gauge how well the government is upholding and enhancing the system. Since taxes are largely seen as an inevitable part of life in any organised society, it has been claimed that only death and taxes are certainties. It can unnerve the public, igniting unrest and even revolution if a change is too severe, by revealing that such a fundamental structure as the tax system (the rates, the bases, and even the administration of taxes) is not, in reality, really "constant." Of course, most changes do not have an effect as profound. Taxes surely impact every person in a society just like the weather does.

Like other countries, Nigeria conducts its fiscal policy using a taxation-targeting structure (Rahman, 2022; Uremadu&Onyele, 2019). This is predicted by the notion that taxes and inflation have a steady and predictable connection. Two competing hypotheses are supported by empirical evidence in this area; some claim that taxes are effective in price stabilization (Adegbite, 2019; Gale & Samwick, 2017; Herbert *et al.,*2018). In contrast, other research found that taxes are ineffective in price stabilization (Alavuotunki *et al.,* 2019; Atan, 2013; Dabla-Norris & Lima, 2018; Dibia & Onwuchekwa, 2019; Ehrhart &Guerineau, 2012; Noord, 2005; Ogbonnay a& Nelson, 2018; Twarowska & Szołno-Koguc, 2014; Wang & Han, 2018).

This study's motivation is hinged on the discrepancies in the findings of prior studies, which are attributed to variations in the geographical scope, period covered, and methodological approach used. Regardless of which viewpoint is stronger, it is still evident that further research is required to move past their restrictions and methods. With the most recent data and the autoregressive distributed lag (ARDL) model with a structural break, this study's main objective is to empirically evaluate the effect of taxation on price fluctuation in Nigeria.

This study made some additions to the knowledge base. This study, which spans a considerable time between 2015Q1 and 2021Q4, is sufficient for time series analysis. Second, by employing more reliable methods incorporating structural breaks of the time series data, this study considers the influence of structural breaks that alter the quality of findings. Significant occurrences include the change in administration in 2015, the decline in oil prices in 2015 and the macroeconomic upheavals that followed, the economic slowdown in the second quarter of 2016 and the COVID-19 pandemic, as well as the enactment of the Finance Act 2020, which amended fourteen (14) primary taxes and laws related to taxes. This represents progress in this field of study because the bulk of earlier studies on Nigeria did not include it, which would have impacted the reliability of their conclusions in more recent years. Studies that used structural break analysis in a study of this kind are rare. This period's disparities may have impacted on the results of this research.

Although there are several studies conducted in Nigeria, the majority of them focused on the influence of value-added tax, while other types of taxes were not included in their studies (Adegbite, 2019; Afolayan *et al.,*2021; Atan, 2013; Eyisi *et al.,*2015; Eze & Atagboro, 2020; Olaoye, 2016; Olatunji, 2013; Ikpeh&Nteegah, 2013). Hence, this study examined the effects of other federally levied taxes, including the CIT, the PPT, and the VAT. The reason for this is that research by Ehiedu (2022), Ewa *et al.* (2020), and Babu *et al.* (2020) has demonstrated that the impact of taxing may vary depending on the type of tax. Although Adegbite (2019) used the expediency theory and the ARDL as an empirical estimation approach for this study, it deviates from it in that it considers structural breaks with quarterly data.

The findings offer analysts and academia an up-to-date understanding of the effect of taxation on price dynamics by addressing the methodological vacuum. By addressing the methodological issues that previous research disregarded, the findings might be more reliable, resulting in a more successful tax system in Nigeria. Clear effects of taxation can be determined when methodological and statistical techniques are used (Babu *et al.,*2020).

## LITERATURE REVIEW

### *The Nigerian Tax System*

The list of taxes the Nigerian government has approved is shown in the table. The three tiers of government are allowed to collect various taxes. According to the 1999 Constitution, people and organizations may be subject to government taxation (Oyedokun, 2020). The legislative branch or the parliament must authorize legislation for taxation to be effective (A.G. of Ogun State v. Aberuagba, 1985). The list of taxes and levies that the three levels of government may impose was authorized by the Federal Government. It aimed to avoid tax overlaps and disagreements across the three tiers of government.

Taxation must be supported by legislation passed. To be effective, legislation must be approved by parliament. As a result, the federal government has the authority to enact taxes. However, the three levels of government are responsible for their administration. The FIRS handles taxes payable to the Federal Government, while the different State Boards of Internal Revenue (SBIRS) and various local government councils correspondingly administer those to the state and local governments.

### *Stylized Facts*

The government has struggled to address Nigeria's continuously weak tax collection in the face of an economy ravaged by low revenue, debt, subpar infrastructure, and excessive inflation. The Nigeria

Extractive Industries Transparency Initiative (NEITI), which conducts annual audits of the oil industry, reiterates in another exposé that the nation loses billions of dollars to tax fraud (NEITI, 2020). The NEITI 2020 study indicated 77 businesses with a whopping $6.8 billion in tax debt. This is extremely troubling but not shocking, given that Nigeria suffers from both egregiously low tax collection and inefficiency on the part of its public servants.

Undoubtedly, the tax system is still archaic and unable to keep up with contemporary trends, which are best exemplified by the use of technology to identify revenue leaks and mobilise them in real-time. Defaulters get away with it because of how negligent the government is. The final component is corruption. Insignificant tax returns are the result.The tax-to-GDP ratio calculates a nation's tax revenue about the size of its economy, which, in this case, is measured by GDP. As the ratio climbs, a greater portion of the money goes into government coffers (Nwadialor & Agbo, 2020; Gasper *et al*., 2016). This can help an economy's long-term health and success if properly managed. According to the International Monetary Fund, a viable economy needs a tax-to-GDP ratio of at least 15% (World Bank, 2022). This indicates that without increasing tax collection, Nigerian economic progress is fiction.

**Table 1:** Trend tax-GDP and consumer price index

| Year | TAX revenue ₦' billion | Nominal GDP ₦' billion | Tax-to-GDP (%) | Tax revenue growth % | Consumer price index | CPI growth % |
|---|---|---|---|---|---|---|
| 2011 | 4628.48 | 58,180.35 | 7.96 | 6.41 | 120.73 | 11.80 |
| 2012 | 5007.65 | 60670.05 | 8.25 | 7.57 | 135.48 | 14.75 |
| 2013 | 4805.64 | 63942.85 | 7.52 | -4.20 | 146.99 | 11.50 |
| 2014 | 4714.56 | 67977.46 | 6.94 | -1.93 | 158.82 | 11.83 |
| 2015 | 3741.76 | 69780.69 | 5.36 | -26.00 | 173.12 | 14.31 |
| 2016 | 3307.46 | 68652.43 | 4.82 | -13.13 | 200.30 | 27.17 |
| 2017 | 4027.95 | 69205.69 | 5.82 | 17.89 | 233.35 | 33.05 |
| 2018 | 5320.89 | 70536.35 | 7.54 | 24.30 | 261.58 | 28.22 |
| 2019 | 5261.92 | 72094.09 | 7.30 | -1.12 | 291.39 | 29.81 |
| 2020 | 4952.22 | 70800.54 | 6.99 | -6.25 | 329.98 | 38.60 |
| 2021 | 6402.71 | 73382.77 | 8.73 | 22.65 | 385.93 | 55.94 |

