Transition to inflation targeting monetary policy framework in Nigeria

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Abstract

Informed by the recent run of rising and persistent inflation in Nigeria, which puts headline and food inflation at 28.2% and 32.8%, respectively, and its attendant consequences on macroeconomic performance, this study makes a case for inflation targeting as an alternative monetary policy framework to achieve the principal goal of monetary policy - price stability. We highlight from the literature and empirically explore relevant criteria that could ensure a smooth transition of the Central Bank of Nigeria to an inflation-targeting institution. First, we suggest either of the following bands for (headline) inflation targeting: 10.56-13.14%, 13.46-14.70%, or 10.90-16.47%, while the Bank can also keep a close watch on food inflation. Second, we propose some well-thought-out econometric models that the Bank can adopt to forecast inflation and determine the optimal policy rate to steer the economy. Third, we recommend legal ways of entrenching the central bank's autonomy through granting the power of appointment, dismissal, and accountability in the legislature rather than the executive to strengthen the central bank's independence. Lastly, we inform that the inflation targeting framework can be enhanced by involving the public through the periodic publication of reports, discussions at town hall meetings, and defence of the monetary policy operation with the legislature.

Keywords: Inflation targeting, monetary policy, Central bank, Forecasting, Nigeria
JEL codes: E17, E31, E52, E58, N17

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1. Introduction

This study seeks to develop a framework under which the monetary policy arrangement in Nigeria can transition to inflation targeting.† The chief motivation for this policy redirection hinges on recent years of rising and persistent inflation in Nigeria to provoke a shift from the current monetary targeting to inflation targeting. Inflation figures on the Central Bank of Nigeria's online database indicate that the three well-known inflation proxies in Nigeria (headline, core and food inflation) have been rising consistently over the past several months, culminating at 28.2%, 22.38%, and 32.84%, respectively as of the figures released for November 2023. Inflation, especially high and persistent inflation, has always been seen as a failure of macroeconomic policies and of the political class as a result of its being detrimental to macroeconomic performance, such as erosion of savings, suppression of investment, promotion of capital flight (into less/unproductive avenues such real estate, precious metals, or foreign assets), inhibition of growth, and distortion of economic planning (King, 2023; Tule et al., 2019; Debelle et al., 1998). A shift to inflation targeting may be desirable to accord utmost priority to inflation above other monetary policy goals and to prepare the central bank to be proactive rather than reactive by constantly forecasting inflation and using monetary policy to steer inflation towards a previously defined target.

There are about four salient motivating issues enmeshed in this policy research which broadly covers developing a framework for the Central Bank of Nigeria to transit to inflation targeting monetary policy framework (see Ismailov, Kakinaka and Miyamoto, 2016; Kumo, 2015; Ferreira de Mendonça, 2009; Mishkin, 2004; Truman, 2003; Roger, 2010; Šmídková and Hrnčíř, 2000; Bernanke and Mishkin, 1997 for extensive details). The first bothers on the need to set a numerical target range for inflation to set off the

† The literature documents several benefits of inflation targeting including reduction in inflation persistence (Gracia-Iglesiasa et al., 2013; Kyereboah-Coleman, 2012; Jha, 2008), economic growth (Ayres et al., 2014; Abo-Zaid and Tuzemen, 2012) and improved financial stability and depth (Ogrokhina and Rodriguez, 2018; Balima, et al., 2017; O'Sullivana and Tomljanovick, 2012).

inflation targeting process. The monetary authority should set a clear, measurable short or medium-term target for inflation, sufficiently communicated with the parliament (rather than the executive) and the public (consumers and the business community who form their inflation expectations based on central bank inflation forecasts and pre-announced policy stance) with specific period to reach it and mechanism to evaluate conformity to the target. It is, therefore, on the basis of the foregoing that this study determines what the inflation target should be.

There are two auxiliary empirical issues along with the determination of the optimal inflation rate to announce and target, which are: (i) the target horizon – the length of time convergence to the target is expected to be achieved, and (ii) the choice of price inflation index to target – prospective candidates include headline inflation, core inflation, GDP deflator, inflation computed from wholesale/producer price indexes, among others. The knowledge of inflation persistence and inflation convergence (explored through the concept of half-life as demonstrated in the sections on data analysis) comes in handy to offer direction to policymakers on the likely time horizon to commit to bridging the gap between actual inflation and the specified target. Second, while a number of country experiences usually favour targeting headline inflation being the comprehensive measure of inflation in the economy, a contribution pursued in this study is to explore alternative proxies (namely, headline inflation, core inflation, food inflation, urban inflation, and rural inflation – limited to data availability) to provide policymakers with a range of options for enhanced policy design.

A transparent, independent, and accountable central bank is at the heart of inflation targeting (see Cachanosky and Mazza, 2021; Kumo, 2015; Garcia-Iglesias et al., 2013; Abo-Zaid and Tuzemen, 2012; O'Sullivan and Tomljanovich, 2012). Hence, this study also provides relevant empirical modelling frameworks to guide the monetary authority. In essence, the central bank must be committed to price stability as its long-run macroeconomic objective, and this goal should supersede any subordinate goals such as economic growth, employment, or exchange rate management. Empirically, we can comment on this by evaluating a workable policy rule function for the inflation-targeting

regime. The constructed model can serve two functions; one, it could be employed to indicate adherence to inflation targeting, which can be reflected through the estimated coefficients that demonstrate stronger relative weight the monetary authority attaches to price stability relative to economic growth, or other subordinate mandates, and two, the policy rule among the class of alternatives suggested in this paper can be adopted for forecasting optimal policy rate when inflation targeting becomes operational.

Independence and accountability of the central bank concern freedom to conduct monetary policy operations outside political interference (particularly, the executive arm of government might want fiscal/political considerations to override monetary policy goals), although with legislative scrutiny to encourage legal accountability, and regular communication of target, timelines, inflation reports, and plans for public accountability. While absolute independence is a mirage, the inflation-targeting central bank should not operate under fiscal dominance (a situation where fiscal factors shape monetary policies). Such include freedom to set an inflation target value that it considers as the ideal, select the set of instruments that it deems appropriate to achieve the target, and refuse to borrow money from the government if yielding to such requests will start off an inflationary pressure (from the fiscal side) that will compromise the effectiveness of the inflation targeting monetary policy. The Central Bank Independence Index, constructed by Garriga (2016), captures some aspects of central bank independence (i.e. legal, personnel, financial, and policy independence) and can be instructive to conduct relevant analyses and draw some conclusions on the independent status of the monetary authority in Nigeria.

Lastly, this study offers a framework to guide the monetary authority in Nigeria on anchoring inflation targeting, which is concerned with the modelling framework for forecasting inflation, and the forecast is compared with the target inflation to determine whether tight or expansionary monetary policy is required. This ensures that the monetary authority is proactive/forward-looking in deploying correctional tools to adjust deviations of inflation from the set target. For this purpose, we construct a predictive model for inflation for Nigeria, demonstrate the predictive content of the macroeconomic

fundamentals used as predictors, and obtain forecasts for inflation based on some assumptions/scenarios analysed.

Thus, in designing the transition framework for adopting inflation targeting in Nigeria, we raise and provide answers to germane research questions as follows: (i) What is the suitable range to set the target for inflation? (ii) What is the appropriate target horizon to specify for reaching the target? (iii) Does the choice of inflation proxy matter? (iv) What constitutes the modelling framework for examining adherence to inflation targeting? (v) To what extent is our monetary authority independent? (vi) What is the suitable model for forecasting inflation in Nigeria on which to anchor monetary policy during inflation targeting? Satisfactory answers to these questions, as detailed in the section on data analysis, are expected to help ease the transition to inflation targeting in Nigeria.

In the subsequent sections of the paper, we provide empirical content to the framework for transiting Nigeria into an inflation targeting country. The second section discusses the underlying theoretical and empirical issues for this to happen in greater detail. The third section of the paper provides relevant background information with stylized facts concerning the inflation dynamics and monetary policy operations in the Nigerian economy. The fourth section conducts extensive data analyses to provide detailed responses to the research questions raised. In the final section, we provide alternative policy options on the different criteria needed for the successful transition of Nigeria to an inflation-targeting monetary policy.

2. Literature review

2.1 Principles of inflation targeting

The inflation targeting (IT) framework assumes that monetary policy takes time to impact the economy; hence, monetary authority bases its policy changes on a forecast of inflation, not past inflation (Ojo, 2013). Inflation targeting works in theory by having a fully independent central bank that publicly species a target for inflation regularly updates the public and the government, and develops a framework to steer the actual inflation to achieve the target using any of the suitable monetary policy instruments.‡ Accordingly, central banks forecast the future path of inflation and compare this with the specified target (the rate believed to be appropriate for the economy). Thus, the targeted and the forecasted inflation rate acts as the nominal anchor in this framework, unlike in monetary targeting, where the nominal anchor is a specific monetary aggregate (Garcia-Iglesias et al., 2013).

Interestingly, most or all known monetary policy tools, such as open market operations, policy rates, and discount lending, remain relevant policy instruments of inflation targeting (Hammond, 2011; Roger, 2010). The policy rate is usually used as the chief policy instrument in inflation targeting (to implement a dovish or hawkish policy stance to boost or slow inflation, respectively, under a clearer and more transparent framework) based on the expected inverse relationship between interest rate and inflation. A tight monetary policy would be required if inflation is predicted to go above the target, while an expansionary monetary policy would be implemented if the forecasted inflation is below the target. These do not preclude varying the quantity of money in circulation to steer actual inflation towards the target when the inflation forecast emphasizes excess liquidity as a driver. A portion of the literature also suggests integrating strong foreign exchange management within the monetary policy framework to enhance the effectiveness of

‡ See more details in the article: “Inflation Targeting: Holding the Line. Economics Concepts Explained.” International Monetary Fund. https://www.imf.org/external/pubs/ft/fandd/basics/72-inflation-targeting.htm.

inflation targeting, especially for an economy operating under a market-based exchange rate regime (Abdulqadir et al., 2020; Buffie et al., 2018).

The literature documents a number of conditions that should be met and certain criteria that should be set in motion by a country in the process of transiting to inflation targeting monetary policy framework (see Ojo, 2013; Jahan, 2012; Meyer, 2001). About four major requirements are discernible from the literature and should inform the migration scheme for the Central Bank of Nigeria from her current system to an inflation targeting framework; they are: Criteria one: setting the target band within which to keep inflation; Criteria two: ensuring adherence to inflation targeting regime; Criteria three: commitment to central bank independence; Criteria four: correcting deviations of inflation from the set target. The choice of price inflation index to target and discussions around the length of time over which deviation of inflation from its target is to be corrected are additional matters of interest. The foregoing serves as the basis for the empirical analysis that comes after to inform the quest for Nigeria's transition to IT. We discuss each IT requirement in greater detail in the present section.

I. Target band for inflation

The Central Bank of Nigeria, proposing a switch to IT adoption, must decide on a suitable numerical target for inflation for the economy. Usually, the choice before the monetary policy authority is to either select a point target or a range within which inflation is expected to lie within its bands. While the former involves deciding on a point target for inflation and does not entertain any band, the latter appears more credible as it is more practicable to employ relevant policy instruments to keep inflation within a target range than around a single value. In some developed countries, the target range is usually between 1 and 3 per cent, and average ranges are about 2 percentage points wide (i.e. target rate plus or minus 1 percentage point). In the early days of IT adoption, this appears as the practice in two industrialised countries, the UK and Norway. On the other hand, most emerging market countries operating IT monetary frameworks favour target ranges, except a few such as Slovakia, Thailand and the Philippines.

An offshoot of the foregoing is the choice of price inflation proxy to target in the proposed IT among the class of alternative price indexes. The monetary authority usually has to select from available choices, which include inflation computed from the headline consumer price index, core CPI, food CPI, GDP deflator, and wholesale/producer price indexes. With the exception of a few countries like Norway and Thailand that chose core inflation as the target, most countries operating in IT use headline inflation as the target. The core inflation can be distinguished from the headline inflation based on the former's exclusion of the energy price index, which is considered highly volatile. Most countries that target core inflation do so because of the belief that volatile prices cannot be directly influenced by monetary policy. Though countries target headline inflation, they also monitor other proxies, particularly core inflation.

