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An Evaluation of the Optimal Inflation Target for Economic Growth in Nigeria

Joseph Ifeolu Falegan (Corresponding author)

Department of Economics, Nile University of Nigeria

Nigeria

E-mail: faleganji@yahoo.com

Ebele Amali

Dean, School of Postgraduate Studies, Nile University of Nigeria

Nigeria

E-mail: ebelea2001@yahoo.com

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Abstract

This study uses the threshold regression method to determine the optimal inflation threshold for economic growth in Nigeria. There is evidence that establish that setting an inflation target as a nominal anchor that constrains price movements to a particular point or within a pre-agreed range is indispensable for economic growth. Application of the Bai-Perron structural breakpoints test to the data detected two breaks dated 1999 and 2011. The Lee-Strazicich Unit Root Test showed that the data were cointegrated. The threshold estimation for optimal inflation values in the 5% to 25% band revealed that the residual sums of squares, RSS, is minimized and the R^2 is maximized at an optimal inflation threshold of 18% with a statistically significant regression model, suggesting that the optimal inflation target for economic growth in Nigeria is 18%. The Autoregressive Distributed Lag model (ARDL) estimate shows that a 1% increase in inflation leads to an increase of 0.017% GDP growth in Nigeria in the long-run. The estimation of the ARDL model indicate that the coefficients of exchange rate, trade openness and population growth present mixed signaling in relation to GDP growth in the long- and short-run. Our results indicate that the implementation of the inflation targeting framework in a credible, transparent and accountable way could help to

anchor inflation expectations, rein in inflation and improve economic growth in Nigeria.

Keywords: inflation targeting, economic growth, threshold regression, least squares, inflation expectations, inflation anchoring

1. Introduction

1.1 Background to the Study

There is now incontrovertible evidence that underscore the central role played by inflation targeting in enhancing optimal outcomes for economic growth. The International Monetary Fund (2006) privileges inflation targeting as the monetary policy tool of choice in reviewing "the implications for the Fund's approach to surveillance, technical assistance, and the design of conditionality in Fund-supported programs" in non-industrial inflation targeting economies. The World Bank established a corollary between inflation expectations and inflation targeting, emphasizing that a credible "inflation targeting regime provides a disciplined framework that helps improve monetary policy transparency", stating further that successfully anchoring inflation expectation on inflation targeting is predicated on the fact that "a transparent central bank communicates to the public its intent, strategy, assessments, procedures, and policies in an open, clear, and timely manner" (Kose et al., 2019).

Yet, arbitrary inflation targets were previously widely used while many emerging economies still do not have credible inflation targeting frameworks, with implications for extreme volatility in inflation rates and suboptimal economic growth (Khan & Senhadji, 2001 and Nkume & Ngalawa, 2014). A number of challenges impede the successful implementation of inflation targeting in emerging economies prominent among which are fiscal dominance, level of central bank independence, technical capacity, credibility, external volatilities and vulnerabilities, amongst others (Khan, 2008 and Montes, 2015). In spite of these challenges, there is consensus that inflation targeting is necessary for economic growth (Bawa & Abdullahi, 2012; Kelikume, 2018 and Salami & Kelikume, 2010). There is indeed an increasing tendency for most developing nations to adopt inflation targeting to manage their economies better. This is in view of the fact that very high levels of inflation are known to adversely affect the economy while lower levels have either positive or no impact on the economy (Marbuah, 2014). Each country tends to consider the peculiarities of its economy in the process of setting inflation targets in order to help improve growth and optimal economic performance.

Nigeria is not an inflation targeting nation. Ewurum et al. (2017) were unequivocal in their work where they were categorical in their conclusion that Nigeria does not practice inflation targeting. Their position was in tandem with Bernanke et al's (1999) explicit exposé on the strict criteria that guide the implementation of inflation targeting. Bernanke holds that inflation targeting requires that monetary authorities adopt, amongst others, a transparent approach that involves the clear, regular and timely communication of inflation targets that are to be adopted widely to the public. This should involve rigorous media engagement with public announcements to raise awareness about the inflation target in view of its implications on inflation expectation and anchoring in the overall economy. Ab initio, it is expected that

the strategy used to determine the inflation target to be adopted by monetary authorities should be transparent and should have evolved with consensus as its fulcrum. This is clearly not the case in Nigeria where the CBN agrees in principle with the important place inflation targeting occupies, but uses a potpourri of monetary policy tools to drive the economy without implementing inflation targeting according to strictly laid down criteria.

There is an increasing tendency for monetary authorities in countries across the world, including the least developed nations, to move away from arbitrary benchmarking of inflation rates to the evidence-supported approach of optimal inflation targeting. Jahan (2014) showed that both industrial and non-industrial countries are now increasingly embracing inflation targeting as one of the most important tools in their monetary policy war chest. He documented that irrespective of income levels, inflation targeting is being increasingly used by countries across the globe.

The body of evidence available to guide monetary authorities in developing countries, Nigeria inclusive, on inflation targeting, is small. Where there is any evidence at all, they have not been subjected to rigorous peer review processes. Nigeria has just a few studies that provide evidence for optimal inflation targeting. Apart from the fact that these studies are dated, they have not taken account of structural alterations that have occurred in the Nigerian economy recently. Current annual data may, apart from highlighting changes in the structure of the economy, reveal inherent shifts in previously estimated inflation targets in order to inform current monetary policy. This study, therefore, sets out to evaluate the optimal inflation target for economic development in Nigeria, estimating the optimal inflation rate for GDP growth as an output of the research.

1.2 Importance of Research Problem

Setting an inflation target as a nominal anchor that constrains price fluctuations to a specific fulcrum or within a predetermined range is indispensable for economic growth, but not all countries have clearly adopted a predictable, transparent and credible inflation targeting regime. Inflation target setting is a means of operationalizing price stability through its sole focus on stabilizing prices rather than focusing on other targets such as exchange, interest or money supply rates. In spite of this, inflation targeting is, however, still not fully practiced by monetary authorities across the world. It is expected that the output from this research will provide the evidence, and, importantly, the much-needed impetus for nations like Nigeria to adopt inflation targeting for full implementation according to laid down guidelines.

There is at the moment a gap in literature written around inflation targeting that needs filling. There is presently no study that has comprehensively estimated the optimal inflation threshold for economic growth in Nigeria in a manner consistent with the rigor proposed in this study. Where there has been any attempt at all, the data points captured have been quite few and have not been as large and varied as those that have been earmarked for use in this study. It is also worthy of note that not many studies account for structural breaks that often occur in data for studies of this type with large data sets. It is expected that accounting for structural breaks will set this study on a pedestal for use by monetary authorities across the world, including Nigeria.

1.3 Literature Review

The link between inflation and growth has been established previously. There continues to be a pressing need, however, to clearly delineate for each country and for individual economies the effects that inflation has on GDP growth. Fischer (1993) made the case that there exists a nexus that connects inflation with economic growth, asserting that that nexus, the so-called threshold, may be positive when inflation rates are low but quickly turns negative when inflation rates rise higher. In other words, low inflation rates tend to increase growth, while the converse is assumed to be true. This concept has been expanded to also connote that at low rates, inflation may not have any impact on growth while at higher rates, the relationship between growth and inflation still remains negative.

The foregoing is consistent with the long-held consensus that the link between high price levels and economic growth is non-linear. The nonlinearities in the inflation-growth link refers to the fact that there is an optimal inflation level below which inflation enhances growth and above which inflation hampers growth (Ndoricimpa, 2017). While this is true, empirical evidence about inflation threshold estimations by different countries appear to vary and may not follow this rule as will be seen later. Instances of such variations have been documented where inflation threshold estimations come in lower for developed economies while they are higher for developing countries. Eggoh & Muhammad (2014) posit that institutional and macroeconomic differences may account for the variations. Seleteng et al. (2013) are also of the opinion that the reasons that optimal inflation rates differ between countries have to do with the structure of the economy, the institutional framework in such countries and the level of economic development. There is no surprise then that the methodology used to estimate the optimal inflation level for each economy vary, depending on the likelihood of non-linearity and depending on the reasons listed previously. It goes without saying then that individual countries have to be introspective in the process of estimating the optimal inflation rate that is best for their economic growth to guide monetary and even fiscal policy making and implementation.

The Bretton-Woods institutions have spared no efforts in empirically establishing the theoretical linkages between inflation targeting, anchoring and expectations. In an IMF paper, Bems et al. (2018) explored one of such linkages by studying the effects of shocks such as volatilities in terms-of-trade and exchange rates on consumer prices. They concluded that these shocks have persistent and significant effects on inflation when inflation expectations are not properly anchored. On the other hand, the effects of the shocks on inflation are dampened and quickly resolve when inflation expectations are strongly anchored.

This finding is consistent with Mishkin's (2007) observation that "With expectations of inflation anchored, any given shock to inflation - whether it is from aggregate demand, energy prices, or the foreign exchange rate - will have a smaller effect on expected inflation and hence on trend inflation." He noted further that "These shocks will then have a much less persistent effect on actual inflation." One important issue stands out in the foregoing. This is the fact that trade and exchange rate are two pivotal shocks that affect inflation and these have thus been captured as variables in this study's model.

Gurkaynak et al. (2007) were able to validate the hypothesis that incomplete anchoring of long-run inflation expectations to the appropriate inflation target has negative effects on the economy. They found that Canada's and Chile's inflation targeting regimes helped to adequately anchor long-run inflation expectations in those countries while the situation was different in the USA as its long-run inflation expectations have not been completely anchored. In another IMF publication, Choi et al's (2018) study of 36 advanced and emerging economies found the hypothesis that growth is faster in countries with properly anchored inflation expectations to be true and that, crucially, what has the most significant effect on growth is inflation anchoring and not the level of inflation itself.