**Source:** Federal Inland Revenue Services (FIRS) Tax Statistics Reportand Central Bank of Nigeria (CBN) Statistical Bulletin (2022)

Total collected taxes as a percentage of GDP had been low between 2011 and 2021, falling from 8.25% in 2012 to 4.82% in 2016. The 2016 economic downturn and the transition process 2015 may be related to this downward trend. Additionally, the tax-to-GDP ratio has increased since 2017 but is still below the 15% set by the World Bank (World Bank, 2022). Nigeria falls short of the 15% of GDP minimum taxation level specified by the World Bank, which is required for economic stabilization, even among its regional counterparts. From Figure 1, the tax-to-GDP ratio for some top African economies was largely higher than that of Nigeria in recent years. This suggests that Nigeria's tax-to-GDP ratio is among the lowest in Africa, much below the 15% threshold, while having the largest economy in the continent.

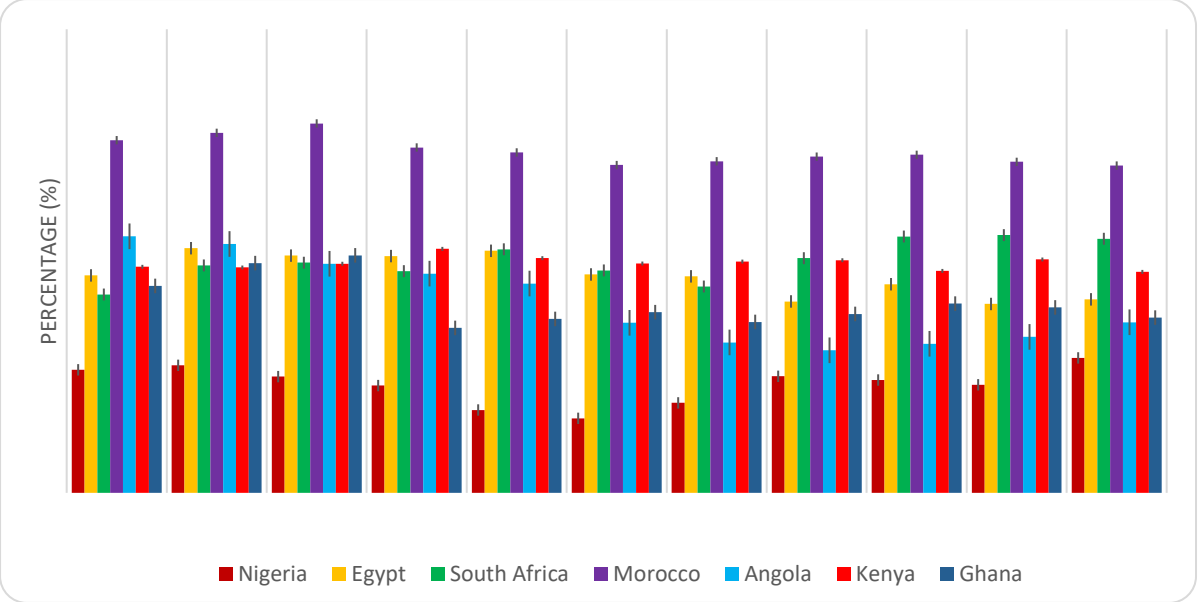



**Figure 1:** Tax-to-GDP ratio (%)
**Source:** Federal Inland Revenue Services (FIRS) Tax Statistics Report

Table 1 and Figure 1 highlight the low tax-to-GDP ratios, demonstrating Nigeria's below-average performance in terms of revenue collection. According to Nami (2022)**,** this might be about some of the ongoing challenges faced by the Nigerian tax system.

- The multiplicity of taxes refers to the payment of comparable taxes on an identical or nearly identical tax basis. Examples of various taxes include value-added tax, sales tax, and others dependent on income, such as company income tax and education tax (based on sales). This problem can be resolved by having a list of permissible taxes that are clearly defined and strictly followed by all levels of government.
- Poor tax administration: MDAs (Ministries, departments, and agencies) struggle to meet the constantly growing demands of individual taxpayers due to a lack of staff, resources, equipment, and tools. In actuality, low pay and lack of motivation can be connected to the pessimistic outlook of most tax collectors. Additionally, it has been highlighted that staff members don't receive frequent training that would consistently keep them up-to-date with tax-related changes. As a result, tax administration coverage and assessment are notably deficient (Edori *et al.,* 2017). By teaching both citizens and government employees about tax issues, this problem can be resolved. Education about taxes may encourage people to fulfill their obligations.
- Tax refunds: Even though the FIRS Establishment Act 2007 has specific procedures for tax refunds, these provisions have not yet been completely implemented. On both the federal and state levels, there should be enough money set aside from tax income received to issue refunds for justifiable overpayments of taxes. Tax authorities should also be more willing to do so. Subject to the required audit, tax authorities are required by the FIRS Act to reimburse a taxpayer's refund claim within 90 days of the application. Late refund payments should be penalized appropriately.
- Lagos State and the federal government disagreed over the state's VAT tax jurisdiction and the question of the proper tax authority to manage various taxes. A clear and suitable law needs to be passed to manage complex issues such as this.
- Inability to prioritize tax efforts: Due to its foundation in variables like population equality, IGR, education, land mass, and state equality, revenue allocation in Nigeria does not support tax efforts. This strategy inhibits proactive revenue generation. To urge the state to look within to enhance tax income, the share of IGR should be raised.

Maintaining the monetary, tax, and revenue policies without harming the market economy and its activities is referred to as being economically expressed (Onyele *et al.,* 2020). All macroeconomic indicators would agree with one another in such a situation. The Consumer Price Index (CPI) for Nigeria, a crucial macroeconomic indicator, has been rising quickly, from 120.26 index points in 2011 to 335.91 index points in 2021, according to the table. The yearly CPI increased between 6% and 13%, indicating macroeconomic instability. Food costs have been rising steadily for some time due to climate change, the COVID-19 epidemic, widespread insecurity, the Russian invasion of Ukraine, and the rise in petroleum products that power Nigeria's industrial sector. The devaluation of the currency has thrown Nigeria's import-dependent

economy one more blow. In just seven months in 2022, the value of the naira decreased by more than 30%, raising import costs and contributing to the economy's inflation (Obiezu, 2022).