II. Adherence to inflation targeting

The monetary authority should, as a matter of principle, stay committed to the IT framework through the announcement of short-term targets for inflation to the public, transparency in the operations as well as in the deployment of monetary policy instruments to achieve the set targets. In other words, the monetary authority is expected to demonstrate a strong willingness and ability of the monetary authority to stay true to the IT regime and not to deviate from targeting any other indicators such as monetary aggregates, output, the level of employment, or the exchange rate. While central banks typically operate under a hierarchical or a dual mandate; inflation targeting is more consistent with the hierarchical mandate, which makes price stability the primary objective for monetary policy and subordinates other potential objectives.[§] With the priority on price stability, preference for a hierarchical mandate is expected to be reflected in terms of the stronger relative weight the monetary authority attaches to price

[§] Dual mandate specifies two macroeconomic objectives such as price stability and full employment, which the monetary authority commits equally to.

stability relative to economic growth, full employment or other subordinate mandates.

Under the IT regime, the overall mandate of the monetary authority is to indicate clearly and unambiguously to the public that hitting the inflation target takes precedence over all other monetary policy objectives. However, inflation targeting allows the central bank to pursue some short-run policy discretion on output stabilisation and employment generation so long as the overriding long-run inflation objective is not threatened (Bernanke, 1999). Hence, there is a margin of freedom allowable for policymakers to pursue other short-run objectives such as stabilising aggregate demand and supply shocks.

III. Central bank independence

A strong and independent central bank detached from political interference and transparent in its policies is an important criterion towards a successful inflation targeting monetary policy framework through relevant statutory laws to implement monetary policy tools and instruments without interference from the political administrators. In other words, central bankers should, independent of the executive arm of government, be empowered by relevant legislation to focus on the traditional goals of monetary policy, which is to tame inflation without having to divide attention for fiscal policy considerations.

The Garriga (2016) paper identifies dimensions of central bank independence, including personnel, financial, and policy independence. Personnel independence reflects limits to the government's influence on the central bank's board membership or tenure. Financial independence restricts the government's ability to use central bank's loans to fund its expenditures, to avoid monetary policy subordination to fiscal policy. The third is policy independence, which reflects the central bank's powers to formulate and execute monetary policy. This includes the central bank's ability to set goals and/or choose the instruments of monetary policy (Debelle and Fischer, 1995). If the government influences the instruments of monetary policy, the political class can push other goals over price stability during

their political tenure, thereby making it difficult to operate inflation targeting (Garriga and Rodriguez, 2020).

IV. Correcting deviations from the target

Since low inflation is a top priority under the inflation targeting framework, it becomes necessary to deploy conventional and unconventional monetary policies at the disposal of the monetary authority to pursue the target set for inflation. In achieving the short-term target band announced to the public, the monetary authority is expected to devise a forward-looking operating procedure through which monetary policy instruments are adjusted (in line with the assessment of future inflation) to hit the chosen target over a specified target horizon. The inflation target horizon defines the period over which any deviation of inflation from its target is to be eliminated. This period is selected based on the expected lags between the introduction of policy actions and their effects on inflation outcomes. Monetary authorities often adopt longer horizons than the minimum required so as to allow the central bank some flexibility in varying the adjustment process of inflation towards the target range.

V. Inflation persistence and inflation convergence

Low and less persistent are key to the achievement of inflation targeting given that low and stable prices is crucial to monetary policy making in general and is a more important goal to the IT monetary policy arrangement. Hence, higher commitment to low inflation is recommended for the monetary authority of countries in preparation for transition to inflation targeting. In essence, the effectiveness of IT monetary policy strategy is defined by its ability to achieve low inflation rate persistence as this indicates that shocks to inflation rate are eliminated within a short period (see Oloko et al., 2021). Hence, it is relevant to frequently examine the extent of inflation persistence as a criteria for inflation targeting (whether it is low or high) and also to evaluate the nature of inflation convergence to monitor the rate of convergence to low inflation (i.e. how long will it will take to tame inflation if the monetary policy framework were effective). The connection between inflation

persistence and inflation convergence is such that, usually, the countries with high inflation persistence tend to have low speed of convergence, leading to long period of convergence.

2.2 Lessons from some advanced countries

Years of uncontrollable inflation in New Zealand culminated in its being the first country to announce inflation targeting (with the time horizon set at 18 months) by the Reserve Bank of New Zealand in February 1990 (see Šmídková and Hrnčíř, 2000). Thereafter, Canada, Germany and Switzerland followed suit among the forerunners of the inflation targeting framework and other advanced countries such as Australia, Japan, Sweden, Spain, and the UK adopted the approach thereafter with relevant lessons for successive countries (Bernanke, 1999; Bernanke, Laubach, Mishkin, and Posen, 1998; Debelle, Masson, Savastano, and Sharma, 1998; Bernanke and Mishkin, 1997; Bernanke and Woodford, 1997). Mishkin (2013) is of the view that advanced industrial countries hold some vital lessons for central banks of countries aspiring as new entrants into the new monetary policy framework. For instance, examples offered by some advanced IT countries such as Canada, UK, and Sweden suggest that the regime has helped to control inflation in the countries, lessens the impacts of inflationary shocks on the economies, and tends to promote stability necessary to stimulate economic growth. In fact, evidence from the cited studies indicate that the advanced IT countries could lower inflation rates than other major industrial economies within the first couple of years of IT adoption.

Additionally, a major factor to the success of Inflation targeting in these countries is the strengthening of a central bank that is empowered to conduct monetary policy independently. Such an independent central bank is expected to exhibit transparency of policy and accountability to the government (usually the legislature) and the public in the operation of the IT through greater communication of clear plans, objectives and direction of monetary policy. An important step in the direction of transparency and that precursors of inflation targeting have practised would be to ensure that inflation reports are published periodically with details about inflation

forecasts and projections and expected policy actions. Such publicly available documents should also contain information on the extent to which the target is met or state compelling reasons if they are not met to demonstrate the accountability of the monetary authority fully.

Accountability and transparency are to the government (legislature) and the general public, respectively. The inflation targeting central bank is expected to defend its periodic reports before the parliament regularly, and such reports (which should contain the outlook of inflation, inflation projections of the Bank, how close or far from the target and probable reasons, and the direction of policy) are to be made available to the general public. As an example, consequent upon the adoption of inflation targeting, the Reserve Bank of New Zealand was mandated to publish a biannual monetary policy statement, which, among other things, declares if the inflation target has been realised or not during the past half a year and the strategy to be adopted during the next half. Similar examples abound in the Bank of England, the Bank of Canada, the Riksbank of Sweden and the Bank of Spain with periodic publications of monetary policy issues exclusively around the inflation target and the inflation targeting regime.

The foregoing assists the central bank in circumventing time-inconsistency that could result from fiscal dominance or pressures from the political class to pursue expansionary monetary policy and short-run expansion in output and employment. Thus, inflation targeting should assist the central bank in streamlining policy discussion on what should constitute the overriding long-run focus of the central bank (i.e. stable inflation) rather than other functions beyond its immediate scope, such as raising economic growth and employment permanently in the long run using expansionary monetary policy.

2.3 Lessons from some emerging countries

Like advanced economies, similar success stories in terms of significant reductions in inflation were reported for emerging economies such as Mexico and Indonesia

following inflation targeting (see Garcia-Iglesias et al., 2013; Kenward, 2013; Galindo and Ros, 2008). However, the inability to attain accountability and independence at desired levels appears to be among the major limitations to the operation of inflation targeting in many countries, including emerging markets and developing economies. for instance, one of the main reasons the IT regime failed (to sustain the disinflation process) in Argentina is that it was rather politically motivated and therefore fraught with interferences (from the government and the Ministry of Economics) (see Cachanosky and Mazza 2021).

Interestingly, as contained in the literature, some of the limitations of the Inflation targeting framework are also instructive here, especially for developing economies with less developed/less deepened financial systems than advanced countries. One of these is that its scope may restrict or affect other macroeconomic variables in the inflation targeting country. Inflation targeting has also been criticised for limiting a country's growth potential, especially among developing and emerging economies. In more extreme scenarios, many highly indebted developing countries often find inflation targeting cumbersome to break out of their debt problem since inflation can be inimical to growth, whereas the developed countries in the desire for anti-inflation credibility could find inflation targeting readily helpful (see Ismailov, 2016). It is also proven in some countries that inflation targeting alone cannot cause a fall in the inflation rate. It is argued that a monetary and fiscal policy mix will yield greater macroeconomic benefits, especially in increasing the economy's growth rate (Carrasco and Ferreiro, 2013).

2.4 Lessons from some IT countries in Africa

There are two full-fledged inflation-targeting countries in Africa: Ghana (Bank of Ghana) and South Africa (South African Reserve Bank). The Bank of Ghana in 2002 announced that it set aside monetary aggregates for inflation targeting (Kyereboah-Coleman, 2012). The Bank of Ghana is the only central bank in West Africa officially registered for inflation targeting. The primary objective of the Bank of Ghana is to pursue sound monetary policies aimed at price stability and creating

an enabling environment for sustainable economic growth (see Bank of Ghana, 2017). The Bank of Ghana was granted operational independence to employ whichever policy tools were deemed appropriate to stabilise inflation around the medium-term target to achieve price stability. The Bank of Ghana uses the monetary policy rate (MPR) as the primary policy tool to set the monetary policy stance and anchor inflation expectations in the economy.

In addition, the Bank uses four sets of instruments to defend the regime. These are the repurchase agreements (repos), the open market operations (OMO) instruments (i.e. the Bank of Ghana bills), term deposits, and reserve requirements. The Bank of Ghana publishes a Monetary Policy Summary, which provides a brief overview of macroeconomic developments and monetary policy considerations, released after each monetary policy committee (MPC) meeting. The MPC members include seven (7) members, which comprise the Governor as the chairman of the MPC, the first and second deputy governors, the head of the research department of the Bank, the head of treasury operations of the Bank, and two (2) external members – these are not employees of the Bank and appointed by the Bank's Board with relevant knowledge and experience in the functions of the Monetary Policy Committee. The full monetary policy report is published after every March and September of every MPC meeting.

The other inflation targeting central bank in Africa is the South African Reserve Bank (SARB), and it has maintenance of price stability as its primary objective and other secondary goals such as sustainable growth and financial stability. In 2000, coordination between the Governor of the SARB and the Minister of Finance led South Africa to announce inflation targeting through a commitment to 3 to 6 per cent inflation. Rather than define a period over which the target should be achieved, the SARB adopts a continuous approach where the aim of using monetary policy is to maintain inflation continually within the target. Interestingly, the operation of the system is flexible and forward-looking, where temporary deviations from the target are allowed (there is no need to make amends for missed targets in the past) so

long as policymaking ensures that inflation reverts towards the target range within a reasonable short time usually a year or two.

The autonomy and accountability of the SARB are entrenched in the Act of Parliament, where Section 224 of the 1996 Constitution empowers it to pursue its primary objective independent of any political interference, but the law provides for regular consultation with a representative of the Cabinet in charge of national financial matters. Accountability is established through two means: (i) regular communication with the public through periodic publication of monetary policy statements after each Monetary Policy Committee meeting; (ii) through a Monetary Policy Forum, which provides an avenue for an open-air discussion with stakeholders among the economic agents (which holds bi-annually) to partake in discussions on monetary policy operation and general economic outlook in South Africa.

3. Stylized facts

We attempt in this section to understand the nature and dynamics of inflation in Nigeria prior to the likely adoption of inflation targeting framework. The descriptive statistics of five inflation series (headline inflation, core inflation, food inflation, urban inflation, and rural inflation) are rendered in Table 1 where Part A to Part C presents the averages of the series, standard deviations, and coefficient of variations respectively.[**] The data covers 2006M1 to 2023M09 with the exception of urban and rural inflation series whose end points are 2022M11 (as made available in official sources). These are all estimated for monthly inflation series over three-year sub-samples making about 36 observations in each panel (including the full sample). In addition, the graphical representations of the series are rendered in Figure 1 which contains from top left to below right quadrants plots of headline and food inflation, headline and core inflation, headline and urban inflation, headline and rural inflation, food and core inflation, urban and rural inflation.

[**] The data are sourced from the Central Bank of Nigeria database (https://www.cbn.gov.ng/#_).

Starting from the figures, we observe similarities in the movements of the inflation series with upwards trends aside some periods of fluctuations. For instance, headline inflation rose from 10.7 percent in January 2006, reached 14.8 percent by March 2010, 18.7 percent in January 2017, and 26.7 percent by September 2023. In the same period, core inflation moved from 11.7 percent in January 2006, 12.35 percent in March 2010, 14.54 percent in January 2017, and 21.84 percent by September 2023. Similarly, food inflation went from 14.7 percent in January 2006, 15.8 in March 2010, 17.82 percent in January 2017, and 30.64 percent by September 2023. Correspondingly, urban (rural) inflation evolved from 12.64 percent (9.82 percent) in January 2006, 12.90 percent (15.30 percent) in March 2010, 20.31 percent (17.34 percent) in January 2017, and 22.09 percent (20.88 percent) by November 2022 when the data currently ends.