Dornbusch et al's (1996) work support the opinion that the nexus joining growth and inflation is non-linear. Drawing from Keynes' model that posits that the increase in aggregate supply as prices rise occurs only short term till an alteration in aggregate demand alters price and output, they established that there is an adjustment path that constantly returns the system to equilibrium. In the early part of the adjustment, inflation reinforces growth but as inflation rises, growth slows. They attributed the growth in output in the first part of the path adjustment to the lag in discerning price movements in the market to the extent that the producer continues to supply on the wrong assumption that only his own price has increased relative to other producers. This time inconsistency or asymmetry in distinguishing between price movements is eventually resolved, triggering a return to equilibrium.

Li (2006) documented the mechanism through which the threshold effect of inflation is transmitted. Li described a definite path through which the effect is mediated, subdividing it into the capital accumulation channel and the efficiency of investment channel. In addition, he named three nexuses between inflation and growth.

In his treatise titled "Rational Expectations and the Theory of Price Movements", Muth (1961) formalized the concept of rational expectations, stating that "the hypothesis asserts that the economy generally does not waste information, and that expectations depend specifically on the structure of the entire system". It was Lucas' seminal Island Model, however, that brought the rational expectations theory to limelight amongst economists (Tobon, 2014).

Economics assumes that humans are rational economic agents and that there is hardly any economic theory that does not make the assumption of rationality. In particular, the rational expectations theory holds that people make decisions based on the best information available. The theory states that by default, individuals use all the information available to them on the economy to predict the behaviour of economic variables in the future. As they practice this act, their predictions about the economy become more accurate. The rational expectations theory provides a sound theoretical basis for and has been adopted to underpin the conduct of this study.

As far back as 2012, Hamond (2012) published his empirical work titled "State of the art of inflation targeting" which detailed the implementation level of inflation targeting as it was known as at then. He unambiguously stated at the time that inflation targeting was being implemented by many monetary authorities as their policy tool of choice. He detailed that as at 2010, more than twenty-seven central banks were considered full implementers of inflation

targeting, with a number of others who were setting up the policy environment to commence implementation.

Hammond (2012) detailed the outcome of his empirical work in his Handbook where he published information about the important elements of the inflation-targeting framework including the implementation process in all the 27 inflation targeters across the globe at the time. His research laid bare the state of affairs regarding inflation targeting including the legal and institutional frameworks, communication, transparency and accountability mechanisms, publication strategies, design, modeling, forecasting and decision-making processes, amongst others, in the hope of providing a reliable footing that will serve as a springboard for would-be inflation-targeting nations.

Multiple other studies have reviewed the implementation of inflation targeting since the advent of the framework. Kose et al. (2018) studied the performance of the inflation targeting mechanism in 16 inflation targeting countries, in close comparison to 21 non-inflation targeting countries to draw conclusions. Their main finding was that there was a marked decrease in inflation and inflation expectations in the countries that implemented inflation targeting. Although they had a list of inflation targeting countries that was close to forty, they only included 16 in their sample. The notes following their study listed the inflation countries they considered with the year of adoption, including Czech Republic (1997), Australia (1993), South Africa (2000), Thailand (2000), South Korea (2001), Poland (1998), Israel (1997), New Zealand (1990), Canada (1991), United Kingdom (1992), Sweden (1993), Brazil (1999) and the European Union countries, amongst others.

In conducting their study, Kose et al. (2018) proceeded to consider two important questions. They wanted to determine if the fall in inflation and inflation expectations was solely due to inflation targeting. They also wanted to know the effect that inflation targeting has on other macroeconomic variables. They evaluated the effects of the threshold mechanism on trend inflation, GDP, inflation and exchange rate in 4-year period segments between 2007 and 2015 comparing that with a baseline period of 1996 to 1999 when neither group had started carrying out targeting. According to them, inflation targeting was quite effective in reining in inflation as well as inflation volatility but found it to be neutral in controlling exchange rates. They, therefore, proposed an alternative upgraded version of the inflation targeting mechanism which has the ability to influence other macroeconomic variables.

A decade after Hamond's (2012) work, inflation targeting has been described in differing lights by many stakeholders. Fratzscher et al. (2020) describe inflation targeting as a shock absorber that protects the economy from perturbations and vulnerabilities. Ekinci et al. (2020) found that inflation targeting had positive effects on economic growth on many countries in their sample. In an interim assessment of inflation targeting in India, Eichengreen et al. (2020) showed that the Indian central bank was found to be a flexible inflation targeter which did not become more hawkish in the aftermath of becoming an inflation-targeting nation. Their study found that inflation in India was better anchored with shocks to the system having minimal impact on the overall stability, with the result that there is confidence in the Reserve Bank's anti-inflation competence and credibility. Eichengreen et al. took the position that the global

rules that set up inflation targeting allows for monetary authorities to develop escape clauses which permit them to tinker with their inflation targets transiently in situations such as the COVID-19 pandemic. The authors showed that that inflation-targeting countries had the capacity to intervene robustly to stem the shocks caused by the pandemic, in accordance with the widely held truism that inflation expectations were better anchored, which allowed the policy space for stakeholders to maneuver robustly.

There is a temptation to regard inflation targeting as the proverbial silver bullet that solves all economic problems without meeting all the requisite conditions. In reviewing emerging markets' implementation of the framework, Šoškić (2015) focused on the experience of Serbia stating clearly that quite a number of emerging market countries are implementing the mechanism with varying amounts of success. Šoškić made the point that emerging markets nations have unique characteristics such as a constrained macroeconomic climate, weakness of monetary policy tools and sub-optimal institutional structures that have significant bearing on the effectiveness of inflation targeting. He opined that these factors impair emerging markets' capacity to fulfil the preconditions required for the success of the inflation targeting framework, with particular focus on Serbia's experience in the six years since the adoption of the framework. Šoškić suggested that the high dollarization and what he called "euroization" of the Serbian economy places severe impediments in the path of successful inflation targeting. He proposed that Serbia's monetary authority's autonomy, fiscal discipline and a reduction in the dollarization and euroization of the economy are indispensable for inflation targeting implementation success.

There is a scarcity of literature that have considered inflation targeting implementation progress in Africa. In Taylor's (2014) treatise to review fourteen years of South Africa's implementation of inflation targeting at a South African Reserve Bank conference, he examined the implementation of inflation targeting by emerging market economies, focusing on South Africa and situating that experience within the international monetary policy context. He established that decisions taken by central banks in developed economies impact countries in the global south. Where monetary authorities in developed economies fail to adhere to rules-based policy, inflation targeting fails to achieve the end it was intended to in emerging market nations. This is partly because monetary authorities in emerging economies have been forced by such deviations from rules-based policy in developed economies to tinker with their own inflation targeting implementation frameworks. Taylor recommended that emerging market nations should do all within their limit not to deviate from the type of inflation targeting mechanism they have had in place since adoption in order to get the required result.

A number of other authors have proposed a drawback inherent in inflation targeting. For instance, Lawton & Gallagher (2020), in their research to investigate inflation uncertainty in the European Monetary Union (EMU), tested the Friedman–Ball hypothesis for EMU countries, deploying a GARCH model. The outcome of their empirical study indicated a positive correlation between inflation and inflation uncertainty. They found that the European Central Bank's inflation control role has a somewhat asymmetric effect on inflation uncertainty since the turn of two decades. It was the case that for most of the EMU nations, divergences from the widely accepted 2% inflation target tended to result in rises in inflation

uncertainty. In an attempt to attain the agreed 2% inflation, inflation uncertainty was found to have risen for a number of EMU countries, which was caused by the failure of inflation to re-anchor. Perhaps rather contrary to the EMU experience, in a study commissioned by the CBN and published recently, Dogo et al. (2015) thought that the inflation targeting framework is quite useful and has positive effects on the economy, drawing conclusions from their empirical analysis that saw them recommending inflation targeting for adoption by Nigeria, stating that Nigeria should implement "a gradual rather than a full-pledged approach in transiting from monetary to inflation targeting".

1.4 Research Objectives and Hypotheses

The main objective of this study is to evaluate the optimal inflation threshold for economic growth in Nigeria. The study aims to:

i. Estimate the optimal inflation target for economic growth in Nigeria;

ii. Determine if there is a significant relationship between inflation rate and Nigeria's economic growth in the study period;

iii. Evaluate if exchange rate, trade openness and population growth rate have any significant relationship with Nigeria's GDP growth rate.

The null hypothesis of no threshold effect $\mathbf{H_0} = \zeta_1 = \zeta_2$ is tested against the alternative hypothesis using the ordinary least squares method to estimate the residual sums of squares at 5% significance level. The first hypothesis, being the null hypothesis that inflation does not have a threshold effect on economic growth in Nigeria, is tested against the alternative hypothesis that an optimal inflation threshold exists where inflation exerts its effects on growth. The second hypothesis, being the null hypothesis that there is no significant relationship between inflation rate and Nigeria's economic growth, is tested against the alternative hypothesis that there is a significant relationship between inflation and Nigeria's economic growth. The study's third hypothesis is the null hypothesis that exchange rate, trade openness and population growth rate do not have any significant relationship with Nigeria's GDP growth rate which is tested against the alternative that they do. The study's null hypotheses are thus laid out as follows:

$\mathbf{H_{01}}$ = inflation does not have a threshold effect on economic growth in Nigeria;

$\mathbf{H_{02}}$ = there is no significant relationship between inflation rate and Nigeria's economic growth

$\mathbf{H_{01}}$ = exchange rate, trade openness and population growth rate do not have any significant relationship with Nigeria's GDP growth rate.

