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Money, Exchange Rate, Prices and Output in Nigeria: A Test of the P-Star Model

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Abstract

The search for robust model to predict inflation within a QTM framework gave birth to P-star model which has attracted less attention of researchers and practitioners in Nigeria. This study applied the methodology to high frequency Nigerian data from 1995M1 to 2018M6 to determine the validity of the model for Nigeria using error correction model (ECM). The result supports the working of the model but with slight modification. The modification centres on the incorporation of foreign price gap, (open economy view of inflation), reserve money (Friedmanic/monetarist view), price per litre of petroleum motor spirit (PMS) and output gap (Structuralist view). With this modification, P-star model proved to be a viable inflation forecasting alternative model for Nigeria. Consequently, the Central Bank of Nigeria is advised to consider adopting this modified version of the model to forecast inflation for Nigeria at least as a complimentary model to be used side-by-side with the existing forecasting model of the Bank. This will no doubt enhance the efficacy of the monetary policy of the Bank as such policies will be predicated on sufficient information, particularly on the future path of inflation.

Keywords

Inflation, forecast, P-star, Error correction model

1. Introduction

The historical relationship between monetary aggregates and prices seems to have been distorted. The stability of money demand function was criticised, particularly by policy analysts, academics and central bankers of the industrialised countries of Australia, the US, France, Italy, Japan and the UK, to have been broken. This subjected the efficiency and reliability of monetary aggregates as predictor of prices to numerous puzzles, hence diminishing its function as an intermediate target of monetary policy. According to the key proponents of this view, the doubt on the continuous relevance of monetary aggregates in determining the general price level, and in some cases, the level of economic activity is gradually rendering money supply increasingly irrelevant and less useful, hence ceased to maintain its position in monetary policy decision making process in the developed countries, some Emerging Market Economies (EMEs) and developing countries. Most of these countries have adopted alternative strategies of monetary policy formulation.

Despite the transition, however, search on the development of new models to predict the direction of prices in relation to the quantity theory of money (QTM) which formed the basis for the relevance of monetary aggregates has been on the increase. Hallman, Porter and Small (1989, 1991) developed a P-star model based on the QTM. The model attributes the determinants of inflation to the discrepancy between the actual price and equilibrium price level. In other words, Hallman, Porter and Small (1989) opined that the direction of movement of inflation can be predicted using the gap between equilibrium and actual prices (price gap). Inflation tends to rise, fall or stabilise as actual prices fall below, rise above or remain at equilibrium, respectively.

The P-star model has since attracted a wide empirical research though with mixed results. While some support a strong validity of the model in predicting inflation, some others reject the validity of the proposition. However, despite the widespread test of the applicability of the model to developed (Note 1), emerging market economies (EMEs) and developing economies (Note 2), its validity, to our knowledge has not been widely tested for Nigeria. A few studies that attempted validating the model for Nigeria used only narrow definition of money (M1) without considering the broad approach to money definition. More so, these studies utilised quarterly data without regard for the fact that inflation computation is a monthly affair. This study is, therefore, a maiden attempt to test the validity, as well as applicability of the P-star model to the Nigerian economy using high frequency monthly data. To achieve this, the paper is structured into five sections including this introduction. Section two provides the theoretical concerns and review of some related empirical literature. The methodological framework for empirical implementation is outlined in section three, while section four discusses the results and the last section concludes.

2. Theoretical Construct and Literature Review

2.1 Theoretical Construct

The journey started with the Monetarist postulations in monetary theories of inflation, in which a strong relationship was established between monetary aggregates, price level and output. The sanction of the relationship was a fall out of the birth of quantity theory of money (QTM) propounded by Fisher (1935). The QTM states that, at any period in time, the stock of money is related to the nominal income. The theory begins with an equation of exchange given as:

$$M_t V_t = P_t Y_t \tag{1}$$

Where M is money stock, V represents the velocity of transaction, P is the price level and Y denotes aggregate income. The equation, at any given period, equates the money stock (M) *times* its velocity (V) to total income (Y) generated in the economy *times* their prices (P). Fisher (1935) assumes that velocity and output are constant in the short-run and that flexible wages and prices are necessary conditions for the attainment of full employment.

With preference for P, equation 1 is transformed as:

$$P_t = \frac{M_t V_t}{Y_t} \tag{2}$$

If we denote the equilibrium price level consistent with money supply as P^e and with the knowledge that P^e relates to long-run potential or equilibrium output as well as long-run velocity otherwise referred to as equilibrium velocity, we have a remodeled equation 2 as:

$$P_t^e = \frac{M_t V_t^e}{Y_t^e} \tag{3}$$

The superscript - e - denotes the long-run levels otherwise referred to as equilibrium.