Looking at the averages in Table 1 Part A, the average values are much lower than the absolute values, which may portend some policy implications. On the average, headline inflation moved from 8.44 percent between 2006 and 2008, dropped to 9.61 percent between 2012 and 2014, increased to 12.25 percent between 2018 and 2020, and 17.72 percent between 2021 and 2023. In the same vein, core inflation (food inflation) moved from 7.94 percent (7.94 percent) between 2006 and 2008, 9.07 percent (10.17 percent) between 2012 and 2014, 10.60 percent (14.76 percent) between 2018 and 2020, and 14.69 percent (20.53 percent) between 2021 and 2023. Likewise, urban inflation (rural inflation) changed from 11.31 percent (7.11 percent) between 2006 and 2008, 10.51 percent (8.93 percent) between 2012 and 2014, 12.74 percent (11.81 percent) between 2018 and 2020, and 18.27 percent (17.20 percent) between 2021M1 and 2022M11.

The full sample suggests that the long run value (the average over the entire sample) for headline inflation is about 12.01 percent, core inflation, 10.56 percent, food inflation, 13.14 percent, urban inflation, 12.41 percent, and rural inflation, 11.73 percent. The variability of the series are presented in Part B and Part C containing standard deviation and coefficient of variation respectively. Comparatively, food inflation (standard deviation - 5.30 percent & coefficient of variation - 0.43) is shown to be more volatile than core inflation (standard deviation - 3.86 percent & coefficient of variation - 0.38) as expected

since the latter excludes volatile price components in its composition. However, surprisingly, rural inflation (standard deviation – 4.22 percent & coefficient of variation – 0.36) shows higher instability than urban inflation (standard deviation - 3.68 percent & coefficient of variation - 0.30).

The implication that one can draw from here (i.e. the averages) is that inflation in Nigeria should be around 12 percent (the mean value of inflation) and therefore, relevant policy that can help to reduce inflation volatility and keep inflation around its long run value (such as inflation targeting framework) will be desirable. One can also draw therefrom that should a rule of thumb be relied upon, the inflation target can be set at around 10.56 percent and 13.14 percent bands.

Table 1: Descriptive statistics [Part A]

Inflation	Headline	Core	Food	Urban	Rural
Three-year averages					
2006-2008	8.4388	7.9430	7.9419	11.3066	7.1097
2009-2011	12.4000	11.3211	13.3500	9.5316	14.2272
2012-2014	9.6055	9.0686	10.1694	10.5136	8.9283
2015-2017	13.7275	11.2277	14.7611	14.2704	13.1019
2018-2020	12.2488	10.6019	14.7619	12.7361	11.8100
2021-2023	17.7239	14.6982	20.5304	18.2695	17.1978
Full sample	12.0137	10.5611	13.1410	12.4192	11.7336

Note: The mean values of the respective inflation series are here reported. The data is in monthly frequency and covers 2006M01 to 2023M09. The exception are urban and rural inflation series which are available up to 2022M11 in official sources.

Table 2: Descriptive statistics [Part B]

Inflation	Headline	Core	Food	Urban	Rural
Three-year standard deviations					
2006-2008	3.5529	6.5425	7.1162	1.8434	4.7534
2009-2011	1.7103	1.4921	2.7542	1.5214	1.9793
2012-2014	1.9528	3.2271	1.0974	3.0475	1.3253
2015-2017	3.8554	2.6000	4.2341	4.4325	3.5814
2018-2020	1.2822	0.8892	1.7685	1.3363	1.2358
2021-2023	1.8625	1.5341	2.3746	1.8517	1.8777
Full sample	3.7651	3.8628	5.3020	3.6831	4.2219

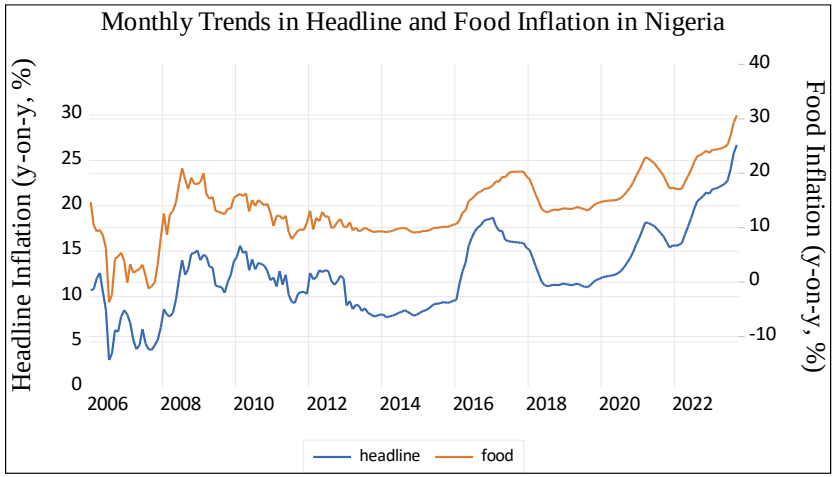
Note: The standard deviation values of the respective inflation series are here reported. The data is in monthly frequency and covers 2006M01 to 2023M09. The exception are urban and rural inflation series which are available up to 2022M11 in official sources.

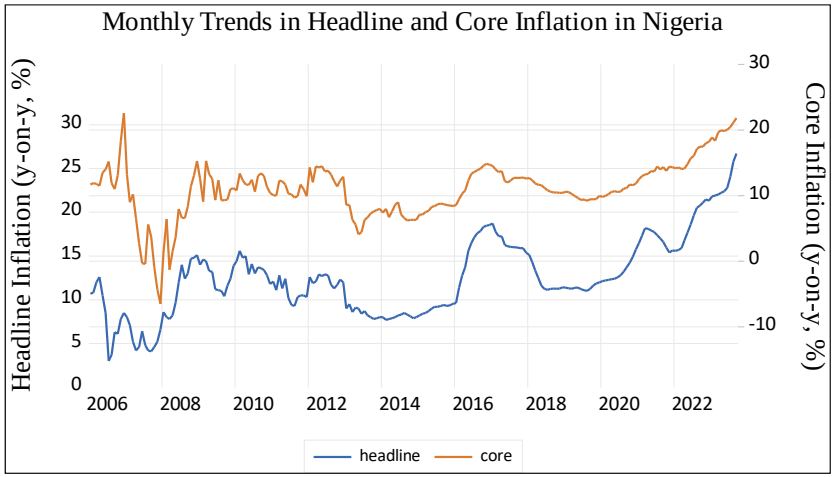
Table 3: Descriptive statistics [Part C]

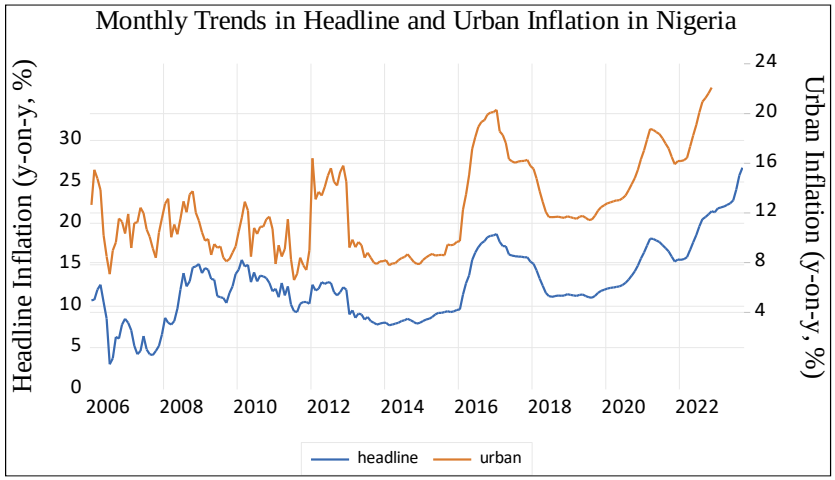
Inflation	Headline	Core	Food	Urban	Rural
Three-year Coefficient of variations					
2006-2008	0.4210	0.8236	0.8960	0.1630	0.6685
2009-2011	0.1379	0.1317	0.2063	0.1596	0.1391
2012-2014	0.2033	0.3558	0.1079	0.2898	0.1484
2015-2017	0.2808	0.2315	0.2868	0.3106	0.2733
2018-2020	0.1046	0.0838	0.1198	0.1049	0.1046
2021-2023	0.1604	0.1712	0.1539	0.1013	0.1091
Full sample	0.3494	0.3873	0.4262	0.2965	0.3598

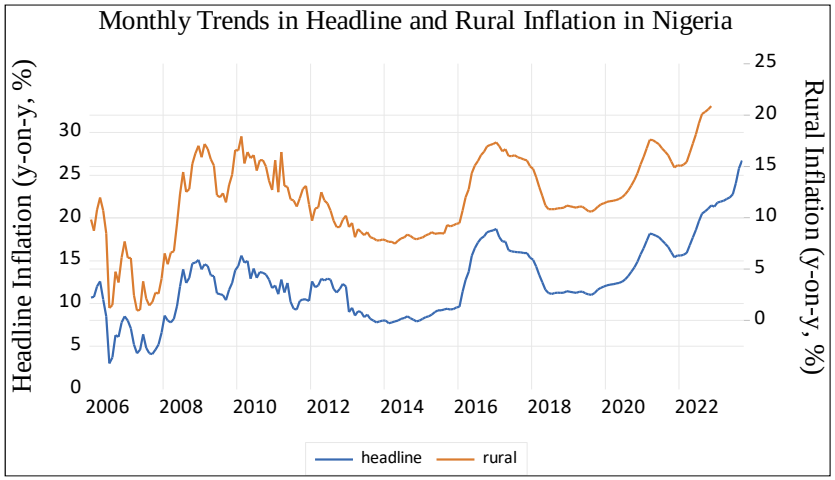
Note: The coefficient of variation values (ratio of standard deviation to the mean) of the respective inflation series are here reported. The data is in monthly frequency and covers 2006M01 to 2023M09. The exception are urban-rural inflation series which are available up to 2022M11 in official sources.

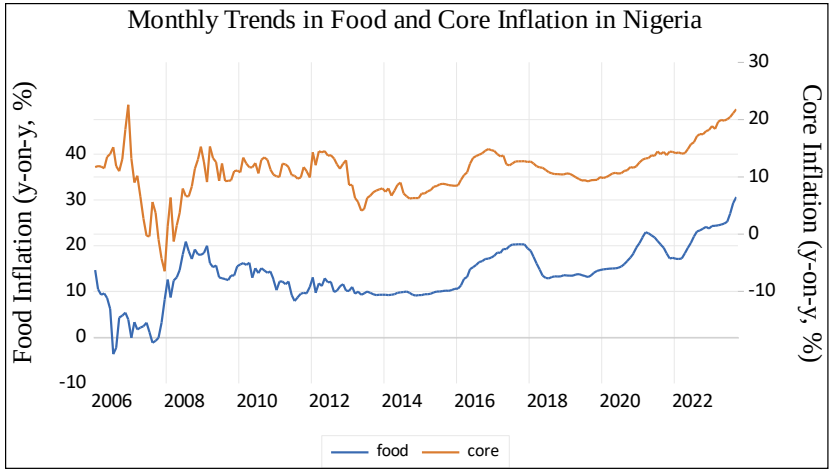
Figure 1: Plots of inflation series

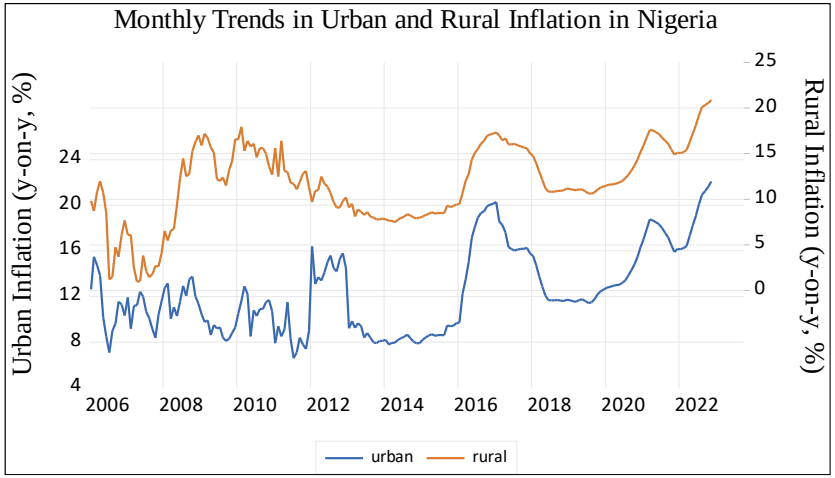












Note: Headline, core, food, urban, and rural represent headline inflation, core inflation, food inflation, urban inflation, and rural inflation respectively. The data is in monthly frequency and covers 2006M01 to 2023M09. The exception are urban and rural inflation series which are available up to 2022M11 in official sources.