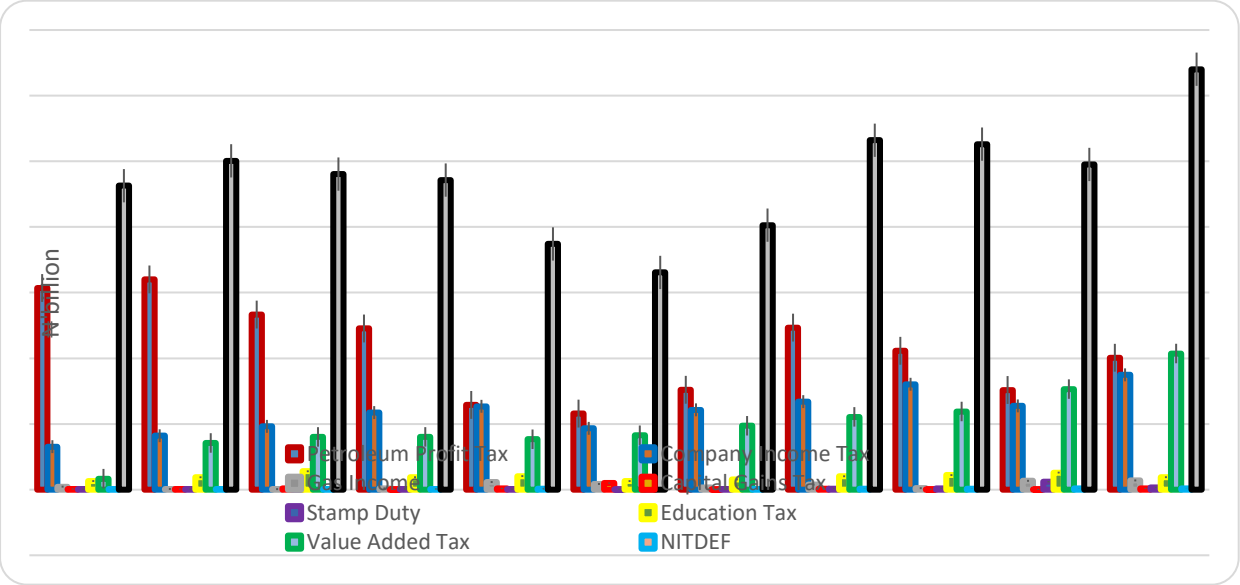
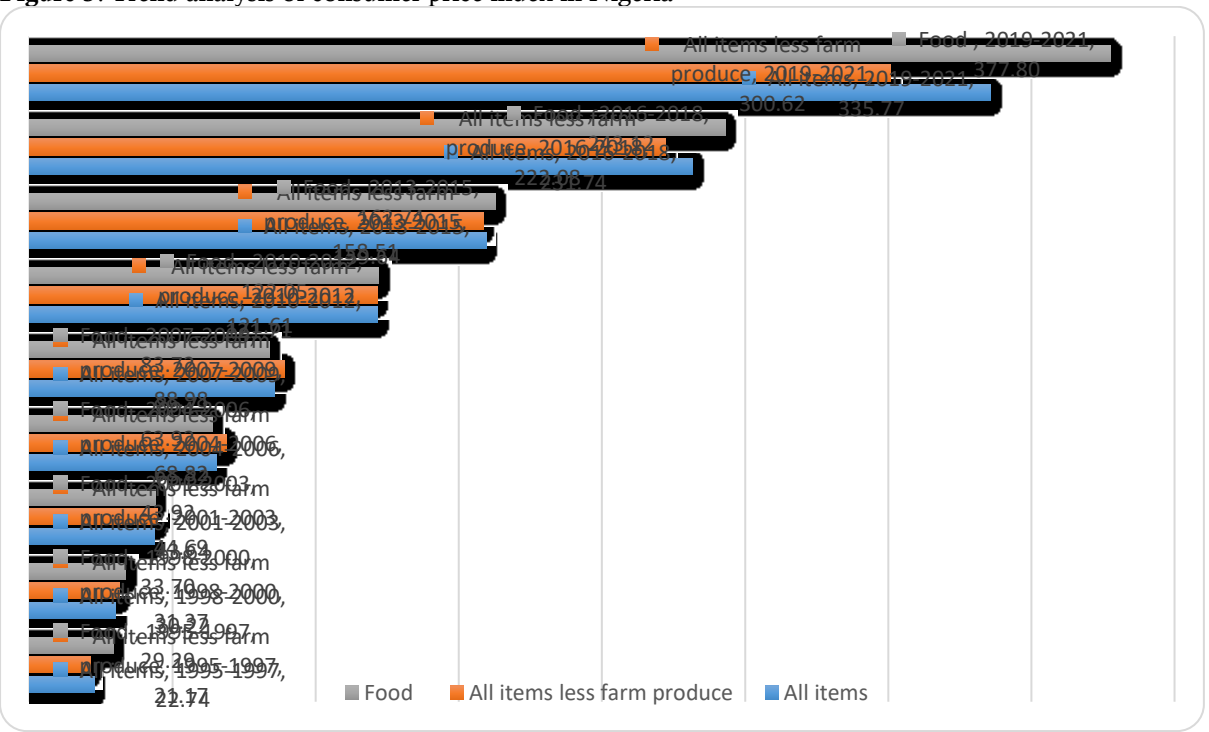



**Figure 2:** Trend analysis of disaggregated tax revenue in Nigeria
**Source:** Federal Inland Revenue Services (FIRS) Tax Statistics Report

The trend analysis for the disaggregated tax revenue presented in Figure 2 has produced particularly relevant information. It shows that while the Nigerian government collects various taxes, the total collectible taxes are dominated by three major types: CIT, PPT, and VAT. Thus, the reason behind the choice of variables used for the empirical analysis is explained.

**Figure 3**: Trend analysis of consumer price index in Nigeria




**Source:** CBN Statistical Bulletin (2022)

Figure3shows that the Nigerian CPI has been upward trending and that the incessant increases in food prices largely occasioned the rising CPI. There were sharp increases in the CPI in 2016 due to the economic recession experienced in that year. Also, there were significant increases in 2020 due to the COVID-19 pandemic and afterward. High rate of import prices, among other things, are also attributed to the rising CPI in Nigeria.

***Theoretical Underpinning***

The expediency principle, which states that any tax proposal must satisfy the practicality test, serves as the theoretical basis for this study. The outcomes of the state's taxation system, together with its national objectives, should be viewed as unimportant. (Bhartia, 2009). This claim is true since there is no use for a tax that cannot be efficiently assessed. Political, social, and economic spectrum groupings are strained. Governments frequently have to modify the tax system to consider these demands. Every group attempts to protect and advance its interests. Additionally, the administrative framework cannot be effective for tax collection at a fair cost of collection (Gale & Samwick, 2016; Mardiasmo, 2011).