If we divide equation 3 by equation 2 we have:

$$\frac{P_t^e}{P_t} = \left(\frac{M_t V_t^e}{M_t V_t}\right)\left(\frac{Y_t}{Y_t^e}\right) \tag{4}$$

Redefining the variables using lower cases as the natural logs yields:

$$p_t^e - p_t = (v_t^e - v_t) + (y_t - y_t^e) \tag{5}$$

From equation 5, it follows that (p^e - p) is decomposed into velocity and output gaps as (v^e - v) and (y^e - y), respectively.

For price gap to correspond to inflation, error correction model can be employed to consolidate both the long-run mechanisms and short-run dynamics. This yield:

$$\Delta p_t = \delta + \theta(p_{t-1}^e - p_{t-1}) + \sum_{i=1}^{n} \varphi_i \Delta p_i + \mu_t \tag{6}$$

From equation 6 δ is the speed of adjustment of prices to the equilibrium. If p is below p^e, inflation will rise as real prices rise towards equilibrium. Contrariwise, if p is above p^e, inflation will fall as real prices fall towards equilibrium and p remains unchanged as p equals p^e.

2.2 Empirical Literature

The modeling of the relationships between money, price, exchange rate and output has triggered debates among economists, researchers and policy makers. This has generated series of empirical investigations in developed, emerging markets and developing economies using different methodologies, across various sample periods, hence different results. For instance, the long-run relationship between money and prices was investigated in the P-star model anchored on the quantity theory of money (QTM) by Tatom (1992). Applying P-star model to Austrian data from 1960 through 1990, Tatom (1992) found that the model performs poorly in terms of identifying permanent shocks to potential output and/or velocity at levels comparatively to at first difference. The study however found evidence in support of the long-run relationship between general price level and money growth. Further investigation of the link between Austrian prices and German P-star measure shows no evidence of the validity of the model but proves the existence of long-run relationship between both countries' level of inflation with significant relationship attached to the level of money supply in Austria.

Similarly, Koenig (1994) estimated both combined and separate models of error correction and inflation equation in a framework that included a P-star model for the US economy using data from 1964Q1 to 1991Q2. The result shows the superiority of the combined model over the P-star model.

Atta-Mensah (1996) investigates the performance of M1 as a predictor of inflation in Canada in a P-star model in an error correction framework. The variables considered in the model include gross money supply (M1), money gap, consumer price index (CPI), gross domestic product (GDP) deflator, 90-day commercial paper rate, a measure of economic activity (GDP), output gap and a dummy variable that proxied financial innovation which began in 1980. The study concluded that the gap between M1 and its long-run path largely dictates the future path of inflation in Canada besides output gap.

Habibullah and Smith (1998) test the applicability of P-star model to the Philippines using data covering output gap, velocity gap, inflation, among others, from 1981:1 to 1994:4. They applied Hodrick-Prescott (HP) filter to derive the gap of the variables and the result supports the validity of the model for the country during the study period.

Habibullah (1999) tests the applicability of P-star model to Malaysia using monthly data from October 1981 to April 1994 across variables which include price level, money supply (M1 and M2), currency-M1 ratio, currency-M2 ratio, real output and interest rate. The result supports the validity of the model in Malaysia. He therefore submitted that the validity holds even if the financial liberalization that occurred in the 1980s to 1990s is built into the model.

Kulhanek (2000) estimated a customized version of P-star model for the Czech Republic during the period 1991Q4 to 1999Q1 using data covering domestic price gap, domestic aggregate expenditures, money supply (M2), circulation velocity, foreign price gap and real CZK/DEM exchange rate. The result supports the efficiency of the model for the country and could therefore be used to compliment other tools of inflation targeting used by Czech National Bank.

Sanchez-Fung (2002) examines the role of monetary aggregates and open economy indicators in inflation targeting economies of Chile and Mexico, using a nested Phillips curve and P-star models covering the period 1990M1 to 2001M6 for Chile and 1986M1 to 2001M6 for Mexico. Observable variables considered in the model include money supply, real income, prices, interest rates, exchange rates and inflation as well as their respective gaps. The results reveal that real money gap and money growth are relevant in predicting deviations of observed inflation from target inflation for Chile. Real exchange rate as well as its gap and money are found to be the predictors of the gap between inflation and expected inflation in Mexico during pre-inflation target regime. The predictors however changed to the gap between inflation and inflation target post inflation targeting regime. Thus, confirm the validity of the P-star model to Mexico particularly after the introduction of Inflation Targeting.

Clostermann and Seitz (2002) use a P-star model within a vector error correction framework, to analyse the impact of monetary policy on German inflation between 1973Q1 to 1997Q4. The variables considered in the model include money supply (M3), general price level, real GDP, output gap and opportunity cost calculated as the difference between yield on bearer bonds and own rate of return of M3. The results, according to the authors, among others, reveal an indirect temporary effect of the monetary policy of the Bundesbank via output gap and support the long-run neutrality of money.