2. Method

2.1 Introduction

This section highlights the research design for this study. It identifies variables that make up the data and their sources. The econometric specification as well as the data analysis method

are also laid out in this section.

2.2 Research Design and Data Sources

Drawing from Leshoro (2012) and Nkume & Ngalawa (2014) and following Mubarik's (2005) modification of Khan & Senhadji's (2001) model, the optimal inflation threshold, K, is determined using the ordinary least squares method. The regressand is the GDP growth rate while the regressors are inflation rate, population growth rate, threshold inflation rate, exchange rate and trade openness.

The data used are annual time series from 1960 to 2020 sourced from the National Bureau of Statistics, IMF database (World Economic Outlook) and the World Bank database (World Development Indicators). This study used real GDP growth rate which is regressed against the inflation rate for the study period. The variables have been carefully selected as they are known to have close relationships with GDP growth and inflation in Nigeria. Exchange rate, population growth rate and trade openness are known to affect economic growth and inflation as has been discussed extensively earlier in the literature review that highlight the theoretical frameworks that underpin the study. The exchange rate regime, tightly controlled by the Central Bank, although, not without some degree of volatility, is known to influence the inflationary trend and trajectory of growth as demonstrated by the structural theory of inflation. Trade openness is the aggregate of imports and exports divided by GDP. When thinking long-term, it has been established that trade openness enhances development through granting access to commodities and services. Nigeria's exposure to international trade, driven by a combination of oil sales and imports from the standpoint of low industrialization, have substantial impact on growth. Nigeria's rapid population growth with a large youth bulge could result in either demographic dividends or crises.

2.3 Model Specification and Data Analysis Method

This study utilized a variety of empirical frameworks to investigate the optimal inflation target for GDP growth in Nigeria. The techniques include descriptive analysis of the data, unit roots testing and cointegration, structural breaks estimation, optimal inflation threshold computation using the ordinary least squares method and Autoregressive Distributed Lag (ARDL) model estimations to determine the relationships between inflation, exchange rate, trade openness, population growth and economic growth. Diagnostic testing to confirm the reliability and robustness of the results obtained were conducted using Breusch-Godfrey LM Autocorrelation test, ARCH heteroscedasticity test, Jaque-Bera normality test, cumulative sum of recursive residuals (CUSUM) stability test and Ramsey Regression Equation Specification Error Test (RESET) test for model misspecification.

2.3.1 Model Specification

2.3.1.1 Threshold Regression Model

The model specification for the attainment of objective one is laid out as follows:

$$GDP_t = \alpha_0 + \alpha_1 INF_t + \alpha_2 INF_K + \alpha_3 POP_{t-s} + \alpha_4 TOP_{t-s} + \alpha_5 EXCH_{t-s} + \mu_t \quad (3.1)$$

which can be represented as:

$$GDPt = \alpha_0 + \alpha_1 INF_t + \alpha_2 D_t INF_{t-K} + \alpha_3 POP_{t-s} + \alpha_4 TOP_{t-s} + \alpha_5 EXCH_{t-s} + \mu_t \quad (3.2)$$

where,

GDP = real GDP growth rate,

INF_t = inflation rate,

INFK = inflation threshold level,

POP_t = growth rate of population,

TOP = trade openness,

EXCH = exchange rate

μ_t = the disturbance term

D_t = a dummy variable which shows the presence of an inflation rate that is lower

or greater than the threshold level $INFK$ and where the threshold level is defined

as $INFK = \alpha_2 D_t INF_{t-K}$ while $D_t = 1$ when $INF_t > K$ and $Dt = 0$: $INF_t \leq K$.

The subscript $t-s$ indicate the variable is lagged to avoid the effect of contemporaneous variable fluctuations on the indicator.

The threshold inflation level, K, indicates the interaction between inflation and economic growth and is represented by α_1 when inflation is low and the sum of α_1 and α_2 when it is high. The threshold inflation, K, is a figure conveniently chosen from a band of inflation rates which yield a rate of inflation that is best for optimal growth. The model is estimated using least squares method to produce residual sum of squares (RSS) values for each level of K where the inflation threshold is the level of K that minimizes the RSS or maximizes the coefficient of determination, R^2.

2.3.1.2 Specification of Autoregressive Distributed Lag (ARDL) Model

Furthermore, the study employed the Autoregressive Distributed Lag (ARDL) model to achieve objective two and three and the model is specified as follows:

$$\Delta GDP = \beta_0 + \beta_1 GDP_{t-1} + \beta_2 INF_{t-1} + \beta_3 POP_{t-1} + \alpha_4 TOP_{t-1} + \beta_5 EXR_{t-1} + \sum_{i=1}^{p} \varphi_1 \Delta GDP_{t-1} + \sum_{i=1}^{p} \varphi_2 \Delta INF_{t-1} + \sum_{i=1}^{p} \varphi_3 \Delta POP_{t-1} + \sum_{i=1}^{p} \beta_4 \Delta TOP_{t-1} + \sum_{i=1}^{p} \varphi_5 \Delta EXR_{t-1} + ECM_{t-1} + \varepsilon_t \quad ----(3)$$

Where

Δ is the first difference operator, β_0 is the intercept term, β_1 - β_5 are the short-run parameters, φ_1-φ_5 and ε is the error term. ECM is the error correction term. The ARDL

model is used to achieve objectives two and three of the study.

2.3.2 Data Analysis Method

2.3.2.1 Bai-Perron Structural Break Test

Structural breaks are said to occur when the characteristics of the data in a time series change abruptly. The abrupt change may have to do with a change in the average or it may be an alteration in the characteristics of the other variables of the process that give rise to the time series. Where an abrupt change over time in the parameters of regression models are not diligently detected, it can lead to inaccuracies in forecasting and the estimated model becomes unreliable.

In view of the wide span in terms of the number of years covered by the data used for this study, the likelihood of structural breaks in the different data sets were envisaged. The Bai-Perron structural break test has been developed to address concerns that has to do with multiple structural changes that occur at different data points and dates in linear regression models that are solved by the least squares method. The test pays due consideration to the estimators' characteristics, estimating the break dates in the process. The Bai-Perron approach help ensures that the right inference is drawn about the whether there are structural breaks in a data set and where they are present, the number and dates of such breaks. The test is also suitable for the partial structural change model where some of the parameters are not amenable to change. The test was found suitable for application in this study. The Bai-Perron structural break test was thus used to check for structural breaks in the data. This function is available on EViews and several other statistical packages.

2.3.2.2 Stationarity and Cointegration Test

The Augmented Dickey-Fuller (ADF) is a model popularly deployed to identify integration order of variables in addition to estimating the stationarity of the data. It tests whether a given times series is stationary or otherwise. It tests the null hypothesis whether a unit root occurs in the times series concerned or not. Therefore, if the null hypothesis that u=1 cannot be rejected, it is not possible to reject the existence of a unit root in the data. Where there are structural breaks in the data, the use of ADF test to check for unit root becomes inappropriate, necessitating the use of a different, more appropriated type of test. After conducting a descriptive analysis of the data and having constructed a correlation matrix and following testing for structural breaks, the ADF unit root test was found to be unsuitable on account of the structural breaks recorded in the data. Alternative models were then employed.

2.3.2.3 Zivot-Andrews, Lee-Strazicich and Lumsdaine-Papell Unit Root Tests

The need to ensure that there are no structural breaks in the data is not mere fuss or conjecture. It stems from the fact that there is adverse relationship between structural breaks and stationarity. Where there is an abrupt change in the data, the time series does not revert around the same mean across all time. The danger is in the bias that arise as a result of this. In spite of the fact that the series may be stationary within individual sections, there is a very high likelihood that most standard unit root tests will be skewed towards not rejecting unit

root for this type of data.

As such, there are specific types of unit root tests that are suitable for time series with structural breaks in the data. The number of breaks determine the types of unit root test used. For instance, the Zivot-Andrews test is often used to check if there is a unit root in a univariate process with coexisting serial correlation and just one structural break. It is an endogenous sequential unit root test which uses the full sample and varying dummy variables for anticipated structural break dates. The break date is selected from the point where the data is least favorable for the unit root null.

It is crucial to note that the critical values estimated by the Zivot-Andrews technique are not the same as those determined by the Bai-Perron approach. This is as a result of the fact that the selection of the break date in the time series is viewed as the intrinsic output of an estimation procedure, rather than the process being determined extrinsically. The null hypothesis in the Zivot-Andrews procedure is that the series has a unit root with a break points against the alternative that the time series is stationary with structural break. The null hypothesis is thus rejected if the value of the t-statistics falls below the tabulated critical value.

Just as was seen above with the Zivot-Andrews unit root test, the Lee-Stazicich and Lumsdaine-Papell tests do not assume structural constancy that is assumed by the Augmented Dickey-Fuller test. Lee-Stazicich allow for endogenous breaks in the data analysis process. When compared with the Lumsdaine-Papell test, Lee-Strazicich integrates the endogenous two-break unit root test in the null. This means that the endogenous two-break unit root test of Lumsdaine-Papell does not assume any structural break under the null.

It is worthy to note that when the null hypothesis is rejected when using the Lee-Strazicich test, it does not necessarily equate to rejection of a unit-root in itself, but it may be tantamount to a rejection of a unit root without structural breaks. The Lee-Strazicich unit root test is an improved model over the Lumsdaine-Papell unit root test that allows for breaks under both the null and alternative hypotheses.