The government has access to a potent set of policy tools in the form of taxes. These tools should be used wisely to address the economic and social problems that plague society, such as price instability, income inequality, regional differences, unemployment, cyclical swings, etc. Governments may introduce tariffs, which impose additional taxes on imported goods, or subsidies, which increase prices and improve the appeal of indigenous goods by taxing the general public and transferring the money to industry. Upward review of taxes may be detrimental to some industries or businesses. When they do, business profits may fall, which could push up the cost of products and services generally.

The benefit principle hypothesis is another theory that describes the dynamics and effects of taxation. Wicksell and Lindahl (1958) first developed the benefit approach to assess the efficiency of taxes and fiscal policy. Just income distribution was the cornerstone of Wicksell's nearly widely embraced interpretation of the concept. This argument suggests that the state should tax people for the benefits they enjoy. The more benefits a person receives from government acts, the more they should contribute to the government.

Also, taxation has been explained within the premises of the ability to pay theory. MS Kendrick introduced the ability to pay theory in 1939. The approach takes taxation as it is—a requirement to pay money to the government without expecting anything in return (Fleming *et al.,* 2001). It makes no assumptions about a formal or informal business connection between the government and its people. This theory holds that a citizen must pay taxes simply because they are due, and their relative tax burden would be decided by their respective ability to pay. This doctrine has been in use for approximately the same amount of time as the benefits theory. Socialist philosophers were forced to support this theory since it upholds the ideals of justice and equity. This theory's core tenet is that the tax burden should be dispersed among society's members following their respective financial capacity to uphold justice and equity (Mehrotra, 2006).

It is clear from the aforementioned empirical investigations that the results on the connection between taxes and price stability are diverse, contradictory, and inconclusive. Studies have also shown that specific tax elements, such as PIT, excise duty, CIT, and PIT, have a noticeable impact on prices. Time scope, economic constraints, and measurement limitations limit the conclusions of prior studies. This study aims to bridge the knowledge gaps left by the Nigerian studies, which were largely outdated and did not address structural break, converted taxation and consumer prices into stock variables, and did not address these issues. As a result, its findings will be more solid and reliable, adding to the corpus of information on the ongoing discussion of the impact of taxation on price levels.

## METHODOLOGY

Using quarterly data from 2011-Q1 to 2021-Q4, the study's main objective is to analyze how taxes affect price stabilisation in Nigeria. Herbert *et al.* (2018) showed that taxes and economic stability are related using an empirical model. However, this study's time series econometric model, which links prices and taxes, modifies Herbert *et al.* (2018) model by substituting GDP for CPI. Also, GDP per capita was introduced as a control variable in addition to the tax's components, which is an improvement over the Herbert *et al.* (2018) baseline model used for this investigation. The following describes the time series econometric model:

$$lnCPI_t = \beta_0 + \beta_1 lnCIT_t + \beta_2 lnPPT_t + \beta_3 lnVAT_t + \beta_4 lnGDPPC_t + \varepsilon_t \quad (1)$$

Where; "ε" is the error term, "t" is the time dimension, which is the quarterly data from 2011 to 2021, and "ln" is the natural logarithm.

The naturally logged consumer price index is abbreviated as lnCPI, the logged corporate income tax is abbreviated as lnCIT, the logged petroleum profit tax is abbreviated as lnPPT, and the recorded value-added tax is abbreviated as lnVAT (VAT). More specifically, the CPI represents the cost of a selection of products and services for consumers that households have purchased. The variables that explain the data are lnCIT, lnPPT, lnVAT, and lnGDPPC. The three components of taxes considered in the study are CIT (which is levied on a company's profit from all sources), PPT (which is levied on a company's income from upstream petroleum operations), and VAT (which is incrementally added to the cost of a good or service at every point in its creation, distribution, or sale to the general public). Since economically developed nations are thought to be more successful and efficient at raising taxes, the GDP per capita (a measure of economic development) is included (Mudenda, 2015).

The series' stability characteristics and the direction of the estimation procedure must first be defined using unit root analysis. It is important to remember whether the time series data are stationary at the level or the

first difference, determining which estimation approach to use. The unit root tests that Dickey and Fuller (1979) and Phillips and Perron (1988) suggested are the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP), respectively. Contrary to the null hypothesis in the ADF and PP unit root tests, the alternative hypothesis asserts that there are no unit roots.

The study used the test created by Bai and Perron (2003) to estimate structural breaks. When the series encounters structural break(s), the common unit root tests might lead to the mistaken acceptance of a unit root null hypothesis, as Perron (1989) shows. The COVID-19 epidemic and the tax revisions in 2020 are among the shocks that occurred during the study's sample period (2011-2021). Nigeria depends heavily on oil. Hence, fluctuations in the price of oil on the international market could cause gaps in the data series. These huge breaks are anticipated to have a big influence on Nigeria's macroeconomic situation. Using unit root tests with structural breakdowns is essential to determining the possibility of structural breaks among the series. More specifically, the employment of several break techniques is justified by the possibility that, in scenarios when the series includes numerous breaks, treating just one inherent break might be insufficient, leading to the loss of key information (Alutghe *et al.,* 2021; Aladejare, 2019).

The Bai and Perron method was applied to identify structural fractures. It constructed an equation with m breaks (m+1 regimes) and revised the basic Chow test. The model is shown in Equation 2.

$$Y_t = x_t^i\alpha + \varsigma_t^i\delta_j + \varepsilon_t \qquad (2)$$

where, $j = 1$, $Y_t$ represents the dependent variable observed at time t. $x_t$ and $\varsigma_t$, are $(p\ X\ 1)$ and $(q\ X\ 1)$ vectors of the explanatory variables; $\alpha\ and\ \delta_j$are vectors of coefficients associated with $x_t and \varsigma_t$, respectively. $\varepsilon_t$is the usual error term assumed to be independently and identically distributed with zero mean and constant variance.

The co-integration test was also carried out using Pesaran *et al.* (2001) autoregressive distributed lag (ARDL) model as a foundation. Compared to other co-integration strategies, the ARDL model has some advantages often discussed in the literature. First, a strictly integrated order of variables is unnecessary for the ARDL approach. Second, the model offers more accurate estimation results, particularly for the attributes of small samples. Third, the ARDL model is a useful tool since it considers the consequences of endogenous independent variables. The ARDL model can be stated as follows using the baseline model in Equation (3) as a starting point:

$$\begin{aligned}\Delta lnCPI_t = \sigma_0 &+ \sum_{i=0}^{p}\alpha_{1i}\Delta lnCPI_{t-i} + \sum_{i=0}^{p}\alpha_{2i}\Delta lnCIT_{t-i} + \sum_{i=0}^{p}\alpha_{3i}\Delta lnPPT_{t-i} + \sum_{i=0}^{p}\alpha_{4i}\Delta lnVAT_{t-i} \\ &+ \sum_{i=0}^{p}\alpha_{5i}\Delta lnGDPPC_{t-i} + \delta_1 lnCPI_{t-i} + \delta_2 lnCIT_{t-i} + \delta_3 lnPPT_{t-i} + \delta_4 lnVAT_{t-i} \\ &+ \delta_5 lnGDPPC_{t-i} + \mu_t \qquad (3)\end{aligned}$$

Where: CPI, CIT, PPT, VAT, and GDPPC remain as previously defined. Δ is the difference operator, and ε refers to the residual term. Similarly, $\alpha$ denotes the drift, $t-1$ denotes the lag lengths, $\alpha_1 - \alpha_5$are coefficients while $ln$is an expression denoting natural logarithms, and $\mu_t$is the stochastic term (error term).