In analysing the role of money in the inflation process in Norway between 1969M1 and 2001M1, Eitrhem (2003) adopted an eclectic approach which included a P-star model. Included in the model are variables such as; equilibrium levels of output, velocity gap, velocity, prices, price gap and inflation expectation, among others. The result of the P-star model reports an inverse relationship between real money gap and price gap. Thus, the model reveals a direct effect of the lagged real money gap on inflation and that price level fluctuations around equilibrium is a function of velocity and output.

Belke and Pollit (2004) apply a P-star model to examine the inflation process in Sweden from 1985Q1 to 2004Q1. The result suggests that broad money supply defined in the context of P-star is a critical predictor of the general price level development process in Sweden. The finding according to the authors is predicated on the fact the out-of-sample forecast by the P-star model yielded a statistically significant satisfactory result.

Pranskeviciute and Sperbega (2005) evaluates the influence of domestic and foreign inflation on the inflation level of Latvia using P-star model in the context of Ordinary Least Squares (OLS) covering the period, 1999Q1 through 2004Q3, considering macroeconomic data such as index of GDP deflator, index of domestic and Eurozone money velocity index, money supply index, nominal and real exchange rates as well as their respective gaps derived through HP filter. The result reveals that inflation process in Canada is dependent on both domestic and foreign inflation gaps. They also posit that the level of economic activities in the Eurozone plays a critical role.

Abdul and Faiz (2005) adopt the P-star model to compute the leading indicator of inflation as well as test its forecasting performance using Pakistani data from 1960 to 2003, covering variables such as velocity, general price level and their respective gaps. The results suggest the superiority of P-star model over simple autoregressive model and the M2 growth augmented model. The authors conclude that the P-star model carries heavy information about future direction of prices.

Herwartz and Reimers (2006) analyse the dynamic relationships between money, real output and prices for an unbalanced panel of 110 countries and found that for high inflation economies, homogeneity between prices and money cannot be rejected. They however suggested that central banks, even in high inflation countries, can improve price stability by controlling monetary growth.

Mihalicova, Gazda, Kubak and Grof (2011) estimated a P-star model using Bulgarian data covering nominal and real GDP, money supply (M2), money velocity among others from the first quarter of 1997 through the second quarter of 2009 which coincided with the currency board regime in Bulgaria. Their findings suggest that domestic price gap plays a crucial role in predicting the country's inflation.

Kelikume (2013) assesses the validity of P-star model for Nigeria using quarterly data from 1970 through 2011. Variables included in the model are narrow money supply (M1), nominal and real GDP, price gap, velocity gap, output gap and inflation. The result provides strong evidence in support of the validity of P-star model in predicting inflation for Nigeria.

Sunil, Sartaj and Ramachandran (2015) use P-star model framework and traditional Phillips curve approach to examine the link between money and inflation in India from April 1993 to August 2014. The study utilized both simple sum and Divisia M3 measures of monetary aggregates and found that the P-star model estimated with real money gap outperforms the traditional Phillips curve approach. Further, the P-star model that considers Divisia real money gap outperforms the one that uses the simple sum implying that variations in money supply is a highly important predictor of inflation for India.

Islatince and Siklar (2015) examine the validity of P-star model for Turkey using data from January 2002 through December 2014 covering variables such as GNP, real GDP, narrow and broad money supply (M1 & M2) and their respective gaps; and opportunity cost of money holding. The result shows that P-star model is relevant to Turkey's short-term inflationary process. The authors however advocated for the inclusion of structural factors in modelling inflation for the country in the long-run so as to yield a relatively more realistic prediction of movement in prices for the Turkey.

3. Data Issues, Empirical Methodology and Estimation Procedure

3.1 Empirical Methodology

Equation 6 suffices for a small closed economy, but for open economies like Nigeria and following Kiptui (2013), the influence of foreign prices in the domestic economy cannot be over-looked, hence, equation 6 is modified to incorporate both domestic and foreign price gaps:

$$\Delta p_t = \delta + \theta_1(p_{t-1}^e - p_{t-1}) + \theta_2(x_{t-1}^e - x_{t-1}) + \sum_{i=1}^{m} \varphi_i \Delta p_i + \sum_{j=1}^{n} \varphi_j \Delta x_j + \omega_i Z_t + \mu_t \qquad (7)$$

Where x is real exchange rate and x^e is the long-run potential or equilibrium real exchange rate, Z is a vector of possible foreign and domestic exogenous shocks selected based on economic theory and the peculiarities of the Nigerian economy.