As the study did not initially envisage the number of structural breaks that will be encountered, the Zivot-Andrews unit root test was scheduled to be used where there is a single structural break while either of Lee-Strazicich or Lumsdaine-Papell unit root test was planned to be used where there are two or more structural breaks. The Bai-Perron Structural Break test eventually yielded more than one structural break in the data. In the end, the Lee-Strazicich unit root test was adopted to test for the order of integration of the variables and determine the stationarity of the data as this was available on the RATS econometric software that was eventually used for the analysis of that part of the study.

2.3.2.4 Optimal Inflation Threshold Estimation using Ordinary Least Squares

Threshold regression models help to clearly define the state of one variable from another. Many at times, the regression model comes up with outputs that show a set of coefficients that indicate unique effects up to the threshold and another set of coefficients that reveal the effects beyond that threshold. Threshold regression models fall into the category that have their predictors associated with the final output in a way that is closely dependent on the

threshold. These regression models enable researchers to clearly describe non-linear relationships between predictors and outcomes in easily understandable ways through the use of turning points, otherwise known as a changepoints. Threshold regression models use time-series data, amongst others. Researchers often choose variables of interest to them as the thresholds to which models are fitted. In the case of this study, the threshold is the level of inflation which is optimal for economic growth. The point at which the residual sum of squares, RSS, is minimized and the R^2 is maximized is taken as the optimal inflation threshold.

2.3.2.5 Autoregressive Distributed Lag Bounds Cointegration Test

In order to attain the objectives of testing the study's second and third hypotheses, the Autoregressive Distributed Lag (ARDL) model is used to estimate the relationships between the variables. Prior to this estimation, cointegration among the variables is checked again using the ARDL Bounds test. This test for cointegration provides further evidence about the quality and suitability of the data for use in this study.

2.3.2.6 Autoregressive Distributed Lag Estimation of Long and Short-Run Relationships Between Variables

The ARDL model is deployed to establish long-run and short-run relationships between the dependent and independent variables. This econometric maneuver allows the study's second and third objectives and hypotheses to be explicitly explored.

2.3.2.7 Diagnostic Tests for Reliability and Robustness of Results

In order to ascertain the reliability and robustness of the study's results, the Breusch-Godfrey LM Autocorrelation test, ARCH heteroscedasticity test, Jaque Bera normality test, cumulative sum of recursive residuals (CUSUM) stability test and Ramsey Regression Equation Specification Error Test (RESET) for model misspecification were conducted.

3. Results

3.1 Descriptive Statistics

It is important to note from the outset that the outcome measures for this study did not deviate from the expected results as the design and research methodology used by this study have been tried and tested by previous workers. The findings from this study can thus be compared to the results obtained from similar studies. Table 3.1 outlines the descriptive statistics for the study. GDP growth rate has a minimum and maximum value of -15.74363% and 25.00724%, respectively. The growth rate in the period was 3.802041%.

Adopting an entirely different design that deployed fractional integration and structural break time series techniques to model Nigeria's GDP growth rates from 1960 to 2017, Awe & Gil-Alana (2019) investigated the statistical properties, structural breaks and non-linearities of GDP rates. They remarked that Nigeria's growth rate of about 2% in their study period is unstable with non-linearities as well as long-range dependence structures. They concluded that unstable political institutions, poor monetary and fiscal management and a never-abating

spate of conflicts and insecurity in Nigeria, among others, following independence from her colonial master contribute significantly to the non-linearities and multiple structural breaks they observed in the GDP growth data.

The findings by Eke et al. (2018) diverge slightly from Awe and Gil-Alana's (2019). Using a probability distribution fitting approach, they analysed data spanning 55 years from the CBN's Statistical Bulletin on GDP to calculate Nigeria's GDP growth rate. They fitted six theoretical statistical distributions using normal distribution, logistic distribution, Laplace distribution, Cauchy distribution, Gumbel distribution and generalized logistic distribution.

Eke et al. (2018) found that the mean quarterly economic growth rate was 4.75% for the period 1960 to 2015. They computed the median value for the quarterly economic growth rate as 2.88% with their standard deviation from the mean estimated to be 11.30%. They found that the distribution of the GDP growth rate is positively skewed to the right with its figure positively different from zero and the skewness value of the quarterly economic growth rate as 2.09. The average economic growth rate they found in their study is close to the 3.8% that was found in this study.

The average inflation rate from 1960 to 2018 was 16.06537% with a range of 11.64385% to 72.83550. Nyoni & Nathaniel (2018) used time series data on inflation rates in Nigeria covering the years 1960 to 2016 to model and forecast inflation using ARMA, ARIMA and GARCH models. They forecasted that inflation in Nigeria is on the upward trend and will rise to around 17% per annum by end of 2021. From their model, they predicted that Nigeria's inflation rate is likely to rise past this level by the end of 2027. Their study found a positive mean inflation rate value of 15.941% with a median of 11.538% and a minimum and maximum of -3.7263% and 72.836% respectively. The results found by Nyoni & Nathaniel (2018) are very close approximations of the inflation figures found in the results of this dissertation.

Nyoni & Nathaniel (2018) opined that the large difference between the maximum and the minimum inflation rates in their data was due to the sudden increase in Nigeria's inflation rate in 1995 due to the political and socioeconomic turmoil that attended Sani Abacha's military dictatorship in Nigeria. They did find that their data was positively skewed at 1.9037 implying that their series had a long right tail with asymmetry. They also found that their data was normally distributed with the kurtosis for their data being 3.2084 which was more than 3 which is the rule of thumb for kurtosis value for normally distributed data. These data characteristics are comparable to the data sets used for the study in this dissertation.

The mean and maximum exchange rates for the study period of this research was 58.24394 and 306.0837 respectively while it was 32.02243 and 53.27796 respectively for trade openness. These exchange rate figures are similar to what have been found in other studies. Apart from his work on Nigeria's inflation data discussed earlier, Nyoni (2018) undertook further work to model and forecast the Naira / USD exchange rates from 1960 – 2017. His Box-Jenkins ARIMA model forecast reveal that the mean exchange rate is 52.275 close to the value of the average exchange rate estimated for this study. The maximum was 265 while the difference between the minimum and maximum was 264.45 showing the large variations and

volatility in exchange rate over the years. The large difference between the minimum and maximum exchange rate indicates that the value of the Naira is on a downward spiral with an unregulated depreciation streak. Note that the exchange rate coefficient is positively skewed and asymmetric with the series having a long right tail. The kurtosis was found to be 0.27064 far below normal kurtosis value which should be 3 for normally distributed variables indicating that the exchange rate series was not normally distributed.

Nyoni's (2018) model forecast that the Naira is bound to continue to lose its value and that urgent action is needed by the Central Bank of Nigeria to devalue the Naira so as to restore stability to the exchange rate and also promote increase in local production with its necessary attendant capital accumulation. While devaluation will likely cause rises in prices of imported commodities especially as Nigeria is an import – dependent economy, Nyoni still recommended that the Naira be devalued in order to ensure the stability of the exchange rate regime in Nigeria. He reckoned that devaluation would speed up local manufacturing with the result that there will be an increase in the inflow of foreign direct and foreign portfolio investments.

As has been said earlier, both GDP growth and inflation rates for this study are positively skewed. The kurtosis for GDP, inflation, exchange, population and trade openness are 4.994979, 6.339205, 4.102571, 3.286212 and 2.198258, respectively. Some of the kurtosis for these five variables are around and some diverge from the absolute figure of 3 which is the benchmark for normally distributed variables. Normal distribution mitigates against extreme events.

Thus, the risk of a structural break is likely for the variables that are not normally distributed. The evidence provided by the kurtosis level of GDP, inflation and exchange rates as pertains to their distribution is supported by the Jarque-Bera P-values indicating adequate reasons not to accept the null hypothesis that the variables are normally distributed. The Jarque-Bera P-values for population growth rate and trade openness are not statistically significant at 0.558335 and 0.401318 respectively.

Table 3.1. Descriptive Statistics

	EXCH	GDP	INF	POP	TOP
Mean	58.24394	3.802041	16.06537	2.530588	32.02243
Median	7.701510	4.430627	11.64385	2.561042	32.44856
Maximum	306.0837	25.00724	72.83550	3.031979	53.27796
Minimum	0.546781	-15.74363	-3.726300	2.028764	9.135846
Std. Dev.	81.87645	7.140780	15.59693	0.219344	11.55848
Skewness	1.359819	0.123103	1.921328	-0.316384	-0.167926
Kurtosis	4.102571	4.994979	6.339205	3.286212	2.198258
Jarque-Bera	20.81255	9.764685	62.63104	1.165591	1.826001
Probability	0.000030	0.007579	0.000000	0.558335	0.401318
Sum	3378.148	220.5184	931.7914	146.7741	1857.301
Sum Sq. Dev.	382113.9	2906.472	13866.06	2.742381	7615.110
Observations	58	58	58	58	58

Note: Samples are 1960-2018 at 5% Significance level.

Table 3.2 sets out to test for multicollinearity between variables in the sample. To establish multicollinearity, the zero-order correlation coefficient between two regressors must be greater than an absolute figure of 0.8. None of the coefficients in the zero-order matrix of the regressors in Table 3.2 is up to 0.8 which indicates there are no multicollinearity problems in the model.