We augment the preliminary analyses with a pre-test regarding the estimation of inflation persistence (a measure of response of inflation to shocks; whether shocks to inflation will be short-lived or permanent) and an associated concept i.e. the concept of half-life, which is a measure of convergence of the inflation series to their long run value (more technically, it measures how long it will take a shock to inflation to be halved). We examine the persistence of the inflation series via two approaches: (i) consideration of the autoregressive/persistence parameter ρ (or $\rho\wedge$) in the specifications in Eq. (1a) without any additional effects and Eq. (1b) which includes linear trend and structural breaks components respectively, and (ii) the use of Augmented Dickey Fuller (ADF) unit root testing approach via the conventional ADF specification in Eq. (2a) and the ADF test that includes linear trend and structural breaks components in Eq. (2b) respectively (see Kishor and Ssozi, 2010; Bussetti et al., 2007; Kocenda and Papell, 1997).

$$infl_t = \alpha + \rho infl_{t-1} + \varepsilon_t \quad (1a)$$

$$infl_t = \alpha + \rho\wedge infl_{t-1} + \delta Trend + \sum_{j=1}^{k} \vartheta_j Break_{j,t} + \varepsilon_t \quad (1b)$$

$$\Delta infl_t = \alpha + \theta infl_{t-1} + \sum_{t=1}^{p} \lambda_i \Delta y_{t-i} + v_t \quad (2a)$$

$$\Delta infl_t = \alpha + \delta Trend + \sum_{j=1}^{k} \vartheta_j Break_{j,t} + \theta\wedge infl_{t-1} + \sum_{t=1}^{p} \lambda_i \Delta y_{t-i} + v_t \quad (2b)$$

where $infl_t$ represents each of the five inflation series, either ρ or $\rho\wedge$ is the persistence parameter, also, either θ or $\theta\wedge$ represents the ADF statistic, $Trend$ is the deterministic trend, $Break_{j,t}$ are the endogenously determined breaks up to a maximum of five obtained using Bai and Perron (2003) approach, Half-life is computed as the ratio of $ln(0.5)/ln(\rho)$ or $ln(0.5)/ln(\rho\wedge)$.

The results in Table 4 (particularly when the special econometric effects are accounted for) show that all the five inflation proxies tested are “highly” persistent as shown by the values in the fourth column that satisfy this condition: $0.5 < \rho\wedge < 1$. According to the last column of Table 4, it will take at least 32 months for conscious policy to bring inflation to its long run equilibrium (see the table for the rest of the inflation series). Further, the finding of high inflation persistence in Nigeria is corroborated by the unit root properties

of the series as shown in Table 5. The foregoing suggests that monetary policy can be employed to manage inflation shocks but it will take a long time to return inflation to its long run state. It can also explain the role of inflation expectation by economic agents in the inflation dynamics in Nigeria where high inflation expectation is associated with higher future inflation. The results support evidences from earlier studies, which found positive relationship between inflation and inflation persistence (Çekin, 2020; Granville and Zeng, 2019).

The high inflation and inflation persistence in the economy could serve as a motivation to explore a different monetary policy framework since the one in operation appears to be inefficient thus far to tame the rising inflation trend in the country. The extant literature has identified inflation targeting as a possible solution to address the problem of high inflation persistence. For instance, Bratsiotis et al. (2015) show that inflation persistence declined with inflation targeting in seven countries studied. Similarly, Gerlach and Tillmann (2012) analysed inflation persistence of Asia–Pacific countries, before and after the introduction of inflation targeting policy. The study finds that although the speed at which persistence fell varied across countries, but persistence tended to decline following the adoption of inflation targeting. Hence, inflation targeting may be looked up to as an alternative to the monetary targeting policy framework currently in operation.

Table 4: Inflation persistence based on AR specification

	ρ	Persistence	$\rho\wedge$	Persistence	Half Life
Headline inflation	1.0028*** (0.0147)	High	0.9786*** (0.0191)	High	32.13
Core inflation	0.9200*** (0.0296)	High	0.8640*** (0.0343)	High	8.32
Food inflation	0.9850*** (0.0183)	High	0.9412*** (0.0244)	High	45.98
Urban inflation	0.9630*** (0.0232)	High	0.9240*** (0.0275)	High	18.41

Rural inflation	0.9705*** (0.0201)	High	0.9519*** (0.0229)	High	23.18

Note: The persistence parameter ρ is obtained from the Autoregressive (AR) specification of this form: $infl_t = \alpha + \rho infl_{t-1} + \varepsilon_t$, where $infl_t$ represents each of the five inflation series. The AR specification that produces $\rho^{\wedge}$ further incorporates deterministic trend and structural break components, $infl_t = \alpha + \rho^{\wedge} infl_{t-1} + \delta Trend + \sum_{j=1}^{k} \vartheta_j Break_{j,t} + \varepsilon_t$. Half-life is computed as the ratio of $ln(0.5)$ to $ln(\rho)$. While standard errors are reported in round brackets, statistical significance is determined at 1 percent with *** indicated on the estimated coefficients respectively.

Table 5: Inflation persistence based on unit root testing

	Level	***FD***	***Level^***	***FD^***	***I(d)***
Headline inflation	-2.2170	-8.0847***	-2.4555	-13.8051***	I(1)
Core inflation	-2.4800	-7.1141***	-3.1656	-15.0735***	I(1)
Food inflation	-3.1877*	-3.2186*	-3.8985	-16.1092***	I(1)
Urban inflation	-2.0786	-5.0618***	-2.9969	-14.8744***	I(1)
Rural inflation	-2.5354	-8.7882***	-3.2611	-16.2653***	I(1)

Note: The unit root properties are examined with augmented Dickey Fuller tests without and with structural breaks (see columns indicated with ^) at level and first difference (FD). Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively. I(d) signifies the order of integration of the series.

4. Modelling and results

Inflation targeting presents a framework where the central bank uses monetary policy instruments to steer inflation within a specified target band. Hence, central banks are expected to be more accountable since their activities can now be appraised alongside the inflation target as the key performance indicator. This section presents eclectic approach in order to offer empirical content to the four earlier discussed criteria of inflation targeting and provide answers to the research questions raised in the introduction section. The inflation targeting requirements explored in this section are: (i) suitable range to set the target for inflation [using time series and panel threshold regression], (ii) adherence to inflation targeting regime [through estimation of variants of monetary policy rule equations], (iii) evaluation of central bank independence [using the Garriga 2016 Central Bank Independence Index], (iv) evaluation of monetary policy anchor [via forecasting of inflation with relevant fundamentals]. Extras include suggesting the appropriate target horizon to specify for the inflation target to be reached and discussion on the choice of inflation proxy to target.

4.1 Suitable range to set inflation target

The crux of inflation targeting regime is the setting of a short/medium term target for inflation, which will serve as the metric for evaluating the performance of monetary policy. The achievement of this target would dictate the direction of monetary policy in the inflation targeting country such that tight monetary policy would be deployed if forecasts indicate higher forecast value than the target, while ease monetary policy would be required if inflation is forecasted below the target. The inflation targeting framework has been motivated for the Nigerian economy given her history of high and persistent inflation which is currently at 28.2 percent (as of the figures released for November 2023) with its far-reaching implications on macroeconomic performance and policy making. Hence, this study suggests a range of values for inflation on which to anchor inflation targeting framework. We approach this by determining the target for inflation that is judged to be tolerable to the economy (i.e. the level of inflation that is growth enhancing) through

estimation of time series and panel threshold regressions across the five inflation proxies examined.

We specify the time series threshold regression model (see Eq. 3) as well as the panel variant (see Eq. 4) for the inflation-output nexus in order to determine the level of inflation (the threshold variable) which enhances or dampens productivity (based on the values of the betas). The level (or range of values) of inflation where the relationship is positive (i.e. $\beta > 0$) is a potential good candidate to be considered for targeting.

$$ln(gdp_t) = \alpha + infl_t\left(\mathrm{q_t} < \lambda\right)\ \beta_1 + infl_t\left(\mathrm{q_t} \geq \lambda\right)\ \beta_2 + \varepsilon_t \quad (3)$$

$$ln(gdp_{it}) = \alpha + infl_{it}\left(\mathrm{q_{it}} < \lambda\right)\ \beta_1 + infl_{it}\left(\mathrm{q_{it}} \geq \lambda\right)\ \beta_2 + \gamma_i + \varepsilon_{it} \quad (4)$$

where $ln(gdp_t)$ is the natural logarithm of nominal gross domestic product measured with two proxies (GDP at Current Basic Prices & GDP at Current Market Prices); $infl_t$ are the five inflation series (headline, core, food, urban, and rural inflation); each of the inflation series is the threshold variable in the respective time series models; β_1 and β_2 are the regime coefficients; λ is the threshold value of inflation, which is of major interest to this study; while the time series regression produces a point estimate for the threshold value, the panel variant is preferred for producing a range of values.

The time series threshold regression where the regressand is GDP at Current Basic Prices is presented in Table 6 and the robustness where GDP is measured at Current Market Prices is rendered in Table 7. In each case, the respective inflation series enter the models as the threshold variable. The threshold value (reported in the fifth columns of Tables 6&7) divides the estimation into two regimes; Regime 1 – the representation of the inflation-output nexus below the threshold value and Regime 2 – the depiction of the inflation-output nexus above the threshold value. The results in Tables 6&7 are robust, showing identical threshold values and the fact that the nexus exhibit statistical significance (with the expected positive sign) at the second regime across the inflation proxies examined. Below the thresholds (about 14.10 percent for headline inflation), inflation does not seem to have effect on real variables (i.e. output). The results also seem to suggest that the economy can tolerate inflation beyond this level, hence, the target may

be set around 14.10 percent for headline inflation. However, as previously alluded the panel threshold regression may be handier since it offers a threshold band rather than a point estimate.

In the panel threshold results contained in Table 8, we also demonstrate the robustness of our findings with identical results for Panel 1 and Panel 2 where the regressand is GDP at current basic prices and GDP at current market prices respectively, and the units considered in the panel are inflation series. In the two regimes, the relationship between inflation and output remain positive and statistically significant whereas the relationship is stronger (in terms of higher magnitude and significance) in the second regime. The panel results give the threshold range of 13.46 - 14.70 as the range of values that the economy can tolerate (that is, the values within which inflation is growth enhancing). The results seem to suggest inflation target in the range of 13.46 and 14.70 percent for the monetary authority in Nigeria to target. This band compares with a more drastic target range of 10.56 and 13.14 percent suggested from the preliminary results. However, should we rely on the individual threshold results, a more extended target range will be suggested for inflation between 10.90 and 16.47 percent.

Table 6: Time series threshold regression [Part A]

	Constant	***Regime 1***	***Regime 2***	***Threshold***
Headline inflation	9.9765*** (0.2312)	0.0049 (0.0208)	0.0344** (0.0133)	14.10
Core inflation	9.9425*** (0.2044)	0.0150 (0.0191)	0.0471*** (0.0142)	13.70
Food inflation	9.8450*** (0.1996)	0.0018 (0.0195)	0.0356*** (0.0111)	12.74
Urban inflation	10.0262*** (0.1907)	-0.0200 (0.0206)	0.0243* (0.0125)	10.90
Rural inflation	9.8905*** (0.2064)	0.0193 (0.0168)	0.0452*** (0.0143)	16.47

Note: The measure of nominal GDP employed is the GDP at current basic prices. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

Table 7: Time series threshold regression [Part B]

	Constant	***Regime 1***	***Regime 2***	***Threshold***
Headline inflation	9.9839*** (0.2313)	0.0053 (0.0209)	0.0347 (0.0133)	14.10
Core inflation	9.9524*** (0.2043)	0.0151 (0.0191)	0.0474*** (0.0141)	13.70
Food inflation	9.8490*** (0.1999)	0.0025 (0.0195)	0.0360*** (0.0111)	12.74
Urban inflation	10.0330*** (0.1912)	-0.0195 (0.0207)	0.0247** (0.0126)	10.90
Rural inflation	9.8994*** (0.2064)	0.0196 (0.0168)	0.0455*** (0.0143)	16.47

Note: The measure of nominal GDP employed is the GDP at current market prices. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

An issue of concern which also features among the research questions is the choice of inflation proxy to target. A review of country experiences suggest that this is more of a policy issue than an empirical one (see Carson, Dziobek, and Enoch, 2002). For instance, the first inflation targeting country, New Zealand adopted a pseudo core inflation targeting where the consumer price index which form the basis for computing the inflation series excludes components such as interest cost, government charges, subsidies, indirect

taxes.[6] Australia also favoured a self-styled core inflation where the underlying CPI leaves out price components such as interest payments, indirect tax changes that are regarded as volatile price constituents. Similarly, Finland and the United Kingdom adopted quasi core inflation target that excludes components like subsidies indirect taxes, house prices, and mortgage interest payments.