Equation 3 was used as the starting point for the OLS technique before the bound test was used to understand the long-term equilibrium relationship between the many factors. The assumption that no co-integration exists between the variables—the null hypothesis—is tested. The other possibility is that the factors are long-term related. The following is a possible formulation of the null hypothesis, according to which there is no long-term link:

$$H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$$

In this case, the alternative hypothesis would be as follows:

$$H_1: \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq 0$$

where, $\alpha_1, \alpha_2, \alpha_3, \alpha_4 and \alpha_5$remain as defined earlier. Lastly, the ARDL methodology used AIC to choose the best model and the appropriate length for the lag level.

Since the study's goal is to comprehend the dynamics of taxation's short- and long-term effects on price variation in Nigeria, it is essential to specify the long- and short-run ARDL techniques. The long run of the model is thus represented by equation 4:

$$lnCPI_t = \alpha_0 + \sum_{i=1}^{v}\alpha_1 lnCPI_{t-i} + \sum_{i=0}^{v_1}\alpha_2 lnCIT_{t-i} + \sum_{i=0}^{v_2}\alpha_3 lnPPT_{t-i} + \sum_{i=0}^{v_3}\alpha_4 lnVAT_{t-i} + \sum_{i=0}^{v_5}\alpha_5 lnGDPPC_{t-i} + \mu_t \qquad (4)$$

To predict the model's short-run parameters when the long-run equilibrium occurs, the error correction model's (ECM) unrestricted ARDL is predicted, as shown in equation 5:

$$lnCPI_t = \alpha_0 + \sum_{i=1}^{v} \alpha_1 \Delta lnCPI_{t-i} + \sum_{i=0}^{v_1} \alpha_2 \Delta lnCIT_{t-i} + \sum_{i=0}^{v_2} \alpha_3 \Delta lnPPT_{t-i} + \sum_{i=0}^{v_3} \alpha_4 \Delta lnVAT_{t-i} + \sum_{i=0}^{v_5} \alpha_5 \Delta lnGDPPC_{t-i} + \theta ECM_{t-i} + \mu_t \quad (5)$$

Where θ is the system's adjustment rate, and ECM stands for the stochastic error term.

## EMPIRICAL ANALYSIS

### *Unit Root Tests for Stationarity of Data*

The unit root test must be run to ensure that no variable is integrated with an order larger than one. This is because the ARDL limits test only takes variables I(0) and I(1) into account; as a result, estimating variables beyond I(1) will produce an incorrect result. To account for any breaks in the time series data, the study used the ADF and PP tests and the Bai and Perron unit root tests for multiple breaks. Then, the structural break-controlled ARDL model uses a dummy variable as a regressor.

To confirm the validity of the results, the tests included an intercept, a trend, and an intercept for both the levels and the first difference of the variables. The ADF unit root test results at levels and first difference are shown in Tables 2 and 3.

**Table 2:**ADF unit root test results

| Variable | At Level: I(0) | | First Difference: I(1) | | Order |
|---|---|---|---|---|---|
| | t-Statistic | Prob. | t-Statistic | Prob. | of Integration |
| ln(CPI) | -3.929271 | 0.0203** | -- | -- | I(0) |
| ln(CIT) | -3.176225 | 0.1040 | -14.61128 | 0.0000*** | I(1) |
| ln(PPT) | -1.864840 | 0.6552 | -5.551488 | 0.0002*** | I(1) |
| ln(VAT) | -1.251832 | 0.8864 | -9.013874 | 0.0000*** | I(1) |
| ln(GDPPC) | -0.936164 | 0.3055 | -2.660086 | 0.0090*** | I(1) |

**Note:** (**) and (***) denote significance levels at 5% and 1% levels

**Table 3:** PP unit root test results

| Variable | At level: I(0) | | First difference: I(1) | | Order |
|---|---|---|---|---|---|
| | t-Statistic | Prob. | t-Statistic | Prob. | of Integration |
| ln(CPI) | -1.639138 | 0.7605 | -3.609450 | 0.0410** | I(1) |
| ln(CIT) | -10.50986 | 0.0000*** | -- | -- | I(0) |
| ln(PPT) | -2.012843 | 0.5779 | -5.573600 | 0.0002*** | I(1) |
| ln(VAT) | -1.021180 | 0.9302 | -8.976980 | 0.0000*** | I(1) |
| ln(GDPPC) | -2.209759 | 0.4723 | -2.525821 | 0.0128** | I(1) |

**Note:** (**) and (***) denote significance levels at 5% and 1% levels

Tables 2 and 3 display the results of the ADF and PP tests, demonstrating that the data are integrated at I(0) and I(1). Although ln(CIT), ln(PPT), ln(VAT), and ln(GDPPC) are found to be stationary after taking their first difference at 1% levels of significance, contrary to what is shown in Table 2. While ln(CPI) is stationary at the level, the other variables are not. Table 3 shows that whereas ln(CPI), ln(PPT), ln(VAT), and ln(GDPPC) all became stationary after the first difference, only ln(CIT) passed the stationarity test at the level. They are shown to be integrated at I(0) and I(1). Since none of the variables is integrated to order 2 (I(2)), the ARDL approach to co-integration can be used for the regression analysis. The ARDL co-integration method is better suited to evaluate the data than the Johansen co-integration methodology because the ADF and PP results combined I(0) and I(1).

### *Variance Inflation Factor (VIF)*

Also, as presented in Table 4, the test for multicollinearity was carried out to ensure that the independent variables were not highly correlated. This test was carried out using the variance inflation factor (VIF). VIF measures how much an explanatory variable's dynamics (variance) are inflated or influenced by its interaction with other explanatory variables. In general, if the VIF values fall between 5 and 10, it shows evidence of a high correlation. However, if the VIF is greater than 10, multicollinearity becomes a significant problem (Sheater, 2009).