Table 3.2. Correlation Matrix

	EXCH	GDP	INF	POP	TOP
EXCH	1.000000	0.088552	-0.118454	0.249106	0.224537
GDP	0.088552	1.000000	-0.129894	-0.061599	0.201885
INF	-0.118454	-0.129894	1.000000	0.236237	0.061816
POP	0.249106	-0.061599	0.236237	1.000000	0.382640
TOP	0.224537	0.201885	0.061816	0.382640	1.000000

3.2 Unit Root Test

Table 3.3 details the output from the Bai-Perron breakpoints test on EViews. As the likelihood of a structural break in the data was highlighted earlier, it was expedient to test for the break to prevent poor inferences, inaccurate forecasts and poor policy recommendations that may arise from spurious results. The Bai-Perron breakpoints test detected two breaks dated 1999 and 2011. The number of breaks help to determine the types of tests used to check for stationarity. Where there is just one structural break, Zivot-Andrews Unit Root suffices. For two breaks, either the Lee-Strazicich Unit Root Test or the Lumsdaine-Papell test may be used. The Lee-Strazicich Unit Root Test was adopted.

Table 3.3. Bai-Perron Structural Break Test

Multiple breakpoint tests					
Compare information criteria for 0 to M globally determined breaks					
Date: 15/12/21 Time: 14:35					
Sample: 1961 2018					
Included observations: 58					
Breaking variables: GDP INF POP TOP C					
Break test options: Trimming 0.15, Max. breaks 2					
Schwarz criterion selected breaks:				2	
LWZ criterion selected breaks:				2	
		Sum of		Schwarz*	LWZ*
Breaks	# of Coefs.	Sq. Resids.	Log-L	Criterion	Criterion

0	5	337772.9	-333.7193	9.019724	9.248734
1	11	31614.51	-265.0254	7.071012	7.586797
2	17	1954.068	-184.2980	4.707356	5.526346
* Minimum information criterion values displayed with shading					
Estimated break dates:					
1: 1999					
2: 1999, 2011					

This study used the Lee-Strazicich Unit Root Test in the RATS statistical package to check the stochastic trend in the time series to determine if there is a random walk with drift. The Lee-Strazicich test is able to detect data that has unit root with a systematic pattern that is unpredictable. The test was applied to each of the series. The interpretation of the Lee-Strazicich Unit Root Test requires a focus on comparisons between the values of the T-Statistics and the critical values at the desired level of significance. The level of significance adopted for this study is 5%. If t-statistics is less than the critical value at the desired significance level, the data is said to be cointegrated. For this study, the output of the Lee-Strazicich test on the GDP series is found in Table 3.4 below and since the t-statistics of -6.1299 is less than the critical value of -6.1080 at 5% significance, we reject the null hypothesis that there is a unit root in the data generating process. Therefore, the data is cointegrated at level. This same test was conducted for all the other variables showing cointegration mostly at first difference.

Table 3.4. Lee-Strazicich Unit Root Test, Series GDP

Regression Run From 1963:01 to 2019:01
Observations 57
Trend Break Model with 2 breaks
Estimated with fixed lags 0

			Critical Values		
Variable	Coefficient	T-Stat	.01	.05	.10
S{1}	-0.8484	-6.1299	-6.7500	-6.1080	-5.7790
Constant	5.4249	1.9909			
D(1968:01)	3.3576	0.5269			
DT(1968:01)	5.7128	1.9333			
D(1982:01)	0.8071	0.1349			
DT(1982:01)	-5.6203	-2.5666			

3.3 Threshold Regression Estimates

The result of the threshold estimation for optimal inflation values in the 5% to 25% band is

summarized in Table 3.5. The selection of the 5% to 25% band in this study was not arbitrary as such decisions are made paying due consideration to issues such as the current inflation rate in the country, the forecasted inflation rate, the target inflation rate, if any, and other such issues. The decision-making process has been aptly described by several authors previously. For instance, Marbuah (2014) was quite explicit about the need for the researcher to use inflation antecedents to select the inflation band to be investigated in a threshold regression for an optimal inflation target for GDP growth. He detailed the basis for selecting the inflation range in his 2014 paper. Following Khan and Senhadji's (2001) method often used in developing countries with a 7-11% inflation range, he opted to determine the threshold regression model at the 5% to 15% band. He surmised that his choice of inflation band to study should be around the Bank of Ghana's inflation range of 7-11%, adopting a threshold band of 5-15% instead of the 6-12% range previously used by other authors. Marbuah (2014) justified choosing the inflation threshold range of 5%-15% to enable him assess the inflation values for both the lower and upper threshold figures beyond Khan and Senhadji's (2001) recommendation to determine if there are any significant threshold values for Ghana below 7% and if there is a threshold greater than Ghana's upper limit of 11%.

The findings from this study indicate that with every regression, threshold inflation (INFK) level has positive effect on real GDP expansion although not statistically significant at all levels. However, inflation rate has a negative effect on real GDP growth for all regressions with only a few being statistically significant. These findings are consistent with the outcomes of Nkume & Ngalawa's (2014) study where they discovered that inflation has a statistically significant adverse effect on GDP growth. On the other hand, and in agreement with the results of analysis from this dissertation, they also found that inflation threshold levels (INFK) have statistically significant positive effects on real GDP growth, all things being equal. All their control variables were statistically insignificant.

Nkume & Ngalawa (2014) are not alone in their findings about the effects of inflation and threshold inflation on economic growth. In their working paper commissioned by the Reserve Bank of Fiji, Gokal & Hanif (2004) reviewed quite a number of previous studies that investigated these relationships. Drawing inferences from the numerous studies they considered and a research of their own into the relationships between inflation, inflation thresholds and GDP growth in Fiji, they concluded that inflation has adverse link with growth stating that the adverse link is "consistent with traditional Keynesian theory, Stockman's neoclassical model and some endogenous growth theories" that show that high price levels have negative correlation with growth. Given findings from the regressions in this dissertation that show that inflation has a negative impact on real GDP growth, there is sufficient ground to reject the null hypothesis that there is no significant relationship between inflation rate and Nigeria's economic growth and accept the alternative hypothesis that there is a significant relationship between inflation and Nigeria's GDP growth.

Table 3.5 indicates that the residual sums of squares, RSS, is minimized and the R^2 is maximized at an optimal inflation threshold level of 18%. This compares closely with results from Nkume & Ngalawa's (2014) study that found that the RSS was minimized and R^2 was maximized at a threshold level of 17%, putting the optimal inflation threshold for economic

growth in Malawi at 17%. Although, RSS and R^2 achieve a minimum and maximum respectively at the 19% threshold in this study, but it is with an insignificant statistical regression model at P equals 0.6931. It is worthy to note that Table 3.5 shows that the values of the t-statistics are greater than the absolute figure of 1.96 around the axis where p-levels are significant which coincide with where R^2 is maximized.

The coefficient of the optimal inflation threshold level of 18% is 6.126722 with statistical significance of p = 0.0149 while the coefficient of inflation at that level is -0.030745 with p = 0.0000. The coefficient of determination is maximized at 0.138884 with an RSS value of 2491.341. The coefficient of inflation rate shows that threshold inflation is negatively related to real GDP growth at the 18% optimal level. This means that for every 1% fall in inflation below the 18% level, GDP growth increases by the sum of the coefficients of the inflation rate and the inflation threshold at the 18% level. Therefore, given the set of data used in this study, 18% is the optimal inflation threshold for economic growth in Nigeria. This leads us to reject the null hypothesis that there is no threshold effect and accept the alternative hypothesis that there is an inflation threshold that exerts its effect on GDP growth.

Table 3.5. Threshold Inflation Model Outputs

Variable	Coefficient	Std. Error	T. Stat.	P-Value	R^2	RSS
INF	-0.046579	0.074282	-0.627060	0.5335	0.058138	2724.950
K=5 (INF5)	4.000747	3.232400	1.237702	0.2216		
INF	-0.045112	0.074582	-0.604874	0.5480	0.050229	2747.832
K=6 (INF6)	2.894813	2.756621	1.050131	0.2987		
INF	-0.045521	0.074750	-0.608977	0.5453	0.048074	2754.066
K=7 (INF7)	2.515298	2.531667	0.993534	0.3252		
INF	-0.063797	0.078216	-0.815644	0.4186	0.050777	2746.247
K=8 (INF8)	2.601306	2.444640	1.064086	0.2924		
INF	-0.064443	0.080859	-0.796979	0.4292	0.043344	2767.751
K=9 (INF9)	2.006180	2.340044	0.857326	0.3954		
INF	-0.069065	0.079170	-0.872359	0.3872	-0.041089	2738.209
K=10 (INF10)	2.453968	2.167010	1.132421	0.2629		
INF	-0.045163	0.079289	-0.569596	0.5715	0.030997	2803.474
K=11 (INF11)	0.637991	2.144475	0.297504	0.7673		
INF	-0.037959	0.078856	-0.481373	0.6324	0.029289	2808.416
K=12 (INF12)	0.041233	2.120991	0.019440	0.9846		
INF	-0.020713	0.078857	-0.262662	0.7939	0.037789	2783.824
K=13 (INF13)	1.417727	2.132275	0.664889	0.5092		
INF	-0.002740	0.076762	-0.035698	0.9717	0.072847	2682.393
K=14 (INF14)	3.261979	2.128125	1.532795	0.1316		
INF	-0.008031	0.075676	-0.106129	0.9159	0.101576	2599.278
K=15 (INF15)	4.294786	2.141140	2.005841	0.0503		
INF	-0.025289	0.074413	-0.339851	0.7354	0.145435	2472.388
K=16 (INF16)	5.697094	2.185371	2.606923	0.0120		
INF	-0.020674	0.074632	-0.277013	0.7829	0.135137	2502.180
K=17 (INF17)	5.488778	2.218744	2.473823	0.0168		
INF	-0.030745	0.075677	-0.406264	0.0000	0.138884	2491.341
K=18 (INF18)	6.126722	2.428646	2.522690	0.0149		
INF	-0.029436	0.074157	-0.396940	0.6931	0.155424	2443.486
K=19 (INF19)	6.712512	2.456336	2.732734	0.0087		
INF	-0.029436	0.074157	-0.396940	0.6931	0.155424	2443.486