3.2 Data Issues

3.2.1 Main Estimation

The data set is obtained from the Statistical Database of the Central Bank of Nigeria (CBN). The estimation uses monthly data spanning the period 1995M1 through 2018M6, Hodrick-Prescott (1980) filter is used to obtain the equilibrium price and exchange rate. The HP filter is a two-sided linear filter that utilises a long term symmetric moving average to de-trend (7) time series (Note 3).

$$Min \sum_{t=1}^{T} (lnY - lnY_t^*) \qquad (8)$$

Subject to:

$$\sum_{t=2}^{T-1}[(lnY - lnY_t^*) - (lnY_t^* - lnY_{t-1})]^2$$

The objective is principally to minimise lnY^*

$$Min\sum_{t=1}^{T}(lnY - lnY_t^*)^2 + \lambda\sum_{t=2}^{T-1}[(lnY - lnY_t^*) - (lnY_t^* - lnY_{t-1})]^2 \quad (9)$$

Where Y is the variable of interest, Y^* is the trend otherwise known as the potential, Y_{t-1} is a period lag of the variable and λ is the Lagrange multiplier which control the smoothness of the variance of the data. It is given as 100, 1600 and 14400 for annual, quarterly and monthly series, respectively.

4. Discussion of Results

4.1 Statistical Properties of the Data

The characteristics of the data used for the estimation was first explored using descriptive statistics. From Table 1 which displays the results, it is evident that there are one hundred (100) observations per variable. The table also shows that most of the data are positively skewed except for *lrm*, *lry* and *ry_gap* which are log of reserve money, log of real output and output gap, respectively.

Table 1. Summary Statistics

	cpi	*lcpi*	*lcpi_gap*	*lexr*	*exr_gap*	*lrm*	*lry*	*ry_gap*	*pms*
Mean	163.38	5.06	0.00	5.36	0.23	15.13	16.85	20918826.00	99.32
Median	154.63	5.04	0.00	5.13	-0.08	15.38	16.87	21566384.00	97.00
Maximum	254.52	5.54	0.03	6.21	138.47	15.73	17.26	30040548.00	145.00
Minimum	103.13	4.64	-0.02	5.02	-48.05	14.11	16.35	7776693.00	65.00
Std. Dev.	42.74	0.25	0.01	0.38	31.77	0.49	0.24	5748846.00	28.58
Skewness	0.60	0.23	0.53	0.85	2.00	-0.70	-0.22	-0.44	0.56
Kurtosis	2.30	2.04	3.11	2.07	8.51	1.99	2.04	2.39	2.11
arque-Bera	7.97	4.69	4.65	15.66	193.51	12.39	4.62	4.75	8.51
Probability	0.02	0.10	0.10	0.00	0.00	0.00	0.10	0.09	0.01
Observations	100	100	100	100	100	100	100	100	100

Augmented Dickey Fuller (ADF) based on Akaike Information Criterion (AIC) and Phillips-Perron (PP) unit root tests were adopted to characterize the long-run properties of the variables. As reported in Table 2, the result reveals that consumer price index (CPI) and its log version (lcpi), exchange rate (exr), reserve money (rm) and the price of petroleum motor spirit (PMS) are first difference stationary I(1) based on both methodologies, hence enter the regression at first difference, while domestic price gap ($lcpi^e$-lcpi), foreign price gap (exr^e-exr), real output (ry) and real output gap (ry^e-ry) are stationary at level I(0) and hence treated as such.

Table 2. Unit Root Test

Variable	Notation	ADF based AIC		Phillips-Perron	
		Level	First Diff.	Level	First Diff.
Consumer Price Index	***cpi***	-1.8832	-3.9789**	0.6547	-6.7546*
Consumer Price Index (Log)	***lcpi***	-2.1709	-5.0698*	-0.6726	-8.6788*
Consumer Price Index Gap	$lcpi^e - lcpi$	-3.0937*	-9.4053	-2.4032**	-9.4414
Exchange Rate (Log)	***exr***	-2.3053	-3.7064**	-1.9020	-8.3987*
Exchange Rate Gap	$exr^e - exr$	-3.1110*	-4.1837	-2.4532*	-8.7736
Reserve Money (Log)	***rm***	-1.9003	-9.1787*	-2.3459	-15.6301*
Real Output (Log)	***ry***	-3.180***	-3.4420	-3.9946**	-4.0301
Real Output Gap	$ry^e - ry$	-3.6850*	-3.8834	-4.0830*	-4.0823
Petrol Motor Spirit (Log)	***pms***	0.8743	-9.9499*	0.8951	-9.9499*

Note. *, ** and *** implies significance at 1.0, 2.0 and 5.0%, respectively. AIC is Akaike Information Criteria.