However, the definition of the inflation series targeted by Canada is closer to the standard definition of core inflation as the index excludes food and energy prices and indirect tax changes. In Africa, South Africa opted for headline inflation as core inflation does not exhaustively manifest the cost of living and therefore may be considered questionable compared with headline inflation. Standing on similar arguments, one could make a case for the monetary authority in Nigeria to also target headline inflation since it is the main inflation proxy that the government, business community, and the general public consider for their respective decisions. Notwithstanding, the central bank could keep an eye on food inflation (being the highest among the inflation series in recent times and connected to important policy discussions around food security).

Table 8: Panel threshold regression

	Constant	***Regime 1***	***Regime 2***	***Threshold***
Panel 1	9.8001*** (0.1085)	0.0233** (0.0098)	0.0406*** (0.0067)	13.46-14.70
Panel 2	9.8096*** (0.1085)	0.0235** (0.0098)	0.0408*** (0.0067)	13.46-14.70

Note: Panel 1 was estimated with GDP at current basic prices as the predictand and Panel 2 with GDP at current market prices. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

[6] Bernanke (1999) argues in favour of core inflation targeting that affords opportunities for inflation targeting to deal with supply shocks. Also, countries may prefer core inflation because it excludes prices that policy measures have no direct control over.

4.2 Adherence to inflation targeting regime

Successful inflation targeting framework requires transparency and accountability from the monetary authority where the central bank must be seen in the eyes of the public to be committed to the achievement of low inflation target. In essence, inflation targeting requires specifying a short term target for inflation with a clear body language that conveys to economic agents that the achievement of the target will dominate any other macroeconomic policy objective(s). This so-called body language can be evaluated on the basis of a monetary policy rule, which we attempt to develop in this section. The workhorse for such rule remains the Taylor rule (see Taylor, 1993, 1999a&b, 2001) which relates the actions of the monetary policy authority (especially variations in the monetary policy rate) with macroeconomic fundamentals such as inflation/inflation deviation from the target rate as the main objective, then output gap and exchange rate as secondary objectives (see also Salisu, Gupta, and Kim, 2023; Fratzscher et al., 2020; Garcia-Iglesias et al., 2013; Cavoli and Pagan, 2008; Šmídková and Hrnčíř, 2000). In essence, the devotion to the inflation targeting regime can be revealed through the coefficient of responsiveness of inflation (or deviation of inflation from its target) which should be higher than that of others. The foregoing is also instructive to tease out relevant policy implications by developing a workable monetary policy rule for the Central Bank of Nigeria to guide monetary policy operation during the inflation targeting regime.

The search for a suitable policy rule leads us to specify and estimate alternative Taylor's rule equations such as: (i) a conventional Taylor rule where inflation deviation from a target and output gap are the predictors, and this may be relevant in an inflation targeting country (see Eq. 5a and the results in Table 9, Panel A), (ii) a conventional Taylor rule where inflation (in its level form) and output gap are the predictors, and this may be relevant for a non-inflation targeting country (see Eq. 5b and the results in Table 9, Panel B), (iii) an extended Taylor rule which contains inflation (with or without deviation from inflation target), output gap, and exchange rate are the predictors (see Eq. 6a&b and the results in Table 10, Panels A&B), (iv) a variant of the extended Taylor rule which contains inflation (with or without deviation from inflation target), output gap, and oil price (measured with Bonny Light as a proxy) are the predictors (see Eq. 7a&b and the results

in Table 11, Panels A&B), and (v) further robustness with another variant of the extended Taylor rule which contains inflation (with or without deviation from inflation target), output gap, and oil price (measured with West Texas Intermediate as a proxy) are the predictors (see Eq. 8a&b and the results in Table 12, Panels A&B).[7]

$$mpr_t = \alpha^a + \beta_1^a mpr_{t-1} + \beta_2^a (inf_t - \overline{inf}) + \beta_3^a (y - \overline{y}) + \varepsilon_t^a \quad (5a)$$

$$mpr_t = \alpha^b + \beta_1^b mpr_{t-1} + \beta_2^b inf_t + \beta_3^b (y - \overline{y}) + \varepsilon_t^b \quad (5b)$$

$$mpr_t = \alpha^c + \beta_1^c mpr_{t-1} + \beta_2^c (inf_t - \overline{inf}) + \beta_3^c (y_t - \overline{y}) + \beta_4^c exr_t + \varepsilon_t^c \quad (6a)$$

$$mpr_t = \alpha^d + \beta_1^d mpr_{t-1} + \beta_2^d inf_t + \beta_3^d (y_t - \overline{y}) + \beta_4^d exr_t + \varepsilon_t^d \quad (6b)$$

$$mpr_t = \alpha^e + \beta_1^e mpr_{t-1} + \beta_2^e (inf_t - \overline{inf}) + \beta_3^e (y_t - \overline{y}) + \beta_4^e bonny_t + \varepsilon_t^e \quad (7a)$$

$$mpr_t = \alpha^f + \beta_1^f mpr_{t-1} + \beta_2^f inf_t + \beta_3^f (y_t - \overline{y}) + \beta_4^f bonny_t + \varepsilon_t^f \quad (7b)$$

$$mpr_t = \alpha^g + \beta_1^g mpr_{t-1} + \beta_2^g (inf_t - \overline{inf}) + \beta_3^g (y_t - \overline{y}) + \beta_4^g wti_t + \varepsilon_t^g \quad (8a)$$

$$mpr_t = \alpha^h + \beta_1^h mpr_{t-1} + \beta_2^h inf_t + \beta_3^h (y_t - \overline{y}) + \beta_4^h bonny_t + \varepsilon_t^h \quad (8b)$$

where mpr_t is the monetary policy rate set by the Central Bank of Nigeria, mpr_{t-1} signifies interest rate inertia,, inf_t could be any of the five proxies of inflation, $\overline{inf}$ is the inflation target which in the meantime is measured with the Hodrick-Prescott (HP) filter, $(y - \overline{y})$ is the output gap which is the deviation between actual output and potential output of the Nigerian economy when the latter is also obtained through the HP filter. exr_t is the bilateral exchange rate between the US dollar and the Naira, $bonny_t$ and wti_t are the Bonny Light and West Texas Intermediate oil price proxies. We employ a self-styled Generalized Least Squares estimator to estimate the parameters of Equations 5-8 and this involves a two-stage-like estimation where Eq. 5a for instance is estimated, the residuals are obtained, and the second stage involves re-estimation after pre-weighting

[7] Given that Nigeria is a small open economy, highly dependent on import and the international oil market for foreign exchange earnings and importation refined products, the need to take into account the augmented Taylor rule by adjusting the target interest rate in response to exchange rate movements and oil price fluctuations become paramount to enhance monetary policy effectiveness.

the variables with the residuals saved from the first estimation. This helps to take care of serial correlation and heteroscedasticity problems.

Recall that this section is primarily concerned with modelling the central bank's adherence to inflation targeting in its monetary policy operations, the estimated models can also be useful for the monetary policy rate setting of the central bank based on the afore-listed macroeconomic fundamentals where closing the gap between forecasted inflation and the inflation target represent the key objective. The theoretical expectation from the results suggest that the central bank would be expected to adopt a hawkish stance if the inflation deviation is wide (i.e. when the difference between inflation and its target value becomes wider). Hence, we expect the coefficients to be positive but inflation deviation should attract the greater response in terms of magnitude and significance in an inflation targeting setting.

Starting from the traditional Taylor rule results in Table 9, we find that the coefficients of inflation deviation and output gap are scarcely statistically significant in Panel A where the models include deviation of inflation from an inflation target (an arbitrary target obtained via Hodrick-Prescott filter) as a predictor. This finding is not surprising since the economy is not currently applying inflation targeting and the real target is not used. However, results in Panel B speaks to reality where the coefficients of inflation and output gap are correctly signed (i.e. positive) and statistically significant as expected, and the importance (i.e. magnitude) attached to output is greater than inflation. The reverse would be expected in an inflation targeting setting where achieving price stability should supersede all other macroeconomic goals. Of lesser importance however, it can be informed from the results (given high magnitudes and statistically significant values of the first lags of the policy rate) that the policy rate setting in Nigeria has been characterized by policy inertia – a phenomenon where the monetary policy authority exercises much caution from either raising or lowering the monetary policy rate for a number of quarters..

The incorporation of exchange rate as an additional predictor has been demonstrated in Table 10 and it indicates that the earlier position obtained from the conventional Taylor

rule is substantiated, hence, the results are insensitive to the inclusion of exchange rate. The coefficients of exchange rate are correctly signed (i.e. positive) in the model for inflation targeting (see Table 10, Panel A) although the coefficients are scarcely significant. These differ from the results in Panel B of Table 10 where the negative signs of the coefficients of exchange rate are confounding, suggesting that monetary policy tightens with exchange rate appreciation. It is hoped that with inflation targeting, the role of exchange rate in the monetary policy rule may be complementing when the framework is institutionalized.

Further, the estimation of the extended Taylor rule augmented with oil price proxies; see the results of the models augmented with Bonny Light in Table 11 and the one extended with another international oil price proxy, West Texas Intermediate in Table 12. In the two tables, oil price is shown to be positively linked to monetary policy where hawkish monetary policy stance follows oil price shocks and this is consistent for the two oil price proxies. However, importantly, the inflation targeting models produce more statistically significant estimates for the oil price series than the models without inflation targeting. These findings might suggest that inflation targeting may be a better monetary policy framework for dealing oil price shocks. In all, the analyses conducted in this section indicate that the conventional Taylor rule without inflation deviation reflects the current Nigerian data well. However, the extended policy rule designed for inflation targeting is shown to be more consistent with secondary objectives such as dealing with external shocks (i.e. exchange rate and oil price fluctuations). The central bank can put faith in the models that contain inflation target for setting the policy rate when the time is ripe to steer inflation towards the predefined target.