**Table 4: Variance inflation factor (VIF)**

| Variable | Uncentered VIF | Centered VIF |
|---|---|---|
| ln(CPI) | 9.37573 | 3.41141 |
| ln(CIT) | 9.07184 | 4.45625 |
| ln(PPT) | 8.58611 | 9.45098 |
| ln(VAT) | 3.09973 | 1.56515 |
| ln(GDPPC) | 2.83623 | 1.42674 |

**Note:**VIF between 5 and 10 denote negligible multicollinearity

***Structural Break Analysis***

This work used the unit root test of Bai and Perron (2003) in addition to the conventional unit root tests of ADF and PP, which are shown in Table 5, to determine whether various structural breakdowns existed in the dataset under analysis.

**Table 5:**Multiple structural breaks

| Breaks | # ofCoefs. | Sum of Sq. Resids. | Log-L | Schwarz* Criterion | LWZ* Criterion |
|---|---|---|---|---|---|
| 0 | 4 | 0.578192 | 32.87155 | -3.988021 | -3.792075 |
| 1 | 9 | 0.087528 | 74.40630 | -5.445943 | **-4.990670** |
| 2 | 14 | 0.053676 | 85.16421 | -5.504917 | -4.769698 |
| 3 | 19 | 0.033735 | 95.38178 | **-5.539330** | -4.495995 |
| 4 | 24 | 0.025382 | 101.6410 | -5.393819 | -4.001545 |
| 5 | 29 | 0.020323 | 106.5315 | -5.186091 | -3.380340 |
| Estimated break dates: | | | | | |
| 1: 2016Q2 | | | | | |
| 2: 2014Q2, 2016Q2 | | | | | |
| 3: 2014Q2, 2015Q4, 2019Q3 | | | | | |
| 4: 2012Q3, 2014Q3, 2016Q2, 2019Q3 | | | | | |
| 5: 2012Q3, 2014Q2, 2015Q4, 2017Q2, 2019Q3 | | | | | |

**Note:** * Values of the minimum information criterion are shaded

The decision of the multiple structural breaks analysis in Table 5was based on the LWZ criteria, which are resistant to serial correlation issues (Liu *et al.*, 1997). The second quarter of 2016 may have been affected by the year's economic slump. This break occurred in 2016Q2, according to LWZ criteria, just 9 months into a new government in 2015, which took office on May 29, 2015. Even before the COVID-19 epidemic and lockdown limitations in 2020, this particular recession seriously weakened the macroeconomic environment in Nigeria, and the country has been battling to recover from its long-term damaging impacts (Farayibi, 2016). There is strong evidence that the 2016 economic slump catalyzed the current economic issues in Nigeria.

The decline in crude oil prices can be linked to the current economic downturn. According to the Organization of Petroleum Exporting Countries (OPEC), between 2013 and 2015, the price of crude oil decreased from over $100 per barrel to less than $60 (OPEC, 2020). This fluctuation in oil prices is easily disruptive to a single-product economy like Nigeria's, which depends on crude oil revenues. Accordingly, the shock brought on by the reduction in the price of crude oil results in virtually all of the states in the federation being unable to pay their employees' salaries, with certain states experiencing salary payment delays. Again, the government's decision to halt pipeline contracts and suspend the amnesty program amid a decline in the price of oil globally caused significant revenue shortfalls due to an increase in oil theft that reduced the amount of oil available for export, a decline in production capacity, the layoff of workers at the major oil and gas companies, low tax revenues, and an increase in the price of commodities in the nation (Onyele & Nwokoacha, 2016; Farayibi, 2016).

The government ordered all government MDAs to move forward and transfer all funds from commercial banks along with revenue owed to the Nigerian government to consolidate all revenue accruing to the Federal Government, restore order to the economy, close loopholes, end corruption, mop up excess liquidity, and more (Farayibi, 2016). Commercial banks' capabilities to create credit and overall economic activity in the nation were hindered by the withdrawal of accumulated deposits from the banks. This is because deposits made by the government with commercial banks are a fairly dependable source of funds for the nation's banks. The Federal Government had to adopt a policy to prevent some banks from funding projects only partially, which prevented their complete completion and resulted in the firing of bank

employees, further escalating the unemployment rate and macroeconomic slump in the nation. According to Agri *et al.* (2017), the policymakers' use of the zero-based budgeting technique caused delays in the passage and signing of appropriations by President Buhari's new government, further hampered economic activity. Lateness in the appropriation bill's passing led to issues, including budget padding, which prevented the full budget's implementation in 2016 and increased the country's long-term economic difficulties.

***Bounds Test with Multiple Breaks***

After determining that the model contained three significant structural breakpoints, estimating an ARDL model that accounted for the multiple structural breakdowns was important by establishing dummy breakpoints. The estimated ARDL model with structural breakdowns on taxation and pricing variance in Nigeria is presented in Table 6.

**Table 6:** Bounds test: multiple breaks-controlled

| Critical value | I(0) | I(1) |
|---|---|---|
| 10% | 2.08 | 3.00 |
| 5% | 2.39 | 3.38 |
| 1% | 3.06 | 4.15 |

Note: F-statistic = 7.835424, K = 5

Table 6 shows that the computed F-statistic value (7.835424) surpasses the upper threshold values for 10%, 5%, and 1% significance levels. The results of the boundaries test demonstrate that when CPI is the dependent variable, the independent variables in the model are bound together. This suggests that the variables will remain in equilibrium and be connected throughout time. Thus, the short—and long-term coefficients of the model can be determined.

**Long-run Estimates**

The long-term ARDL parameters are estimated since the model is discovered to be co-integrated. The study used the Akaike Information Criterion (AIC) to determine the best lags for the model. The results of the long-term ARDL on how taxes affect price variation are shown in Table 7.

From the long-run estimates, it can be inferred that there was evidence of a long-term negative and statistically insignificant association between corporation income tax (CIT) and consumer price index (CPI). The coefficient (-0.130772) of LNCIT suggested that a percentage increase in company income tax caused about a 1.31% decrease in LNCPI, while the probability value (0.1011 > 0.05) implied non-significance of LNCIT in influencing the changes in price fluctuations in Nigeria. This indicated that LNCIT had no considerable impact on price fluctuation within the study period. The results supported the research by Adegbite (2019) and Chen et al. (2020), while the findings were in contrast with those of Dibia & Onwuchekwa (2019) and Ehrhart & Guérineau (2012).