4.2 Estimated Results

Table 3 presents results of the P-star model estimated using equation 7 and from five different perspectives. Model 1 considers only domestic price gap as the predictor of changes in prices, while Model 2 besides domestic price gap incorporates foreign price gap. The vector *Z* is first considered in Model 3 by addition of reserve money reflecting Friedmanic proposition otherwise known as monetarist view on inflation. This also mimics the monetary policy framework of the Central Bank of Nigeria. Expanding the vector *Z* further by incorporating the price of PMS yield Model 4 and with the inclusion of real output gap in the vector *Z* we establish Model 5. The reason behind the gradual built-up of the equation is to facilitate comparison among different versions of the P-star models. It also enables us to distil the relevance/validity of other views of inflation in Nigeria.

Model 1 as reported in Table 3 shows that domestic price gap on its own is not adequate to explain inflation dynamics in Nigeria. Domestic price gap is not only statistically insignificant but also wrongly signed. Besides, the model only weakly passes Breusch Godfrey LM test at 10.0 percent. The inclusion of foreign price gap (i.e., Model 2) leads to a drastically different result. Both domestic and foreign price gaps yield statistically significant positive coefficients and relatively higher R^2.

Model 3 which in addition to domestic and foreign price gaps incorporated the monetarist view proxied by reserve money yielded an R^2 lower than that of Model 2 but slightly higher than Model 1. Both domestic and foreign price gaps are correctly signed and statistically significant but the coefficient of reserve money, against appriori expectation returns negative coefficient. The model however passes all post estimation diagnostic tests.

Table 3. Results of the Estimated Equation and Post Estimation Diagnostic Tests

Regressors	Model 1	Model 2	Model 3	Model 4	Model 5
C	0.003***	0.006*	0.006*	0.003***	0.004*
Dom. price gap	-0.006	0.081**	0.094**	0.111**	0.136*
∆p(-1)	0.198***	0.131**	0.101**		
∆p(-2)	0.203***	0.046***	0.003*		
∆p(-3)				0.298*	0.413*
∆p(-12)	0.272*	0.290*	0.314*	0.449*	0.163**
Foreign price gap		0.031*	0.341**	0.00003	0.00008*
∆exr(-3)		0.036*	0.022***	0.030**	0.021*
∆exr(-5)		0.030*			
∆exr(-12)		0.018		0.019***	0.029*
∆rm(-3)				0.017**	0.018*
∆rm(-4)			-0.012***	-0.015**	-0.022*
∆rm(-12)				0.015**	-0.022*
∆pms(-1)				0.016**	0.0002*
∆pms(-12)				0.016**	0.0002*
Output gap(-2)					0.0002*
Output gap(-6)					0.0006*
Output gap(-10)					0.0009*
Output gap(-11)					0.0005*
R^2	0.223	0.288	0.245	0.559	0.694
AIC	-7.729	-7.794	-7.758	-8.004	-8.346
SBC	-7.589	-7.626	-7.619	-7.501	-7.815
HQC	-7.673	-7.726	-7.702	-7.801	-8.132
DW Stats	2.137	1.789	1.746	1.931	2.160
Breusch Godfrey	F=2.597	F=2.460	F=1.078	F=0.761	F=0.419
LM Test	(0.081)	(0.092)	(0.346)	(0.471)	(0.670)
Heteroskedasticity	F=1.407	F=0.714	F=1.231	F=1.323	F=1.254
Test	(0.239)	(0.615)	(0.254)	(0.204)	(0.245)

Note. *, ** and *** implies significant at 1.0, 5.0 and 10.0 per cent, respectively.

Model 1: contains only domestic price gap.

Model 2: contains both domestic and foreign price gaps.

Model 3: contains domestic and foreign price gaps and reserve money.

Model 4: contains domestic and foreign price gaps, reserve money and price of PMS.

Model 5: contains domestic and foreign prices gaps, reserve money, price of PMS and output gap.

The fourth model (Model 4) brings-in the price per litre of Petroleum Motor Spirit (PMS). The inclusion of PMS is predicated on our knowledge of the Nigerian economy. Shocks to the price of PMS exert immediate but supposedly temporary impact on inflation in Nigeria. PMS is taken particularly to reflect the structuralist view on inflation. At this level, R^2 significantly improved and all the post-estimation diagnostic tests were satisfactory. However, foreign price gap yielded statistically insignificant positive coefficient.

The extant literature is awash with the relevance of output gap to movement in the general price level (Mujeri, Shahidduzzaman, & Ezazul Islam, 2009), hence the consideration of output gap in Model 5. The model which included all the variables in the first four models besides output gap returned all variables statistically significant and recorded the highest R^2 of 0.694. Interestingly too, the model also passes all the post-estimation diagnostic tests including Breusch Godfrey LM and Heteroskedasticity tests.