Table 9: Conventional Taylor's Rule

Inflation proxy	*Constant*	*Policy inertia*	*Inflation deviation*	*Output gap*	*SSR*
Panel A: Modelling with inflation target					
Headline inflation	2.8763*** (0.7093)	0.9221*** (0.0592)	0.0433 (0.0824)	5.4523* (3.0520)	5.7876
Core inflation	3.8783*** (0.8123)	0.8395*** (0.0651)	0.1222 (0.1088)	3.6136 (3.2243)	4.8482
Food inflation	3.4282*** (0.6574)	0.8730*** (0.0506)	0.1875 (0.1090)	2.5604 (2.8047)	4.1064
Urban inflation	5.3244*** (0.9787)	0.6999*** (0.0853)	0.1394** (0.0625)	4.7604 (2.8108)	4.0851
Rural inflation	4.9962*** (0.8489)	0.7153*** (0.0735)	0.2692*** (0.0739)	2.6684 (2.4345)	3.0954
Inflation proxy	Constant	Policy inertia	Inflation	Output gap	SSR
Panel B: Modelling without inflation target					
Headline inflation	2.9151*** (0.5292)	0.7264*** (0.0670)	0.1360*** (0.0324)	10.1890*** (2.5161)	3.5764
Core inflation	3.6282*** (0.4094)	0.6314*** (0.0420)	0.1978*** (0.0208)	7.0672*** (1.6048)	1.2282
Food inflation	4.0467*** (0.5424)	0.6472*** (0.0658)	0.1260*** (0.0281)	5.1964** (2.3431)	2.2683
Urban inflation	6.1934*** (0.5833)	0.4260*** (0.0691)	0.1506*** (0.0223)	7.6089*** (1.8620)	1.5535
Rural inflation	4.6518*** (0.4286)	0.5113*** (0.0457)	0.1941*** (0.0184)	7.1298*** (1.3984)	0.7656

Note: SSR represents sum squared residuals. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

Table 10: Extended Taylor's Rule [Exchange rate]

Inflation proxy	*Constant*	*Policy inertia*	*Inflation deviation*	*Output gap*	*Exchange rate*	*SSR*
Panel A: Modelling with inflation target						
Headline inflation	0.7760 (1.5716)	0.8012*** (0.0934)	0.0348 (0.0762)	7.4033** (3.1179)	0.5900 (0.3969)	5.2157
Core inflation	1.7117 (1.6170)	0.7125*** (0.0848)	0.1321 (0.0932)	4.9152 (3.0756)	0.6181 (0.3781)	3.7986
Food inflation	1.5004 (1.2452)	0.7691*** (0.0715)	0.2066** (0.0883)	3.5619 (2.6465)	0.5297* (0.3012)	2.9646
Urban inflation	0.0952 (1.1094)	0.2700*** (0.0886)	0.0097 (0.0430)	9.9576*** (1.9274)	1.7272*** (0.3114)	1.3536
Rural inflation	-1.0286 (1.4024)	0.2389** (0.1111)	0.0170 (0.0710)	11.2322*** (2.4245)	1.9882*** (0.4253)	1.3150
Inflation proxy	Constant	Policy inertia	Inflation	Output gap	Exchange rate	SSR
Panel B: Modelling without inflation target						
Headline inflation	7.3680*** (2.4324)	0.8149*** (0.0818)	0.2601*** (0.0734)	9.2413*** (2.3714)	-1.2638* (0.6816)	2.9893
Core inflation	6.5857*** (1.0634)	0.7107*** (0.0450)	0.2875*** (0.0354)	6.5742*** (1.3631)	-0.8670*** (0.2939)	0.8611
Food inflation	10.5371*** (2.0094)	0.6871*** (0.0542)	0.2814*** (0.0508)	4.0178** (1.8671)	-1.6256*** (0.4862)	1.4344
Urban inflation	0.4593 (2.9732)	0.2860*** (0.0966)	0.0149 (0.0722)	9.7589*** (2.0079)	1.5979* (0.8195)	1.3252
Rural inflation	8.4910*** (2.3348)	0.7450*** (0.1235)	0.3228*** (0.0730)	5.0587** (2.0303)	-1.4379* (0.8013)	0.5645

Note: SSR represents sum squared residuals. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

Table 11: Extended Taylor's Rule [Oil price – Bonny Light]

	Constant	***Policy inertia***	***Inflation deviation***	***Output gap***	***Bonny light***	***SSR***
Panel A: Modelling with inflation target						
Headline inflation	-3.1120* (1.6170)	0.9359*** (0.0521)	0.1667** (0.0560)	4.7543* (2.4616)	1.2897*** (0.3235)	2.9721
Core inflation	-1.9968 (1.3448)	0.8683*** (0.0448)	0.2224*** (0.0626)	3.8253* (2.1192)	1.2274*** (0.2789)	2.2538
Food inflation	-1.9343 (1.1402)	0.9121*** (0.0380)	0.2980*** (0.0665)	1.7760 (1.9823)	1.0851*** (0.2320)	1.7185
Urban inflation	-0.8696 (1.5536)	0.7682*** (0.0626)	0.1724*** (0.0399)	3.9002* (2.0853)	1.2044*** (0.2815)	2.0532
Rural inflation	-0.9551 (1.3465)	0.8229*** (0.0586)	0.2425*** (0.0429)	2.7980 (1.8105)	1.0634*** (0.2250)	1.3584
	Constant	***Policy inertia***	***Inflation***	***Output gap***	***Bonny light***	***SSR***
Panel B: Modelling without inflation target						
Headline inflation	0.4217 (1.5799)	0.7300*** (0.0754)	0.1331*** (0.0308)	7.1188** (2.4847)	0.5880* (0.2911)	2.1666
Core inflation	2.0078** (0.8488)	0.6500*** (0.0398)	0.1897*** (0.0200)	6.3167*** (1.3537)	0.3497** (0.1640)	0.7630
Food inflation	2.1303 (1.2222)	0.6229*** (0.0647)	0.1421*** (0.0259)	4.9056** (2.0131)	0.4475* (0.2380)	1.3930
Urban inflation	2.2410* (1.2012)	0.5269*** (0.0600)	0.1367*** (0.0170)	5.7998*** (1.6378)	0.6960*** (0.2028)	0.8473
Rural inflation	2.5643*** (0.7928)	0.5845*** (0.0389)	0.1796*** (0.0137)	6.2263*** (1.0513)	0.3457** (0.1350)	0.3625

Note: SSR represents sum squared residuals. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

Table 12: Extended Taylor's Rule [Oil price – WTI]

	Constant	***Policy inertia***	***Inflation deviation***	***Output gap***	***WTI***	***SSR***
Panel A: Modelling with inflation target						
Headline inflation	-3.8046** (1.6338)	0.9471*** (0.0498)	0.1667*** (0.0529)	4.8741* (2.4039)	1.4468*** (0.3374)	2.9509
Core inflation	-2.5438 (1.4652)	0.8753*** (0.0467)	0.2227*** (0.0637)	3.8464 (2.2399)	1.3608*** (0.3128)	2.2560
Food inflation	-2.4238* (1.1925)	0.9187*** (0.0379)	0.3014*** (0.0650)	1.7582 (2.0048)	1.2025*** (0.2506)	1.6935
Urban inflation	-1.2435 (1.7008)	0.7737*** (0.0651)	0.1694*** (0.0413)	3.7983 (2.1995)	1.3032*** (0.3182)	2.1137
Rural inflation	-1.2953 (1.4779)	0.8303*** (0.8303)	0.2375*** (0.0448)	2.7453 (1.9075)	1.1463*** (0.2563)	1.4856
	Constant	***Policy inertia***	***Inflation***	***Output gap***	***WTI***	***SSR***
Panel B: Modelling without inflation target						
Headline inflation	-0.3039 (1.7635)	0.7602*** (0.0784)	0.1261*** (0.0327)	7.2309** (2.6466)	0.7110* (0.3401)	2.3943
Core inflation	1.6781 (1.0096)	0.6624*** (0.0441)	0.1865*** (0.0224)	6.3400*** (1.5220)	0.4087* (0.2023)	0.8899
Food inflation	1.7620 (1.4096)	0.6412*** (0.0698)	0.1376*** (0.0280)	5.0013** (2.1854)	0.5071* (0.2831)	1.5842
Urban inflation	1.9203 (1.3450)	0.5398*** (0.0638)	0.1339*** (0.0183)	5.7350*** (1.7486)	0.7599*** (0.2367)	1.0136
Rural inflation	2.3246** (1.0641)	0.5978*** (0.0495)	0.1767*** (0.0177)	6.2793*** (1.3438)	0.3812* (0.1893)	0.5461

Note: SSR represents sum squared residuals. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

4.3 Evaluation of central bank independence

Central bank independence (CBI) and transparency have been identified as major requirements for the success of inflation targeting as they can help deliver good macroeconomic outcomes in terms of low and stable inflation through insulating monetary policy from short-term political pressures (Garriga and Rodriguez, 2020; Alpanda and Honig, 2010; Walsh, 1995). Providing empirical measurement for central bank independence however remains a challenge. Nonetheless, the widely known global central bank independence measure put forward by Garriga (2016) can be employed to comment on the level of independence of the monetary authority in Nigeria among several other countries covered in the study (see also Garriga and Rodriguez, 2020). A caveat however applies such that the CBI index is yet to be updated beyond year 2012, hence, the information offered by the index may be inadequate.

The CBI index covers four main components which include: (i) legal indicator – described as legal variables aggregate weighted [CBI-LVAW], which measures the existence of clear legal distinction between the operations of fiscal and monetary policy institutions; (ii) CEO indicator [CBI-CEO] – it measures the frequency of the appointment and dismissal of the governor and other executives of the monetary policy institution; (iii) policy indicator [CBI-Policy] – which defines the interference/non-interference of the fiscal authority in the formulation of monetary policy; (iv) public sector lending indicator [CBI-LIMLEN] which measures the resilience of the monetary authority to independently determine lending to public sector or financing of public sector expenditure (see Garriga and Rodriguez, 2020). For ease of analysis, we classify the measurements of Central Bank Independence into Low (CBI<0.5), Moderate (0.5≤CBI<0.7), High (0.7≤CBI<0.8), Very High (0.8≤CBI<1) and Perfect (CBI=1).

We document the findings in Tables 13a-d and include comparisons for two advanced economies operating inflation targeting; New Zealand and United Kingdom, two emerging economies where inflation targeting is operational; Brazil and Turkey, as well as two countries currently operating inflation targeting in Africa; Ghana and South Africa. Based on the latest available data (i.e. 2010 and beyond), results in 13a suggest that the

monetary authority in Nigeria has moderate legal independence (0.626) outside of fiscal authority. While this sits below the New Zealand (0.777) and United Kingdom (0.701) with high legal independence, Turkey has a very high legal independence (0.899), but Nigeria ranks in this regard better than Ghana (0.560) and South Africa (0.365).

Table 13b shows the trends in the CBI when described by the frequency of changing the chief executive officer (CEO) of the monetary authority institution. This describes the turnover of the executive or the central bank governor. Higher/lower turnover of chief executive implies lower/higher CBI, hence, the lower the CBI-CEO, the more preferred. The table shows moderately high CEO turnover for Nigeria (0.645) which although ranks among the values for New Zealand, Turkey and South Africa, but it is not a preferred outcome since lower CBI-CEO index indicates higher independence in the present case. In this instance, United Kingdom (0.582) performs better in the advanced economies group, Brazil (0.062) in emerging, and Ghana (0.457) in the African group.

Table 13c shows the average values of the CBI when described as bank's policy formulation attributions (Policy). This describes the degree of interference of the fiscal authority in the monetary policy formulation. The higher/lower the POL index, the lower/higher the bank's policy formulation attributions measure of CBI. New Zealand (0.270), UK (0.268), and Brazil (0.165) offer better CBI-Policy performance than Nigeria (0.500) since the lower the index, the better the outcome in this regard.

Table 13d shows the averages of the CBI when described as limitations on lending to the public sector (LIMLEN). The higher/lower the CBI-LIMLEN, the higher/lower the limitations on lending to the public sector measure of CBI, thus lower CBI-LIMLEN is preferred. Therefore, Nigeria (0.664) performs poorly than the two inflation targeting African countries – Ghana (0.533) and South Africa (0.172). Turkey had a perfect score, New Zealand (0.916) and United Kingdom (0.909) had near perfect scores. In all, although the CBI index is dated, we can learn from the available information here examined to instruct direction of thoughts of the policy makers towards the adoption of

inflation targeting framework in Nigeria as we currently fall short in about three of the four CB indicators.

Table 13a: Central Bank Independence [CBI-LVAW]

	1991-1999	2000-2009	2010 & beyond
Nigeria	0.5278	0.5573	0.6262
New Zealand	0.3486	0.4343	0.7773
United Kingdom	0.3621	0.7011	0.7011
Brazil	0.2548	0.2548	0.2548
Turkey	0.4678	0.8558	0.8990
Ghana	0.3056	0.5096	0.5606
South Africa	0.3077	0.3486	0.3651

Note: The table presents the average values for CBI by legal indicator. The higher the CBI, the better for smooth transition to inflation targeting. The categorisation of Central Bank Independence is as follows: Low (CBI<0.5), Moderate (0.5≤CBI<0.7), High (0.7≤CBI<0.8), Very High (0.8≤CBI<1) and Perfect (CBI=1).

Table 13b: Central Bank Independence [CBI-CEO]

	1991-1999	2000-2009	2010 & beyond
Nigeria	0.5825	0.6012	0.6450
New Zealand	0.4175	0.4630	0.6450
United Kingdom	0.5825	0.5825	0.5825
Brazil	0.0625	0.0625	0.0625
Turkey	0.3950	0.6200	0.6450
Ghana	0.4575	0.4575	0.4575
South Africa	0.5277	0.5625	0.6450

Note: The table presents the average values for CBI by CEO turnover indicator. The higher the CBI, the better for smooth transition to inflation targeting. The categorisation of Central Bank Independence is as follows: Low (CBI<0.5), Moderate (0.5≤CBI<0.7), High (0.7≤CBI<0.8), Very High (0.8≤CBI<1) and Perfect (CBI=1).