K=20 (INF20)	6.712512	2.456336	2.732734	0.0087		
INF	-0.009493	0.075882	-0.125096	0.9009	0.101738	2598.807
K=21 (INF21)	5.172096	2.575386	2.008280	0.0500		
INF	-0.003125	0.076610	-0.040793	0.9676	0.073524	2680.436
K=22 (INF22)	4.212982	2.726465	1.545217	0.1286		
INF	-0.003125	0.076610	-0.040793	0.9676	0.073524	2680.436
K=23 (INF23)	4.212982	2.726465	1.545217	0.1286		
INF	-0.020778	0.076926	-0.270108	0.7882	0.043709	2766.694
K=24 (INF24)	2.460739	2.833158	0.868550	0.3892		
INF	-0.009874	0.077586	-0.127266	0.8992	0.055830	2731.628
K=25 (INF25)	3.547818	2.992134	1.185715	0.2413		

The result of this study is at variance with the widely held view that single digit inflation is best for economic growth as an optimal inflation threshold of 18% was estimated. There continues to be a school of thought that holds strongly to the position that single-digit inflation has better positive impact on economic growth than double-digit inflation (Obi & Uzodigwe, 2016). This is because it is widely believed that single-digit inflation is less associated with price volatility and variability, allowing for efficiency of both inputs and the production process itself. The outcomes of this research are, however, similar to an estimation of inflation threshold of 17% for Malawi determined by Nkume & Ngalawa (2014) using broadly the same methods used in this study. While due consideration is paid to Akerlof et al's (2000) position that single-digit inflation of between 2% to 4% allows the capitalist to have the flexibility to adjust wages since workers fail to notice decreases in real wages with increase in nominal wages, this assertion holds true mainly for developed economies where the culture of low inflation is entrenched. Fischer (1996) and Truman (2003) believe that in newly formed or emerging economies, adoption of low, single-digit inflation is counterproductive. They opined that infrastructural development in such places do not have the capacity to maintain single-digit inflation as the risk of unemployment and loss of output from disinflation is quite high.

Emerging economies continue to search for methods to force their inflation thresholds to approach or be in the single-digit range. While reporting the outcomes of his work titled "Searching Threshold Inflation for India", Singh (2010) acknowledged that India's inflation rate was in the double-digit environment. Reference was made to different inflation rates at different periods of India's growth and to the need to be dynamic in setting targets. An inflation threshold of 6% was found to be optimal for India's growth but that rate would only be optimal for the desired growth levels contingent on meeting the requirements for such growth. With increasing industrialization, India is at the single-digit inflation band today. India's example is a case in point where the need to match appropriate inflation thresholds with growth rates comes to the fore.

There is general consensus on the need to adopt inflation targeting in Nigeria with only a few exceptions. One of such exceptions is Aliyu & Englama's (2009) work which reveal that inflation in Nigeria is unresponsive to monetary transmission variables in their model. It is to be noted that their study focused on finding the relationship between prices and other variables and not necessarily between price levels and GDP. They found a weak link between prices, credit and interest rate channels with evidence of an inverse association between

exchange rate and prices. Since they did not find any remarkable statistical connection between monetary aggregates and prices, they recommended that Nigeria should only adopt inflation targeting partially in view of the benefits to be derived from inflation targeting as a well-tested tool.

In a sixty-five-page CBN working paper, the case was strongly made for the CBN to transition from using its current monetary targeting framework to inflation targeting (Dogo et al., 2015). The paper went on to list three policy options for implementation, identifying the challenges and benefits for each of the options. The authors suggested which of the options is the most preferred based on the empirical evidence available to them, recommending that the CBN, in view of the need for effectiveness of monetary policy and credibility, should adopt option A. They recommended that the CBN should use core Inflation as the main anchor for monetary policy rather using monetary aggregates. They advised that a Technical Transition Implementation Committee on Inflation Targeting be set up which will midwife the process and subsequently serve as a permanent secretariat that would be responsible leading the transition process from monetary to Inflation Targeting.

Several years on, monetary authorities in Nigeria have not made public as at yet whether they follow a strict inflation targeting regime which adheres with the standard criteria for inflation targeting. It is noteworthy to state that when the outcomes of the quarterly Monetary Policy Committee (MPC) meetings are made known to the public, the values of other metrics of interest are usually announced very clearly, transparently and unambiguously to the general public. In the first of such meetings for 2022, the MPC of the CBN voted unanimously to maintain the MPR which is Nigeria's benchmark interest rate at 11.5%. A well broadcasted announcement about this and other metrics such as the asymmetric corridor of +100/-700 basis points around the MPR, a Cash Reserve Ratio (CRR) of 27.5% and a Liquidity Ratio of 30% was made known to the general public.

This indicates that monetary and interest rate targeting apparently still predominate at the apex bank while the content of the working paper referred to earlier in terms of making core inflation the main metric in the new inflation targeting framework has still not been implemented as recommended. The level of decisiveness, transparency, accountability, prudence and probity that attends the CBN's administration of the interest rate metrics and monetary aggregates measures currently being used by the monetary authority is what is required to entrench an effective inflation targeting regime in Nigeria's monetary body polity. There is just the need to translate or transmit those qualities as it were to the proposed inflation targeting regime.

Reference has been made by monetary authorities on many occasions to the need to maintain a single-digit regime but the shocks and volatilities that the Nigerian economy is regularly confronted with is the very reason why clarity and transparency is needed regarding which specific inflation threshold Nigeria should use. In setting a threshold, cognizance must be taken of the need to establish the level of investment and the needed infrastructure base that has the carrying capacity for single digit inflation.

3.4 Cointegration Analysis using ARDL Bounds Test

Prior to investigating the effects of inflation and exchange rate on Nigeria's economic growth, cointegration among the variables using the ARDL Bounds testing approach was conducted. The result is presented in Table 3.6 below. Cointegration is said to exist if the F-statistics of the estimated results is greater than the critical values (lower and upper bound), which implies rejection of the null hypothesis of no long-run relationship. The decision rule is that if the F-statistics is less than the lower bound value at a chosen level of significance (5% level of significance for this study), the null hypothesis cannot be rejected suggesting that a long-run relationship does not exist between the variables. But, if the F-Statistics is greater than the upper bound value at 5% level of significance, then there exists a cointegration or long-run relationship between the variables. Lastly, if the F-Statistics falls in-between the lower bound and upper bound values at 5% significance level, then the result of the ARDL bounds test is said to be inconclusive.

Table 4.6. Results of the ARDL Bounds Test for Cointegration

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Critical Value	I(0)	I(1)
F-statistic	**6.126664****	10%	2.2	3.09
		5%	2.56	3.49
		1%	3.29	4.37

Note: I(0) and I(1) indicate lower and upper bounds of the ARDL bounds test respectively. ** shows statistical significance at 5% level.

Judging from the results in Table 3.6, it is safe to reject the null hypothesis of no cointegration among the variables since the F-Statistic value of 6.126664 is greater than the critical value at 5% level of significance. This implies that there exists cointegration or long-run relationship among the variables of the study, thereby necessitating the application of a long-run model such as the ARDL.

3.5 Long-Run and Short-run Estimates of the ARDL Model

Given that the ARDL bound test result in Table 3.6 confirmed the presence of cointegration among the variables, we estimated both the long-run and short-run models to establish the relationship between the study variables. The result is presented in Table 3.7 while diagnostic tests outputs can be found in 3.8.

Table 3.7. Results of the Long and Short-run ARDL Model

(GDP as the Dependent Variable)

	Variable	Coefficient	Std. Error	t-Statistic	Prob.
	INF	0.017548	0.034295	0.511659	0.6116
Long-Run	POP	-1.173213	3.371448	-0.347985	0.7296
	TOP	0.031521	0.055348	0.569513	0.5721
	EXCH	0.023740	0.007817	3.037021	0.0041
	C	3.562434	8.567066	0.415829	0.6797
	D(GDP(-1))	0.979417	0.226002	4.333666	0.0001
	D(POP)	345.8206	91.98229	3.759644	0.0005
Short-Run	D(EXCH)	-0.050592	0.048297	-1.047517	0.3010
	CointEq(-1)*	-1.676499	0.261053	-6.422064	0.0000
	R-squared	0.547106	Mean dependent var		-0.055800
	Adjusted R-squared	0.478187	S.D. dependent var		7.865975
	S.E. of regression	5.682112	Akaike info criterion		6.448477
	Sum squared resid	1485.174	Schwarz criterion		6.743141
	Log likelihood	-166.1089	Hannan-Quinn criter.		6.562117
	Durbin-Watson stat	1.884604			

Note: ***, ** and * indicate significance at the 1%, 5% and 10% levels respectively.