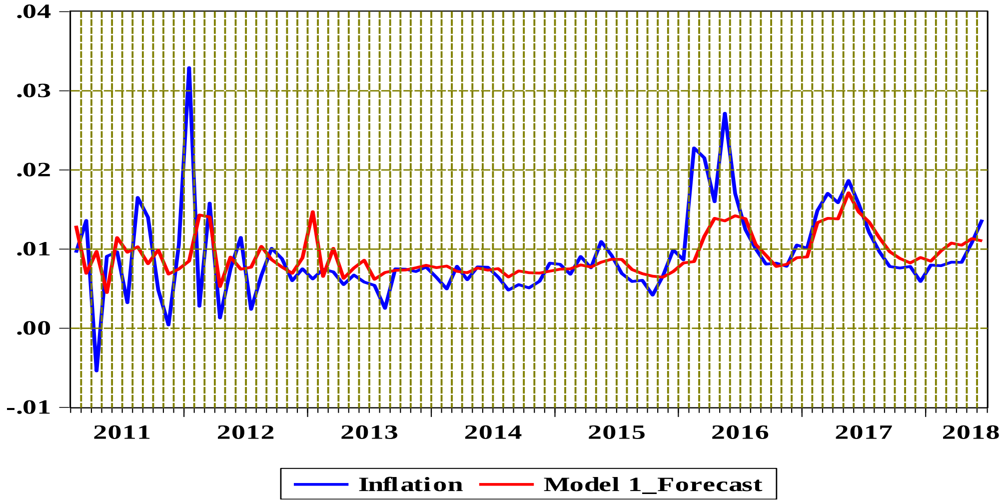

Figure 1. Model One Inflation Forecast

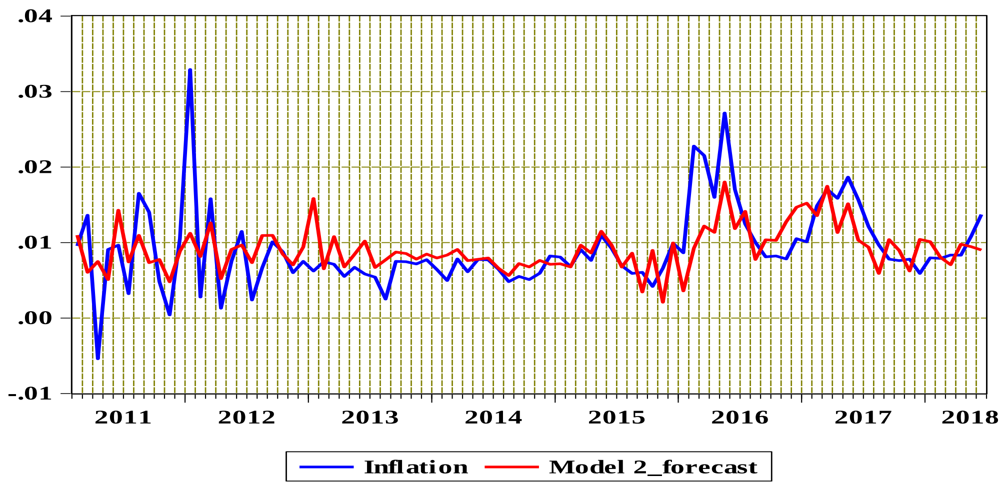

Figure 2. Model Two Inflation Forecast

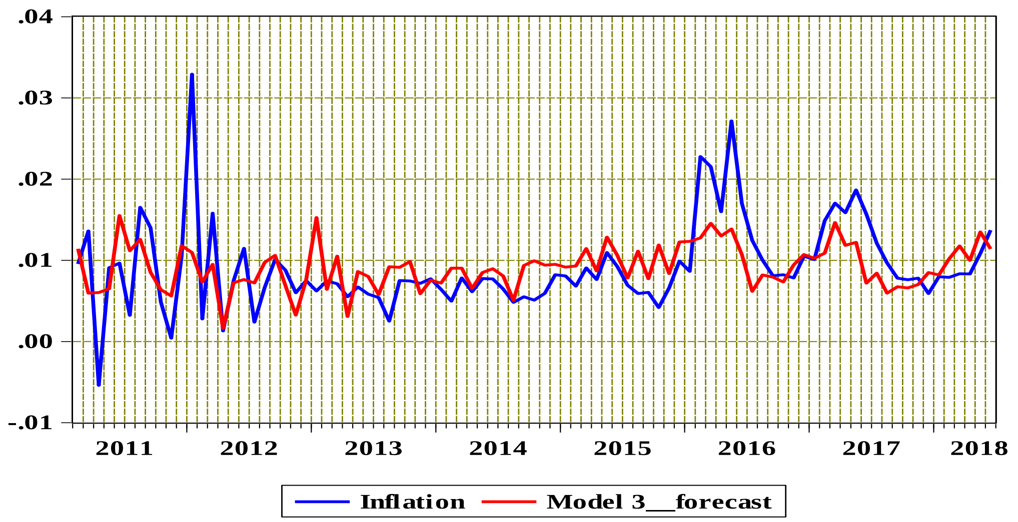

Figure 3. Model Three Inflation Forecast

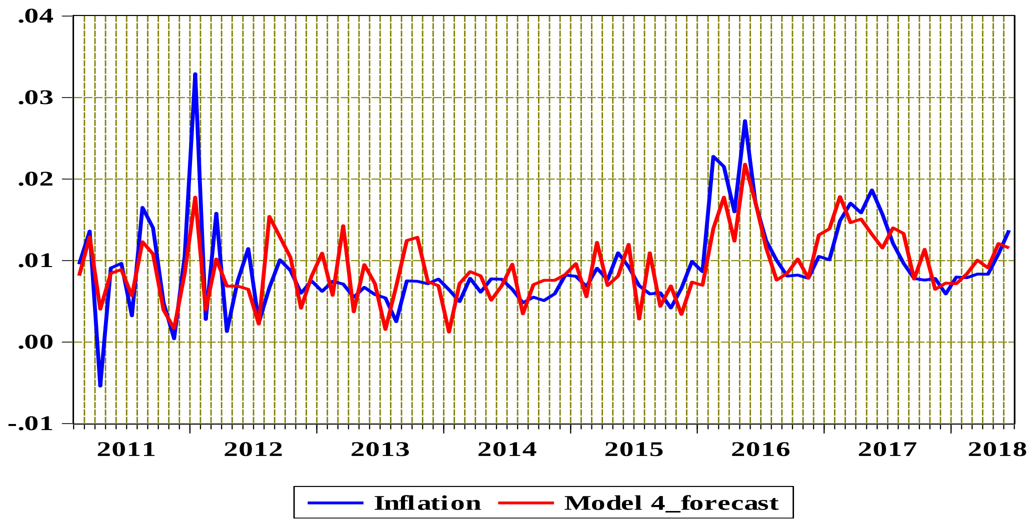

Figure 4. Model Four Inflation Forecast

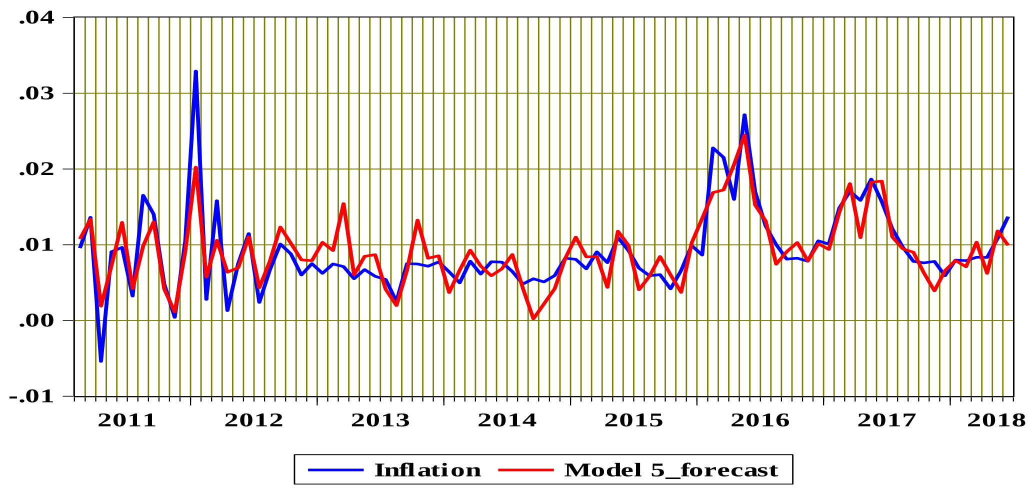

Figure 5. Model Five Inflation Forecast

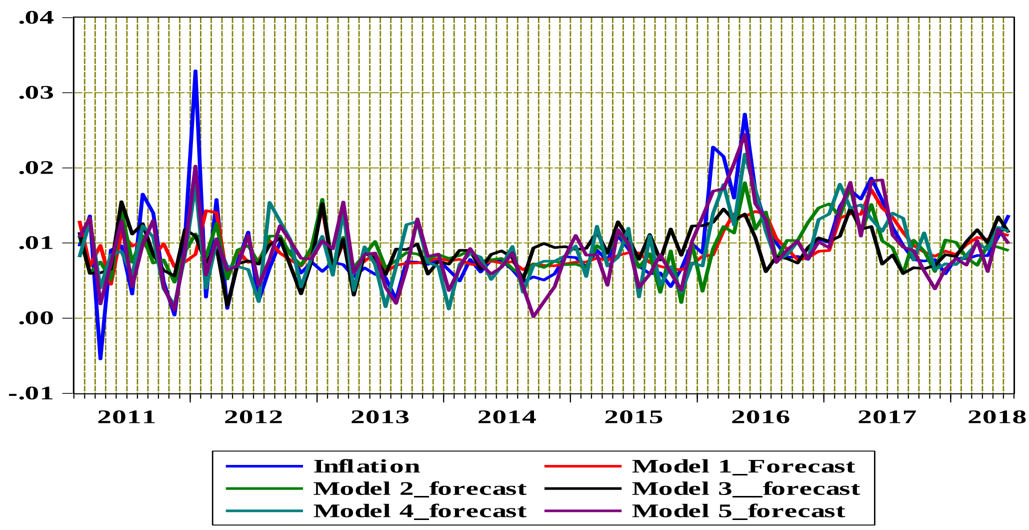

Figure 6. All Models Inflation Forecast

4.3 Forecasting Performance

In line with Kiptui (2013), the forecasting performances of the models (i.e., Models 1 to 5) are evaluated using five criteria, namely: root mean square error (RMSE), mean absolute error (MAE), Theil inequality, bias and variance proportions. Table 4 presents the results of the evaluation criteria across all models. The results returned Model 5 as the best model implying that Model 5 outperforms all others. By implication, this validates the applicability of P-star model for Nigeria but with slight modification.

Using the domestic price gap alone as contained in the first column of Table 1 cannot predict movement of prices in Nigeria. More so, the inclusion of foreign price gap improves the model but not as good as when other variables such as reserve money, PMS and output gap are included in the model.

Table 4. Forecast Evaluation

	Root Mean Squared Error		Mean Absolute Error		Theil Inequality Coefficient		Bias Proportion		Variance Proportion	
	Static	**Dynamic**	**Static**	**Dynamic**	**Static**	**Dynamic**	**Static**	**Dynamic**	**Static**	**Dynamic**
Model 1	0.005	0.005	0.003	0.004	0.238	0.275	0.000	0.000	0.359	0.682