Table 13c: Central Bank Independence [CBI-Policy]

	1991-1999	2000-2009	2010 & beyond
Nigeria	0.2675	0.3372	0.5000
New Zealand	0.2700	0.2700	0.2700
United Kingdom	0.0594	0.2675	0.2675
Brazil	0.1650	0.1650	0.1650
Turkey	0.7325	0.9732	1.0000
Ghana	0.0825	0.6165	0.7500
South Africa	NA	NA	NA

Note: The table presents the average values for CBI by policy independence indicator. The higher the CBI, the better for smooth transition to inflation targeting. The categorisation of Central Bank Independence is as follows: Low (CBI<0.5), Moderate (0.5≤CBI<0.7), High (0.7≤CBI<0.8), Very High (0.8≤CBI<1) and Perfect (CBI=1).

Table 13d: Central Bank Independence [CBI-LIMLEN]

	1991-1999	2000-2009	2010 & beyond
Nigeria	0.5625	0.5931	0.6645
New Zealand	0.1500	0.3032	0.9163
United Kingdom	0.3867	0.9090	0.9090
Brazil	0.4352	0.4352	0.4352
Turkey	0.3780	0.9378	1.0000
Ghana	0.2235	0.4713	0.5333
South Africa	0.1710	0.1723	0.1723

Note: The table presents the average values for CBI by public sector lending indicator. The higher the CBI, the better for smooth transition to inflation targeting. The categorisation of Central Bank Independence is as follows: Low (CBI<0.5), Moderate (0.5≤CBI<0.7), High (0.7≤CBI<0.8), Very High (0.8≤CBI<1) and Perfect (CBI=1).

4.4 Correcting deviations from the inflation target

Inflation targeting is anchored on the ability of the monetary authority to conduct forecasts and identify the direction of inflation so as to employ relevant monetary policy tools to drive inflation towards the set target. This is the channel with which inflation targeting is expected to achieve low inflation (see empirical results in Mishkin and Schmidt-Hebbel, 2007; Walsh, 2009 in countries that have adopted inflation targeting monetary policy framework). Thus, given the reality of monetary policy inertia i.e. lags in the deployment of and effectiveness of monetary policy, the central bank operating under inflation targeting framework should be forward-looking to be able to predict the direction of inflation and take relevant actions before inflation starts to rise, for instance. Consequently, it is sacrosanct for the central bank to have a suitable model for forecasting inflation.

It is on the basis of the forgoing that we suggest the following predictive model for forecasting inflation in Nigeria based on three macroeconomic fundamentals, namely, inflation persistence (which captures expectations of economic agents about prices and costs), money supply, and exchange rate, such that expectation of higher inflation, money growth and exchange rate depreciation will be expected to be inflationary i.e. positive relationships expected in theory.[8]

$$inf_t = \alpha^{ms} + \delta_1^{ms} inf_{t-1} + \delta_2^{ms} ln(ms_{t-1}) + \delta_3^{ms} \Delta ln(ms_t) + \varepsilon_t^{ms} \quad (9)$$

$$inf_t = \alpha^{exr} + \delta_1^{exr} inf_{t-1} + \delta_2^{exr} ln(exr_{t-1}) + \delta_3^{exr} \Delta ln(exr_t) + \varepsilon_t^{exr} \quad (10)$$

where inf_t could be any of the five proxies of inflation; the inclusion of inf_{t-1} captures inflation expectation/inflation persistence in a more technical language; ms_t is the broader definition of money supply; exr_t is the bilateral exchange rate; the first lags of the predictors are captured in the models to abstract from the delayed response among macroeconomic variables; each of the predictors (money supply and exchange rate) are captured separately in order to combine their inflation forecasts without falling into

[8] We do not preclude the role of other notable predictors of inflation such as oil price.

multicollinearity problem; $\Delta ln(ms_t)$ and $\Delta ln(exr_t)$ are included to circumvent unit root problem in the data; the estimator employed is a pseudo Generalized Least Squares (as in Westerlund and Narayan, 2012, 2015) which involves pre-multiplying the variables with the inverse of the residuals when the models are first estimated with OLS to take care of heteroscedasticity and serial correlation problem.

We document the estimation results for the exchange rate-inflation nexus in Table 14, the money supply-inflation nexus in Table 15, explore the predictive content of the predictors (i.e. how effective are money supply and exchange rate able to predict inflation in Nigeria) in Figures 2a-e, and obtain combined out-of-sample forecasts for inflation based on the scenario analysis that the monetary authority pursues a policy direction that drive down the two variables (i.e. policies that mops up excess liquidity from the economy and those that manages exchange rate depreciation). The out-of-sample forecasts involving the "what if" analysis are produced in Tables 16a-c to demonstrate how forecasting inflation with the use of relevant policies can be used to drive down inflation.

The results in Tables 14 and 15 confirm that Inflation expectation, money growth, and exchange rate depreciation contribute to inflation in the Nigerian economy. The coefficients associated with the two predictors are positive and significant for nearly all the five inflation proxies. In essence, aside from confirming the importance of demand factors as determinants of inflation (see previous evidences in Tule, Salisu and Chiemeke, 2020; Salisu, Ademuyiwa, and Isah, 2018), the outcomes also highlight the role of expectations of economic agents about future costs and prices in driving up prices (see corroborations outside Nigeria in Bouras et al., 2023; Glover et al., 2023). The predictability graphs in Figures 2a-e show that the predictors examined are good predictors of inflation in Nigeria. Hence, the forecasting model to be adopted by the Central Bank for Nigeria during the inflation targeting regime should at least include these three fundamentals. Further, we also demonstrate in Tables 16a-c through scenario analyses (reduction in the predictors by 5%, 7.5%, and 10%) that inflation can be consistently brought down by influencing money supply and exchange rate downwards.

The details about the how this can be realised become the business of the monetary policy authority.

Table 14: Exchange rate-Inflation estimation

	Constant	Inflation expectation	Exchange rate
Headline inflation	-1.3828* (0.7246)	0.9660*** (0.0220)	0.3356** (0.1647)
Core inflation	-2.2734* (1.2517)	0.8667*** (0.0350)	0.6813*** (0.2579)
Food inflation	-2.8015** (1.2158)	0.9346*** (0.0261)	0.6812** (0.2622)
Urban inflation	-2.1464** (0.9617)	0.8958*** (0.0315)	0.6337*** (0.2185)
Rural inflation	-0.9767 (0.9142)	0.9419*** (0.0241)	0.3055 (0.1913)

Note: Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

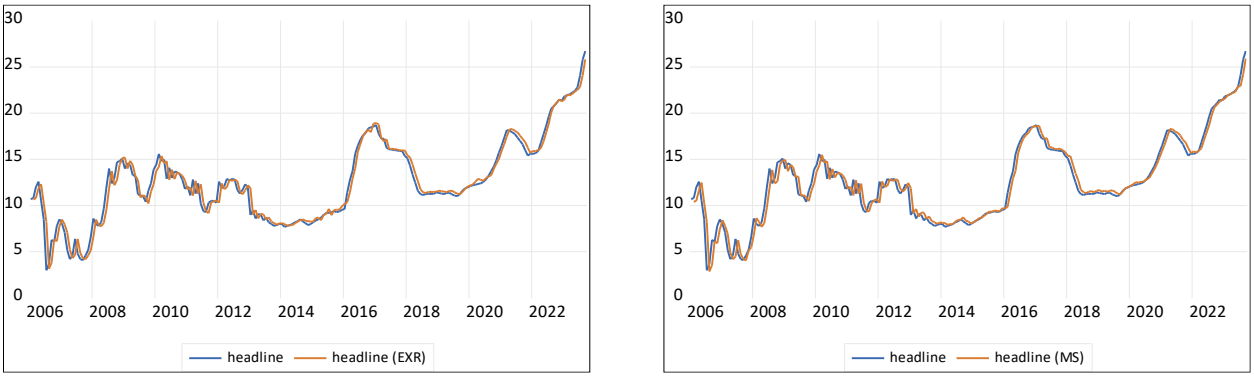
Table 15: Money supply-Inflation estimation

	Constant	Inflation expectation	Money supply
Headline inflation	-3.8448** (1.6559)	0.9760*** (0.0188)	0.2500** (0.1071)
Core inflation	-4.7230* (2.8214)	0.8892*** (0.0315)	0.3623** (0.1745)
Food inflation	-10.2527*** (2.9044)	0.9286*** (0.0246)	0.6704*** (0.1866)
Urban inflation	-4.1961**	0.9360***	0.2981**

	(2.0488)	(0.0257)	(0.1302)
Rural inflation	-4.0604* (2.1186)	0.9457*** (0.0234)	0.2841** (0.1343)

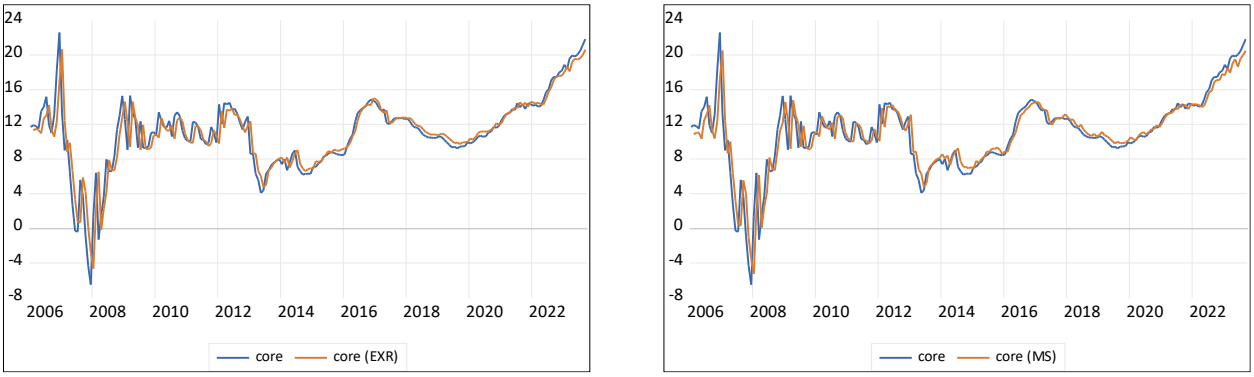
Note: Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.

Figure 2a: In-sample predictability results [Headline]



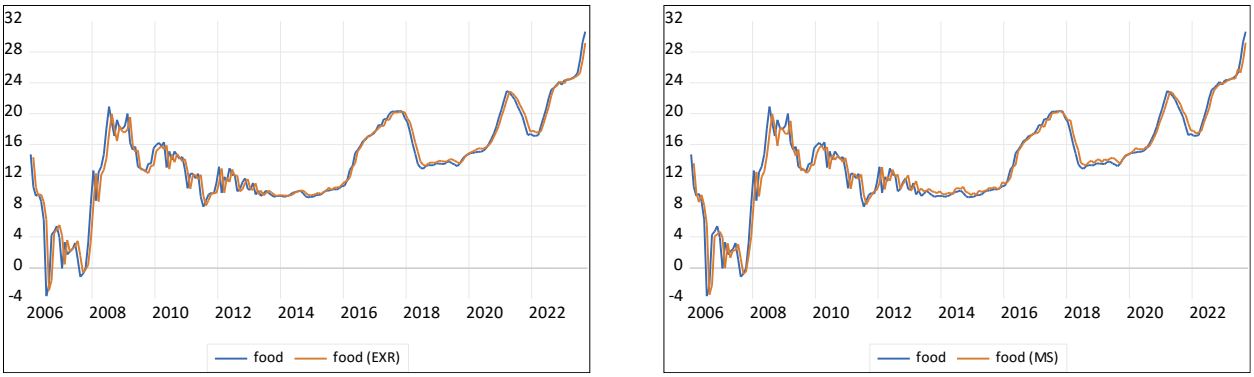
Note: The predictability of headline inflation is here examined. The predictive results with exchange rate (money supply) as the predictor is rendered on the left (right).