The results in Table 3.7 showed that in the long-run, inflation (INF), trade openness (TOP) and exchange rate (EXCH) have positive impact on economic growth in Nigeria, while population has negative impact on economic growth in Nigeria. A 1% increase in inflation leads to a marginal increase in economic growth by 0.017% in the long-run, though the impact is statistically not significant given that the corresponding p-value is greater than 0.05. This result partly conforms to economic expectations in that increase in inflation indicate a rise in money quantity in circulation which tends to raise the level of investment in the economy as well as the general level of economic activities, leading to economic growth. Also, the results showed that a 1% increase in exchange rate which implies an appreciation of the domestic currency (the Naira) causes a 0.024% increase in economic growth. Again, this finding also conforms to economic expectations because the appreciation of the domestic currency implies an increase in the purchasing power and a rise in the general level of economic activities. This impact is statistically significant indicating the importance of the exchange rate in Nigeria's economy. Since the economy is import dependent, a stronger Naira will encourage domestic investment, improve trade balance and ensure economic growth in the long-run.

With regards to the effects of population and trade openness, the results showed that a 1% increase in population will lead to a decrease in economic growth by 1.173%, while a 1% increase in trade openness will lead to a marginal increase in economic growth by 0.0315%. Both impacts are statistically not significant given that their p-values are all greater than the 0.05 significance level. The statistically insignificant effects of population and trade openness on Nigeria's economic growth may be due to the fact that the Nigerian population is essentially a consuming population rather than a producing population. And, since trade openness reduces trading barriers which fosters imports, a reasonable proportion of the goods, especially industrial goods consumed in the country, are imported. This further weakens the domestic currency against the dollar.

Examining the short-run relationships by taking a close look at the results in Table 3.7 revealed that the previous value of GDP (GDP lag 1) has positive and statistically significant impact on economic growth in the short-run. Also, the coefficient of population growth showed a positive and statistically significant impact on economic growth in Nigeria in the short run. Regarding exchange rate, the results indicated a negative and statistically insignificant short-run impact on economic growth, contrary to the findings in the long-run estimates. This can be explained by the fact that, the short-run period is too short for economic adjustments that would correct for any possible shocks to the domestic currency. The short-run results did not report the inflation and trade openness estimates. This implies that both impacts are very infinitesimal and negligible in the short-run, hence, the failure of the software to report them. Further, the coefficient of the error correction mechanism (ECM) which captures the speed of adjustment to the long-run in the event of a short-run shock is negative and statistically significant implying that the model adjusts towards the long-run. Its coefficient of -1.676499 implies over-correction or oscillatory convergence towards the long-run. That is, about 167% of the short-run disequilibrium are corrected annually.

3.6 Diagnostic Testing for Robustness and Reliability of Results

In order to confirm the reliability and robustness of the results, several diagnostic tests were conducted and the results are presented in Table 3.8.

Table 3.8. Diagnostic Post Estimation Tests

Diagnostics	**Statistic**	**p-value**
Autocorrelation (Breusch-Godfrey LM test)	0.187528	0.8297
Heteroscedasticity (ARCH Test)	0.010678	0.9181
Normality Test (Jaque Bera)	2.465960	0.2914
Ramsey RESET Test	0.385344	0.5383
Stability (CUSUM)	Stable	

Evident from Table 3.8 is the fact that the results of the residual-based tests indicate the

absence of serial/autocorrelation and heteroskedasticity in the model. This finding is consequent on the decision to not reject the null hypotheses of the two tests. The decision rule for the diagnostics tests is that the p-value of the respective residual-based statistics has to be statistically insignificant (i.e greater than 0.05). The same decision holds for normality and model misspecification tests using the Jaque Bera test and the Ramsey Rest test given that their respective p-values are greater than 0.05 significance level. Regarding the stability of the coefficients, we applied the plot of cumulative sum of recursive residuals (CUSUM) and since the line of symmetry falls within the critical bounds, the coefficients of the estimates are judged to be stable.

4. Discussion

Inflation targeting is a regime that requires a strict adherence to the guidelines put in place to make for an effective inflation threshold implementation. This requires that strong institutions are in place to implement the framework. This has led some to opine that a rules-based approach to monetary policy, inflation targeting inclusive, is not the right policy for developing countries such as Nigeria.

The major reason why some make this assumption is the fact that structural rigidities and volatile inflation conditions persist in countries such as Nigeria, creating a potpourri of bottlenecks for monetary authorities to navigate in order to have any success. It goes without saying that when rules that guide policies such as inflation targeting are put in place, they tend to constrict the space within which monetary authorities can maneuver to influence policy. It has been construed that such rules take away the discretion that authorities have to address the shocks that may confront the economy.

Yet, price stability is regarded as one of the most important macroeconomic objectives of any government or Reserve Bank. A poorly managed inflation regime does so much damage that reverberates throughout the whole economy with potential impact on the credibility of government, monetary authorities or both. The impact too on growth is significant as has been highlighted by this study. It is commonsense then, to skillfully and prudently address inflationary pressures and the methods adopted, such as inflation targeting, need to be well communicated and implemented according to well-defined criteria to have the desired impact.

One thing that inflation targeting has got going for it is the fact that the requirements for implementation, the so-called implementation guidelines or criteria, are not a new phenomenon. These stipulated conditions are well-known best practice that guide the successful implementation of standard monetary policy. Principles such as transparency, probity, accountability, participation, inclusiveness are all known to play crucial roles in the formulation and successful implementation of monetary policy. It should not be difficult, therefore, for monetary authorities to display these principles not only because it has a bearing on their credibility, but because it affects the kind of outcomes they achieve.

Whilst it is desirable to implement inflation targeting wholesale and according to strictly laid down criteria, it is understood that its implementation is not that straightforward. To start with,

the dynamics that determine price levels in many countries are complex often necessitating a complicated approach to manage. This fact is also compounded by the truth that some level of discretion is allowed for those implementing inflation targeting to enable them respond to potential problems that may affect the economy. Inflation targeting is thus viewed as a mechanism with constrained discretion that strives to balance the whole economy against the risk of short-run destabilization in price levels.

This view of inflation targeting having a short-run effect on output has been contested especially in the African context where output levels are low. It appears that it is within sound reasoning to surmise that inflation targeting not only has short-run effects but also long-run impact, not just on price levels but also output levels, considering the established link between inflation and output as has been shown by this study.

The foregoing underscores the need to make progress on institutional reforms, including in the real and financial sectors of the economy, in order to strengthen monetary authorities' role in dispensing their duties. This is especially so because monetary policy affects output, and in the long-run, national development. The quality of monetary policy is no doubt influenced by the quality of the institutional framework saddled with conceptualizing, adopting, adapting and implementing such policies.

In instituting such reforms, it should be noted that full autonomy is central to the seamless and effective functioning of the monetary bodies saddled with the lofty task of ensuring that all is well with such an important aspect of the economy. Autonomy will allow them to take full cognizance of and act to address inflation, volatilities and even structural rigidities that affect the economy.

This study set out to estimate the optimal inflation threshold for economic growth in Nigeria. There is at the moment an urgent need for monetary authorities to be transparent about the inflation threshold they use as it is a best practice recommended by the World Bank and IMF. As has been established by this investigation, there is indeed an inflation threshold that is best for Nigeria's economic growth. A firm grasp of the threshold and its band is useful to guide not just monetary policy but fiscal policy as well. There is an added advantage that economic agents are able to manage inflation expectations better as they participate in economic activities.

This research process used methods that have been previously used for such research, having conducted structural break tests, unlike many similar studies, to account for shocks, structural transformations of the economy and any other extreme events or perturbations in the period. The outcomes of this study show that inflation impacts GDP growth, with an estimation of the model yielding an optimal inflation threshold level of 18% for Nigeria.

While many studies have yielded lower inflation thresholds that are in the single digit range, ample evidence exists that have shown that many nations have attained sustained economic growth with double-digit rates (Fischer, 1996). It may be the case that setting lower inflation targets may be the reason why it has been difficult to sustainably maintain the single digits inflation rates so desired and why growth has eluded many emerging economies till now. This

is especially so when the cost of disinflation to a struggling economy is taken into account. This study adds new information to the body of evidence that already exists and can be the basis of further research to examine the status quo.

Drawing from the findings of this study, a number of recommendations can be made in order to inform policy. Following previous workers and using rigorous econometric methods that accounted for structural breaks and shocks to the data, this study firmly established that there is a threshold inflation rate that is optimal for Nigeria's economic growth. While global and regional financial institutions have made repeated calls for the widespread adoption of inflation targeting, Nigeria still lags behind in the adoption of the framework according to the strictly laid down criteria that govern its implementation. This study provides robust evidence that supply the threshold inflation data needed to anchor inflation expectations.

Although inflation rate is found to have a positive relationship with economic growth in the long-run, the effect is statistically not significant. This suggests that the gains of increase in the general price level are unsustainable. Therefore, Government and monetary policy authorities have the unique responsibility of aligning efforts through the simultaneous use of both monetary and fiscal policy instruments to enhance self-sustaining growth, reversing the current trend of high, uncontrolled inflationary pressure in Nigeria in the process.

Policies that lead to improvement in the exchange rate regime, enhance trade liberalization and ensure productive population growth need to be implemented by government, in collaboration with other key players in the economy, including the private sector. Regarding exchange rate, policymakers need to reconsider the current regime of multiple and differentiated exchange windows with a view to streamlining them into a single regime that unifies the rate at which the public accesses domestic and foreign currencies, without let or hindrance. Also, trade liberalization should be encouraged without exceptions. The recent decision that led the Nigerian government to close the country's borders for more than a year was counterintuitive, with evident dampening of economic activities and consequences that the country is still reeling from. The repeated command-control interventions by policymakers that tend to shift the post when dealing with different economic actors in a layered and discriminatory way ought to be stopped in order to allow all actors play in a rules-based manner. Arbitrary and discretionary bans by policymakers on certain sectors of the economy that tend to disrupt capital inflows and foreign direct investment and such similar policies should be discouraged. Lastly, government should consider and implement policies that will take the economy from a predominantly consumption system to one with a wide productive base, particularly one that takes advantage of value addition to the available primary commodities at base in order that employment opportunities improve for citizens, thereby enhancing their participation in the wider economy.