Model 2	0.005	0.005	0.003	0.003	0.227	0.236	0.000	0.000	0.302	0.394
Model 3	0.005	0.005	0.003	0.004	0.234	0.245	0.000	0.000	0.338	0.626
Model 4	0.004	0.006	0.003	0.005	0.175	0.279	0.000	0.000	0.144	0.039
Model 5	0.003	0.003	0.002	0.003	0.144	0.157	0.000	0.001	0.091	0.089

Figures 1 to 5 graphically present movement in the general price level vis-à-vis the forecast based on each of the models, while Figure 6 combines the actual price level and all forecasts based on all models combined. It is important to note that the forecast is carried out using both static and dynamic models but only the results of the static model are presented here, because they seem to outperform those of the dynamic models.

Close scrutiny of the figures show that all models forecast traced the actual inflation closely but Figure 5 representing Model 5 traced the actual far more closely, further supporting the position of Table 4.

5. Conclusion and Policy Advice

The importance of the possibility of predicting the future path of inflation to proactive monetary policy formulation cannot be overemphasised. This is so, considering that price stability is said to be the primary basis for the existence of central banks. Forward looking monetary policy requires prior knowledge of the trend of inflation, hence the importance of inflation forecasting models to monetary policy formulation by central banks.

Most central banks, particularly those of the EMEs and developing countries still rely largely on monetary targeting as framework for monetary policy on the pretext that the relationship between monetary aggregates and prices still hold, although not as perfect as most theories suggest. This is happening at a time when analysts and practitioners of the industrialised world intensify criticisms of the QTM which form the building block of monetary targeting framework of monetary policy.

The search for robust model to predict inflation in a QTM framework gave birth to P-star model which attracts less attention of researchers in Nigeria. This study applies the methodology to high frequency Nigerian data from 1995M1 to 2018M6 to test the validity of the model for Nigeria. The result supports the working of the model but with slight modification by considering foreign price gap to capture the import dependent nature of the Nigeria economy. Other considerations include the inclusion of reserve money, price per litre of PMS and output gap.

With this modification, P-star model can be said to be a viable inflation forecasting alternative model for Nigeria. Consequently, the monetary authority, in this case, Central Bank of Nigeria, is hereby advised to consider adopting this modified version of the model to forecast inflation for Nigeria at least as a complimentary model to be used side-by-side with the existing forecasting model of the Bank. This, if done will enhance the efficiency of the monetary policy of the Bank as policies will be predicated on sufficient information, particularly on the future path of inflation.

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Notes

Note 1. See Kool and Tatom (1994), Herwartz and Reimers (2001).

Note 2. See Nechane and Lashimi (2002).

Note 3. See Hodrick and Prescott (1980).