**Table 7:** Long run coefficients

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| LNCIT | -0.130772 | 0.075885 | -1.723292 | 0.1011 |
| LNPPT | 0.144698 | 0.057839 | 2.501746 | 0.0217** |
| LNVAT | 0.609718 | 0.069929 | 8.719101 | 0.0000*** |
| LNGDDPPC | -1.535301 | 0.182640 | -8.406140 | 0.0000*** |
| BREAK | 0.843840 | 0.182957 | 4.612236 | 0.0002*** |
| C | 14.93927 | 1.771501 | 8.433118 | 0.0000*** |

**Note:**At the 5% and 1% levels, significance is indicated by (**) and (***)

The petroleum profit tax (PPT) significantly and negatively influenced the consumer price index (CPI). The estimated coefficient (0.144698) of LNPPT indicated that an increase in petroleum profit tax caused the consumer price index to rise by 1.45%. The statistical significance of LNPPT was confirmed by the probability value (0.0217 < 0.05). The outcome implied that PPT accelerated price fluctuation in the long run. The rise in the petroleum profit tax is implied to have caused an increase in the CPI by the positive coefficient of LNPPT. This suggested that the cost of PPT might have been transferred to consumers of petroleum products. This research challenges the conclusions of Adegbite (2019) and Herbert et al. (2018), who found that PPT negatively impacted CPI. It, however, lends credence to the findings of Dibia & Onwuchekwa (2019).

Likewise, the analysis also confirmed a statistically significant positive linkage between value-added tax (VAT) and CPI. The observed coefficient (0.609718) of LNVAT indicates that a percentage increase in value-added tax caused price fluctuation to increase by approximately 6.09% in the long run. The probability value of LNVAT was 0.0000 < 0.01, implying the statistical significance of LNVAT at a 1% level. This could be explained by the fact that producers are increasing their prices to cover the increased VAT, shifting the burden to ultimate consumers. In other words, producers are increasing consumer prices, forcing consumers to shoulder part of the cost. This result is in agreement with studies by Afolayan *et al.* (2021), Dibia &

Onwuchekwa (2019), Gerladi (2014), Gautier &Lalliard (2014), and Ikpeh & Nteegah (2013). However, it is in disagreement with studies by Adegbite (2019). Eze & Atagboro (2020), Herbert *et al.* (2018).

Also, it was discovered that GDP per capita (GDPPC) had a long-term, considerable negative impact on CPI in Nigeria. The coefficient (-1.535301) indicated that an increase in GDP per capita led to approximately 15.35% decrease in the consumer price index, while the probability value (0.0002 < 0.01) shows its significance at a 1% level. This lends credence to Kobyagda (2019), who felt that a gain in domestic productivity in the face of tax collection would lessen inflationary pressure, which is consistent with the decreasing influence of GDPPC. GDPPC is discovered to be statistically significant over the long term at a 1% level of significance. This demonstrates that raising the GDPPC is essential for promoting price stability and may even lessen the influence of taxes on consumer prices in Nigeria.

The break dummy's coefficient is statistically significant, indicating that it had an impact on the overall long-run outcome. This showed that the breakpoint in 2016Q2, occasioned by the economic recession, exerted a considerable impact on price fluctuation in Nigeria. Also, breakpoints observed in 2015 and 2019 can be attributed to the country's leadership transition in those years.

***Error Correction Mechanism (ECM)***

Additionally, the model's short-run dynamic relationship was calculated using the ARDL framework, and the outcome is shown in Table 8. The co-integrating equation's coefficient of ECT, which uses the CPI as the dependent variable, indicates a slow return to equilibrium, a restoration to the long-run equilibrium in the current year of around 9.4% of the imbalance from the prior year. This implies that a shock to the Nigerian tax system in the short run could linger for a long period before adjustments are made over time.

**Table 8:** Short run dynamics and error correction model using ARDL

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D(LNCPI(-1)) | 0.046922 | 0.134061 | 0.350007 | 0.7302 |
| D(LNCPI(-2)) | -0.377145 | 0.116131 | -3.247593 | 0.0042*** |
| D(LNCPI(-3)) | -0.131906 | 0.090224 | -1.461994 | 0.1601 |
| D(LNCIT) | -0.008571 | 0.001568 | -5.466725 | 0.0000*** |
| D(LNPPT) | -0.009945 | 0.002215 | -4.489703 | 0.0003*** |
| D(LNPPT(-1)) | -0.024221 | 0.004593 | -5.273305 | 0.0000*** |
| D(LNPPT(-2)) | -0.015678 | 0.004383 | -3.577183 | 0.0020*** |
| D(LNVAT) | 0.001668 | 0.011194 | 0.149050 | 0.8831 |
| D(LNVAT(-1)) | -0.062274 | 0.011733 | -5.307459 | 0.0000*** |
| D(LNVAT(-2)) | 0.005090 | 0.009716 | 0.523831 | 0.6065 |
| D(LNVAT(-3)) | 0.043843 | 0.010437 | 4.200866 | 0.0005*** |
| D(LNGDDPPC) | -0.043004 | 0.026702 | -1.610474 | 0.1238 |
| BREAK | 0.034987 | 0.004050 | 8.639200 | 0.0000*** |
| ECT(-1) | -0.093618 | 0.011020 | -8.495198 | 0.0000*** |
| | | | | |
| R-squared | 0.918748 | | | |
| Adjusted R-squared | 0.873247 | | | |
| Durbin-Watson stat | 2.161482 | | | |
| Serial correlation LM test | 0.264198(0.7709) | | | |
| Heteroskedasticity test | 0.772700(0.7142) | | | |
| Jarque-Bera test | 0.382072(0.8261) | | | |

**Note:** At the 5% and 1% levels, significance is indicated by (**) and (***)

Interestingly, CIT is positive in the short run, conforming to the long-run result. Also, it was found to be statistically significant, implying that the impact of CIT on CPI was instantaneous. This shows that a change in CIT would immediately increase CPI.

The short-run PPT finding suggests that PPT and CPI have a strong negative relationship, indicating that a change in the PPT led the CPI to decline. Since PPT has a negative effect at odds with the long-term relationship, Nigeria's PPT rate is not steady. This may be related to the fact that the PPT changes over time and that the government may change the regulations in the future, causing the CPI to shift over time.

The coefficient of VAT was statistically significant at lags 1 and 3, although it was generally positive at the other examined lags. This demonstrates that the effect of VAT on the CPI changed over time and was not immediate, as it was discovered to have a negligible effect at lag zero. The business cycle's booms and busts are to blame for this. For instance, during a recession, an increase in the VAT would cause price trends to rise, while a decrease would assist in keeping them stable. Major economic players may also respond differently to changes in the VAT policy, particularly if the change in VAT is not slight. This is in line with

the findings of Gelardi (2014), who discovered that the consumer price index was impacted when the VAT and other tax rates were significantly modified.

The control variable (GDPPC) had a negative coefficient despite being statistically insignificant. The GDPPC coefficient demonstrates that a rise in GDP per capita—a metric of economic development—was associated with a drop in consumer prices. However, the insignificance of GDDPC highlights the underdevelopment inherent in the Nigerian economic system. The negative GDPPC coefficient aligns with the *a priori* supposition that increased economic development aids in price stabilisation.