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References

Akerlof, G., Dickens, W., & Perry, G. (2000). Near-rational wage and price setting and the long-run Phillips curve. *Brookings Papers on Economic Activity, 1,* 1-44. https://doi.org/10.1353/eca.2000.0001

Aliyu, S. U. R., & Englama, A. (2009). Is Nigeria ready for inflation targeting? *Munich Personal RePEc Archive, 14870,* 1-26.

Awe, O. O., & Gil-Alana, L. A. (2019). Time series analysis of economic growth rate series in Nigeria: structural breaks, non-linearities and reasons behind the recent recession. *Applied Economics, 51*(50), 5482-5489. https://doi.org/10.1080/00036846.2019.1613513

Bawa, S. & Abdullahi, I. S. (2012). Threshold Effect of Inflation on Economic Growth in Nigeria. *CBN Journal of Applied Statistics, 3*(1), 43-63.

Bems, R., Caselli, F., Grigoli, F., Gruss., B., & Lian W. (2018). Expectations' Anchoring and Inflation Persistence. *International Monetary Fund, 18*(280), 1-31. https://doi.org/10.5089/9781484388846.001

Bernanke, B., Laubach, T., Mishkin, F., & Posen, A. (1999) *Inflation targeting: Lesson from the International Experience. Princeton, NJ: Princeton University Press.*

Choi, S., Furceri, D., & Loungani, P. (2018). Inflation Anchoring and Growth: Evidence from Sectoral Data. *International Monetary Fund, 18*(36), 1-37. https://doi.org/10.5089/9781484344200.001

Dogo, M. M. Y., Odeniran, S. O., Oladunni, M. S., & Omolu, M. C. V. (2015). Transition From Monetary to Inflation Targeting in Nigeria: A Background Paper. *Monetary Policy Department, Central Bank of Nigeria, 1-65.*

Dornbusch, R., Fischer, S., & Kearney, C. (1996). *Macroeconomics. The Mc-Graw-Hill Companies, Inc. Sydney.*

Eggoh, J. C., & Muhammad, K. (2014). On the nonlinear relationship between inflation and economic growth. *Research in Economics, 68*(2), 133-143. https://doi.org/10.1016/j.rie.2014.01.001

Eichengreen, B., Gupta, P., & Choudhary, R. (2020). *Inflation Targeting in India.*

Eke, C. N., Osuji, G. A., & Nwosu, D. F. (2018). Modeling of Nigeria's Economic Growth Rate: A Probability Distribution Fitting Approach. *Asian Journal of Probability and Statistics, 2*(1), 1-17. https://doi.org/10.9734/ajpas/2018/v2i124559

Ekinci, R., Tüzün, O., & Ceylan, F. (2020). The relationship between inflation and economic growth: Experiences of some inflation targeting countries. *Financial Studies, 24*(1(87)), 6-20.

Ewurum, N. C., Kalu, C. U., & Nwankwo, D. J. (2017). Inflation Targeting and Economic Growth Nexus in Nigeria: Implications for Monetary Policies. *International Journal of Academic Research in Business and Social Sciences, 7*(1), 12-27.

https://doi.org/10.6007/IJARBSS/v7-i1/2550

Fischer, S. (1993). The Role of macroeconomic factors in growth. *Journal of Monetary Economics, 32*(3), 485-512. https://doi.org/10.1016/0304-3932(93)90027-D

Fischer, S. (1996). Why are central banks pursuing long-run price stability? *Achieving Price Stability, 2,* 7-34.

Fratzscher, M., Grosse-Steffen, C., & Rieth, M. (2020). Inflation targeting as a shock absorber. *Journal of International Economics, 123,* 103308. https://doi.org/10.1016/j.jinteco.2020.103308

Gokal, V., & Hanif, S. (2004). *Relationship between inflation and economic growth (Vol. 4). Suva: Economics Department, Reserve Bank of Fiji.*

Gurkaynak, R. S., Marder, A. N., Levin, A. T., & Swanson, E. T. (2007*). Inflation Targeting and the Anchoring of Inflation Expectations in the Western Hemisphere. FRBSF Economic Review,* 25-47.

Hammond, G. (2012). *State of the art of inflation targeting. Handbooks.*

International Monetary Fund. (2006). Inflation Targeting and the IMF. *IMF eLibrary, 1-64.* https://doi.org/10.5089/9781498332927.007

Jahan, S. (2014). Inflation Targeting: Holding the Line. *Finance and Development/Back to Basics, 72-73.*

Kelikume, I. (2018). An estimation of inflation threshold for Africa. *International Journal of Management, Economics and Social Sciences, 7*(4), 283-300. https://doi.org/10.32327/IJMESS/7.4.2018.18

Khan, B. (2008). Challenges of inflation targeting for emerging-market economies: The South African case. *Reserved Bank of South Africa, 123-150.*

Khan, M., & Senhadji, A. (2001). Threshold effects in the relationship between inflation and growth. *IMF Staff Papers, 48,* 1-21. https://doi.org/10.5089/9781451853339.001

Kose, M. A., Matsuoka, H., Panizza, U., & Vorisek, D. (2019). Inflation expectations: review and evidence. *World Bank Policy Research Working Paper No. 8785.* https://doi.org/10.1596/1813-9450-8785

Kose, N., Yalcin, Y., & Yucel, E. (2018). Performance of inflation targeting in retrospect. *Empirica, 45*(1), 197-213. https://doi.org/10.1007/s10663-016-9357-z

Lawton, N., & Gallagher, L. A. (2020). The negative side of inflation targeting: revisiting inflation uncertainty in the EMU. *Applied Economics, 52*(29), 3186-3203. https://doi.org/10.1080/00036846.2019.1707764

Leshoro, T. (2012). Estimating the inflation threshold for South Africa. *Journal for Studies in Economics and Econometrics, 36*(2), 53-65. https://doi.org/10.1080/10800379.2012.12097238

Li, M. (2006). Inflation and economic growth: Threshold effects and transmission mechanisms. *Department of Economics, University of Alberta, 2*(5), 8-14.

Marbuah, G. (2014). On the Inflation-Growth Nexus: Testing for Optimal Inflation for Ghana. *Journal of Monetary and Economic Integration, 11*(2), 54-82.

Mishkin, F. S. (2007). "Inflation dynamics". *International Finance 10*(3), 317-334. https://doi.org/10.1111/j.1468-2362.2007.00205.x

Montes, G., & Macedo, R. (2008). *Challenges on Inflation Targeting.* Brazilian Association of Graduate Programs in Economics.

Mubarik, Y. (2005). Inflation and growth: An estimate of the threshold level of inflation in Pakistan. *State Bank of Pakistan Research Bulletin, 1*, 35-44.

Muth, J. F. (1961). Rational Expectations and the Theory of Price Movements. *Econometrica, 29*(3), 315-335. https://doi.org/10.2307/1909635

Ndoricimpa, A. (2017). Threshold effects of inflation on economic growth in Africa: Evidence from a dynamic panel threshold regression approach. *African Development Bank Group, Working Paper, 249.* https://doi.org/10.1111/1467-8268.12282

Nkume, J., & Ngalawa, H. (2014). Optimal Inflation Threshold for Economic Growth in Malawi. *Journal of Economics and Behavioral Studies, 6*(12), 933-946. https://doi.org/10.22610/jebs.v6i12.551

Nyoni, T. (2018). Modeling and forecasting Naira/USD exchange rate in Nigeria: a Box-Jenkins ARIMA approach. *Munich Personal RePEc Archive, 88622,* 1-36.

Nyoni, T., & Nathaniel, S. P. (2018). Modeling rates of inflation in Nigeria: an application of ARMA, ARIMA and GARCH models. *Munich Personal RePEc Archive, 91351*, 1-30.

Obi, K. O., & Uzodigwe, A. A. (2016). "Inflation-Output Growth Nexus in Nigeria" A Threshold Analysis. *International Journal of Economics, Commerce and Management, 4*(8), 174-196.

Salami, D., & Kelikume I. (2010). An Estimation of Inflation Threshold for Nigeria 1970-2008. *International Review of Business Research Papers, 6*(5), 375-385.

Seleteng, M., Bittencourt, M., & van Eyden, R. (2013). Non-linearities in Inflation-Growth Nexus in the SADC Region: Panel Smooth Transition Regression Approach. *Economic Modelling, 30,* 149-156. https://doi.org/10.1016/j.econmod.2012.09.028

Singh, P. (2010). Searching Threshold Inflation for India. *Economics Bulletin, 30*(4), 3209-3220.

Šoškić, D. (2015). Inflation targeting challenges in emerging market countries: The case of Serbia. *Economic annals, 60*(204), 7-30. https://doi.org/10.2298/EKA1504007S

Taylor, J. B. (2014). Inflation targeting in emerging markets: The global experience. In Speech at the Conference on Fourteen Years of Inflation Targeting in South Africa and the

Challenge of a Changing Mandate. *South African Reserve Bank, Pretoria.*

Tobon, S. (2014). The Rational Expectations Hypothesis: An assessment on its real-world application. *Ecos de Economia, 18*(39), 37-47. https://doi.org/10.17230/ecos.2014.39.2

Truman, E. (2003). *Inflation targeting in the world economy. Washington: Peterson Institute Press, All Books.*