Figure 2b: In-sample predictability results [Core]



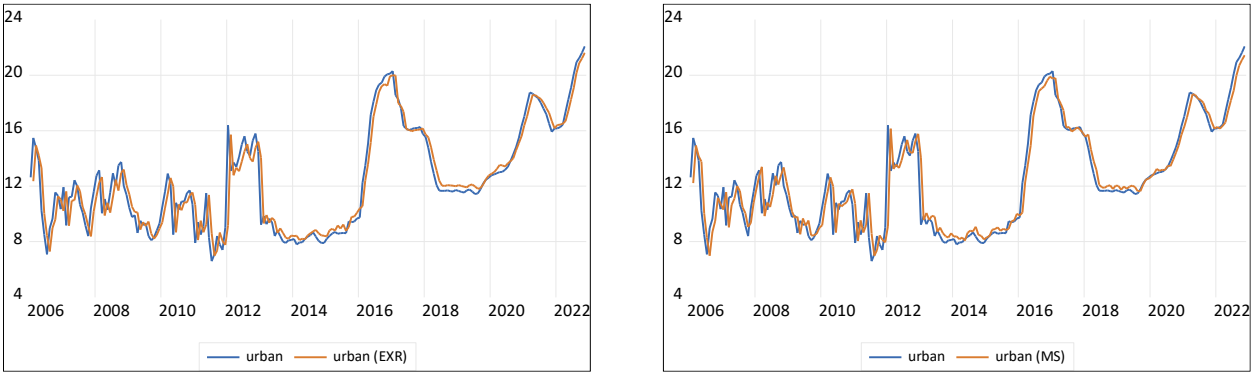
Note: The predictability of core inflation is here examined. The predictive results with exchange rate (money supply) as the predictor is rendered on the left (right).

Figure 2c: In-sample predictability results [Food]



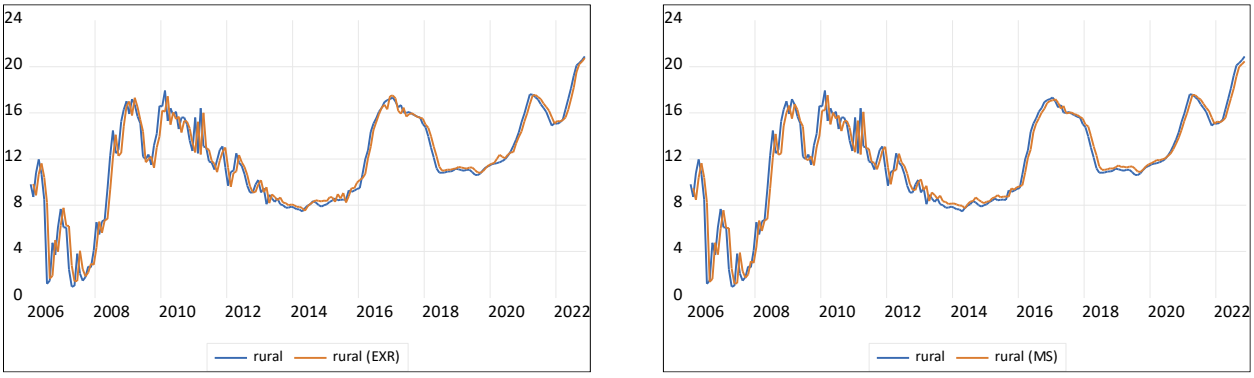
Note: The predictability of food inflation is here examined. The predictive results with exchange rate (money supply) as the predictor is rendered on the left (right).

Figure 2d: In-sample predictability results [Urban]



Note: The predictability of urban inflation is here examined. The predictive results with exchange rate (money supply) as the predictor is rendered on the left (right).

Figure 2e: In-sample predictability results [Rural]



Note: The predictability of rural inflation is here examined. The predictive results with exchange rate (money supply) as the predictor is rendered on the left (right).

Table 16a: Combined forecasts [5% reduction in EXR & MS]

Forecasts	**2023M10**	**2023M11**	**2023M12**	**2024M01**
Headline inflation	26.53	26.36	26.12	25.90
Core inflation	21.25	20.72	20.24	19.76
Food inflation	30.10	29.56	29.01	28.48
	2022M12	**2023M01**	**2023M02**	**2023M03**
Urban inflation	21.62	21.18	20.73	20.29
Rural inflation	20.60	20.28	19.95	19.65

Note: The out-of-sample forecasts for the inflation series are offered based simulations that the policy makers employ relevant policy instruments to target 5 percent reduction in the drivers of inflation. The data is in monthly frequency and covers 2006M01 to 2023M09 with the exception of urban and rural inflation series which are available up to 2022M11 in official sources.

Table 16b: Combined forecasts [7.5% reduction in EXR & MS]

Forecasts	**2023M10**	**2023M11**	**2023M12**	**2024M01**
Headline inflation	26.44	26.13	25.83	25.50
Core inflation	21.29	20.68	20.14	19.67
Food inflation	29.94	29.27	28.60	27.95
	2022M12	**2023M01**	**2023M02**	**2023M03**
Urban inflation	21.53	20.95	20.41	19.89
Rural inflation	20.47	20.08	19.69	19.29

Note: The out-of-sample forecasts for the inflation series are offered based simulations that the policy makers employ relevant policy instruments to target 7.5 percent reduction in the drivers of inflation. The data is in monthly frequency and covers 2006M01 to

2023M09 with the exception of urban and rural inflation series which are available up to 2022M11 in official sources.

Table 16c: Combined forecasts [10% reduction in EXR & MS]

Forecasts	**2023M10**	**2023M11**	**2023M12**	**2024M01**
Headline inflation	26.34	25.94	25.54	25.07
Core inflation	21.24	20.69	20.17	19.69
Food inflation	29.89	29.11	28.30	27.45
	2022M12	**2023M01**	**2023M02**	**2023M03**
Urban inflation	21.41	20.72	20.06	19.40
Rural inflation	20.39	19.90	19.43	18.92

Note: The out-of-sample forecasts for the inflation series are offered based simulations that the policy makers employ relevant policy instruments to target 10 percent reduction in the drivers of inflation. The data is in monthly frequency and covers 2006M01 to 2023M09 with the exception of urban and rural inflation series which are available up to 2022M11 in official sources.

4.5 Migration scheme and conditions CBN should start thinking about

i. Announce a target band for inflation

- The first requirement for inflation targeting is to publicly announce a target for inflation preferably around a band.
- We offer three options for the monetary authority in Nigeria to start off the inflation targeting framework with either of the following target ranges: (a) 10.56 - 13.14 percent; (b) 13.46 - 14.70 percent; (c) 10.90 - 16.47 percent.

ii. Choice of price inflation proxy to target

- We make a case for the central bank to target headline inflation since it is the main inflation proxy that economic agents in Nigeria base their decisions on.
- We also suggest that the authorities keep an eye on food inflation given its strong policy implications.

iii. Inflation targeting horizon

- Two choices confront the authorities; either they define a period for the target to be achieved or adopt a continuous approach.
- Should the first approach be preferred, we suggest at least 32 months (about 2 ½ years) if a target period is to be specified.
- Otherwise, a continuous approach can be adopted like the South African Reserve Bank, which is more flexible and allows temporary deviations from the target as long as the policymakers ensure that inflation reverts towards the target range within a reasonably short time, usually a year.

iv. Adherence to inflation targeting

- An extended Taylor rule equation that reflects inflation deviation from the set target, output gap, exchange rate, and oil price may be adopted to frequently examine the commitment to inflation targeting and to determine the optimal policy rate for the system.

v. Central bank independence

- There may be need for a legal backing to entrench the autonomy of the Central Bank of Nigeria through necessary amendments to the Act of Parliament that established the Bank.
- It is preferred to vest the power of appointment/dismissal of head of the Bank (and its board members) as well as its accountability in the legislature rather than the executive to preclude political/fiscal interference/dominance.
- A formal research should be commissioned to develop a better central bank index for Nigeria.

vi. Correcting deviations from target

- The predictive model developed in this paper that include inflation expectation, money supply and exchange rate, alongside econometric features built-in can be employed for forecasting inflation to stay ahead with the direction that inflation needs to be steered to achieve the target.

vii. Accountability

- There should be a periodic publication of inflation reports (about twice in a year). This should be made public and defended on the floor of the National

Assembly. This report should contain details about inflation forecasts, the extent to which the target is met, compelling reasons if they are not met, and direction of policy actions.

5. Concluding remarks

In this study, we discuss for the Central Bank of Nigeria to transit to inflation targeting monetary policy framework. We explore a number of migration scheme and conditions as informed from the literature; namely, (i) determination and announcement a target band for inflation, (ii) Ascertain the choice of price inflation proxy to target, (iii) Determine the horizon to achieve the inflation target, (iv) Assess the adherence of the monetary authority to the goal of inflation targeting, (v) Evaluate the extent of central bank independence and accountability, develop a framework forecasting inflation to serve as the basis for correcting deviations from the target. We build relevant research questions around these and employ an eclectic data analysis approach including summary statistics, graphical analyses, model estimation and forecasting to provide responses to the questions and offer relevant direction to guide the monetary authority on the inflation targeting transition scheme.

We suggest inflation target in the range of 10.56 - 13.14 percent or 13.46 - 14.70 percent or 10.90 - 16.47 percent. We argue for targeting headline inflation with special attention on food inflation as well. On central bank independence, we suggest legal ways to deepen central bank independence in Nigeria and call for commissioning of a research to develop a better central bank index for Nigeria. We offer relevant econometric models to forecast inflation and to determine the optimal monetary policy. Also, during the inflation targeting operation, we recommend a biannual publication of inflation reports and defense of same on the floor of the National Assembly, as a step to promote accountability and trust in the system with the public and the legislature.

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Appendix

Table A1: Inflation persistence based on AR specification [Quarterly]

	ρ	Persistence?	ρ^*	Persistence?
Headline inflation	1.0380*** (0.0489)	High	0.9500*** (0.0579)	High
Core inflation	0.9608*** (0.0701)	High	0.9030*** (0.0999)	High
Food inflation	1.0470*** (0.0480)	High	0.9163*** (0.0670)	High
Urban inflation	0.9587*** (0.0625)	High	0.8615*** (0.0752)	High
Rural inflation	0.9553*** (0.0632)	High	0.8959*** (0.0657)	High

Table A2: Inflation persistence based on unit root testing [Quarterly]

	Level	FD	Level*	FD*	I(d)
Headline inflation	-1.5140	-5.0356***	-2.1724	-5.2953***	I(1)
Core inflation	-1.5263	-7.5179***	-2.3333	-8.3770***	I(1)
Food inflation	-1.5256	-4.5711***	-1.7375	-4.7545**	I(1)
Urban inflation	-2.9526	-4.5570***	-3.4442	-5.1911***	I(1)
Rural inflation	-1.8118	-7.3397***	-3.8900	-7.4410***	I(1)

Table B1: Extended Taylor's Rule [Oil price – Brent]

	Constant	***Policy inertia***	***Inflation deviation***	***Output gap***	***Brent***	***SSR***
Panel A: Modelling with inflation target						
Headline inflation	-3.3642* (1.6473)	0.9393*** (0.0510)	0.1696*** (0.0551)	4.8024* (2.3944)	1.3454*** (0.3310)	3.0549
Core inflation	-2.1903 (1.4823)	0.8711*** (0.0471)	0.2258*** (0.0668)	3.9053 (2.2256)	1.2707*** (0.3087)	2.3447

Food inflation	-2.1213* (1.2039)	0.9153*** (0.0385)	0.3020*** (0.0677)	1.7801 (1.9979)	1.1253*** (0.2455)	1.7713
Urban inflation	-1.0538 (1.6860)	0.7673*** (0.0653)	0.1761*** (0.0424)	3.9283* (2.1677)	1.2547*** (0.3104)	2.1157
Rural inflation	-1.1142 (1.4102)	0.8239*** (0.0594)	0.2457*** (0.0438)	2.8250 (1.8251)	1.1023*** (0.2386)	1.4055
	Constant	***Policy inertia***	***Inflation***	***Output gap***	***Brent***	***SSR***
Panel B: Modelling without inflation target						
Headline inflation	0.3555 (1.6453)	0.7316*** (0.0769)	0.1335*** (0.0313)	7.2808** (2.5181)	0.5993* (0.3045)	2.2442
Core inflation	1.9863** (0.8990)	0.6515*** (0.0410)	0.1898*** (0.0205)	6.4151*** (1.3912)	0.3515* (0.1738)	0.8136
Food inflation	2.1306 (1.2908)	0.6266*** (0.0668)	0.1409*** (0.0266)	4.9805** (2.0653)	0.4433* (0.2514)	1.4792
Urban inflation	2.2609* (1.2730)	0.5237*** (0.0624)	0.1376*** (0.0178)	5.9552*** (1.6839)	0.6989*** (0.2171)	0.9147
Rural inflation	2.6082*** (0.8569)	0.5820*** (0.0414)	0.1807*** (0.0146)	6.3783*** (1.1058)	0.3389** (0.1468)	0.4067

Note: SSR represents sum squared residuals. Standard errors are reported in round brackets. Statistical significance is assessed at either 1, 5, or 10 percent with ***, **, or * indicated on the estimated coefficients respectively.