The model's ability to control for breaks in the short run and long run, respectively, is supported by the coefficients of the dummies included in the model to account for the effect of the break period(s) identified by the Bai and Perron test being positive and significant at the 1% significance level. This suggests that the variables in the model were significantly impacted by things like the economic slowdown, which peaked in the second quarter of 2016. The independent variables are believed to be responsible for over 87 percent of the variations in the consumer price index, according to the modified R-squared value of 0.873247. Given the high percentage of R-squared, the model accurately describes the data. The ECT coefficient is also discovered to be inverse and considerably significant at the 1% level. This shows a sluggish convergence rate as the model pushes itself towards equilibrium by 9% every quarter. It can be demonstrated that any disequilibrium brought on by shocks from the previous year would take approximately 42.73 quarters $\left(\frac{1}{0.093618} * 4 = \text{ 42.73 quarters or 10.68 years}\right)$.

The team also completed several diagnostic tests on the ARDL model with structural fractures to ensure solid and trustworthy results. The estimated model has passed all diagnostic tests, as shown in Table 7, demonstrating that it is a strong fit for the data and passing the tests for normal distribution, heteroscedasticity, serial correlation, and misspecification.

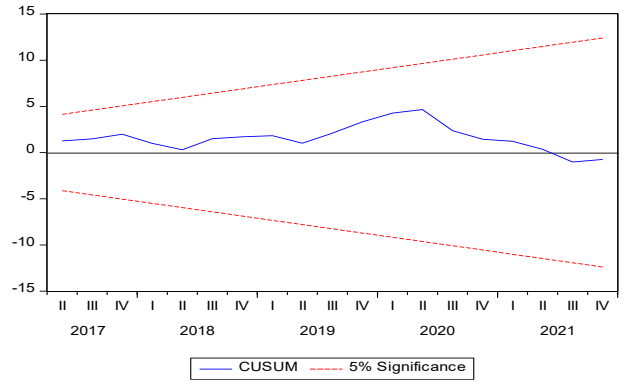



**Figure 4:** CUSUM

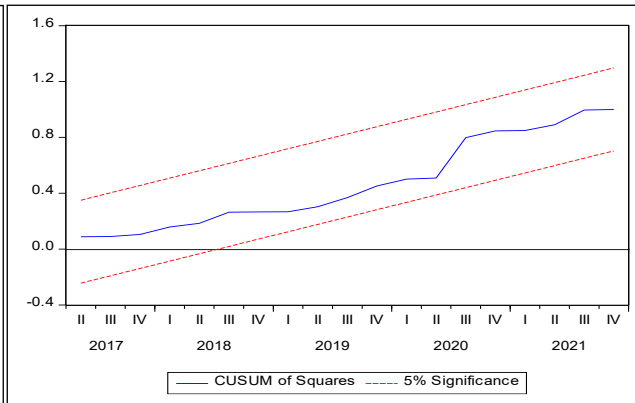



**Figure 5:** CUSUMSQ

Graph 4 shows the plots of model stability for the estimated ARDL model. According to the critical line, which is located within the critical level of significance of 5%, the plots imply that the coefficients are stable, which means that they are not changing systematically or irregularly. Consequently, it is adequate to draw conclusions and say that the model is stable.

## CONCLUSION AND RECOMMENDATIONS

This study used quarterly time series data covering the period from 2011Q1 to 2021Q4 to empirically evaluate the impact of taxation (disaggregated into CIT, PPT, and VAT) on price variance in Nigeria. The ARDL model was applied to the research. Both the unit root test and the co-integration analysis of the study account for structural fractures to ensure that the conclusions are reliable. The ARDL bounds test findings show that each variable in the model has a long-run co-integrating connection. According to the study's findings, the CPI's short and long terms were negatively impacted, particularly in the short term. It was also noticed that the PPT had a mixed effect on the CPI; over the long run, it had a statistically significant positive effect, while over the short term, it had a statistically significant negative effect. Similar results for VAT showed a long-term, significant impact on CPI but a short-term, statistically insignificant impact. This still holds despite careful consideration of the impact of structural breaks and the inclusion of GDP per capita as a control variable in the model. It is then concluded that taxation is a potent determinant of the general price level in Nigeria.

To effectively manage price fluctuation, it is advised that tax authorities consistently encourage businesses to pay taxes. The amount collected should be reinvested into productive sectors to aid the productivity of Nigeria's large population, which would, in turn, stabilise prices.

Again, PPT had a significant impact on price fluctuation in both the long run and the short run. As a result, it was advised that the Nigerian government use the money received from the petroleum profit tax to upgrade the underperforming Nigerian refineries and increase the output of petrol products that are requisite to domestic production and price stabilisation.

Likewise, the long-term disadvantageous effect of value-added tax on the consumer price index may be attributable to its increase from 5% to 7.5%. Hence, the study advocated for a relative increase in the overall share of value-added tax within the fiscal policy framework whenever expansionary fiscal measures are adopted to achieve the goal of price stabilisation in Nigeria.

This study's main limitation is that it is a macro analysis based on Nigeria and did not focus on a particular income group. Different income groups in Nigeria's economic sphere may have differing perceptions of the influence of taxation. Hence, it is recommended that future studies use primary data to conduct a micro-level analysis of the influence of taxation on households, women's entrepreneurship, and small-scale businesses.

**Implications (Theoretical and Practical) of The Study**

This study's fundamental conclusion is that taxation's effect on price variance in Nigeria varies over time. This is based on the variable long-run and short-run effects of various forms of taxes, as well as the lagged coefficients. These inconsistencies could be attributed to the dynamics of Nigeria's macroeconomic environment, which is usually characterised by a succession of booms and busts, resulting in varying taxing consequences. For example, during a boom, the relationship between taxation and price level may be less severe because the economy is at its pinnacle of productivity. However, in a time of crisis, such as the current dispensation of fuel hikes owing to the removal of fuel subsidies, a rise in the rate of taxation would result in exorbitant price levels. This is consistent with the study's theoretical background, which believes that governments should continually change tax rates and regulations to reflect current economic price realities. In practice, this means that taxation anticipates price changes in Nigeria. The effect can be improved by informing the findings of this study. By articulating this, the need for time-varying tax adjustments would be cemented. These would benefit investors seeking to grasp the Nigerian tax system and price fluctuations over time. Furthermore, a fair and transparent tax structure would provide stable pricing levels and further drive economic production, thereby increasing economic development. Furthermore, it would be interesting to see if this effect is stronger when combined with diverse macroeconomic factors to determine their interacting effects, necessitating further research.

Furthermore, knowing that taxes have a time-varying effect on price variance provides an additional opportunity for the government to focus on long-term and short-term measures that would align the inflationary effect of taxation with Nigeria's current and future economic aims. One method is to investigate the likely causes of the discovered dynamic impacts of taxation on price variation. There is a rising emphasis on taxation, and Nigeria is presenting itself as transparent and fair, with equality for all. By addressing the current issue, they will better brand themselves to their citizens and the global community, improving the economic picture through price stabilisation.

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